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The New Year.

THE majority of our readers will receive the present number of the ELECTRICAL REVIEW on the first morning of the New Year, and we avail ourselves of this timely and appropriate moment for greeting all of our supporters, and all whom we endeavour to serve, with a very cordial and confident wish that they may have happiness and prosperity from January to December in 1926.

We do not say this purely because it is the custom for good wishes to be on everybody's lips on New Year morning—in the past there have been times when the prevailing and threatening conditions have heavily beclouded the situation and prospect so that any such wish seemed to be little more than father to the thought. To-day, we believe, notwithstanding the difficulties that are known to lie ahead of us in settling some of our serious industrial problems, that there are signs that justify greater optimism than could safely be entertained at any other time during the last few years.

The official analysis of unemployment returns reveals encouraging information regarding the industrial "spots" where changes for the better have lately been taking place, and it cannot fail to be of assistance in dealing with this serious problem to know just where and why things have been getting worse. It narrows down the questions for discussion and clears the pathway to betterment. It is of practical value to other branches of industry to know that the Ministry of Labour finds that, apart from the crisis in the coal industry, the figures appear to indicate that the general improvement in employment experienced in 1924 continued during 1925. In the engineering industries—which have been up against exceptional difficulties for a long while—there has been a distinct improvement in employment. As an indication of the general trend of things, it is noteworthy that, while the year's increase in unemployment in mining was 116,878 workers, the total number of insured

persons unemployed increased by only 55,178. The improvement of the last month or two affords further encouragement, but from the standpoint of national engineering industry, the fly in the ointment consists in the reduction of men engaged in engineering industry by their transfer to other trades or their departure to lands where their class of work has presented better opportunities than they could find in this, the Birthplace of Engineering.

If we turn from the general to the particular, and limit our thought to the outlook for the electrical engineering industry and trade, we have every reason to be optimistic, for there appears to be abundant work in prospect in every section—plant, switchgear, &c., for power stations and industrial works, cables for electricity supply, telegraph and telephone development, overhead and underground lines, radio apparatus, appliances and fittings for domestic electric service, and indeed in the whole range of things comprised in the term "Everything Electrical."

If we pull "all together" enthusiastically, and are unafraid and full of initiative in enterprisingly launching out upon the development of departments of electrical activity in which there is unmistakable scope—such, for example, as domestic electricity and railway electrification—we shall be able to give employment to thousands more employés, and strengthen still further the position of British electrical industry. We might write much on the need for the spirit of Locarno to permeate our ranks—employers, staff, and workpeople—but the mere mention of that spirit will suffice at the moment. Another point which also presses in upon one's thought as one looks forward is the need that exists for us to continue to hang together in the support of British electrical industry, for there are many who fear that as the Continental situation improves under the influence of the great achievement at Locarno, the menace of foreign electrical competition will become much more serious.

Combustion Engineers in Power Stations.

THE correspondence on this subject which has appeared in our pages, together with the article by Mr. C. F. Wade which we published last week, should do good service in directing attention to the importance of this branch of central-station practice. It may no doubt be a platitude, but it is true, that the greatest scope for economy in the generation of electricity is to be found in the operation of the boiler house. The boilers, turbines, condensers, and other plant are the tools with which the station engineer manufactures electricity—once installed, they cannot be materially altered in design; but they may be used efficiently or inefficiently, and the financial results of the working of the plant depend mainly upon the ability of the engineers who are directly responsible for their operation. Certain economies can be effected in the engine room, but it is in the boiler house that skill and knowledge have the greatest opportunity. In emphasising this fact, we have no thought of "belittling" the status of the engineer in charge of the engine room, who bears a heavy responsibility.

We are pleased to note that the views of the Electrical Power Engineers' Association, as embodied in the editorial columns of the current issue of its journal, *The Electrical Power Engineer*, are in harmony with our own. Referring to the recent correspondence, our contemporary agrees "that there still appears to be a deplorable lack of appreciation of the importance of the work that a technically-trained combustion engineer may carry out in the boiler house," and proceeds to take the Southampton Corporation to task for offering a salary of less than £300 a year for a fully-qualified man, pointing out that to satisfy the specified requirements an applicant must not only have had a good technical training, but also must have held a responsible position in a large power station where it was the practice to make tests both of fuel and of boilers. "Usually a man fitted for the vacancy must have held at least a charge engineer's position." The journal points out that such poor salaries will deter engineers from qualifying themselves for these important positions, and that "it is not likely that a man will spend time, energy, and money equipping himself with special qualifications if the inducement to do so is so unsatisfactory." The *Electrical Power Engineer* therefore regards the competent combustion engineer as an adequately trained and experienced charge engineer who has added to his attainments further special qualifications, and rightly claims that in order to secure the economies that such a man can bring about in the boiler house, electricity supply authorities must be prepared to offer him a fair rate of remuneration.

A Washer not "All-Electric."

IN our "Correspondence" columns to-day we are reproached for publishing a description of a new electric washer because it is provided with a gas burner for heating the water. Surely the ease with which an electric immersion heater can be substituted for the gas burner is so obvious that the objection is trivial. The design of the washer *qua* washer presented so much novelty that we would not let the one patent defect of the device condemn the whole to obscurity. Moreover, if the small motor—the most expensive single item in the construction, and the only part which interests the electrical manufacturing industry—does not justify the description of this washer in an electrical journal, then *no* electric washer is entitled to appear in our pages; for the other machines, as our correspondent implies, have no provision for heating at all, and have only the motor to justify their inclusion.

With regard to that question of heating, we have heard strong objection raised to the ordinary electric washer by a practical housewife on the ground that she would have to retain the "copper" to heat water for the washer. The suggestion implied in the last paragraph of our correspondent's letter (that washing machines do not require heating arrangements) savours of the "what-was-good-enough-for-father-is-good-enough-for-me" idea; and in the many large areas where electricity for heating water is still charged for at over 2d. per kWh, there is quite a good reason why the heating medium should not be electricity. The part-electric house came along before the "all-electric" home, and every step towards lightening domestic labour, improving the day load, and giving employment to electrical workpeople is, in our opinion, a step towards a higher plane of comfort and prosperity.

French Industrial Progress.

THE report of Mr. J. R. Cahill, British Commercial Counsellor at Paris, which we review in this issue, records a continuance of the prosperity which the French electrical industry has enjoyed since the war. All over the world the extension of the use of electricity is proceeding, but it is probably true that France is in the van of progress in seeking to make up her severe war losses by its aid.

Summing up the present position of France, Mr. Cahill says that she has considerably reinforced her permanent capacity as a producer of raw materials; she is acquiring a wider and more penetrating hold upon her home market; and by virtue of her improved equipment, her larger-scale production, the combination and consolidation of her great industries, and her enhanced comprehension of foreign trade methods, she possesses now greater industrial capacity, skill and competitive power as regards foreign trade.

Electric Panel Heating.

A Brief Description of the Most Recent Installation.

By R. M. BUSSY.

DUE perhaps to the fact that "electric panel heating" has, until recently, been confined to private houses and establishments, few people seem to be familiar with it. It has, therefore, been a surprise to many to hear of the remarkable results that have been obtained from the most recent installation, which is the first of its kind in a public theatre, namely, the Cinema de Paris, in Leicester Square, London. It is proposed to give here a few details, to acquaint readers with the principles of this system, with special reference to the installation mentioned.



Fig. 1.—Cinema de Paris Auditorium, showing Ceiling Panel Heaters.

So far as has been possible standard size, or "unit," panels have been utilised throughout the theatre, being 6 ft. by 3 ft. by 1⅛ in., fixed on the surface of the ceiling and finished with suitable moulding so that they follow the general lines of decoration. Although this method was adopted in this case to save time in erection (the theatre was not closed during the whole of the work), it is more usual to bury or form the panels in the ceiling, thus giving a smooth ceiling surface. There are thirty-four standard panels on the auditorium ceiling, fig. 1, and two in the corridor from the Charing Cross Road entrance. Further, three panels are fixed in the Charing Cross Road (two) and Bear Street (one) entrance lobbies, which have been specially shaped and have their sides parallel with the adjoining walls. Every panel is fixed with six ¼-in. bolts, two passing right through the roof and four being ragged into it.

The conduit used is of the heavy gauge screwed class, and is embedded under the cornice on each side of the auditorium. Square boxes, 4 in. by 4 in. by 2 in. deep, are fixed in the centres of each bay, and tubing from the panels is bent down behind the cornices and into the boxes. In this way all the wiring is confined to the two chases, while the square boxes (with their lids flush with the wall) allow ample openings for handling, should it be necessary in the future. The panels are wired in pairs, each pair having a separate switch and pair of fuses.

The switchroom is situated by the side of the projection room at the end of the theatre, fig. 2. The gear consists of a main 150-ampere ironclad switch and fuses surmounted by a connector box, on each side of which is a ten-way ironclad fuse board. The central connector box provides ironclad protection for the extended bus-bars, the connections from the main switch, and also the shunt for an ammeter, reference to which will be made later. Under each fuseboard is a cast-iron box having a teak front panel on which are mounted ten rotary switches.

The ammeter is of the long-scale type divided in such a way as to show a definite movement as each circuit is energised. This enables the operator to see at a glance whether each circuit is in perfect order when he manipulates its switch. The whole of the switchgear is mounted on a metal frame and efficiently earthed.

The method of switching that has been adopted gives a control of 17 variations, not only of radiant heat emitted, but also of location of the panels emitting. The heat control enables the auditorium temperature of 55 deg. F. to be maintained constantly, while the control of the panels from the point of view of location enables variations of wall absorption, due to variations of wind, &c., to be counteracted.

It is due to this perfect control that the consumption of electrical energy is so low. In the extreme case of a prolonged outside temperature of 30 deg. F., only 23 kWh per hour are required to maintain a temperature of 55 deg. F. in the whole of the theatre when it is empty; when the outside temperature is about 42 deg. F., not more than 15 kWh an hour are required. These

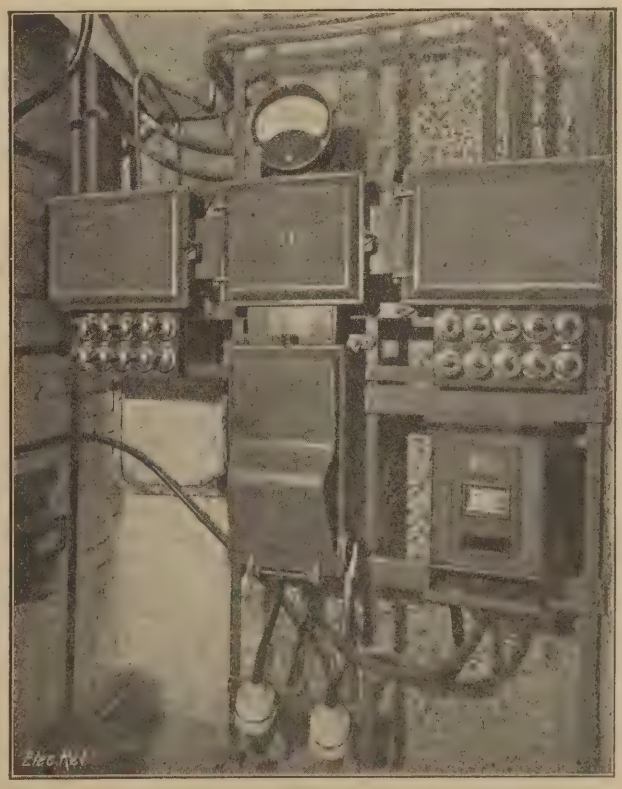


Fig. 2.—Switch Room for Panel Heating.

figures are based on the assumption that there is no audience present and, therefore, are higher than is generally found necessary in practice.

At the Cinema de Paris, the unanimous opinion of the management is that the heating bill for entertaining over four hundred patrons at each performance is lower than it would be with any other system. Further, it must be remembered that only radiant heat is used, the panel temperature being too low for convection currents, even were this possible with the panels fixed to the ceiling. It is the freshness and coolness of the atmosphere which first strikes the visitor so pleasantly upon entering the building.

With regard to maintenance cost, it must be remembered that not only is the price of electricity for heating very low, but in many cases special prices are quoted by the electricity supply authorities for such loads as these. Moreover, the control requires no special operator. A simple chart has been hung on the switch-room wall, and on it the panels are indicated and numbered, the numbers referring to the switches by which they are operated. Obviously, all that has to be done is to look at the chart for the reference numbers of the panels that are to be put into use and then to turn the corresponding rotary switches. No special knowledge at all is required.

It should be added that only after a long trial of gas-steam radiators, was the decision made to change over to an electrical installation. The panel system was chosen rather than that of electric radiators, on account of the increased seating space which became available when the source of heat was removed entirely from the floor.

Since the completion of this installation, which was carried out entirely by Messrs. Grierson, Ltd., the patentees, to the instructions of the architect, Mr. Robert Atkinson, F.R.I.B.A., the popularity of the system has increased enormously, and several of the contracts now in hand are the direct outcome of the excellent results obtained at the Cinema de Paris.

An All-Electric Experiment.

Some Particulars of Cottages Recently Erected near Birmingham.

AN experiment of considerable interest is being carried out at Birmingham, where the Woodlands Housing Society, Ltd., has recently erected two cottages equipped with apparatus for lighting, heating and cooking by means of electricity. The cottages, fig. 1, have been built to a compact design by the Society's architect, Mr. S. A. Wilmott, special thought being given to the questions of comfort and convenience to the householders. Each dwelling comprises a large front sitting room, 16 ft. 5 in. by 11 ft., a combined kitchen and scullery, three bedrooms, and a bathroom. One cottage is "all-electric," while the other one has one coal range to warm the kitchen and heat the hot-water system.



Fig. 1.—All-Electric Houses.

The sitting room, fig. 2, of the "all-electric" cottage is lighted by means of a 100-W gasfilled lamp in an Italian alabaster bowl fitting, a plug being provided for a reading lamp. The room is heated by a 3-heat 3-kW radiator, a three-way adapter plug being installed to accommodate any other apparatus such as a vacuum-cleaner, kettle, toaster, &c.

The lighting equipment in the kitchen - scullery, fig. 3, consists of an enclosed-globe ceiling - type kitchen fitting with a 60-W gas-filled lamp. A modern electric cooker is supplied on hire by the City of Birmingham Electric Supply Department. A supply of hot water can be instantly obtained from a 3-kW Santon geyser, and a 3-kW wash boiler is also installed. A 3-heat 3-kW Utility fire,



Fig. 2.—Sitting Room.

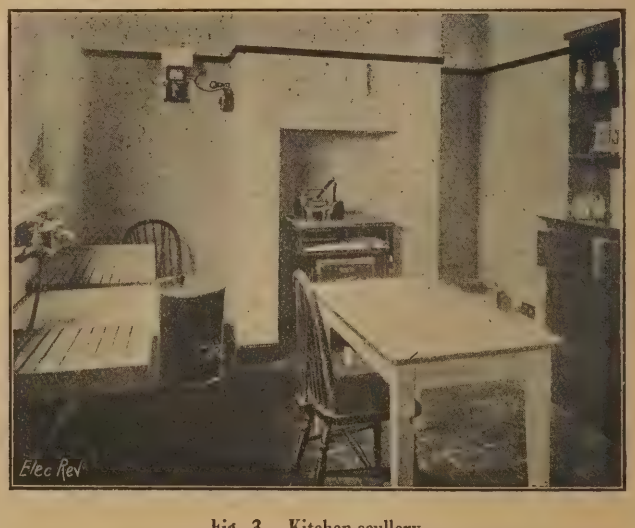


Fig. 3.—Kitchen-scullery.

equipped with a hot plate, supplies the necessary heating to this apartment.

Two lighting fittings, with 60-W lamps, serve the large bedroom, which is heated by a 2-kW electric fire. The other bedrooms each have one lighting point, and a wall plug is provided for a radiator. Two fittings provide for the lighting of the hall and the landing. A hot-water storage tank is installed in the bathroom and in the circuit for this and that of the wash boiler, pilot lamps are provided.

Ample allowance for extensions has been made in the wiring, which is run in screwed tubing.

In order that builders, architects, and all interested in the housing problem might have an opportunity of seeing the cottages, they were open for public inspection during the week commencing December 14th, when members of the staff of the City Electricity Department, which is naturally supporting the Housing Society in its experiment, were daily in attendance to give information. During the week additional apparatus, consisting of an electric sewing machine, vacuum-cleaners, toasters, irons, and other labour-saving appliances, were installed, and a cookery demonstration was given each afternoon by the department's lady demonstrator.

Great credit is due to the Woodlands Housing Society for its progressive move, which, we believe, is the first of its kind to be undertaken by such a society, and which should prove an encouragement to similar concerns and to private builders; the result of the trial will be awaited with interest by many who are interested in the housing problem.

The purchase price of the "all-electric" house, complete with the apparatus, on leasehold for 99 years, is £500, and Mr. Dean, the secretary of the Society, who has all along enthusiastically supported the experiment, states that this house has already been sold. The gardens of both cottages have been tastefully laid out by the Bournville Village Trust.

Large v. Small Generating Stations.

A Comparison of Coal Consumptions.

(COMMUNICATED.)

ACCORDING to statistics prepared by the Electricity Commissioners nearly sevenpence out of every shilling spent on the generation of electricity in Great Britain is required to pay the coal bill. That the cost of fuel usually outweighs all the other expenses of running a power plant put together is generally recognised among central station engineers, and a healthy rivalry exists in the reduction of this preponderating item of the generating costs. While, however, the cost of fuel per unit generated is a satisfactory measure of efficiency for the accountant, it is not so fair from the technical point of view. The figure varies exactly in proportion to the price per ton at which coal can be purchased, so that the engineer whose plant is unfavourably situated with regard to coal supplies is under a heavy handicap when costs alone are considered. The real technical criterion of performance is, of course, the thermal efficiency of the station, but so great is the difficulty of determining the true average calorific value of the fuel burnt—to say nothing of the impossibility of getting other engineers to believe that it has been accurately determined—that the Commissioners, wisely, we think, have disregarded thermal efficiencies in their recent "Return of Engineering and Financial Statistics." They give, instead, merely the pounds of coal per kWh generated, leaving the reader, from his knowledge of power station matters in general, to make what assumptions he likes as to the calorific value, and therefore as to the thermal efficiency in any case. Should a station be burning "duff" or other low-grade coal the pounds of fuel burned per kWh may appear high, but reference to the tables of costs will indicate whether the performance is justified by its financial results.

Unfortunately, no method of comparison can be fair to all stations. Costs, as we have seen, have no necessary correlation with technical efficiencies. The latter, again cannot be fairly appraised by merely regarding the quantity of fuel burnt per unit generated, as this figure will depend not only on the quality of the fuel, but on the size and nature of the station concerned. With all its defects, however, the simple method of comparing fuel consumptions per unit, without reference to anything else, gives us the best "first approximation" to what we want. Allowances can be made afterwards for disturbing factors. The two things which are known with as much certainty as anything in a power station are the weight of coal burnt in a year and the quantity of electricity produced in the same time. Hence the data for the calculation are fairly reliable. Besides, after all, a pound of coal is a pound of coal, and if one station burns four pounds per kWh while another only requires two pounds, the fact is interesting, and the explanation, if there is a satisfactory one, can generally be found.

Keeping then to this basis of comparison, it is instructive to note how the fuel consumption of different stations varies with their magnitude. The question often arises as to why a comparatively small station, so long as it is large enough to justify the expense of modern equipment, should not be practically as efficient as a station of the largest size. Put in another way, the question becomes: "What is the limit of size, below which a high efficiency is not obtainable?" The matter is not one that can be satisfactorily settled by calculation. A small station may not be able to afford combustion engineers, chemists, and other specialists to supervise operation, but on the other hand every detail can receive the personal attention of the chief, who, if he is a good man, will achieve results that many a more elaborately organised undertaking fails to attain. The best engineers are by no means always to be found in the biggest stations. The salaries which attract good men attract bad ones as well, and neither electricity committees nor boards of directors are infallible in their judgment.

Instead of trying to determine from theoretical considerations how small stations should compare with large ones in the matter of coal consumption, it is much more satisfactory to see how they do actually compare in practice. It is misleading to bring individual plants into contrast because of variations in managerial ability and other features. The only fair comparison is on a statistical basis, taking a large number of stations into consideration so that individual peculiarities may average out. The data collected by the Electricity Commissioners enable this comparison to be made. Particulars are given in their return of the fuel consumption per kilowatt-hour of nearly every power station in Great Britain, whether owned by a company or a municipality. To present the facts in a graphic form, the coal consumption per kilowatt-hour has been plotted in fig. 1 against the annual output for 123 stations having outputs of less than 20 million kilowatt-hours per annum. These are all municipal plants, the company plants being omitted merely in order to keep down the number of points. Disregarding stations using oil fuel partially or wholly, and also those for which the required data were missing, there are tabulated in the Return 153 municipal plants

in England alone. Twenty-nine of these are excluded, as having outputs of over 20 million kilowatt-hours per annum, and one, with an output of about 100,000 kWh, has been omitted because its coal consumption point of 12.8 lb. per kWh fell outside the limit of the chart. The performances of the remaining 123 stations are represented by the points plotted.

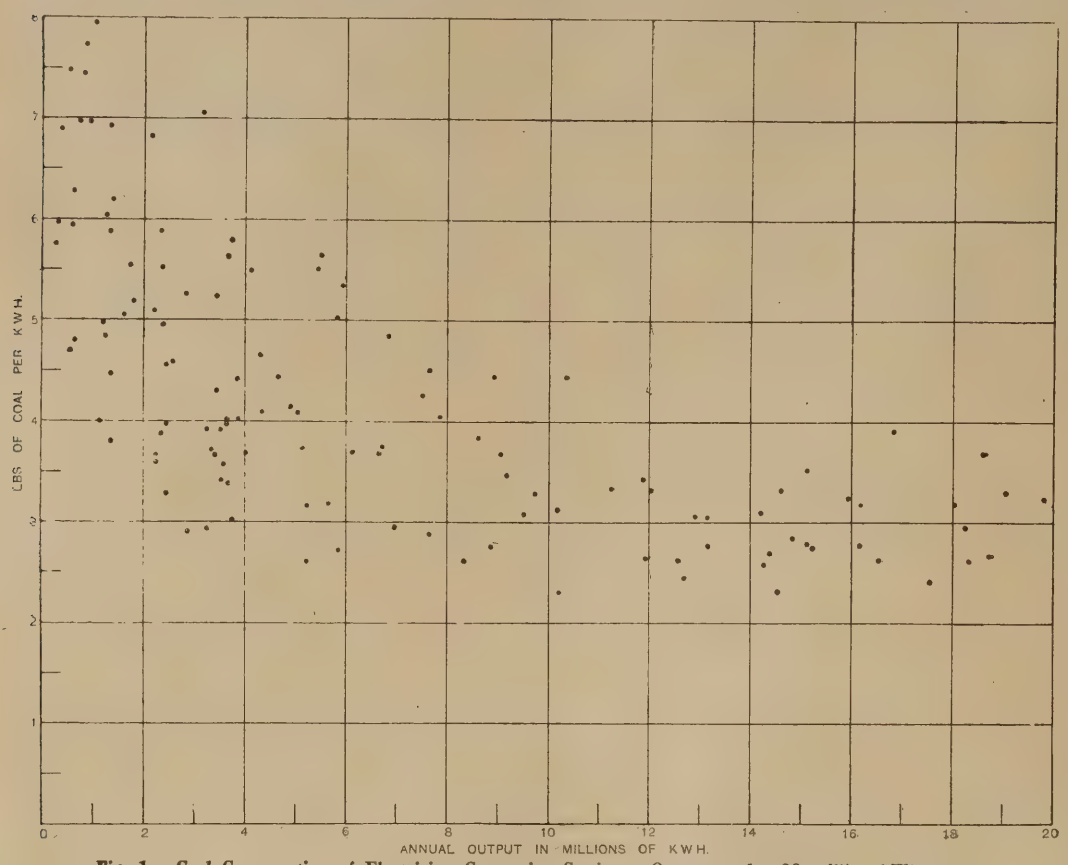


Fig. 1.—Coal Consumption of Electricity Generating Stations; Output, under 20 million kWh per year.

Two things strike one especially when looking at the diagram: first, the relatively large coal consumption of the smaller stations, and, secondly, the extraordinary differences between individual performances. Of the 12 stations having an output of less than a million kilowatt-hours per annum, one required 7.73 lb. of coal and another only 4.69 lb. per kWh. Of the next 13 stations, with outputs between one and two million kilowatt-hours, the fuel consumption ranged from 7.96 lb. to 3.80 lb. per kWh, and so on. In the 5 to 6 million group one station, with an output of 5.517 millions, consumed as much as 5.65 lb. of fuel per kWh, while another produced 5.220 millions for a consumption of only 2.61 lb. The former station we will not mention by name, as the engineer, no doubt, has sufficient trouble already, but the latter, which is that at Nelson, in Lancashire, deserves credit for its performance. The fuel consumption is only beaten by five other stations, all much larger, and only one of the seven plants with outputs over 18 million kilowatt-hours can equal it.

Only four of the 123 stations dealt with could show a fuel consumption of less than 2.5 lb. per kWh, and the best of these, Rawtenstall, also in Lancashire, with a consumption of 2.30 lb. per kWh for an output of 10.199 millions, beat every other station up to the limit of 20 million kWh, at which the diagram ends. It will be also noticed that there is practically no difference between the average performances of stations with outputs ranging from 10 to 20 million kilowatt-hours per annum. From the evidence of the chart, it would appear that a 10-million station would be every bit as economical as a 20-million one. The range might even be extended, for it is very clear that even a 5-million station under good conditions can, in practice, do as well as the average station three or four times as large.

Leaving exceptional cases, however, out of consideration, one could fairly conclude that stations of an output of less than about 10 million kilowatt-hours are unduly heavy on coal consumption, and unless they are likely to grow rapidly to larger dimensions, the justification for their continued existence should be examined. This does not imply that there is any *à priori* case for scrapping them. Circumstances may well be such that the cost of electricity transmitted from a large and economical station a long way off would be greater than that of electricity generated in a small and uneconomical station locally. Every case must be considered on its merits, but if the smaller stations are to survive anywhere but in the remotest country districts, those responsible for their management should see that their performances are brought to within measurable distance of what has been shown to be possible.

We may now turn to the records of the larger undertakings. As these are not only of greater interest on account of their magnitude, but are also fewer in number, all stations having an output of over 20 million kilowatt-hours in Great Britain, whether municipal or company owned, will be considered together. The largest undertakers in the country have, as a rule, more than one generating station, and it is generally difficult to determine from the Commissioners' Return the performance of the individual plant. Neglecting for the moment cases of this kind, we have particulars of 28 stations with outputs ranging from 20 to 100 million kilowatt-hours. The performances of these stations are plotted in fig. 2. The great majority, as will be noted, have coal consumptions ranging between 2.5 lb. and 3.0 lb. per kWh. Again we find no sign that a large station is more economical than a smaller one. The record, among the undertakings dealt with, is

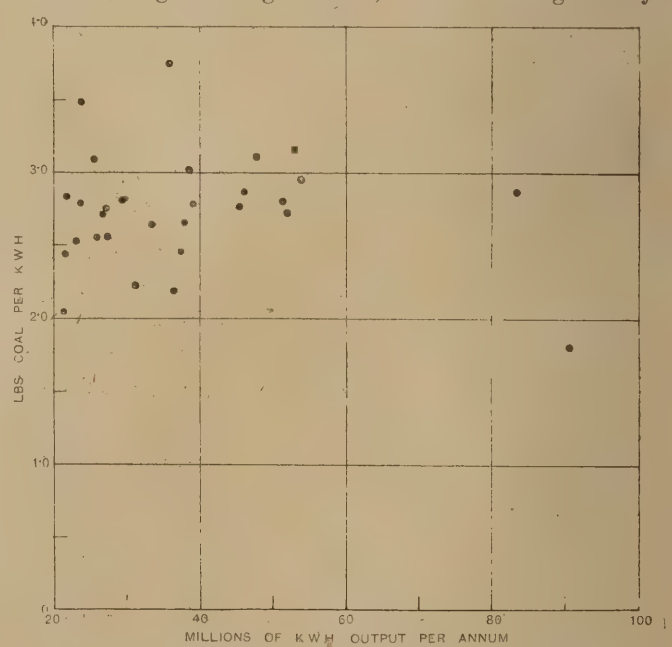


Fig. 2.—Coal Consumption of Generating Plant; Output from 20 to 100 kWh per year.

certainly held by the wonderfully efficient station of the Lancashire Power Co. at Radcliffe, where Mr. Adams, with steam at only 160-lb. pressure and 520 deg. F. temperature, has reduced his coal consumption to 1.8 lb. per kWh on an output of 90.377 millions per annum. The next best performance of the group is that of Mr. L. L. Robinson at Hackney, with a consumption of 2.04 lb. on an output of 21.464 millions. The unfortunate city which, at the date of the return, required 3.74 lb. of coal per kilowatt-hour to generate an output of nearly 40 million kWh, has now got a new plant in service, and better results may be expected in the next return.

The performances of the undertakings which have been omitted from the diagram, fig. 2, for the reason given above, are tabulated below (see Table I) in the order of economy of coal consumption. Since no particulars are given as to the quality of the coal, the order of thermal efficiency is not necessarily the same as that given in the table, so readers must make what allowances they think fair in comparing the results. It must also be recollected that the Newcastle company's output, for example, is spread over four power stations, varying in size from 17,600 to 78,850 kW capacity of installed plant. Hence the coal consumption of 1.86 lb. per kWh, which is the average over all the four stations, is necessarily inferior to that of the best station of the group, which in the aggregate generates an output of 415.2 million kWh per annum.

In studying the performances which have been brought under review, it must be remembered that the figures are all concerned with periods prior to March, 1923. When the next Return of the Commissioners appears, it is very certain that the relative positions of many of the stations will be changed, and also that an appreciable general improvement in coal consumption will be manifest. Nevertheless, there is no reason to expect that the main conclusion will be different. This seems to be that for all stations with an output of more than ten million kilowatt-hours per annum, the performances will be approximately equal given equal efficiency of management. Below the capacity mentioned, the engineer is handicapped by the general inferiority of his equipment, but the results obtained by some of the small stations where the management is exceptionally good should serve to stimulate other undertakings to greater efficiency.

TABLE I.
COAL CONSUMPTION AND ANNUAL OUTPUT OF VARIOUS ELECTRICITY UNDERTAKINGS.

Name of Undertaking.	Coal lb./kWh.	Output in millions of kWh.
Newcastle E.S. Co., Ltd. ...	1.86	415.2
Glasgow Corporation	1.92	179.0
Manchester Corporation ...	2.04	244.2
Rotherham Corporation ...	2.20	46.9
Liverpool Corporation	2.24	134.4
Sheffield Corporation	2.24	151.5
Dundee Corporation	2.30	31.1
Clyde Valley Power Co. ...	2.35	123.8
Yorkshire Power Co.	2.46	75.8
County of London E.S. Co. ...	2.47	76.3
North Metropolitan E.S. Co. (Brimsdown)	2.65	68.0
North Metropolitan E.S. Co. (Willesden)	2.31	
Mersey Power Co.	2.49	23.3
Cardiff Corporation	2.93	26.1
Wolverhampton Corporation ...	2.95	33.1
Shropshire Power Co.	3.11	49.2
Metropolitan E.S. Co.	3.26	38.7
Edinburgh Corporation ...	3.48	55.1
Birmingham Corporation ...	3.72	156.4
Nottingham Corporation ...	6.15	23.6

The Italian Electrical Industry.

(From Our Special Correspondent in Milan.)

UPON the principle that disappointment is the nurse of wisdom, Italy should soon derive some practical advantage from her somewhat costly experiences in pursuing a vast—and not very well considered—scheme of hydro-electric enterprise. Many millions of capital have been invested and, perhaps, many thrown away owing to the disinclination of Italian engineers—who, as a body, deem themselves inferior to none—to accept suggestion, let alone the offer of practical assistance, outside their own circles. The result of this somewhat unwise policy has been the perpetration of a number of mistakes, some, indeed, of a serious nature—such as defective designs for reservoirs and dams; ill-chosen sites for power-houses; and the selection for exploitation of districts which have subsequently proved subject to drought.

At the time of writing, there are signs that history may possibly repeat itself. Heavy storms have lately passed over the northern districts of Italy; while these have served to replenish the supply dams, the violence of the rains is believed to have undermined more than one of the main structures (built too hurriedly, it is to be feared, and without sufficient consideration having been given to the matter of contours). The terrible Gleno barrage catastrophe which took place at about this time two years ago (December, 1923), when material damage was caused exceeding 100,000,000 lire, has not by any means been forgotten. There are some who declare that the initial errors connected with the building of the Dezzo reservoir, the collapse of which caused the two villages of Teveno and Gueggio to be washed away and many persons to lose their lives, have been repeated in certain other localities. It is to be hoped that eventually this may prove not to have been the case. But the worst feature of this occurrence was that the dam at Lake Gleno had been built and put into use without the permission of the Ministry of Public Works. It is still possible to ignore the Department, and to proceed with public works of this nature without official supervision.

Notwithstanding these facts, the electrical industry of Italy is showing signs of real progress. During the current year the number of central stations has been appreciably increased, and plans are being made for additional stations. An attractive market for electrical machinery, appliances, and fittings is to be found in this country. While the Italians themselves have invested something like 3,000 million lire in the establishment of hydro-electric plant, a not inconsiderable proportion of foreign capital has been employed in the same direction. It is estimated that during the next five years not less than 700,000,000 lire per annum will be expended on new power plant, transmission lines, sub-stations, and other necessary construction.

The Electrical Market.

The opportunities for the sale of electrical goods in Italy are encouraging, notwithstanding the expanding domestic industry, which is constantly developing its home market as well as reaching overseas. Both in quantity and value the total imports in 1925 probably showed a slight decline over the previous twelve months. The principal imports which have come from the United Kingdom and the United States have included several classes of generators and motors, transformers, and various kinds of electrical apparatus. During the first three months of last year generators and motors, weighing 4,121 quintals, and valued at 6,073,303 lire, were imported, as against 3,786 quintals and 3,974,754 lire in 1923, and 4,335 quintals and 5,381,955 lire in 1924. Transformers showed a slight decline in weight, to 1,438 quintals, valued at 1,311,564 lire for the January-March quarter of 1925, compared with 2,085 quintals and 1,993,095 lire in 1923, and 1,229 quintals, valued at 970,967 lire, in 1924. Batteries, magnetos, electric meters, telegraph and telephone apparatus, and

electrical apparatus of various kinds also showed slight reductions either in quantity or in value. While the total imports for the period mentioned actually increased in quantity from 10,340 quintals, in 1924, to 11,100 quintals during the first quarter of last year, the value declined from 25,988,095 to 25,245,770 lire. This is all the more remarkable in view of the fact that the lira has continued to depreciate, the quotation now being nearly 20 per cent. lower during 1925 than in 1924 for sterling and for United States dollars. Regarding exports, which have included all the classes of electrical goods above enumerated, there was an advance over the same period from 4,871 quintals (valued at 7,951,213 lire) in 1923, to 7,407 quintals (valued at 11,103,329 lire) in 1925.

The largest supplier of electrical equipment to Italy has been Germany; Hungary ranked second, the United States third, Great Britain fourth, and France fifth. On the other hand, exports of electric generators and motors from Italy, which showed a decline in quantity from 5,529 quintals for the first three months of 1924, to 4,931 quintals in the first quarter of 1925, were shipped principally to British India (which took 25 per cent. of the total); Brazil and Argentina (which absorbed about 36 per cent.); and Germany, Spain and France (taking between them 17 per cent. and in the order named). The purchases made by Great Britain were small, not exceeding 135 quintals; these figures, however, showed an advance upon the previous year's record, which was 77 quintals, and very much exceeded that of 1923 when the figure amounted to no more than 1 quintal. It is worthy of note that while in the first quarter of 1923 the United States ranked third in the list of countries from which electrical goods were imported by Italy, in 1924 it sank to eighth, and in 1925 it was seventh. During the first ten months of last year, it is estimated, less than three per cent. of Italy's imports of heavy electrical machinery originated in the United States.

Development and Home Production.

Up to recent years, Italy was very largely dependent upon electrical apparatus of foreign manufacture, and, to a certain extent, is still so. None the less, a striking advance has taken place in home production, especially with regard to domestic lighting. This has now been extended to the great majority of the towns and villages of the Kingdom, except to those located in the more inaccessible of the mountainous districts. The use of electricity varies enormously in different sections of the country. In Calabria, for instance, the consumption for lighting *per capita* is only 2.8 kWh, whereas in Piedmont it reaches 26.70 kWh. The average for the entire kingdom is 13.70 kWh. For the current year (1926) the consumption is forecast at not less than 8,000 million kWh, and for 1927 to 1928, some 10,000 million kWh. In 1933, when most of the new stations now under construction, and those for which plant has been made, are completed, the consumption is expected to reach 12,000 million kWh.

Like most European countries, Italy is finding the production and use of electrical appliances of greater and greater importance in connection with the carrying-on of daily life and the conduct of its many industries. The demand for electrical equipment for the home, the office, the shop, the factory, and places of amusement has become insistent, giving rise to the establishment of a number of new factories and retail stores which are being supported and encouraged (by the most favourable taxation) to compete with foreign imports. But the country is still unable to do without resort to a variety of these. Figures of last year's trading in electrical supplies are likely to show little difference in actual value, but in quantity and weight the total may vary considerably from those recorded for the two preceding years.

The annual importation of incandescent lamps now exceeds 11,000,000, a figure which is below that of 1924, and some 2,000,000 under that of 1923. The difference in quantity means that the Italian home manufacture has increased, and is now more fully supplying the ever-increasing local demand. The main source of imported lamps is the Netherlands. To-day, the Dutch have the privilege of furnishing the supplies that formerly came almost entirely from Germany, which held first position among exporting countries. During the first six months of 1925, the Netherlands furnished close upon 3,000,000 lamps, which may be compared with 2,447,109 for the January-June period of 1924, 1,805,022 for 1923, and 2,972,925 for 1922. Germany, which has been under obligation to furnish Italy with lamps under the Reparation Agreement, failed last year to send anything in the way of supplies; but between January and June, 1923, 1,160,000 lamps, mostly of low power and of a decidedly inferior quality, were provided. The ordinary commercial supply of lamps, other than reparations, from the same source, for the period January-June, 1924, was 1,858,351, while during the first six months of last year over 2,000,000 were imported. Austria is another large furnisher of electric lamps, while Hungary and Switzerland send smaller supplies. There is a smaller market for British or American incandescent lamps—notwithstanding their admittedly superior quality—owing to the heavier freight rates involved and the longer distance of transport.

The largest sales—in some districts almost exclusive—are found for metallic filament lamps, with round and pear-shaped bulbs and Edison screw and bayonet bases.

Installation Practice.

Special receptacles, most frequently of the bayonet type, for the attachment of electric toasters, heaters, vacuum-cleaners, and other household appliances, are now installed in most houses. The rotary switch is generally used, but the push-button type is likewise popular. Switches of the snap and tumbler type are practically unknown. On the other hand, American switches are favoured by some Italian electricians, and strenuous efforts are now being made to push their sale by enterprising United States travellers. The fuses most commonly employed are the open link and the German "Z" type. The Edison screw plug takes precedence over both the American cartridge and the British thumb-grip types. The wiring of dwellings is left almost entirely to the discretion of the electrician or the house-owner, little or no control being exercised by the municipal authorities, but the organisation known as the Associazione Elettrotecnica Italiana consents, upon application, to exercise technical supervision over the introduction of new installations. The practice of wiring houses in Italy varies but little from that adopted by other European countries, and the rules governing insulation are only slightly different. Large quantities of twisted cord (a large proportion is imported) are employed, but of a type rather more flexible than the British standard. The most common practice followed in house-wiring is to run the wire or flexible cord on small porcelain knobs, or through thin insulated conduits of the Bergmann type. In houses built during the last twenty years, where the construction of the walls is of brick or cement throughout, this has been found to be the only possible way of introducing electricity. In modern houses, however, a cheap kind of low-grade iron conduit is being used, embedded within the walls or passed through the ceilings.

Water Turbine Testing.—In view of the fact that the rotors of electric generators driven by hydraulic turbines have usually to be designed to withstand for short periods from 1.8 to 2.5 times their normal speed, the Oerlikon Co., of Switzerland, has recently made special provision in its testing department for checking the accuracy of the mechanical calculations and the strength of the materials used in the construction of the machines by over-speed tests. To this end a pit capable of accommodating the largest rotor in a vertical position has recently been constructed; it is about 32 ft. deep and is provided with a thick lining of bags filled with sand as a protection against damage should a rotor burst during test. The pit, which is of a size enabling rotors up to a diameter of 21 ft. and of a weight up to 120 tons to be tested, is surmounted by overhead driving gear comprising two d.c. motors developing together about 1,000 kW at pressures ranging between 250 and 1,500 volts.

Miners' Electric Safety Lamps.

By EDWIN LYON, B.Sc.(Tech.), A.M.I.E.E.

(*Abstract of Paper read before the* BATLEY AND DISTRICT MINING SOCIETY.)

Of the desirable characteristics which a miner's portable electric safety lamp should possess, perhaps the cost of upkeep has been given too much prominence of late. The cutting down of upkeep costs has, in some instances, been taken so far as to reduce the efficiency of the installation. For the sake of a fraction of a penny in the weekly cost per lamp, spares have been cut down to a minimum, at times being foreign parts of doubtful quality, and the installation starved until it is unable to operate efficiently, and an apparent gain becomes an actual loss.

Owing to the heavy service demanded from an accumulator in use underground, it must possess additional characteristics to those needed for ordinary service: Strength is an important feature; accessibility is very desirable, also visibility of the electrodes; repairs should be easily carried out, the attention demanded as little as possible, and not skilled. The lead-acid and the alkaline types differ widely in construction, characteristics, and performance. The most familiar and widely used type is the lead-acid; when used in a miner's lamp special designs are necessary; for example, the grids of the "Ceag" electrode are triangular in section with the apex towards the inner side, to secure the active material safely. Whilst flat electrodes give more active surface area for a given space, circular concentric electrodes are simpler in construction and inherently stronger. The cost of upkeep is greatly increased if the acid is not prevented from leaking or creeping, and the three general methods of approaching the "unspillable" ideal are the provision of tortuous passages for the gases, the "inkbottle" principle, and "jelling" the electrolyte.

In practice gassing chambers require constant attention to prevent them becoming filled with acid, when leakage occurs. The "inkbottle" principle (the provision of space above the electrodes to hold all the electrolyte when the accumulator is reversed, the gassing tube being above the level of the acid in every position) necessitates a larger container, and is effective when kept in good condition. "Jelling" the electrolyte is the nearest approach to the ideal; not only is there no leakage at the inlet or gassing vents, but creeping and leakage at the joints, or minute cracks, are avoided and surprising results have been obtained by the use of "Jellac" (the "Ceag" semi-solid electrolyte). The consumption of spare parts has, in some instances, been cut down to half, and, in addition, the lamp operates much more reliably.

Owing to the higher internal resistance when a "jelled" electrolyte is used, the capacity of the accumulator is slightly reduced, but this is more than balanced by the saving in spare parts and the cleaner and regular operation. Another effect is a more even length of life of the electrodes, the negative having a shorter life than when free acid is used. Both electrodes are generally changed at the end of 12-15 months' service, this period being a fair average. With free acid the positive and negative electrodes are changed at different times owing to the irregular life and the maintenance is not so simple as in the other case, for the free-acid accumulator must be closely watched and topped up to compensate for the escaped acid, but the attention required by the "jelled" accumulator is regular and pre-determined; this means that a simple routine can be followed and the work systematised and simplified.

Another type for which rather startling claims have been made is the alkaline accumulator, which is inherently much stronger than the lead cell, owing to the steel electrodes and container, which also enable it to stand short-circuits and rapid charge and discharge. For many duties these features are desirable, but for lighting a miner's lamp they are of little value, as short circuits very rarely occur, and the rate of discharge and charge does not vary. The voltage of each cell is 1.3, so that the usual standard unit is composed of two cells and the voltage of the battery is therefore 2.6 volts. The discharge curve is comparatively steep, particularly at the commencement, with the result that when used in a miner's lamp the bulb is working at a higher voltage at the beginning of the shift. This means that the bulb is over-run at the first stage, or is not operating efficiently over the greater portion of the discharge, see fig. 1. The watt-hour efficiency is much lower than that of the lead-acid accumulator; although this, in itself, is not an important factor as the cost of current is rarely considered, it has an effect on the initial cost of the charging equipment. Owing to the high internal resistance the final voltage of the battery when on charge is nearly 3.6 volts, so that on a 110-volt circuit only thirty alkaline cells can be charged in series, whereas the same equipment would be suitable for forty of the lead-acid type. The initial cost of the battery is also high, being approximately three times that of the other type.

The bulb is the next component of fundamental importance. The bow-shaped filament seems to be now universally adopted as the simplest and strongest design. The modern bulb is a reliable and efficient component; there is, however, one important factor that might well be considered, and that is the relation between the watts per candle and the length of life. The higher the watts per candle, the longer the life; in other words, the higher the illuminating efficiency the shorter the life, and the most serviceable bulb is a compromise between these factors. A bulb working at about 1.9 watts per c.p. has an average life of 500 burning hours, and this is the usual rating. Another interesting relation is that between the applied voltage and the candle power of a bulb. Fig. 2 shows that for an increase in voltage the increase in candle power is more than correspondingly great. It follows that the c.p.-time curve is an exaggerated copy of the discharge curve, showing the importance of an even discharge voltage.

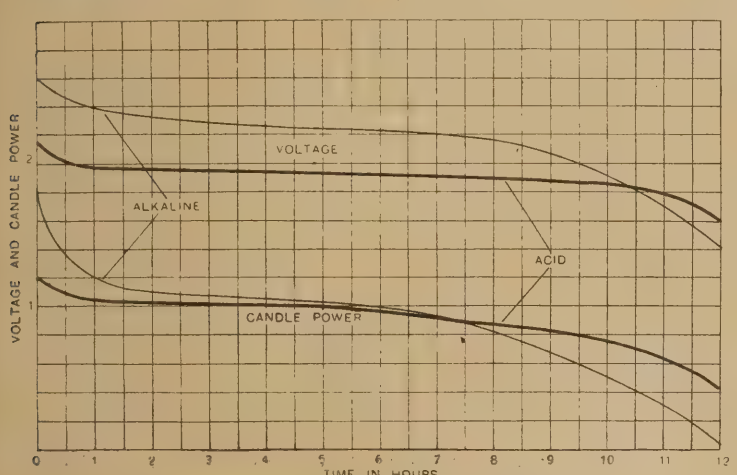


Fig. 1.—Discharge Curves of Miners' Electric Lamps; equal size, and bulbs of same efficieney.

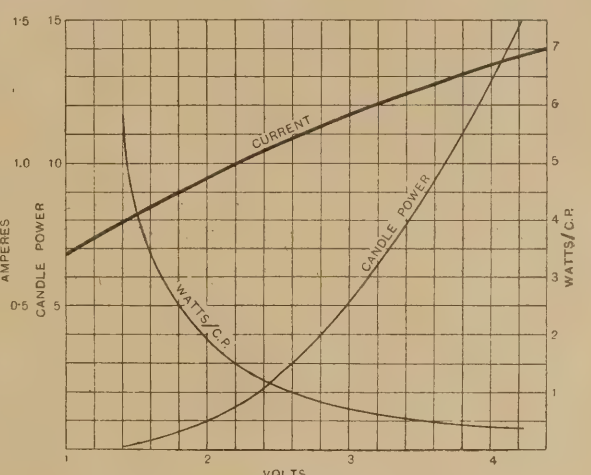


Fig. 2.—Characteristic Curves of 2-V Miners' Lamp Bulb.

There are two alternative methods of securing the lamp parts together: the Oldham lamp is a typical example of machine-operated screw-thread joints, and the "Ceag" lamp an example of the application of the bayonet joint. An interesting speed joint is the "Ceag" ratchet retaining ring: To remove the wellglass and bulb the ring is given a quarter turn with a small hand key and the fittings are available without further dismantling. A recent development in the direction of quick operation of components is the Oldham "snap-on" lid, which enables the electrodes to be taken out and the cell case cleaned out in a very short space of time, as the lid is removed by a simple machine. The lid carries an annular ring with a groove in the periphery, and when pressed on to the case, expands it past the edge of the ring when it closes into the groove; a rubber ring in the groove makes a leak-proof seal.

The "Ceag" quick-action lid operates on a different principle: Three lugs on the lid are so designed that by pressing the lid on the case they drop into internal slots, definitely locating and retaining the lid in position. The accumulator is made unspillable by the provision of a groove in the lid which holds a special composition. As the case fits into the groove a light leak-proof joint is made, although, as "Jellac" is used, this is not essential. When the lid is given a twist, the lugs disengage and allow the removal of the electrodes whilst still on the lid. It is not necessary to remove the contact nuts, so that the time needed for dismantling is reduced to the minimum.

One of the chief advantages of an accumulator which can be rapidly dismantled is that there is more encouragement for the lampman to give it regular periodic attention. This is most important; if inspection and cleaning can be performed without much trouble there is more probability of it being done

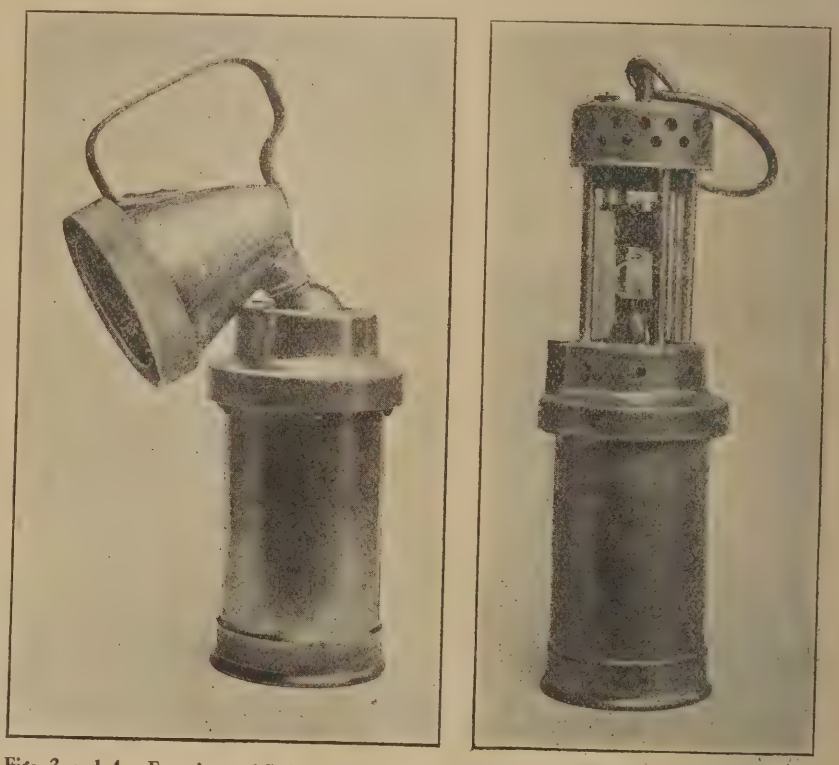
at the correct time. Particularly in the case of "jelled" electrolyte, topping up should take place at least every fortnight, and attention given to this will lengthen the time before cleaning out is necessary and keep the accumulator in a healthier condition. Differences between the upkeep costs of installations using the same type of lamp are often attributable to lack of attention to these points.

In the two-piece lamp, the accumulator is made an integral part of the bottom case. This reduces the number of parts to be handled to two, but any advantages due to the increased speed in handling must be weighed against the disadvantages of not being able to see the condition of the accumulator, corrosion of the bottom casing, and the fact that spare accumulators alone can not be carried. One method of making an ordinary lamp into a "two-piece" lamp is to fasten the accumulator into the case with paraffin wax, which has been adopted in the Bruay mines in France, where it has apparently proved successful. As a semi-solid electrolyte is used, there is no trouble from leakage and less attention is required.

The electric lamp is inherently a safe lamp, but under certain conditions it is possible for the glowing filament of the bulb to ignite gas. To remove any possibility of damage the "Ceag" lamp is fitted with a safety fuse: The bulb has a taper socket and a central contact, making connection with a spring inside the reflector. An opposing spring fits over the pip of the bulb so that the bulb is carried between two springs, which protect it from bumps and jolts. If the outer glass should be broken the bulb rises and with it the bottom spring, which makes contact with the reflector, short-circuiting the accumulator and causing a tiny fuse in the reflector to isolate all the exposed parts, so avoiding any danger from ignition.

Objection was at first taken to the "pillarless" lamp on the ground of the apparent unprotectedness of the wellglass, but in practice it has been proved that this is an asset, as the lamp receives more care for this reason, and breakages are not increased, in some cases they have even been reduced.

To meet the demand for more light, a 4-volt lamp was introduced by the Ceag Co. Two of the ordinary circular accumulators are carried in an aluminium case and, by means of a simple arrangement in the lamp top, are automatically connected in series; it is made impossible to close the case if they are not placed in the correct way. The standard 2-volt fittings are used, including the safety fuse, and when used with the reflector down, a beam of 12 candle power is thrown forward, approximately four times the light given by the 2-volt lamp. Cap lamp reflection is much more effective than when the reflected light has to pass through thick wellglass, distortion due to refraction being considerable. If a white enamelled reflector, or one of frosted aluminium, is used, the distribution of the light is even and free from bright spots. In view of its many advantages it is surprising that its general use is confined to Scotland. Its restriction to this area is apparently due to prejudice.



Figs. 3 and 4.—Experimental Swivelling (left) and Gas-detecting (right) Miners' Electric Lamps.

To secure the increased efficiency of reflection given by the cap lamp, and be able to throw the beam in any desired direction—up or down and all round without any connecting wires—sounds like an ideal, but a lamp which fulfils these conditions has been designed. It has not yet made its appearance in public, and for the first time the details are now available: A head-piece, similar to that on the cap lamp, but larger, carries a lens and reflector. At the base of this is a ball joint which fits into a corresponding concave facing in the lamp top, fig. 3. This ball is split and the two parts are insulated, contact being made inside the lamp top. No live part is outside the lamp top, and as the spherical ball gives a universal movement, the light can be thrown in any direction; the collier can hang up his lamp and direct the beam on to his work. This is the nearest approach to the ideal in reflecting efficiency, and its tests underground will be watched with considerable interest. The design has been developed by the Ceag Co.

An electric lamp that will detect gas must be reliable, simple, and capable of being handled by the collier as easily as the lamp he is accustomed to use. A lamp, fig. 4, which approaches very closely to this ideal is now undergoing severe tests underground, and has so far justified the hopes of its sponsers. The principle on which it operates is simple: an ordinary electric safety lamp fitted with a special wellglass, carries above the bulb a small oil lamp; by the provision of double gauzes at the top and bottom the flame is made quite safe and the lamp is lit by a platinum filament. For general usage the ordinary electric bulb is used; when a test for gas is to be made, the light is switched off and, by rotating the lamp case, connection is made with an additional pair of contacts on the insulating plate. Current from the accumulator then flows up the supporting columns to the platinum filament, so igniting the wick of the small oil lamp. The current is then switched off, and the oil flame continues to burn, being regulated externally by a variable sleeve over the wick tube. The test for the presence of gas is carried out in exactly the same way as when using an ordinary oil lamp, and therefore requires no additional skill. Rigorous tests at collieries in different parts of the country will result in various minor modifications being shortly embodied. The manufacturers hope by this to go a long way towards solving a very old problem in a simple manner.

Reviews.

The Dynamo: Its Theory and Manufacture. Vol. III. Alternators. Sixth Edition. By C. C. HAWKINS, M.A.; M.I.E.E. Pp. xviii+572; figs. 710. London: Sir I. Pitman & Sons, Ltd. Price 30s. net.

The many earnest students of electrical machinery who have long awaited this—the concluding—volume of the latest edition of "The Dynamo," will not be disappointed, for the author is to be as heartily congratulated on this as on the earlier volumes. The new edition, however, has not been a matter of mere revision; in the present volume the subject of alternators has been treated in such a manner that we really have a new book before us. For example, the modern turbo-alternator, having reached the premier position among generators, is dealt with accordingly.

In the treatment of alternator armature windings, with which the book opens, no great degree of novelty is found or is to be expected. But when the e.m.f. induced in a loop on a toothed armature comes to be considered, an original method of explaining tooth ripples is introduced. For this purpose, a tooth cycle is divided into quarter stages, and the average e.m.f. induced per stage is deduced from the flux embraced by the loop in these positions. The results are interesting and it is to be hoped that designers will test this mode of attack by comparing curves thus predetermined with oscillograms.

A long chapter deals very fully with armature reaction in both salient-pole and non-salient pole alternators. The author is a firm believer in Blondel's two-reaction method of dealing with the effect of armature reaction in alternators for the purpose of design; he strongly maintains not only the accuracy of the method, but also its extreme simplicity. It is true that the formula for the direct (magnetising) armature ampere-turns is a little more difficult of establishment in the first instance, but this done it is only a question of inserting values. Starting on this basis, the writer has been at pains to calculate curves to be used for determining the regulation of alternators based upon the Blondel diagram instead of upon the simple triangle of magneto-motive forces. The latter method, so often used by others, including the reviewer, is strictly correct only for the ideal turbo rotor with uniformly slotted rotor and constant air-gap. As, however, modern practice has departed from the ideal by the adoption of non-slotted pole-centres, it will be seen that there is something to be said for the author's point of view.

The value that may be reached by the stator current on sudden short-circuit is discussed at some length, and in its pre-determination the author follows the simplified method in

which the resistances of the stator and rotor windings are neglected. The approximate result thus obtained is therefore a maximum which cannot be exceeded.

After further details of armature and magnet construction, the design of the salient-pole alternator and of the turbo-alternator are in turn considered. In the latter much space is devoted to a careful pre-determination of the full-load flux curve, the method employed being essentially the same as that set forth by the author in "Papers on the Design of Alternate-current Machinery," in conjunction with Mr. S. Neville, where it is used for the no-load condition. In the calculation, the fundamental of the flux curve is adopted as the origin of the specified e.m.f.—a process that will be found to make an appreciable difference in the actual maximum density.

An exhaustive study has been made to trace the air-flow in a turbo-alternator and to draw up a balance sheet of losses and rises of temperature

For the determination of the critical speed of the turbo-rotor, a new method of treatment is suggested. The author truly points out that when the rotor is still in the design stage nothing is known about the degree of mass eccentricity that may afterwards be found to exist in the finished rotor; consequently it is a waste of time to start from anything but a perfectly balanced shaft. For such an ideal shaft it is necessary to find some unique property, and it is argued that this may be found in a particular shape for the deflection curve, which the author determines by a process of trial and error.

The last chapter on the parallel working of alternators is a splendid example of the thoroughness of the author's work. Newer features in this connection are the treatment of two alternators when paralleled with unequal frequencies, and the action of damper windings in salient-pole machines in contradistinction to that in non-salient-pole machines.

Modern design is well illustrated with examples by such makers as the General Electric Co., Witton; Metropolitan-Vickers Electrical Co.; Société Alsacienne de Constructions Mecaniques; and the General Electric Co., of America.

Apart from the features to which special attention has been drawn above, the reader will find that the author has spared no pains in his endeavour to keep the book suitable for students and at the same time abreast of modern practice and theory. We know of no writer on electrical machinery whose work is more deserving of the title "classical" than the author of "The Dynamo."

Many of us pride ourselves on possessing the three volumes of Mr. Hawkins's work, but the permutations and combinations of the title on the cover backs do not appeal to an artistic taste. Though the publisher keeps the same position for his name, he does not use the same type.

Continuous Current Circuits and Machinery. By JOHN H. MORECROFT and FREDERICK W. HEHRE. Volume I. Pp. 467; figs. 377. London: Chapman & Hall, Ltd. Price 20s. net.

Professors Morecroft and Hehre, both of Columbia University, have collaborated to provide a volume on the direct-current side of electrical engineering that should prove of great value as a text-book in engineering classes. They very justly claim that the material here presented "seems to be about what the average engineering student wants whatever may be the branch of engineering in which he expects to specialise." It would also be an excellent book to put into the hands of any well-educated youth who is just starting upon an electrical apprenticeship, as it deals with the why and wherefore of the construction of electrical machines in an exceptionally clear and sensible manner.

In the early chapters dealing with electrostatics and simple current phenomena, the electron theory is used and the subject is viewed very largely from the electron standpoint. The chapters on electromagnetism, the electric circuit and self and mutual induction, also bear evidence of the hand of the experienced and painstaking teacher. The last-named section is especially well done, excellent use being made of oscillographic representations of inductive phenomena.

The treatment of practical subjects, such as meters and batteries, is equally happy and leaves little to be desired either in choice of subject matter or method of illustration. One curious little slip occurs in the description of the depolarisation of a battery: "this extra substance is generally an oxidising agent, to reduce (*sic*) the hydrogen set free at the positive pole of the battery: it is called a depolariser."

The best chapters in the book are those dealing with the dynamo electric machine. The first of these treats of the various parts, their functions, material and construction, and the reviewer has certainly never read a better account of the make-up of a dynamo. Not only are all the parts described and illustrated most carefully, but the general principles governing the design of electrical machines are explained by reference to actual calculations of their magnetic and electric circuits. The second chapter covers the subjects of commutation, field distortion, armature reaction, characteristic curves of shunt, series and compound-wound generators, and the parallel operation of generators. Then follows an equally comprehensive treatment of the direct-current motor and a chapter on efficiency, heating and rating—an excellent *vade-mecum* for the test-bed.

A chapter on Auxiliary Apparatus includes a general survey of switchgear, meters and regulators, and has also brief accounts of automobile starting and lighting equipment and electric welding—the latter appearing a little out of place in this particular chapter.

A very practical section on the location and cure of faults in electrical machinery completes the text book proper, and then follow a series of fourteen experiments in which the whole subject matter of the book would appear to be adequately reviewed by means of actual laboratory tests on generators, motors, meters, batteries and all the usual auxiliary apparatus found in a well-equipped electrical laboratory. The whole book has been thoroughly well done: it is in every respect a credit to its authors and is likely to find a wide field of usefulness on both sides of the Atlantic.

P. H. S. K.

Talks About Wireless. By Sir OLIVER LODGE. Pp. xiii+251. London: Cassell & Co., Ltd. Price 5s. net.

A new book by Sir Oliver Lodge is wont to receive a hearty welcome by a large circle of readers, and his "Talks about Wireless" will prove no exception. It is written for the people, simply, broadly, and large-heartedly. The Ether figures prominently, as one would expect, and Sir Oliver here clears away, once for all, the no-ether cobweb which has been spinning lately in the mind of the man in the street.

Part I, entitled "Radio in General," consists largely of a valuable, because authoritative, historical record of the early days of wireless. All non-essential details are omitted, the outstanding facts and the outstanding men alone are mentioned, and it is indeed pleasant to find full tribute paid to one great pioneer whose name is often omitted in this connection—Sir William Crookes. Sir Oliver's summary in a single paragraph on pages 46-47, in which are mentioned only three names, Maxwell, Hertz, and Marconi, might well be learnt by heart by all those who are accustomed to grapple with the distressing question: "Who Invented Wireless?"

Professor Elihu Thomson's claim that the Heaviside layer is unnecessary to explain transmission, is discussed generally, and though Sir Oliver says that he has "nothing dogmatic to say about it," it is clear that he certainly does not endorse that view.

Part II, entitled "Details that make for Efficiency," consists of an explanation of what should be done to minimise losses, and as an extreme case the author even visualises the possibility of immersing the receiving set in liquid hydrogen or helium, though, as he says, "such an arrangement could surely never be more than a curiosity." We notice that in considering the "Plain Aerial" from a theoretical point of view Sir Oliver concludes definitely that that system should be used for transmitting the S.O.S. signal, but in point of fact, as most of our readers are aware, it is not so used as practical considerations have been found to outweigh these theoretical advantages.

Part III, entitled "Calculations for Amateur Constructors," consists mainly of simple calculations of inductance and capacity, and is noteworthy for the fact that it is shown how simple these calculations become when the units of capacity and inductance are taken as lengths. For instance, what could be simpler than $L = 3\ n\ l$, the expression given for the inductance of a coil wound so as to give to that inductance a maximum value for a given length of wire?

Sir Oliver sends out this book as "a message of greeting to the great army of wireless amateurs and experimenters," and he may rest assured that his greeting is valued and welcomed by us all.

Electrical Engineers' Data Books. Edited by E. B. WEDMORE, M.I.E.E., F.Inst.P. Vol. III. Radio Engineering. (With Special Sections on Telegraphy and Telephony.) By J. H. REYNER, A.C.G.I., B.Sc. (Hons.). Pp. xxii+412; 314 illustrations. London: Ernest Benn, Ltd., Radio Press, Limited. Price 15s. net.

This is the third volume of the series of data books planned and edited by Mr. Wedmore, director of the British Electrical and Allied Industries Research Association.

In books of this description, where the aim is to give useful up-to-date data in a form convenient for practical application, it is all to the good if the author himself has had a wide practical experience of the subject in addition to sound theoretical knowledge.

Mr. Reyner possesses both qualifications in a marked degree, as, after a distinguished University career, he was employed for several years as a wireless engineer in the Post Office, and has recently joined the editorial staff of the Radio Press. He has thus acquired by practical experience a knowledge of just the sort of data required by professional radio engineers and amateur experimenters, and has produced a book of reference which will be found of great value to both these classes of practical workers in radio-telegraphy and telephony.

In this country, line telegraphy and telephony are a government monopoly, so that the section dealing with these subjects is confined to only 40 pages, and deals solely with matter which is of special interest to radio engineers, references being made to sources of more detailed information, should such be required.

The radio section proper, which takes up about half the book, is divided into sections, which deal, respectively, with calculations and measurements, tuning and radiation, thermionic valves, transmitters, receivers, masts and aerials, and miscellaneous data

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The Appendices deal with mathematical, electrical, mechanical, and physical tables, electricity and magnetism, and wiring rules and regulations.

A certain amount of descriptive matter is included to make the data applicable to new developments, and frequent references are made to publications where fuller particulars can be obtained.

Wherever tested, the information given has been found accurate and up to date, except, indeed, that it has been noticed that no mention is made of the new method of applying inductive loading to submarine cables, an improvement which bids fair to change the whole scope of cable communication, and in the short-wave section, the statement that "perhaps the chief advantage of the system lies in the entire absence of any atmospheric disturbances on these wave-lengths" can hardly be justified by the results hitherto obtained.

There can be no doubt that Mr. Reyner has succeeded well in achieving what he says is the primary object of the book, *viz.*, to be "a handy volume of reference which will be indispensable to everyone concerned with the technique of radio."

Electric Lighting and Power Distribution. By W. PERREN MAYCOCK. Ninth Edition, revised and enlarged by C. H. YEAMAN. Volume 2. Pp. 600; figs. 365. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

Few men have exerted so powerful an influence upon the methods of teaching electrical engineering as the late Mr. Perren Maycock. His books made an immediate appeal to the practical type of mind and provided a welcome alternative to the heavy, academic treatment of the subject so commonly found in the text books of twenty years ago. It would have been a pity indeed to allow so valuable a series of books as those which came from the pen of Maycock to fall into desuetude for lack of the constant revision and enlargement necessitated by the rapid growth of the subject, and the completion of this new edition of what was possibly his most important and valuable work is a matter upon which both publishers and revisers are to be congratulated.

Although the old sky-blue covers have given place to a more serviceable and pleasant green, Mr. Yeaman has well maintained the mode of presentation of the original author and has certainly brought the book thoroughly up-to-date. This volume contains eleven chapters, of which the first two deal with direct-current dynamos and motors and appear to be something in the nature of an overflow from Volume I. The six main chapters, however, are concerned with alternating currents and constitute a very well-balanced account of the subject. A.c. principles, a.c. circuits, alternators, transformers, a.c. motors, and a.c. distribution, are dealt with in turn, and each section is well illustrated by many worked examples and clear line diagrams.

In addition, there are chapters on batteries, meters and systems of distribution of direct current. The book is rounded off by the inclusion of a list of a hundred books for further study and a remarkably complete index both to the letterpress and the illustrations.

P. H. S. K.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Rural Electricity Supply.

I was very much interested in Mr. W. W. Clarke's letter of the 8th inst., on the subject of wayleaves, and perhaps the following notes on my own experience may prove of interest.

Owing to the fact that many of the large estates are split up into small holdings, even a short line usually means a dozen or more landowners. When the line runs into miles, the work of getting wayleaves becomes, as Mr. Clarke says, of great importance. That this is a difficult job cannot be gainsaid, for if the line is to be erected at a reasonable figure for wayleaves, the hapless individual whose work it is to get them signed is in the unhappy position of a person asking favours with nothing to offer in return.

I agree with Mr. Clarke's suggestion that the standardising of pole rentals would simplify matters somewhat, but even this would not eliminate the annoying delays and expense of inquiries. I would further suggest that a committee be formed to inquire into what is a reasonable figure per pole, which could be applied generally, and then that compulsory powers be vested with the supply authorities for all cases where a line is to be erected for the public benefit. Probably there are numerous ancient statutes which have prevented this course being taken already.

In the actual work of obtaining signatures to the wayleave agreement, many lines of argument occur to one, but it can be safely said that there is no certain way to success. After a first interview the line to be followed will vary according to the temperament of the person dealt with.

Personal experience has convinced me that nothing is to be gained by trying to persuade a farmer that you are doing him a good turn by sowing his land with poles, even if the annual crop is unaffected by adverse seasons. Another method I found of little use is to try to point out that the rental paid for so many square yards occupied by the poles is far greater than that which would be paid for an equivalent area leased to a tenant. Poles other than those in hedges are in the farmer's way, and a knowledge of the cost of farming operations is desirable in such cases.

In tackling a new line every effort should be made to create a good feeling between the authority and the landowner, avoiding if possible all hints of what will happen should the landowner refuse to sign. The difficulties of any other route but the one decided on should be quietly emphasised, and a little sympathy with the landowner and his unfortunate position in the line of route is not wasted. A few general remarks as to the benefit gained from a supply of electricity to the countryside, and tactful illusions to the fact that the landowner in allowing the line to go over his property is a benefactor to mankind, sometimes work wonders. The above generally constitute the method adopted in successfully negotiating the wayleaves for a number of lines with rentals as low as 1s. per pole.

At the best, however, the work takes a long time, with numerous interviews and the use of unlimited patience and tact and with very little thanks from the powers that be. It can only be relieved by further powers being given to the supply authorities.

Harry G. Steel, A.M.I.E.E.

Tynemouth, *December 20th*, 1925.

The scant reference which is made to "wayleaves" in both the technical and daily Press makes Mr. Clarke's letter in your issue of December 18th particularly interesting. Also his suggestion for a standard rental; but might I suggest that the proper term is "Standard" standard rental.

I agree with your contributor that there is a great temptation to which authorities sometimes succumb to increase the price in isolated areas where the landowner is more than usually hostile or when wayleaves are nearly completed. Often this increased price represents a large sum which is in the nature of a gratuity, but that is from thenceforward quoted as a standard by the potential granter of wayleaves, and in this way the average rental throughout the country is gradually forced higher. Morally, the practice of varying from the standard price is a sin against other authorities as well as against the guilty ones. Each authority has its own opinion as to the meaning of "standard."

Strictly speaking, I suggest that this national standard rental should be nil or that of a peppercorn given annually, and the only payments that can in any case be justifiable are those of compensation for the amount of land that goes out of cultivation due to the presence of the pole legs; an annual sum to cover the cost of hand labour on the diamond-shaped piece of land which machines must avoid; and a small sum to cover extra work to the farmer due to reinstatement after pole erection. I estimate these items to be respectively 3d. (assuming an area of .121 square yard with 10-in. diameter double poles and land worth 2s. 6d. per square yard); 9d. in the second case, and 3d. in the third case (assuming initial cost of 10s. spread over the life of the pole).

Therefore this electrically optimistic total is that of 1s. 3d. per double pole per annum for the worst position. Of course the farmer will say that he ought to be paid for the fact that he is more unfortunate than his neighbour, who has no poles inflicted upon him, and for the offence to his sense of beauty, but since fields are not particularly chosen and this sense of æsthetic beauty usually proves to have a value which can be numbered in shillings, I feel justified in saying that no payment should be permissible on sentimental grounds. Even power companies prey upon themselves in this matter. A case occurred some years ago in which an authority applied for wayleaves for sixteen poles—offering of course its standard price—to a landowner closely connected with another company. In reply an answer was received that "the wayleaves would be granted only at a price 25 per cent. in excess of the above, and provided the latter company's standard wayleave form—enclosed—was used." On this was a printed clause which stated that a sum of shillings *which was 50 per cent. of the standard price offered* was paid for all poles (A or H) with stays and wires attached!

It is the range in the scale on which wayleaves, in the various parts of the country, are paid which varies from 6d. to 15s. per double pole, that compels me to ask Mr. Clarke to define more fully the term "standard rental." Assuming that he is connected with a company whose lines are proving highly remunerative immediately, having a comparatively high load factor, and who pay a high rent per pole (my knowledge of wayleaves is that the higher the standard price paid the less easy it is to obtain wayleaves, since the principle of "biting the hand that feeds" applies here) he will have to take into account those authorities who, on rural work, for instance, pay a very much smaller figure, which is necessitated by the ratio between expenditure and pole rent, and income from the line. A country line in rural work is a far more speculative proposition than a line which is perhaps erected to give a bulk supply previously authorised by the Minister of Transport. Anything more than the fixing of the standard by Act of Parliament, such as the power to be given to authorities to force the poles at this standard price, is a serious and drastic step. But if this is not taken it will merely mean that one will be forced to negotiate wayleaves at a possibly lower price than one is authorised to give now, when the last state would be worse than the first. I agree that it would do away with that bugbear of precedents quoted, often invented, of the higher prices which so-and-so gave for their poles, and I would only make

the stipulation that once the standard is fixed it be a punishable offence for more to be offered in any circumstances.

Wayleaves and wayleave assistants are the "salt of the earth," and Mr. Clarke's plea for more publicity is both timely and necessary. After all, his sometime despondency and feeling of incompetence are things which I know his brother wayleave assistants share in common. Perhaps the Electricity Commissioners will again consider the matter for us. At a meeting in London last week the head of one of the largest supply authorities stated that "wayleave difficulties and stringent regulations had made them give up overhead work." Such a statement makes one think furiously as to methods which can be adopted to obviate these difficulties, and if the principle suggested by Mr. Clarke can be shorn of the many pitfalls that beset it I feel sure that he has done the electricity industry in general, and all of us, a good turn by inviting discussion on the matter.

J. A. Sumner.

Northwich, *December 21st*, 1925.

Honesty in Advertising.

It is the duty of every man or company with anything to sell to advertise it to the best possible advantage. But it is also their duty to be accurate and not emulate the methods of quack medicine proprietors.

One of your advertisers in this week's REVIEW claims to make one in four of the a.c. industrial motors sold in this country. With as much knowledge of the subject as they have I would guess that they don't make one in ten. It is a guess on both sides as there are no available statistics, but they could make a start by issuing a chartered accountant's certificate as to the number they make.

The same firm, however, in an earlier advertisement (September 18th, 1925) are on more certain ground, although not more inaccurate than the above. They state that motors not manufactured on their "thorough" system "may" take 15 per cent. more current, presumably for the same duty, and cite as an example a 100-h.p. motor. From a well-known firm's catalogue I find that a four-pole, 50-period motor of this capacity has an efficiency of 90.5 per cent. with a power factor of .92. For 100 h.p. this means an input of 89.5 kVA, or 103.5 amperes at 500 volts. As this motor is supposed to take 15 per cent. more current than the advertised motor, the current for the latter would be 90 amps., or 76.9 kVA, which gives an efficiency of 97 per cent. at unity power factor, or perhaps if the power factor is less than this the efficiency may be a "leading" one.

I hope other engineering concerns will not take this form of advertisement as an example to copy. Truth in advertising all the time!

Truth.

December 18th, 1925.

Choosing and Using an Electric Washing Machine.

I am stating the opinion of several of your readers when I express surprise that you have given up so much of your valuable space to boosting a gas-consuming apparatus because it happens to be compelled to use a tiny electric motor for the really *essential* part of its operation.

Will the next step be a description of gas cooking and heating installations because they have to use electric fans to take the fumes away? Perhaps the gas journals will reciprocate by giving laudatory notices of electric grills if the old fish-tail burner is left alongside.

We are getting rather an overdose of gas just now. We had more than a whiff at the B.E.A.M.A. dinner. The tap was turned on at the last Institution meeting, and now our very own ELECTRICAL REVIEW is making us swallow the beastly stuff.

To get back to our muttons—if washing machines should have heating arrangements attached to them (a point which seems to have escaped the 4,000,000 users referred to on page 967) why should not the heating medium be electricity? Some of us object to having a poisonous high-explosive in our houses.

E. E. Sharp.

London, *December 21st*, 1925.

[We refer to this matter in our leading columns to-day.—EDS. ELEC. REV.]

Super-Station Switchgear.

The article on this subject in the ELECTRICAL REVIEW of December 18th contains a number of very sweeping statements which, in the opinion of the writer, are not strictly correct, and for this reason should not go unchallenged.

A consideration of the oil circuit breakers built by the five main switchgear manufacturers in this country will show that the clearances in air, and oil, tank sizes, quantity and head of oil, rupturing speed, &c., are very similar for a given rating. The cubicles, trucks, and cellular structures manufactured by these concerns are so much alike in construction and arrangement of gear that it is difficult to tell one make from another without reference to the nameplate.

The actual lay-out of switchgear for large power stations in this country follows very stereotyped lines except in cases where it has to be arranged to fit into a certain space.

Under these circumstances it is difficult to condone the author's statement that there is no unanimity of opinion as to the design of oil circuit breakers, or the physical design and lay-out of switchgear, and it certainly does not support his suggestion that the design of switchgear is a matter of guesswork only.

The author states that the isolated-phase arrangement of switchgear is no more expensive than the usual cellular type from a space and building point of view, and suggests that a duplicate busbar, duplicate oil switch method of control, arranged on the isolated-phase system, is a panacea for all ills, remarking that no expense is too great to expend on control gear in continuity of supply can be assured.

It has been generally agreed that the isolated-phase arrangement of switchgear requires more space, and hence is more expensive, than the usual cellular type; more especially where duplicate circuit breakers are employed. This appears to be the reverse of the author's experience; however, he will agree that from a space and building point of view at any rate, there is nothing to approach the duplicate busbar, single or duplicate oil circuit breaker compound-filled units which can be obtained in this country, and which have made a very prominent position for themselves in power-station service.

G. L. E. Metz.

Birmingham, *December 20th*, 1925.

Assisted Wiring.

"Manufacturer's Salesman" is suffering from a complaint well known in the electrical industry. I call it "Grumblitis"; it is diagnosed by a general wail, and ignorance of the real facts of the situation, as well as a "Funk-Hole" *nom-de-plume*.

Mr. Tate, who speaks with a deep knowledge of the contracting side of the industry and with authority, has definitely stated that he is in agreement with the assisted-wiring scheme as adopted in South Shields. I know many contractors who are also in agreement with the scheme, and have heard only one speak against it, and he had a temporary "bee in his bonnet."

May I ask "Manufacturer's Salesman" to consider for one moment who has been chiefly responsible for developing the installation side of our industry for the last thirty years.

In the United States the most successful supply companies have, from experiment, found it better to use the contractor than to execute their own installation work.

Your correspondent mentions the absence of contractors in the gas industry. He is still blind to the fact that that is of tremendous advantage to the electrical industry. How many gas users visit gas showrooms, or even see them or anyone representing the gas industry? Have the gas monopolies many independent people outside themselves with a practical knowledge of gas to put in a good word for it?

The great British public has a profound dislike for a complete monopoly, as most thinking people already know.

It can be proved conclusively that immediate co-operation between all sections of our industry is the shortest cut to sound development and success.

Contractors as a body will co-operate to-day.

Will the others?

H. T. Young.

London, *December 19th*, 1925.

Replies to Correspondence.

May I ask employers who reply to advertisements in your "Situations Wanted" columns, asking for references, &c., to acknowledge receiving them and to state if there is a possibility of the applicant being suitable for the position they have to offer?

I have had two experiences lately in which this has not been done. In one case references, &c., were sent, and nothing further was heard. In the second instance, after an interview when apparently everything was satisfactory, I was told that a letter would follow in the course of a few posts. It, however, did not arrive, and a letter sent to them a fortnight after the interview, asking how the matter stood, was not even answered.

Only those people who are seeking a job know the anxiety of waiting for the postman and the disappointment when he passes the door.

Dri Cell.

December 14th, 1925.

Will "Combustion Engineer" kindly send us his name and address?—EDS. ELEC. REV.

Survey of the National Coal Resources.—An important part of the work on fuel research undertaken by the Department of Scientific and Industrial Research is a survey and classification of the coal seams in the various mining districts.

Committees have for some time been actively at work in the Lancashire and Cheshire and in the South Yorkshire areas. The Department recently appointed a committee for work in the North Staffordshire area. A further committee has now been formed to deal with the survey of the coalfields of Scotland. The Coal Owners of Scotland and the Mining Institute of Scotland are co-operating in this work.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The "Electrical Review" Index.—The Index for the last half-yearly volume of the ELECTRICAL REVIEW (July to December), will shortly be published. Copies will be forwarded post free to those requiring them for binding or for reference purposes, if they will make application to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.

British Patents in 1925.—An estimate of the number of patent applications filed at the British Patent Office in 1925 brings the total up to about 35,000, of which about 12,250 relate to motor vehicles and internal-combustion engines. Messrs. Hughes & Young, patent agents, state that a noticeable feature of the inventions relating to motor vehicles is the large number of patent applications relating to devices for reducing the dazzle or glare of headlamps. In the latter part of the year a large number of patent applications were filed in connection with wireless apparatus. At least one-quarter of the applications filed last year came from the United States and Germany.

The Danish Electrical Market.—In a recent survey of the market for electrical appliances in Denmark, *Commerce Reports* states that the popularity of vacuum cleaners is growing, the market being dominated by Swedish, Danish and German makes. Irons are also used to a large extent, most of them being of home manufacture. Apart from these two items there are few applications of electricity which enjoy a wide use. Electrical household appliances are in most cases bought direct from the foreign manufacturer. The retailers buy from the importer, who is usually also the wholesaler, and generally situated in Copenhagen. Local firms, when undertaking the representation of foreign firms, usually require this to be exclusive to them for the whole of Scandinavia, but experience has proved that it is more satisfactory in most cases to grant a Copenhagen agent the exclusive right for Denmark only.

An E.D.A. Film Display.—The British Electrical Development Association organised a display of electrical films at Australia House recently. These depicted in a very interesting manner the production of electrical goods at the works of leading British manufacturers and also presented palatable propaganda for a number of applications of electricity. The works films included the Rugby works of the British Thomson-Houston Co., Ltd., and Messrs. Johnson & Phillips, Ltd. Two films taken under the auspices of the General Electric Co., Ltd., showing electricity at work in the home were also exhibited, while a Vickers film showed erection work in progress at the Fulham electricity works.

Strowger Automatic Telephone Manufacture.—During 1925 the following Strowger equipments were completely manufactured in Liverpool at the works of the Automatic Telephone Manufacturing Co., Ltd., and installed for the Post Office. The number of lines is given in parentheses:—York (1,700), Headingley, Leeds (1,300), Stanningley, Leeds (800), Roundhay, Leeds (900), Chapeltown, Leeds (1,300), Torquay (1,230), Paignton (690), Newport (extension) (600), Cwmbran (80), Risca (60), and Leeds, 10 trunk equipments. In addition, manual telephone switchboards and equipment have been manufactured in Liverpool and installed at:—Weston-super-Mare (880), Accrington (extension) (500), Cardiff (1,500), Maidenhead (1,120), Worthing (540), and Blackburn (extension) 2 multiple sections. A number of important Colonial and foreign orders have also been executed, including Strowger apparatus consisting of 26,900 lines and trunking equipment for Tokio.

Electric Ovens for Battleships. — The Metropolitan-Vickers Electrical Co., Ltd., informs us that four of its ovens have just been ordered for the two new battleships *Rodney* and *Nelson*, at present being built in the yards of Messrs. Cammell Laird and Armstrong-Whitworth respectively. These ovens, while similar in general construction to the standard "Metrovick" oven supplied to bakers and confectioners, embody a number of important modifications designed to meet the special conditions obtaining on board ship. This is the second order which the company has received from the Admiralty for large electric baking ovens, a somewhat smaller but similar oven having been installed on H.M.S. *Tiger* about a year ago. The electric water heating equipment for the bakeries on board the *Rodney* and *Nelson* is also being supplied by the company. Other recent installations include large ovens for Messrs. Duncan & Foster, Manchester, Messrs. W. & R. Jacob, Dublin, Messrs. E. Cookson & Sons, Ltd., Preston, and Messrs. A. D. Wimbush & Sons, Ltd., of Birmingham.

Employment During November.—The December *Ministry of Labour Gazette* says that employment in the engineering industries generally remained bad, showing very little variation from the previous month's position, although it was fairly good in the electrical branch. The overall percentage of unemployed in the industry was 11.3, whereas in the electrical section it was only 5.6, although this was an increase of 0.1 per cent. during the month. In the electrical wiring and contracting industry the proportion of unemployed persons was 9.7 per cent., a decrease of 0.5 per cent., but unemployment in the electrical cable, wire and lamp manufacturing group rose by 0.5 per cent. to 6.5 per cent.

Industrial Lancashire.—A diagram prepared by Mr. A. H. Banks, employers' secretary of the North-Western District Council for the Electricity Supply Industry, and published recently by the *Manchester Guardian*, analyses the occupations of 1,689,056 persons employed in Lancashire, according to the 1921 census. This shows that, apart from the non-industrial group, the largest number of workpeople are employed in the engineering, shipbuilding and allied trades, cotton, mining, building, &c., and railway transport following in the order named so far as classified industries are concerned.

The International Forty-eight Hour Week.—Last week a joint deputation of employers and workers in the engineering industry interviewed the Minister of Labour upon the subject of the application of the principle of the 48-hour week internationally. It had previously been maintained by the interests represented by the deputation that it was a declared obligation of the parties to the Versailles Treaty that some sort of uniformity should be arrived at. It was said that while the hours worked per week in this country were 47, in France, Germany, Belgium and Italy they were supposed to be 48, although in practice they often extended to between 50 and 60. At the prior interview the Minister asked for an adjournment to enable him to communicate with the Governments of the countries specifically mentioned, and last week he said that replies had been received from the Belgian and German Governments expressing their willingness to take part in a conference on the matter; no definite replies had been received from France and Italy, but further steps were being taken.

Tramway Employés' Strike at Burnley.—About 50 men in the Burnley municipal tramway and other undertakings ceased work last week, the Corporation having declined to grant an increase of 10s. per week in the existing wages of £3 1s. 6d., arguing that the undertaking was to grant this advance on the basic wage of £2 16s. The men contend that other municipalities of smaller size have already done what Burnley refuses to do.

Telephone Development.—The Telephone Development Association has issued a booklet setting forth the advantages of being "on the 'phone" and explaining how to obtain them. It is well and humorously illustrated.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, December 29th: Copper (electrolytic) bars, £66, 5s. dec.; ditto, ditto sheets, no change; ditto, ditto wire rods, £76, 5s. dec.; ditto, ditto h.c. wire, no change.

Messrs. James & Shakespeare report, December 29th: No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £36 10s., 10s. inc.

Messrs. Edward Till & Co. report, December 29th: India-rubber, Para fine, 4s. 1d., 1d. inc.

A Japanese in America.—Doctor Keiji Ito, consulting engineer to the Toho Electric Power Company and Professor at the Tokio Institute of Technology, spent a few days recently at the East Pittsburgh plant of the Westinghouse Electric and Manufacturing Company. Dr. Ito's chief reason for visiting the United States was for the purpose of making a study of the application of motors to industrial equipment and household appliances, including heating and lighting the home, and also the study of industrial heating. When approached on the question of the use of electrical appliances in Japan, Dr. Ito stated that the Japanese were not backward in taking to electrical home appliances, and that those who could financially do so had also installed electric heating appliances in their homes. He further stated that the use of gas had been practically eliminated by electricity.

Philips' Glow Lamp Works Extensions.—In connection with the new issue of capital by the Philips' Gloeilampenfabrieken of Eindhoven, to which reference was recently made, it is stated that the proceeds of the new issue are intended for the financing of extensions at Eindhoven, as well as abroad. Among others, the company is interested in the International General Electric Company by means of an interchange of shares, while Philips Lamps, Ltd., has been formed for sales in England.

A Valve Display.—An entire window on the Oxford Street frontage of Messrs. Selfridge's premises was given over last month to the display of "Osram" valves. Twelve circular openings were cut into a proscenium, and in each of the openings a valve of nickel-plated seating was fitted. These valves lighted up in pairs. Commencing from the bottom, the first two would light up, and when these went out the next two lighted, and so on, until the two in the centre of the top cross bar followed suit, to complete the entire set of twelve. When these were extinguished the process started again. The window furniture of gold stools and a table and blue curtain hangings were arranged to emphasise the colour scheme of the blue and gold carton of the "Osram" valve.

A Battery Locomotive Order.—For the constructional work of the Ben Nevis tunnel in connection with the new power station of the British Aluminium Co., Ltd., an order for 22 electric locomotives equipped with "Exide" batteries has been placed with Messrs. Joseph Booth & Bros., Ltd., Rodley, Leeds.

Unemployment.—During the week ended December 14th the number of unemployed persons registered at the exchanges fell by 33,750 to 1,127,500. Upon the equivalent date of 1924 the total was 1,158,475. The latest total includes 912,400 men, 26,800 boys, 164,700 women and 23,600 girls.

Social Events.—The annual dinner of the staff and employés of the Maidstone Corporation Electricity Department was held on December 19th. About 70 attended and the borough electrical engineer (Mr. E. E. Hoadley) presided. The chairman of the Electricity Committee (Councillor W. H. Martin, J.P.) was prevented by illness from attending, but the vice-chairman (Councillor S. P. Sanders) and the former chairman, Mr. J. H. French, were present.

At the annual social meeting of the staff of the Ayrshire Electricity Board, held at Kilmarnock recently, Mr. W. C. Bexon, chief engineer and general manager, who occupied the chair, was congratulated on the progress of the undertaking which now has a capital of about a million and a quarter. The adoption of electricity in coal-mining, it was predicted, would give a wide outlet for electricity in the future. The A.E.B. orchestra, trained by Mr. Upton, rendered selections during the evening.

The staff of the Electric Supply Corporation, Ltd., Dumbarton, and their friends, held a whist drive and fancy dress ball on December 16th. Mr. Dixon, the company's engineer for Scotland, thanked the staff for making the event a success. Mrs. Dixon presented the whist and fancy costume prizes. Mr. Gow-Russell, the resident engineer, and Mr. Clacher acted as M.C.'s.

Trade Announcements.—MR. F. H. SOWDEN, electrical and mechanical engineer, has removed to larger premises at Alpha Street, Dewsbury Road, Leeds.

The shareholders of HOLOPHANE, LTD., have accepted a favourable offer to purchase their American and Canadian rights. This will necessitate a reconstruction for the purpose of re-arranging the share capital, and to this end the company has just gone into voluntary liquidation. The position of the ordinary trade creditors will in no way be affected as they will be paid in full. A new company is being registered bearing the same name, but the business will continue as heretofore, with the same directorate and *personnel*.

THE RADIO EQUIPMENT CO. has opened demonstration and showrooms at Market Avenue, Huddersfield.

MESSRS. J. R. & A. H. BROOKING, who have purchased an electrical business at 44, High Street, Exeter, from the trustee under a deed of assignment from Messrs. Bird & Ewings, announce that that business will in future be known by the name of Brooking Bros. They wish to have a set of up-to-date electrical catalogues at the above address.

THE FOOLPRUFE ACCUMULATOR CO., LTD., Kettering Road, Market Harborough, desires to receive catalogues of electrical fittings and accessories.

MR. O. A. BROWN has opened an electrical and radio engineer's business at 78, West Princes Street, Helensburgh.

MR. J. A. BROOK has taken over new central premises at 24, John William Street, Huddersfield (Telephone No. 2929), to cope with increased business in electric lamp locks. He asks for copies of manufacturers' lists of electrical goods for his factoring business.

MR. ALEXANDER MILLER announces that he has given up business in Maidstone, and has purchased as a going concern the Central Garage (Newcastle-on-Tyne), Ltd., Carliol Square, Newcastle-on-Tyne. He was for five years chief draughtsman with Messrs. Mavor & Coulson, and was subsequently with various other well-known electrical manufacturing companies.

Some time ago (ELECTRICAL REVIEW, June 26th, 1925, p. 1015) we referred in some detail to the amalgamation of two of the oldest firms in the electrical fittings trade—Messrs. OSLERS (established in 1807) and MESSRS. FARADAYS (established in 1814). The developments that have taken place since the amalgamation include the opening of new branches at Glasgow, Manchester, Cardiff, and Belfast. The address of the company—Osler & Faraday, Ltd.—has now been changed to Lanthorne House, 89-91, Newman Street, Oxford Street, London, W.1.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive Leaflet No. 750/1-1, dealing with the Metropolitan-Vickers coal-cutter protection system. Fully illustrated.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured poster advertising the company's two-valve receiver and the "Sterling Dinkie" loud speaker.

MESSRS. RICHSON & CO., LTD., 113, Oxford Street, W.1.—A well-illustrated catalogue (72 pp.) of artistic lighting fittings of all kinds—electroliers, bowls, shades, standards, brackets, statuettes, &c. Many of the illustrations are in colour.

THE LODGE FITTINGS CO., LTD., 57, Albert Road, Aston, Birmingham.—A price list of electric signs of various patterns.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—The Christmas number of the "Chloride Chronicle," containing numerous notes and articles upon "Exide" batteries. The publication is profusely illustrated.

MESSRS. R. M. PAPELIAN, LTD., Wolseley House, Piccadilly, W.1.—An illustrated pamphlet dealing with the "Autopulse" fuel-supply system for i.c. engines which is based on a magnetic principle.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—Catalogue W.L.5, containing illustrations and particulars of "Isco" cut-outs for house services, &c. Three ranges are dealt with, *viz.*, 15-30 A, 30-60 A, and 60-120 A.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 101, containing an illustrated description of the "Morris" electric runway.

THE HACKBRIDGE ELECTRIC CONSTRUCTION CO., LTD., Hersham, Walton-on-Thames.—A well-illustrated catalogue of the company's transformers.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—List No. P.194, illustrating and describing "Prescot" a.c. prepayment meters.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A mailing card bearing illustrations and prices of "Osram" valves.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—An illustrated list of display lighting equipment. It contains useful data on the subject of shop-window lighting, &c. Also a leaflet advertising "Bowyer-Lowe" radio products.

Calendars, Diaries, &c.—MESSRS. C. A. PARSONS & CO., LTD., Newcastle-upon-Tyne, have sent us a set of monthly date sheets for 1926, each of which bears an illustration of the company's turbines and other products.

THE LIVERPOOL ELECTRIC CABLE CO., LTD., of Linacre Lane, Bootle, Liverpool, has sent us one of its wall calendars with monthly slips and a sea view in colour.

MESSRS. AITON & CO., LTD., of Derby, have issued a large artistic wall calendar with monthly slips placed inconspicuously beneath a charming reproduction of "Marigold" from a pastel by I. M. Cohen.

A "memory jogger" has been sent us by the POWER MACHINERY TRADING CO., 17, Queen Victoria Street, E.C.4; this is a leatherette bound memoranda block.

A calendar received from the MARCONIPHONE CO., LTD., bears a portrait of Senatore G. Marconi, and monthly date slips.

A neat and human calendar has been received from MESSRS. FRANK V. COLLINS & CO., of 155, Kingston Road, Wimbledon, S.W.19.

A fine view in colour of "the longest electrical overhead span in the British Empire," very finely produced in the form of a wide wall calendar with the complete year in small monthly spaces beneath the picture, has been received from CALLENDER'S CABLE & CONSTRUCTION CO., LTD., of Hamilton House, E.C.4. The view shows a mile of route of overhead main at Blaengarw, South Wales, and includes four spans of 2,800, 325, 475 and 1,600 feet respectively.

Bankruptcy Proceedings—A. A. WATMOUGH, trading with another at 41, Town Street, Horsforth, near Leeds, and 1, Back James Street, Harrogate, electrical engineer.—The application for discharge of this debtor was heard on December 21st at the County Court House, Leeds; the proceedings took place in 1921. The Official Receiver supported the application, and the discharge was granted subject to debtor's consenting to judgment for £50.

H. L. WOOD, electrical engineer, 7, Taswell Street, Southsea, and late of Elm Grove, Southsea.—First meeting, January 8th, at the Official Receiver's offices, 87, High Street, Portsmouth. Public examination, February 1st, at the Court House, Portsmouth.

L. A. RADFORD, electrical engineer, 50, Welford Road, Leicester.—Trustee, Mr. E. Barlow, Official Receiver, 1, Berridge Street, Leicester, released December 14th.

W. K. M. WILSON, wireless apparatus dealer, 1, Mount St. Heanor, Derby.—First and final dividend of 3½d. in the £, payable at the Official Receiver's offices, Nottingham, on January 4th.

J. E. ELLIOTT and J. M. ELLIOTT (J. E. Elliott & Co.), electrical engineers, 12, Broad Street, Oxford.—Trustee, Mr. W. J. H. Boyle, Senior Official Receiver, Carey Street, W.C., released December 18th.

J. F. GUEST (L. D. & J. Guest and Guest & Robinson), plumber, electrician, &c., 97, Great Horton Road, and Barker-end Road, Bradford.—Trustee, Mr. G. S. Smith, 17, Piccadilly, Bradford, released December 4th.

F. H. P. HOOLAHAN (Holloway Bros.), electrical engineer and instrument maker, The Hale, Highams Park, and 299, Holloway Road, N.—First and final dividend of 1s. 8d. in the £, payable at Carey Street, W.C.

Company Liquidations.—PARK ROYAL ENGINEERING WORKS, LTD.—The liquidator of the company, Mr. G. D. Pepys, Official Receiver, states that he is applying for his release; objections should be addressed to the Board of Trade within 21 days from December 19th. Mr. Pepys reports that the assets have been sold by the Receiver for the first debenture holders, who states that after the payment of the costs and the claims of the first debenture holders there will only be a small balance to be paid over to the second debenture holders. There will therefore be no funds available for distribution amongst either the unsecured creditors or shareholders.

WEST LANCASHIRE ELECTRICAL CO., LTD.—A meeting of members is called for January 30th at the offices of Messrs. Davies and Crane, Houghton Chambers, Southport, to hear an account of the winding up from the liquidators, Messrs. J. A. Bond and J. F. Warburton.

BELGRAVIA ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. W. H. Lovatt, 21, Ironmonger Lane, E.C.

MARINE AND MECHANICAL ELECTRIC WELDING CO. (CARDIFF), LTD.—Winding up voluntarily. Liquidator, Mr. L. C. F. Robson, 146, Bishopsgate, E.C. Meeting of creditors January 11th, at the offices of the liquidator. Particulars of claims to be sent to the liquidator by February 8th.

For Sale.—Ipswich Board of Guardians invites offers for generating plant consisting of :—Two suction gas engines and producer plant, dynamos, motor booster, switchboards, &c., due to changing over to town supply. Messrs. S. D. Harrison and Sons have for disposal several steam generating sets, one Weir condenser, pumps, &c. The Liquidators of the British Empire Exhibition, Wembley, invite offers for surplus electrical equipment, consisting of motor generators, cables, meters, cut-outs, projectors, &c. Edinburgh Corporation Electricity Department has for disposal a quantity of scrap metal, &c., lying at the McDonald Road station. Mr. H. J. Shaw will sell by auction on January 7th, at 85, Newington Causeway, S.E., an electrical contractor's stock, and on January 20th, at 13, High Holborn, W.C., the stock of an electrical and wireless goods factor. (See our advertisement pages to-day.)

Book Notices.—We have received a copy of the "Interim Report on Artificial Light and X-Ray Therapy" (H.M. Stationery Office, price 1s.), issued by the Scottish Board of Health. Apart from dealing at length with questions relating to the application and administration of radiant energy for medical purposes, much useful information is contained on the theoretical considerations of the subject. The division of the spectrum shown diagrammatically adds to the interest of the publication. Ultra-violet radiation and treatment are dealt with extensively.

"Six-valve Supersonic Heterodyne Receiver." Pp. 21, with blue prints; illustrated. London: Igranic Electric Co., Ltd. Price 2s. 6d.—This is an instructional carton containing a fully-illustrated handbook, full-size lay-out drawings, wiring diagram, and drilling template for the construction of a six-valve receiver from the Igranic supersonic heterodyne outfit, which is a very attractive one. The set is very fully described in the illustrated handbook that is enclosed in the carton, and contains theoretical notes, a general description, and operating data. It is replete with diagrams and descriptive matter concerning the functions of a receiver built up under this system, and with interesting detail regarding the various methods of operating to the best advantage. A very valuable feature of the handbook consists of the constructional notes, which touch on the various operations of assembling and the ordered sequence of wiring, and the fitting up of the components. It will be found also that the series of questions and answers that apply to the many problems connected with the operating of a receiver on supersonic principles will prove most valuable to all who are interested in this phase of radio reception. The instructional carton is obtainable from all Igranic dealers.

"The Henley Telegraph," September-December, 1925. London: W. T. Henley's Telegraph Works Co., Ltd. Price 6d. net.—The excellent literary standard of this bright little journal is maintained in the current issue, which contains a number of interesting and amusing articles. We were particularly interested in a description of a golf match played in the vicinity of our offices—but we don't recollect it.

"Amplion Magazine." Pp. xvii+73. Vol. 1, No. 3; illustrated. London: Alfred Graham & Co. Price 1s. net.—Besides the lighter fare, this, the first Christmas number of a well-printed and interesting house organ, contains several items of technical and practical value.

"Cosmos Radio Valves: A Talk to Valve Users." Pp. 20; 13 figs. Manchester: Metro-Vick Supplies, Ltd.—The somewhat bewildering array of thermionic valves now obtainable makes the provision of proper descriptive and explanatory literature to guide the purchaser in his choice of suitable types of valves to perform particular functions imperative. The object of writing the article which gives its title to this booklet was to explain, in language that can be understood by the non-technical reader, the meaning of the various technical terms and data generally set out in valve manufacturers' catalogues, and to show how the various constants can be calculated from the properties and performance of a valve, deduced from its published characteristic curves. So far as we are aware, nothing quite like this booklet has been attempted before; it should be of considerable interest to valve users, both amateur and experimental.

"*Journal* of the Institution of Production Engineers." Vol. V, No. 2, December, 1925. Price 1s.—In a short article on electrical gauging devices the principles of a few examples of electrical sizing indicators, employed during the processes of machining or grinding, and electrical gauging devices for testing finished components, are briefly described.

"The *Journal* of the South African Institution of Engineers." Vol. XXIV, No. 5. December, 1925. Price, 2s.

"Electrical Engineering for Mining Students," by G. M. Harvey. Pp. vii + 156; figs. 108. London: Sir Isaac Pitman and Sons. Price, 5s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIV. No. 12. December, 1925. New York: The Institute. Price, $1.

A Swedish Re-organisation.—At an extraordinary meeting of the shareholders, held on December 19th, it was decided, says *Goteborgs Handels och Sjofartstidning*, to liquidate the Elektriske A.B. Chr. Bergh and Company. At the same time an agreement was entered into with a new company under the title of the Nye Elektriska Aktiebolag Chr. Bergh and Co., which has taken over the assets and liabilities and is continuing the business on the same lines.

Unemployment in Germany.—It is reported that on December 1st the number of unemployed persons in Germany was about 670,000, an increase of 200,000 in less than a month. Unemployment was most marked in the building trades.

French Electrical Experts in Madagascar.—At the request of the Governor of the island, a commission of French electrical experts, consisting of representatives of Schneider & Cie., La Compagnie Francaise d'Exploitation des Procédés Thomson-Houston, and the Compagnie Générale des Colonies is, it is reported, about to visit Madagascar with the object of studying the question of the electrification of the Tananarivo-Tamatave railway and also the Batsileo line. It is also proposed to supply the district traversed with electricity for lighting and power purposes.

Local Exhibition.—PREESALL.—The Urban Council Electricity Committee, in conjunction with the General Electric Co., Ltd., Manchester, held an electrical exhibition in the Parochial Rooms, Preesall, recently. The numerous domestic exhibits covered a wide field and each day a lady expert gave demonstrations in cooking and baking by electricity. The exhibition is said to have had a very beneficial effect in stimulating the sale and hire of electrical appliances in the district.

A Canadian Power Plant Contract.—Eight firms submitted bids for the new 5,000-h.p. turbines and generators required by the Winnipeg Hydro to complete the installation of equipment at the Point du Bois power plant. The Canadian Boving Company, Lindsay, Ont., submitted the low bid of $88,920 for the turbines. Other bidders were the John Inglis Company, of Toronto, the Canadian Allis-Chalmers Company, and the Canadian Vickers Company, Montreal. The Swedish General Electric Company, bidding through its Canadian office in Toronto, tendered the lowest bid for generators—$143,700. Other bidders for this equipment were the Canadian General Electric Company, C. A. Parsons & Co., Ltd., and the Canadian Westinghouse Company.—*Electrical News* (Toronto).

New Canadian Companies.—Affiliated Engineering Companies, Ltd., is the name of a concern recently registered in Toronto with a capital of $150,000 to carry on, *inter alia*, the business of electrical engineers and contractors.

Niagara Lamps, Ltd. (capital £40,000) has been formed in Hamilton, Ont., to carry on the manufacture of electric lamps, &c. Other companies recently constituted in Canada are the Skeely Electric Mfg. Co., Ltd. (Montreal), and Beeby Thermos Ranges, Ltd. (Montreal, capital $750,000), heating apparatus manufacturers.

German Tariff Reductions.—The *Board of Trade Journal* for December 24th published a list of articles, which, by the provisions of a commercial treaty between Germany and Italy, are to be subject to a lower rate of duty upon importation into either country. By virtue of the Anglo-German commercial treaty similar British goods entering Germany will enjoy the lower rates. The list includes "Dynamos (generators), except lighting and ignition dynamos for motor vehicles and except starters for combustion engines." The duty on articles under this head weighing 10 kg. or less is reduced from 80 to 40 Rm. per 100 kg.; on articles weighing more than 15 and up to 25 kg. the reduction is from 40 to 23 Rm. per 100 kg. Electrically-heated apparatus for making coffee is subject to the following duty reductions :—Weighing more than 3 kg. each, from 60 to 50 Rm. per 100 kg.; 3 kg. or less, from 75 to 70 Rm. per 100 kg.

Aluminium Production.—According to a tabular statement published in the Essen *Gluckauf*, the production of aluminium throughout the world amounted to 64,800 tons in 1913. Switzerland is credited with 12,000 tons of this total, France with 14,500 tons, Great Britain with 7,600 tons, Norway 1,500 tons, Italy 800 tons, the United States 22,500 tons, and Canada with 5,900 tons. The figures and countries of production for the past two years are given below :—

	1923. Tons.	1924. Tons.
Germany	15,900	18,700
Switzerland	15,000	20,000
German Austria	1,500	2,200
France	17,000	18,500
Great Britain	8,000	12,000
Norway	13,300	22,000
Italy	1,500	2,000
United States	85,000	85,000
Canada	10,000	8,000
Total	167,200	188,400

New Belgian Companies.—A new company has lately been formed in Brussels with a capital of 1,600,000 fr., and the title Société Belge des Accumulateurs Fulmen.

The S.A. Belge pour l'Equipement Electrique des Véhicules has been formed in Brussels with a capital of 250,000 fr., to manufacture and sell all kinds of electrical equipment for vehicles.

The Etablissements Paulet (S.E.P.) has been constituted in Brussels for the construction, equipment, and sale of electrical and mechanical systems, &c. (Capital, 250,000 fr.)

The S.A. Fluoris is another company recently formed at Brussels to undertake electric lighting by means of fluorescent tubes. (Capital, 200,000 fr.)

E.D.A. Activities.—The E.D.A. has produced a card relating to its advertisements which are to appear in the ELECTRICAL REVIEW and other electrical journals during this year. The card not only gives the dates, but also reproduces the distinctive border which is being employed for each advertisement.

New Italian Companies.—Among the new hydro-electric undertakings recently organised in Italy are the Società Idro-Elettrica del Sabato, Benevento, capital 162,000 lire; and La Società Idro-Elettrica del Tul, Travesio, capital 421,000 lire.

The Electrical Age.—The Sunlight League has issued No. 2 of *Sunlight*, "a journal of light and truth" (December, 1s.). One of the articles is by Mr. D. N. Dunlop. It is entitled "Coal and Sunlight," and concludes by pointing to the necessity of avoiding raw coal combustion wherever possible, the substitution of smokeless fuels, and the introduction of a motive force into industry which will be clean, efficient, elastic and economic in operation. "Electricity," he says, "supplies this last and, from many points of view, the electrical age may be of greater value to the progress of humanity and of human existence, material, physical and even social, than any other age that has come and gone—bronze age, iron age, or steam age." Elsewhere in the journal is a reference to the first annual dinner of the Sunlight League held in May last, when the money to cover all expenses of the dinner was borne by "our very generous friends, the British Electrical and Allied Manufacturers' Association," Mr. D. N. Dunlop being "our host."

An Analysis of Unemployment.—In the *Ministry of Labour Gazette* for December the unemployment statistics from July, 1923, to October, 1925, are analysed according to groups and other circumstances; the result is illuminating in view of the fact that we are accustomed to look at the unemployment figures as a whole It is seen, for instance, that the coal mining industry, with its wide fluctuations, is the all-important factor of the situation. Indeed, during 1925 the curve of unemployment in the coal industry was reflected in a remarkable way in the general unemployment curve. Seasonal fluctuations are clearly illustrated, but it is observed that during 1925 the variations were far less violent than in the preceding year. A feature of the general curve is the remarkably low level reached in the second quarter of 1924, a position which has not been regained since. In June, 1924, the total of unemployed fell to 1,040,000; the lowest level reached in 1925 was just over 1,220,000 in April and May. The general and marine engineering curve is practically a gradually descending straight line, showing a very slow improvement.

Patent Application.—Application has been made for the restoration of patent No. 27,355 of 1913 granted to F. L. Hollister for improvements in or relating to magneto-electric machines.

Swedish Enterprise in Russia.—According to statements attributed to Mr. A. Linden, director of the Allmanna Svenska Elektriska A.B., a commencement of the supply of electricity from the Volkhoff hydro-electric works to Leningrad is expected to be made next May. The electrical equipment for this large station has been supplied by the Swedish company, while orders for electrical machinery and apparatus have also been received by the A.S.E.A. for other places in Russia. Mr. Linden stated that the company had initiated negotiations with the competent authorities with a view to securing a new concession for the workshops which the company carried on at Yaroslav before the revolution, the concession aiming not only at manufacturing, but also the right of free disposal of the manufactures. The idea was that the works in question, which in recent years had only been carried on by a Russian company on a small scale with the A.S.E.A. as an interested party, should be restored to the level of production which formerly prevailed, so that the number of persons employed would exceed 1,000. According to the concession proposal, the works would be under Swedish management and have an administration composed of certain percentages of Swedes and Russians and would be financed by the Swedish company. Confirmation of the scheme is also forthcoming from Russian sources, which announce the arrival in Leningrad of representatives of the Swedish company in the third week in December, together with Mr. Ericsson. In conversation with the representative of a Moscow newspaper, the chief representative of the Swedish company is reported to have stated that the construction of the Yaroslav works, which was in progress at the beginning of the revolution, was only stopped in November, 1917. This particular works was the only foreign undertaking in Russia which had not been subject to nationalisation, as the A.S.E.A. during recent years had executed orders for the Soviet Government. The completion of the works was to be commenced immediately on the grant of the concession from the General Concessions Commission, and some 1,500 workpeople would be employed on the production of generators, transformers, and other electrical equipment.

United States Electrical Exports.—In a recent issue of *Commerce Reports*, the exports of electrical goods from the United States during the first nine months of 1925 were reviewed. There was a slight decline in comparison with the previous corresponding period—from $63,281,553 to $63,031,943. There was a substantial decrease in transformer shipments which was not fully offset by rises in exports of a.c. generators and parts and steam turbine sets. Electric locomotives for mines and railways both showed declines; the former fell in value from $1,887,668 to $146,496. There were also small decreases in motor exports, while shipments of starting and controlling equipment for industrial motors fell in value by 50 per cent. On the other hand, there were important rises in the exports of radio equipment and associated lines, and domestic appliances. Lamps and lighting fittings, wiring materials, and insulated wires and cables, all showed substantial gains. The review proceeds to deal with the United States' customers and it is said that electrical exports to Europe show a satisfactory trend reflecting the improvement of economic conditions. Great Britain was again the leading European buyer, while Spain was second with 50 per cent. more than France, which occupied the third place. The strong position held by the United States in the South American markets was maintained, and it is stated that the influence of American-controlled public-utility developments in Panama and Guatemala is undoubtedly the reason for the growing importance of those markets as compared with others. In conclusion, our contemporary says:—"Considering the electrical export trade as a whole, the distribution throughout the world continues quite uniform, though its strength this year is to some extent maintained through the increased volume of radio exports."

United States Radio Exports.—The world-wide interest in radio is reflected in an increase of nearly 100 per cent. in the value of radio apparatus exported from the United States in October as compared with the same month of 1924. For October, 1925, Department of Commerce figures show the value of radio apparatus exported as $1,317,846; in October, 1924, the value of exports was $760,249. For the first ten months of 1925 radio exports were valued at $7,659,000.—*Reuter's Trade Service* (Washington).

A Striking Poster.—We reproduce below the wording of an attention-compelling poster which is being employed by the Torquay Corporation Electricity Department:—

DO
YOU
WANT
A BATH

JUST WHEN YOU FEEL LIKE IT WITHOUT HAVING TO WAIT FOR THE WATER TO GET

HOT ?

THEN HIRE

A BASTIAN ELECTRIC GEYSER

FROM

THE TORQUAY CORPORATION ELECTRICITY DEPT.

FROM 3/6 PER QUARTER.

A constant supply of Scalding Hot Water available day and night at an average cost of 3/- per week.

A Greenock Blotter.—The Greenock Corporation Electricity Department has issued an attractive blotter calling attention to the benefits of electricity. A coloured view of a fishing village appears on the card.

Lighting and Power Notes.

Ayrshire.—EXTENSION OF TIME.—The Ayrshire Electricity Board has intimated that it is to apply to Parliament to extend the time as now limited by the Ayr Burgh Electricity Act, 1922, for the compulsory purchase of land required for the purposes of the electricity undertaking authorised by that Act.

Barking Town.—EXTENSION OF SUPPLY.—The Electricity Committee has agreed to a scheme for the extension of electricity supply to the Eastbury area, at a cost of £22,100, and a loan of £4,600 is to be sought for the last portion of the scheme, which includes the erection of sub-stations in River Road. The Housing Committee has decided to wire 59 houses on the Eastbury estate for electricity.

LOANS SANCTIONED.—The Committee has obtained sanction to the borrowing of £5,500 for buildings and £10,000 for plant.

ELECTRICITY CHARGES.—The Electricity Committee has decided that, as and from the termination of the current quarter, the maximum demand charges for a.c. power supply shall be altered to:—35s. per kVA of the maximum demand per quarter, plus ¼d. per kWh, subject to the standard discount, and that the treasurer and engineer shall report on the question of the revision of the charges for d.c. supply.

Bo'ness.—LOAN.—The Town Council is applying for sanction to a loan of £1,200 for cables and meters.

Canada.—ELECTRICAL DEVELOPMENT.—According to the *Electrical News*, the Manitoba Power Co. now requires the immediate installation of a new unit of 28,000 h.p., in addition to the 56,000 h.p. now in operation, as it has received a contract from the Spanish River Pulp and Paper Co. for the supply of approximately 30,000 h.p. for a new mill. It is also reported that the power company will proceed with the construction of a fourth unit of 28,000 h.p., thus bringing its total output up to 112,000 h.p.

Chelmsford.—ELECTRICITY SUPPLY.—At a recent meeting of the Town Council it was decided not to purchase the Electric Supply Corporation's undertaking at the estimated purchase price of £75,000. Efforts will be made to arrange for the company to continue to supply electricity under a scheme that would limit profits and enable the Corporation to acquire the undertaking at a future date upon reasonable terms.

Continental.—BELGIUM.—The Société Saboterie Mécanique, of Presgaux, Hainaut Province, in order to utilise the waste wood resulting from the manufacture of sabots, has decided to establish a power station consisting of three 250-h.p. gas engines and dynamos and one set of 120 h.p. The necessary gas for the engines will be furnished by gas producers in which the waste wood will be utilised. Negotiations are in progress for the supply of electricity from the station to 34 villages in the district.

Croydon.—LOANS.—The Electricity Committee has received sanction to the borrowing of £1,360 for feeders, and is applying for a further loan of £1,500 for domestic apparatus to be let out on hire.

STREET LIGHTING.—The Corporation has decided to convert 100 gas lamps to electricity at a cost of £1,411.

Faversham. — NEW ELECTRICITY CHARGES. — The Town Council has adopted the following new scale of charges for electricity for power:—First 12,500 kWh per quarter, 3d. per kWh; next 37,500 kWh, 2d.; beyond this amount, 1¾d. per kWh.

Glasgow.—PROGRESS DURING NOVEMBER.—The Glasgow Corporation electricity manager reports that 165 houses were wired in November, bringing the total to 1,606, and that the applications for the hire of appliances numbered 659, bringing the total to 9,074.

NEW SUB-STATION.—The Electricity Committee has recommended the purchase of land in Ibrox as a site for a static sub-station.

Grange-over-Sands.—ELECTRICITY SCHEME.—The Urban District Council has approved of an electric lighting scheme submitted by the consulting engineer, Mr. Burnett, and application is to be made for sanction to a loan of £8,200 to cover the cost. The mains and services of Messrs. Wilkinson are to be purchased for £2,000, and 40 street lamps are to be converted from gas to electricity.

Huddersfield.—ELECTRICITY CHARGES.—The Electricity Committee has received a deputation from the Huddersfield Chamber of Trade asking that the charges for electricity for the lighting and heating of shops should be reduced. The Committee has decided to consider the matter at a special meeting to be held at the end of the current financial year.

Irish Free State.—LUCAN.—The electricity supply for Lucan and surrounding districts, which was discontinued with the suspension of the Dublin-Lucan tramway service, was recently restored by arrangement with the Dublin United Tramway Co.

Keighley. — ELECTRICAL DEVELOPMENT.—The Corporation Electricity Committee has recommended that work be proceeded with at once upon the erection of a transmission line from Eastburn foundry and the laying of distribution mains for general supply in the township of Sutton. It is also recommended that an agreement be entered into between the Corporation and the Haworth Urban District Council for the supply of electricity to the Council. It is proposed that, where desired by the consumer, electricity shall be supplied by the Corporation to private houses only through pre-payment meters at 6d. per kWh with no meter rent.

London.—BATTERSEA.—The Electricity Committee is to proceed with the following works:—Services for electric lighting to 54 premises, £514; renewing the special mains to the Town Hall and Shakespeare Theatre in connection with the work of replacing the distributors on the north side of Lavender Hill, £521; replacement of old vulcanised bitumen distributors by three-core paper insulated and armoured cables—Park Road, Bridge Road, and Queen's Road—£2,448.

Mexborough.—LOAN.—The Urban District Council is applying for sanction to the borrowing of £20,000 for the extension of the plant at the generating station.

Millom.—APPLICATION FOR ORDER REJECTED.—The Urban District Council has been notified by the Electricity Commissioners that owing to the industrial position of Millom they cannot see their way at present to grant the Order for the electricity scheme, which it is estimated would cost from £10,000 to £12,000.

Nelson.—ELECTRICITY IN BULK.—The Electricity and Tramways Committee has received a communication from the Barnoldswick Urban District Council asking for terms for a bulk supply of electricity, and has recommended that a supply be given and that the Generating Station Sub-Committee consider the question of terms with power to act.

Peterborough.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £2,000 for the provision of meters.

Preesall. — INAUGURATION OF SUPPLY.—The electricity supply for the town was formally inaugurated on December 19th.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

WALTON AND WEYBRIDGE.—*Urban Electric Supply Co., Ltd.*—Lighting: From 11d. to 9d. per kWh.

FULHAM.—Lighting: From 4½d. to 4¼d. per kWh. Power: From 1¼d. to 1⅛d. per kWh.

DARLINGTON.—Lighting: All energy used during the lighter eight months, from 2d. to 1½d. per kWh, and one kWh at 1½d. (instead of 2d.) during the darker months for every two kWh consumed during the lighter months, and 3½d. per kWh for all additional electricity consumed during the darker months. Power: First 3,000 kWh per quarter, 1d. per kWh, and ¾d. per kWh for energy in excess of this amount.

Plymouth.—NEW PLANT.—It was reported at a recent meeting of the Corporation Electricity Committee that the Electricity Commissioners had sanctioned the extension of the generating station at Prince Rock by the installation of a 6,000-kW turbo-alternator and the necessary auxiliary plant. Cable extensions were authorised by the Committee at an estimated cost of £1,397.

Rothbury.—ELECTRICITY SUPPLY.—The Rural District Council has agreed to support the application of the Newcastle-upon-Tyne Electric Supply Co., Ltd., to the Electricity Commissioners for sanction to distribute electricity within parts of the rural district.

Stoke.—ELECTRICITY SUPPLY.—The Town Council has under consideration a request from the Wolstanton Urban District Council for a supply of electricity at May Bank.

The Electricity Committee is to extend the mains in the Hanley area at a cost of £2,800, and in the Burslem area at an estimated cost of £4,000. A site has been obtained at Longton for the erection of a sub-station.

Stone.—SPECIAL ORDER.—The Urban District Council has passed a resolution authorising the Clerk to make application for the Special Order, for which the Council is applying, to be extended so as to include the parishes of Stone Rural, Darlaston, and Trentham. The Stone Rural District Council has decided to make no objection.

Walsall.—ELECTRICITY EXTENSIONS.—The Town Council has authorised the Electricity Committee to proceed with extensions of mains, and the installation of transformers, switchgear, &c., on consumers' premises at a total estimated cost of £1,750.

Willesden.—NEW PLANT.—The electrical engineer has reported that additional feeder cables are required in the Harlesden area, and estimates that the cost will be £4,000 for the extension of the sub-station and provision of a 1,500-kW rotary converter and necessary switchgear, and £4,152 for laying and jointing the feeder cables.

LOAN.—The Electricity Committee is applying for sanction to the borrowing of £25,000 for mains and services.

Wolverhampton.—TRANSFER OF UNDERTAKING.—The Town Council has agreed to transfer its generating station to the Joint Electricity Authority for the West Midlands, for which together with its portion of the main transmission line to Ocker Hill, the Council will receive £379,550.

Tramway and Railway Notes.

Cheadle and Gatley.—TRAMWAY LINKING-UP.—The Urban District Council has agreed to receive a deputation from Manchester Corporation to discuss the question of powers being obtained for joining up the city tramway system with the Council's existing routes.

Continental.—PORTUGAL.—It is announced that a Spanish syndicate has secured a concession for the construction of eight underground electric railways radiating from a central point in Lisbon. To supply the necessary power a hydro-electric station is to be established on the River Zezere at El Cabril, about 100 miles from the town. It is estimated that 20,700 h.p. is available.

Croydon.—NEW EQUIPMENT.—The Tramways Committee has recommended the purchase of tramway equipment at a cost of £7,600 in connection with the through-running arrangements with the London County Council.

Southern Railway Electrification.—The Southern Railway Company announces that the alterations to the track and stations, consequent on the coming electrification of the suburban services to and from Cannon Street, will begin on different parts of that line on January 1st, and that it will be necessary to make certain alterations in the morning and evening trains. Embraced in the portion of the company's system affected by these alterations are the main line, *via* Chislehurst to Orpington; the line from St. John's, through Catford Bridge and New Beckenham, to Addiscombe; the Elmer's End to Hayes branch; and the Grove Park to Bromley North branch. It is hoped that these lines will be electrically operated by the end of February. The section from London Bridge to Charing Cross, *via* Waterloo, is ready for opening, and will be brought into use at the same time as the section from Cannon Street to London Bridge, about to be taken in hand. At Cannon Street the work involves the reconstruction of the track, considerable alterations to the junction outside the station, and the closing down of locomotive depôts, to make room for electric sub-stations.

Modern Lighting in Ancient Buildings.

The Recent Lighting by Electricity of two Notable Cathedrals.

PROBABLY if it were realised more fully that electric lighting could be introduced into some of our fine old buildings without in any way detracting from their appearance, and indeed, with the result of exhibiting to better advantage their architectural beauty, more



Fig. 1.—Nave, Looking West, Canterbury Cathedral.

churches, cathedrals, and such buildings in this country would now be illuminated by means of electricity. The problem is not only to provide sufficient light for the purposes for which they were built, but also to enable the beautiful craftsmanship usually found in places out of the range of ordinary lighting, to be seen from all positions.

The Lighting of Canterbury Cathedral.

An admirable example of such an installation may be seen in the Cathedral at Canterbury, where the first section of a scheme for the revision of the artificial lighting has recently been finished. The portions of the building so dealt with are the nave and transepts, where the sources of lighting have been placed directly and centrally overhead. The interior roof construction of the nave consists of Gothic arches terminating in centrally placed rosettes at the apex, at a height of some 80 ft. above the ground, and separated by intervals of about 20 ft. It is in the rosettes that the electric lighting fittings are nested. There are eleven of these in all; each consists of a small silvered-glass parabolic reflector, 10 in. in diameter, directing the upper hemispherical rays to the floor level, the lower rays being utilised to illuminate the adjacent ceiling arches and the upper parts of the supporting columns. The power of the rays directly below each source of light amounts to 10,000 c.p.; between that point and 10 degrees from the vertical it falls to 5,000 c.p., and then falls rapidly to the normal power of the lamp. Thus the high-power rays can only fall on the eye when it is looking abnormally, directly upwards. The illumination to which the eyes of the general public are exposed, even when looking at the ceiling arches, is from 500 to 1,000 c.p., the visible area of each source being 25 sq. in.

The results are thus free from any disadvantages of glare, and the illumination is claimed to be wonderfully even, such shadows as are produced being sufficient to give a necessary relief to the architecture. Shadows at the floor level of the nave are noticeably absent, the illumination at all parts being ample for reading in comfort. The ceiling lighting of the aisles will eventually be supplemented by fittings similarly placed to those in the nave. All irregularities of illumination, such as striation, so often produced by highly-directive reflectors, are avoided, it is claimed, by the use of "Multiplane" reflecting surfaces, an invention patented by Mr. Haydn T. Harrison, who has been responsible for the design of the installation. In the side transepts, where the area covered by a single fitting is greater, "Holophane" concentrating reflectors have been adopted. Each fitting is equipped with a 500-W gasfilled Osram lamp, with its lower part sprayed to prevent any possible direct view of the filament.

The fittings are of special design to conform with the construction of the roof. The only parts of each fitting showing are its reflector and the lower part of the lamp. The stonework of the arches is pierced at each point by a hole 5 in. in diameter, to a depth of from 18 to 24 in. The upper part of each fitting forms a copper chimney, passing through the hole, and thus allowing the heat from the lamp to escape into the roof. The main framework of the fitting is attached to the cylinder at its lower end, the upper end being provided with a shackle to which is attached a steel suspension rope which, in conjunction with a safety winch, is



Fig. 2.—Nave, Looking East, Canterbury Cathedral.

used for lowering the fitting to near the floor level for the purposes of cleaning, effecting renewals, &c. Each fitting is provided with a two-pin plug socket placed with the winch in the roof; an extra safety clamp is also supplied. The wiring in the roof is run

in heavy-gauge screwed-steel conduit along the cross beams. Each fitting is controlled by a d.p. ironclad switch-fuse. The installation is arranged in three main circuits, which are controlled from the main switchboard in the crypt. A dimmer is installed to give the same even illumination at about one-third of the intensity at times when a subdued light is preferable. Probably the most interesting feature of the work is that on entering the nave normally, one does not notice that any artificial lighting apparatus exists. From the illustrations, figs. 1 and 2, it will be seen that the pointed Gothic arches of the roof are as well illuminated as the floor; the flutings of the wonderful perpendicular columns are all brought out in detail, and the tracery work of the great west window is accentuated; in fact, many lovers of architecture who have seen the window, state that fresh beauties have been disclosed, which were never visible in daylight. When the work is completed, the steps under "Bell Harry" Tower" and the choir stalls will be lighted, making the vista to the east end complete.

The portions of the building so far dealt with have a floor area of 14,000 sq. ft., including the aisles which cover half this area. The floor of the nave is illuminated on an average to 2.5 foot-candles and the aisles to one foot-candle. With the ceiling and vertical walls, &c., the total area illuminated is about 50,000 sq. ft., with an average illumination of 1.5 foot-candles, equivalent to 75,000 lumens. This represents the utilisation of 85 per cent. of the luminous energy provided by the eleven lamps which, according to the B.E.S.A. specification, should produce 88,000 lumens. The wiring has been carried out by Messrs. H. M. Biggleston and Sons, of Canterbury, who also manufactured the special fittings. The photographs were taken by Messrs. B. & W. Fisk-Moore, also of Canterbury.

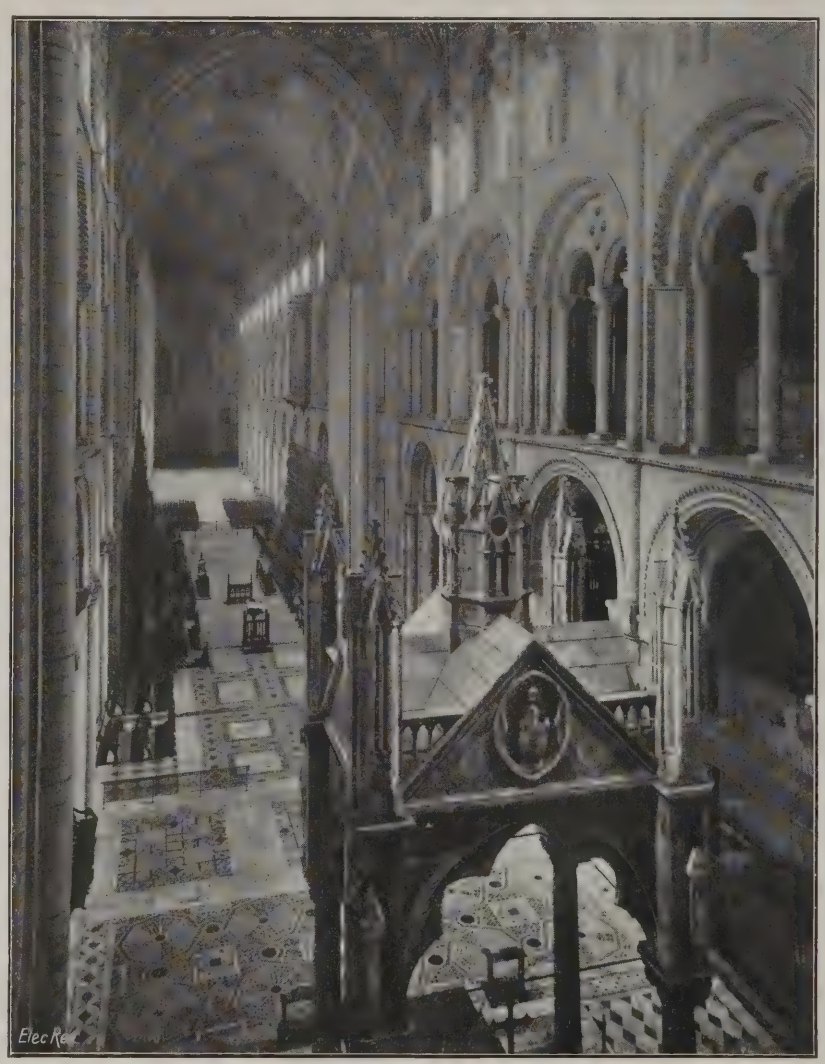


Fig. 3.—Nave and Chancel, Peterborough Cathedral.

Peterborough Cathedral Lighting.

The lighting of Peterborough Cathedral was recently converted from gas to electricity. The building is almost wholly Norman; the chancel, nave, and transepts are arranged in three stages, namely, the arcading, triforium, and clerestory. Most of the lighting is effected by means of fittings placed in the recesses on either side of the clerestory windows, so that the artificial light comes from practically the same direction as the daylight, and the fittings being beyond the normal angle of vision, are practically concealed from view up and down the length of the building. Each lighting unit consists of a specially-designed projector comprising three silvered-glass mirrors mounted in a suitable case, and is equipped with a 250-W projector-type "Mazda" gasfilled lamp. The lamp is supported in a porcelain holder suitably mounted to permit of its being correctly focused in relation to two of the mirrors, the third mirror being itself adjustable. The projector is mounted on an arm with a slide adjustment on a bracket attached to the wall of the building. The bracket is jointed, so that by releasing a screw the complete projector can be swung into a position where it can be easily reached for cleaning, &c., from the walk which runs round the clerestory. The beams from these projectors are trained diagonally downwards across the nave towards the bottom of the piers on the far side. A small lip at the bottom of the reflector deflects a portion of the beam upwards to that part of the walls above the fittings. This scheme was not possible beneath the central lantern tower, where eight special fittings are mounted nearly 100 ft. above the floor. Each of these is provided with a single silvered-glass reflector and a device to prevent any glare effect on the walls in the upper part of the tower. These fittings are supported on tubular arms, which are carried from a pivot attached to the wall of the building, and are provided with a counter-balance weight so that the units themselves, which project some considerable distance beyond the masonry, can not only be swung round to accessible positions for cleaning, but can also be adjusted in all directions from this position.

The lighting of such positions as the eastern end of the apse is effected by "Mirolux" trough reflectors placed in the triforium and the clerestory. The illumination throughout is particularly effective; fig. 3 shows the nave and chancel in the artificial light. An important feature of the installation is the absence of any fittings in the aisles, which depend for their illumination on light reflected from the nave. The result, shown in fig. 5, is a notably soft uniform illumination. Special wall lanterns in keeping with the surroundings are employed for the illumination of the vestries. The entrance in the west porch, fig. 4, is lighted by means of flood-light fittings inserted in the paving. The light from these units is thrown upwards on to the vaulting, whence it is diffused over the entrance way to the west doors. Strip spirals are placed vertically in front of the lamps to prevent them from being seen directly in passing from the porch to the cathedral, or *vice versa*.

The circuits are controlled by contactor switches, which are in turn under push-button control. Two contactor panels are situated on the triforium level, and the corresponding push-button panels are placed

at the back of the choir stalls on the south side. Multicore control cables, specially made by Messrs. Callender's Cable & Construction Co., Ltd., are run from the push-button boards through the crypt to the staircase at the south end of the south transept, up the staircase to the triforium, and to the contactor panels. Each of these cables is equipped with 37 numbered conductors; 16 pairs of push buttons are provided on each control panel. Each contactor panel is provided with 15 contactors, each furnished with a no-volt and an overload release. The panels are contained in well-ventilated sheet-steel cases mounted on concrete.



Fig. 4.—West Porch, Peterborough Cathedral.

The building is wired throughout with the Henley wiring system; the lead-covered cables are placed out of sight of the congregation. Mr. H. A. Nevill, the city electrical engineer, acted as consultant for the work to the Cathedral authorities. The design of the installation and the manufacture of the fittings were undertaken by the British Thomson-Houston Co., Ltd., and the wiring and erecting work by Messrs. Amies & Sons, contractors.



Fig. 5.—Lighting of the Aisles, Peterborough.

York Corporation's "One-Man" Tramcar.

A Real Effort to Reduce Operating Costs.

By J. A. BROMLEY, A.M.I.E.E., M.I.A.E., M.Inst.T.

GIVEN a route approximately three miles in length, with permanent way and overhead equipment almost new, an average income of 14.25d. per revenue mile run and little prospect of any immediate increase in revenue, with operating costs, interest, and sinking fund charges respectively 13.81d. and 3.00d. per mile—the problem to be solved is: how to reduce the deficit? The annual mileage on the route concerned is, with a maximum number of six cars, approximately 200,000 miles. If I could reduce the operating costs by an amount equal to half the platform labour costs (in my case it is 5.173d. per mile), an approximate net loss of £2,000 would be converted into a net profit of about £20 per annum. I decided, therefore, and my Corporation agreed, that under such circumstances the "one-man car" was the solution.

The use of the "one-man car" in this country has, so far, been very limited, and although many tramway managers and engineers have experimented with this type of car, it is only recently that an order has been placed in this country for a "one-man tramcar" as a complete vehicle. In designing the "one-man car," the principal factors which have been kept in mind have been: safety

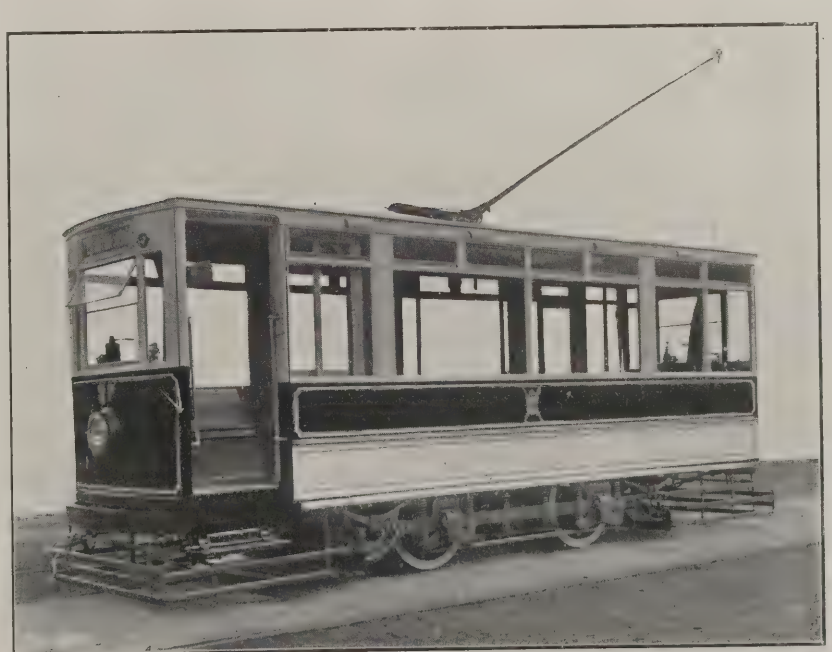


Fig. 1.—"One-man" Tramcar; York Corporation.

for the travelling public and simplicity in operation, as the driver, in collecting the fares and also in driving the car, must have as few complications as possible. It was decided, after consultation with the Ministry of Transport, that the maximum seating capacity for the first car should not exceed 24. From the experience gained by the operation of this car, I say without hesitation that this number can, with perfect safety, be increased to from 28 to 30. The accompanying illustrations show the car to be of the single-deck variety, mounted on a standard Preston 4-wheel truck having a wheel base of 6 ft., the overall length of the car being



Fig. 2.—Interior of Car, showing Driver's Platform.

23 ft. 6 in. The complete vehicle, when empty, weighs approximately 8 tons 7 cwt., the car body alone weighing about 3 tons 5 cwt. The very sound construction of the car is characteristic of the English Electric Co.'s practice.

A feature of the vehicle is the main and platform floors, which are run through at the same level and are made of $\frac{7}{8}$-in. tongued and grooved pine boards—a very good arrangement, as it avoids that step into the saloon which is so very objectionable. Platform vestibules are fitted at each end of the car, and the two doors are operated by levers from the platform; the doors work in conjunction with the folding steps, the door-operating lever on the platform being so arranged that when the door is open it is impossible for the driver to move the controller handle, thus preventing him from starting the car until the door is closed. The doors on both platforms are provided with a locking device consisting of a spring plunger in the floor and operated from the driving end by means of a "Bowden" wire, the control lever being within easy reach of the car controller, so that it is impossible for anyone to open the rear door unless a catch which is under the driver's supervision has been released. The lever operating the "Bowden" wire is fitted with a quadrant arrangement that fixes the lever in either the open or closed position, so that the driver, when moving from one end of the car to the other, can unlatch the door at the driving end (which is under his personal control) while he is on the platform at that end. For an emergency exit when the quadrant lever is released at the driving end, the sliding doors are so balanced that the rear door can be opened by hand without difficulty. When the doors are open, a signal arm projects and indicates to oncoming traffic that passengers are about to alight from the front exit, the arm working in conjunction with the door and step. To avoid any risk of accidents at night time during loading and unloading, when the door opens an automatic switch operates a lamp above the door and throws a light on the step. In addition, an illuminated sign bearing the words "Danger, front exit car" is fitted on each dash. Depending on the way the car is travelling, the rear notice is illuminated, thus giving due warning to oncoming traffic.

With trolley reversers equipped throughout the system, the trolley will not require changing from the time the car leaves the depôt in the morning until it arrives back again at night.

Provision has been made for a smoking compartment at the opposite end to that from which the car is driven. The signal bells are of the "Numa" air-operated type with push buttons at convenient places. The driver is provided with a circular seat, and the lifeguards, of the Hudson and Bowring type, work in conjunction with the side-guards on each side of the platform. A Westinghouse straight air brake is arranged to work in conjunction with the "dead man's" controller, which has a "run-back" preventer and other features, as shown in fig. 3, but its operation is similar to that of the standard drum controller, the only difference being that the power-handle "dead-man's" device automatically operates the air brake and mechanically trips the circuit breaker. To restart the car it is only necessary to bring the controller to the "off" position and reset the circuit breaker, which is within easy reach of the driver. With the controller handle on the rheostatic brake notches, if the "dead-man's" lever is released, the emergency air valve will apply the air brakes, but the circuit breaker will not be tripped. Likewise, with the controller handle in the "off" position and the reverse lever in the "on" position, on releasing the "dead-man's" lever, the emergency air valve applies the brakes, but the circuit breaker is not tripped.

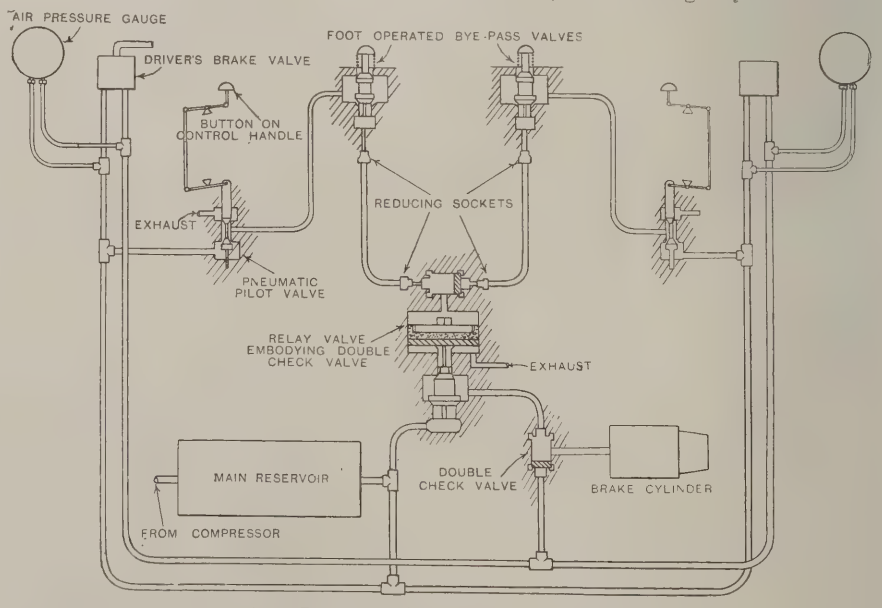


Fig. 3.—"Dead Man's" Pneumatic Control System.

A novel feature of this system is the use of a foot-operated pedal which, when depressed, renders the emergency air brake inoperative. This is used by the driver only when he releases the "dead-man's" handle for the purpose of taking fares, the object being to preserve the air pressure in the reservoirs.

The trucks are fitted with wheels 32 in. in dia-

meter, and two "English Electric" D.K. 29A motors of 30 h.p. at 500 volts on the one-hour rating, and the drive is through single-reduction spur gearing. The motors are self-ventilating, and are easily accommodated on the 3 ft. 6 in. gauge which is standard in York.

The air brake equipment, supplied by the Westinghouse Brake & Saxby Signal Co., Ltd., consists of one 6 cu. ft. air compressor coupled direct to a Metropolitan-Vickers 1¼-b.h.p. protected motor, two reservoirs, and a governor, which can easily be set to operate at any predetermined pressure; from experience I have found maximum and minimum pressures of 65 and 45 lb., respectively, to be the most serviceable.

The Minister of Transport, on whose behalf the car was inspected and tested by Lieut.-Colonel Mount, states that the details of the car have been well thought out, and has requested to be furnished with a report upon its operation under traffic conditions in six months' time.

Telegraph and Telephone Notes.

Australia.—NEW RADIO TELEGRAPH STATION.—The new Commonwealth Government wireless telegraph station at Camooweal, Queensland, which was opened in November last, completes the chain of stations across Northern Australia—Wyndham (W.A.) to Wave Hill (Northern Territory) thence to Camooweal, and then on to Brisbane. As there is no telegraph office at Camooweal, the station will bring a large area into closer touch with civilisation, and if squatters and private persons desire to link up with any of these stations, by either ordinary or wireless telephony, the telegraph department will be prepared to handle their traffic for them.

Belgium.—NEW TELEGRAPH CABLES.—The Belgian Government some time ago decided to install a telegraph cable between La Panne and Herbesthal, and another between Lille and Rosendael, with the object of opening up direct communication between Germany and England, on the one hand, and France and Holland, on the other. *The Times* now reports that the Minister of Railways, Posts and Telegraphs has received tenders for the laying of these long-distance cables from various firms, and has decided to give three-quarters of the work to certain Charleroi concerns, the remaining quarter being assigned to a German firm. It is anticipated that the work, which will cost the State about 70,000,000 fr. (approximately £660,000), will be completed within two years. It is expected that an increased revenue of 10,000,000 fr. a year will accrue to the Belgian telephone and telegraph administration from the new cables, this sum representing the approximate value of the communications which the Belgian administration is at present compelled to refuse owing to the absence of direct cables.

China.—WIRELESS TELEPHONE SERVICE.—The Ministry of Communications is taking steps to install a wireless telephone service between Tientsin and Shanghai.—*Reuter's Trade Service* (Shanghai).

Holland.—POLICE RADIO SERVICE.—A Commission representative of the police force and radio authorities has reported that wireless is useful to the police as an efficient and speedy means of communication, and that its cost, in comparison with the service it could render, is very small.—*Daily Mail.*

Germany.—TELEPHONES ON TRAINS.—Travellers on express trains running between Hamburg and Berlin will, from January 4th onwards, be able to telephone by wireless from the railway trains, and the service will be extended to other trains as soon as possible.—*Reuter* (Berlin).

Madeira.—WIRELESS STATION.—Marconi's Wireless Telegraph Co., Ltd., has recently commenced work upon the erection of a wireless station under its Portuguese concession near Caniçal, Madeira, on a small table-land about 800 ft. above sea level. The building is to be constructed of ferro-concrete and cement blocks, all of which, together with the water, has to be transported up the mountain side, a new road having been made for this purpose. The work is being done by a British firm, the Madeira Supply Co., Ltd., engineers, of Funchal, of which Mr. J. H. Quicke is the chief engineer.

Telephones in the Far East.—THE POLYGLOT PROBLEM.—Automatic telephones, a proportion of which are of British manufacture, are finding favour in the Far East; they appear to be the only satisfactory method of dealing with the large number of different languages (some 26) commonly spoken in the large towns. China possesses the largest automatic exchange of the Far East in that of the Dairen telephone system, which was installed in 1922; it is operated by the South Manchurian Railway Co., and is equipped for 4,800 lines. The Automatic Telephone Manufacturing Co. has recently completed four municipal automatic exchanges in Shanghai, and there is also an automatic exchange at Harbin, which was installed a year before that at Dairen, and is equipped for 3,000 lines. It was the successful operation of this exchange that paved the way for the Dairen project. Work has begun on the installation of an automatic system to serve the Tientsin district. Japan is replacing the Tokio system, which was destroyed by the earthquake and fire, by an automatic system of English make and of the type approved by the British Post Office.

The Telephone Service.—PROGRESS IN MANCHESTER.—The annual report of the Manchester Telegraph and Telephone Advisory Committee, signed by Mr. W. J. Medlyn, superintending engineer, shows that considerable progress has been made in the preliminary work connected with the introduction of automatic telephones in the Manchester district. Subscribers who will be served from the new Ardwick exchange are now using the numbers which will be allotted to them in the automatic exchange; the main building will be in Chapel Street. Complete new exchange equipment has been provided at Didsbury, Higher Broughton, Leigh, Saddleworth, and Delph, and a substantial addition has been made to the equipment at Oldham. New exchanges or equipment are to be provided at Atherton, Bramhall, Knutsford, Openshaw, Stalybridge, and Whaley Bridge. A relief exchange at York Street will provide for development pending the introduction of automatic working, and the new subsidiary automatic exchanges at Ardwick, Moss Side, and Collyhurst will be commenced shortly.

During the last year 8,974 new telephones were fitted, a net increase of 5,677, which constitutes the highest record for 13 years. The number of telephones was 70,958 in September, 1925, a growth of 115 per cent. in 13 years. The number of outstanding applications which could not be accepted owing to shortage of underground cables had been reduced at the end of October to 15. It is now generally practicable to give service on new lines in about 65 per cent. of the cases within one week of the receipt of the order, and 85 per cent. within two weeks. During the past two years the increase in underground cable mileage has been 50,151 miles, or an average of nearly 500 miles of wire per week. In the past 13 years the total has risen from 75,476 to 246,126.

The repeater stations at Fenny Stratford and Derby, on the London-Manchester cable, have given excellent service: that at Manchester, which was originally equipped for 30 repeaters, has been enlarged to 50 and 42 of these have been brought into use. Fifteen additional repeaters are now being installed.

The number of effective trunk calls in the Manchester district during the past year was 5,339,487, an increase of more than three-quarters of a million over 1924. Telegrams received by telephone from the public numbered 403,321, an increase of 61,500, and the local effective calls during the year numbered 46,391,000, an increase of over six million calls. On an average the telephonist answers the calling subscriber in 5.7 seconds. Street kiosks number 119, and a new feature is being introduced in connection with the Stockport automatic exchange in the shape of multi-coin boxes at call offices which provide for trunk calls.

The apparatus at the head post office for handling telegrams by telephone is being replaced by equipment of the latest type, and auto-Baudot apparatus has recently been installed to provide eight channels between Manchester and London. The volume of traffic makes the London-Manchester group the heaviest telegraph channel between any two offices in the world.

United States.—TELEPHONE FACTS.—There are now 10,000 telephone companies in the United States, more than twice as many companies as there are exchanges in the United Kingdom. In addition, there are approximately 30,000 rural telephone lines, operated largely on a co-operative basis, which do not rank as companies.

Radio Notes.

Australia.—NEW STATION.—The new broadcasting station (2KY) is owned by the Labour Council and will apparently be used for Socialist propaganda. According to the *Sydney Morning Herald* the Government was represented by Mr. A. C. Willis, vice-president of the Legislative Council, who, in officially opening the station ("an Australian product, built by Australian engineers") said that the development of wireless in Australia had been hampered by a Nationalist Federal Government, acting in concert with big vested monopolies. The Government's plan for the establishment of a high-power central station, and the erection in provincial and country centres of a series of relay broadcasting stations was now in the final stages of completion.

Canada.—WAVE-LENGTH.—The Department of Marine has authorised a wave-length of 52.51 metres as the "Trans-Canada" wave-length exclusively for long-distance relay work. This is also the authorised wave-length for communication with other parts of the Empire.—*Reuter* (Ottawa).

Latvia.—LICENCES AND TAXES.—H.M. Consul at Riga (Mr. G. Shepherd) has forwarded to the Department of Overseas Trade extracts of the regulations governing the use of broadcast radio receivers. Permits are issued for the installation and use of sets on payment of the subscription for one quar-

ter, the holder being entitled to acquire sets and parts thereof either from the Post and Telegraph Main Administration or from private firms possessing the requisite manufacturing or trading permit of the Administration. Quarterly subscriptions range from three lats in the case of State and municipal institutions, hospitals, &c., and six lats in the case of the ordinary subscriber, up to 90 lats in the case of kinemas, hotels, &c. All articles must be stamped according to the regulations, which came into force in November, 1925, the sealing charges being as follows: Receivers and amplifiers, 10 lats per valve (max. 40 lats for one apparatus); separate tuning apparatus, 10 lats; crystal receiving sets, 2 lats; valves 2 lats each; earphones 1 lat (double 2 lats); and loud-speakers from 5 to 20 lats, according to size (price). The total sealing dues, charged yearly for small appurtenances sold by commercial undertakings, vary from 100 to 500 lats, according to the town or district in which the sale takes place. Wireless apparatus is not specifically mentioned in the Latvian customs tariff, but is probably included in telegraph and telephone apparatus, the rate for which is 0.50 gold franc per kilogm.

Simultaneous Transmission.—ALTERNATIVE PROGRAMME DIFFICULTY.—The B.B.C.'s proposal to provide London with an alternative programme by using the old aerial at Marconi House, Strand, in addition to the 2LO aerial in Oxford Street, has been turned down by the Government's Wireless Telegraphy Board. According to the *Daily Mail* the Postmaster-General had regarded the idea sympathetically, but the Board (a sub-committee of the Imperial Defence Committee) considered that the Air Ministry in Kingsway would be hampered in receiving official communications.

Ships' Radio Apparatus.—SPARK AND CRYSTAL SETS.—At the Liverpool Centre of the Institution of Electrical Engineers, Mr. E. H. Shaughnessy, of the wireless section of the Post Office, recently lectured on "Post Office Wireless Stations." He said that listeners would experience less interference if they used coupled circuits on their sets. One of the advantages of the spark system from the shipping point of view was its broad tuning, though that was a defect from the point of view of the broadcaster. Loose coupling made spark signalling less offensive to the listener, but it could not be carried too far as it reduced the range of the transmitter. There were still something like 3,000 ships fitted with crystal receiving sets, which had a limited range, and until they were replaced with more sensitive and longer-range valve sets the Post Office would be obliged to use spark transmission.

Not long ago Mr. H. Bishop estimated that spark stations represented a capital of £2,000,000.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—March 16th. Postmaster-General's Department. Battery-charging power board equipment.*

Beckenham. — January 14th. Electricity Department. Water-heating and softening plant. (December 18th.)

Belgium.—February 24th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. Supply and installation of telephone switchboard tables with c.b. and luminous signals, for the interurban and regional telephone exchange at Verviers. Particulars (Cahier des Charges Special, No. 3-160) for 8¼ fr.

March 1st. Compagnie Intercommunale des Eaux, Liége (20, Rue des Guillemins). Nine sets of electric motors and centrifugal pumps at three water-pumping stations.

Birmingham.—January 9th. Tramways Committee. 50 tramcar bodies. Forms of tender (£2) from Mr. A. Baker, general manager, Tramways Offices, Birmingham.

Blackpool.—January 23rd. Electricity Department. One 2,500-kVA phase and frequency changer. (See this issue.)

Bulgaria.—Tenders are being invited by the "Watscha" Wassersyndicat, of Kritschim (Plovdiv), for the equipment of a steam-operated central electric power station, consisting of two steam turbines and generators, a motor generator, main and auxiliary transformers, and a battery of accumulators.

Croydon.—January 11th. Tramways Department. 12 sets of electrical equipment for tramcars. (See this issue.)

Dundee.—January 14th. Electricity Department. Two electrically-driven centrifugal drainage pumps controlled by float gear. (December 18th.)

Town Council. Electric lighting installation at day nursery, North George Street. Particulars from Mr. G. Baxter, city engineer.

January 15th. Harbour Trust. Electric lighting installation at New Wharf. Schedules from Mr. J. Hannay Thomson, general manager and engineer.

Eastbourne.—January 9th. Electricity Department. 12 months' supply of h.p. and l.p. paper-insulated cable. (See this issue.)

January 25th. Electricity Department. One 2,500-kW turbo-alternator, with condensing plant and pipework, one water-tube boiler and economiser, feed heaters and piping, one water-cooling tower. (See this issue.)

Edinburgh.—January 4th. Electricity Supply Department. Two 1,200-b.h.p., 6,600-V, 3-ph. induction motors. (December 11th.)

Egypt.—CAIRO.—February 20th. Director-General, Mechanical Department, P.W.M. Power plant for Giza.*

January 20th. Local Commissions Section. Electric motor and accessories at Manfalout waterworks.*

Ilkley.—January 20th. Electricity Department. Feeder cables, distribution cables, feeder pillars, and network boxes. (See this issue.)

London.—CAMBERWELL.—January 11th. Borough Council. Stores, including electric lamps, for 12 months. Particulars from Borough Engineer, Town Hall, Camberwell.

LAMBETH.—January 5th. Board of Guardians. Twelve months' supply of incandescent electric lamps. (December 25th.)

SHOREDITCH.—January 27th. Electricity Department. One 50,000-lb. water-tube boiler, with economiser, forced and induced draught, &c.; one 10,000-kW turbo-alternator, with condenser, pumps, &c. (December 25th.)

BETHNAL GREEN.—January 19th. Board of Guardians. Three Lancashire boilers for the hospital, Cambridge Road. Specifications, &c., from Mr. C. F. Jones, clerk to the Guardians, Bishops Road, Bethnal Green, E.

METROPOLITAN ASYLUMS BOARD.—January 27th. Installation of electric lighting at the Darenth Colony, Dartford (approx. number of points 2,300). (See this issue.)

Manchester. — January 12th. Tramways Committee. Steel girder tramway rails. Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

January 6th. Board of Guardians. Electric lighting installation at the pathological and dispensing block, Crumpsall Infirmary. Specifications from Mr. A. J. Murgatroyd, architect, 23, Strutt Street, Manchester.

New Zealand.—WELLINGTON.—March 2nd. Public Works Department. Synchronous condenser and transformers for the Arapuni electric power scheme.*

30,000-V switch and protective apparatus for Lake Coleridge electric power supply.*

DUNEDIN.—February 26th. Otago Harbour Board. Motors, control gear, and cable.*

Rumania. — January 26th. Municipal authorities of Temesvar. 14 transformers and a quantity of lead-covered cables for the central electric lighting station in that city.

South Africa.—JOHANNESBURG.—January 21st. Municipal Council. 106 current transformers.*

February 26th. Motor-driven air compressor, with electrical equipment.*

S.A. Railways and Harbours. February 25th. Electrically-operated hoists for raising, &c., heavy locomotives, electrically-driven geared winches, &c.*

CAPE TOWN.—January 27th. Electricity Department. Oil-cooled transformers.*

Sweden.—The Swedish Water Power Utilisation Department, Stockholm, has invited tenders for the supply and installation of a 12,500-kVA outdoor transformer plant, and an indoor plant of a capacity of 10,000 kVA for the Aelvkarleby and Norrviken hydro-electric stations.

Thurnscoe.—January 12th. West Riding Education Committee. Electric lighting installation at new school. Specifications from Education Department, County Hall, Wakefield.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barking Town.—Electricity Committee. Accepted:—
2,000 yd. e.h.p. 3-core cable (£851).—Hackbridge Cable Co., Ltd.
Steelwork for transformer house in Axe Street (£932).—Sanders and Forster, Ltd.

Bradford.—Tramways Committee. Accepted:—
Railless trolley cars.—Associated Equipment Co. and R. Garrett and Sons.

Croydon.—Electricity Committee. Recommended:—
Boiler feed pump (£341).—Mather & Platt, Ltd.

Glasgow.—Corporation. Accepted:—
Electric hot plate, for the Greendyke Street Home (£82).—Carron Company.
Wiring and switchgear (£55).—Corporation Electricity Department.

Tramways Committee. Accepted:—
Forged mild steel axles.—Glasgow Railway Engineering Co., Ltd.
Armature and field coils.—P. R. Jackson & Co., Ltd.
Steel pinions.—British Hele-Shaw Patent Clutch Co., Ltd.; Cammell, Laird & Co., Ltd.; W. C. Yuille & Co., Ltd.

Government Contracts.—The following Government contracts were placed during November, 1925 :—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Dry batteries.—Edison Swan Electric Co., Ltd.
Condensers.—W. H. Wilson.
Electric annealing furnace.—Electric Furnace Co.
Motor alternators.—Crompton & Co., Ltd.
Motor generators.—Small Electric Motors, Ltd.
Starters, &c.—Watford Electric Mfg. Co., Ltd.
Repair of starters.—Marconi Co., Ltd.
Switchboards.—Whipp & Bourne, Ltd.
Switches.—Hawkers, Ltd.; Player & Mitchell; W. McGeoch & Co., Ltd.; Gabriel & Co.; Park Royal Engineering Co., Ltd.
Change-over switches.—General Electric Co., Ltd.; Park Royal Engineering Co., Ltd.
Fuse release switches.—Whipp & Bourne, Ltd.; Bertram Thomas.
W/t. switches.—General Electric Co., Ltd.; Whipp & Bourne, Ltd.
Switchgear (branch breakers).—Whipp & Bourne, Ltd.
K's new patent forced feed-oil cans.—J. Kaye & Sons, Ltd.

WAR OFFICE.

Battery, &c.—Chloride Electrical Storage Co., Ltd.
Electric light fittings, &c.—General Electric Co., Ltd.

AIR MINISTRY.

Voltage control boxes.—Pyne Mfg. Co., Ltd.
Underground cables (Altrincham).—G. E. Taylor & Co.
Ignition accessories.—Robinhood Engineering Co., Ltd.
Repair of receivers.—Muirhead & Co.

POST OFFICE.

Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones and Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing, measuring, and protective apparatus.—British Thomson-Houston Co., Ltd.; Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Walters Electrical Mfg. Co., Ltd.
Wireless apparatus.—Telegraph Condenser Co., Ltd.; Zenith Mfg. Co.
Cables.—British Insulated & Helsby Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Receivers of H. W. Smith (1920), Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Conduit and fittings.—Eureka Conduit & Fittings Co.; Longmore Bros.
Telephone cords.—British Insulated & Helsby Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.
Ducts.—H. R. Mansfield, Ltd.
Lamps.—Cable Accessories Co., Ltd.; A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.
Battery plates.—Alton Battery Co., Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Battery-charging sets.—Stuart Turner, Ltd.
Lead sleeves.—British Insulated & Helsby Cables, Ltd.
Electric trucks.—W. Goodyear & Sons.
Copper binding wire.—Enfield Cable Works, Ltd.; Pirelli-General Cable Works, Ltd.
H.d. copper wire.—Nevill Druce & Co., Ltd.
Tinned copper wire.—Pirelli-General Cable Works, Ltd.
Manufacture, supply, drawing-in and jointing cable.—Swansea-Ammanford : W. T. Glover & Co., Ltd. Walsall-Lichfield : British Insulated and Helsby Cables, Ltd. Marks Tey-Ipswich : Johnson & Phillips, Ltd.
E.h.p. transformers (G.P.O. (South) sub-station).—Siemens Bros. & Co., Ltd.
E.h.p. and l.p. switchgear (G.P.O. (South) sub-station).—A. Reyrolle and Co., Ltd.
Electric lighting, Leicester Telephone Exchange.—T. H. Wathes & Co., Ltd.
Private branch exchange telephone equipment.—Carpet Trades, Ltd. (Kidderminster); Lancashire County Council offices (Preston); Watney, Combe & Reid, Ltd. (Mortlake, S.W.); the British Mannesmann Tube Co., Ltd. (Newport, Mon.) : Relay Automatic Telephone Co., Ltd. Pearson, Dorman, Long & Co., Ltd. (Betteshanger Colliery, Kent) : Standard Telephones & Cables, Ltd.
Telephone exchange equipment.—Sherwood (Nottingham), Arkwright Street (Nottingham) : Automatic Telephone Mfg. Co., Ltd.; sub-contractors : Tudor Accumulator Co., Ltd., for batteries; Crompton and Co., Ltd., for charging machines. Basford (Nottingham) : Automatic Telephone Mfg. Co., Ltd.; sub-contractors : Tudor Accumulator Co., Ltd., for batteries; Crompton & Co., for charging machines; Newton Bros. (Derby) for ringing machines. Buckhurst : Automatic Telephone Mfg. Co., Ltd. Seven Kings : Siemens Bros. and Co., Ltd.; sub-contractors : Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co. for ringing machines. Dumfries : Siemens Bros. & Co., Ltd.

H.M. OFFICE OF WORKS.

Wiring, &c. (Charity Commissioners' office, Ryder Street, W.).—Electrical Installations, Ltd.

CROWN AGENTS FOR THE COLONIES.

Battery material.—Siemens Bros. & Co., Ltd.
Copper cable.—T. Bolton & Sons, Ltd.
Ceiling fans.—General Electric Co., Ltd.
Electric headlights and spares.—C. Stewart & Co., Ltd.
Porcelain insulators.—Doulton & Co., Ltd.
Lightning arresters.—International General Electric Co., Ltd.
Transmission line material.—Callender's Cable & Construction Co., Ltd.
Telegraph poles.—Bullers, Ltd.
H.d. copper wire, &c.—F. Smith & Co.; Elliotts Metal Co., Ltd.
Wood separators.—Chloride Electrical Storage Co., Ltd.

Hornsey.—Electricity Committee.

Meters and time switches.—Chamberlain & Hookham, Ltd.; Ferranti, Ltd.; Reason Mfg. Co., Ltd.; and Venner Time Switches, Ltd. (Recommended.)
Disconnecting boxes (£23 per box).—Motor Gear & Engineering Co., Ltd. (Accepted.)

Hull.—Electricity Committee. Accepted:—

Cooling towers (£5,539).—Davenport Engineering Co., Ltd.

Kilmarnock.—

Electrical equipment of new premises, for D. Lander & Sons.—W. Dow and Sons, Ltd.

Lamp Contracts.—Siemens & English Electric Lamp Co., Ltd., has received contracts for 12 months' supplies of train-lighting lamps from the London & North-Eastern Railway Co.; for traction lamps from the Dublin United Tramways; and for vacuum gasfilled and carbon-filament lamps from Geo. Thompson & Co. (Aberdeen Line). The Great Western Railway Co. has placed a 12 months' contract for "Osram" gasfilled lamps with the General Electric Co., Ltd.

Lichfield.—Town Council. Accepted:—

Transformers and switchgear (£2,790).—Ferguson, Pailin, Ltd.
Cables and road work (£20,488); public lighting cables (£2,579); barracks line (£2,350).—W. T. Henley's Telegraph Works Co., Ltd.

Southampton.—Harbour Board.—In connection with the new sub-station to be erected on the Town Quay, 24 tenders were received for the electrical equipment, only one of which was for the complete specification. The following tenders were recommended for acceptance by the Works Committee :—

Carrick & Sons, Edinburgh, for sections 2, 3 and 4, subject to the fitting of controllers and panels made by Allen, West & Co., at a total cost of £8,050.
George Ellison, section 5, for £749.

The Board, which at the last meeting accepted a contract of £1,000 for the construction of the sub-station, adopted the report, and will take its supply of electricity from the Corporation Electricity Department.

South Africa.—CAPE TOWN.—Recommended :—

43 tons bare copper wire (£3,534).—Davis & Soper, Ltd.
40 tons ditto (£3,505).—Telegraph Mfg. Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Cable (£327).—Macintosh Cable Co., Ltd.

Wakefield.—Rural District Council. Accepted:—

Installation of pumps, electric motors, &c., in connection with drainage scheme of Shay Lane, Walton, near Wakefield.—Pulsometer Engineering Co.

Windsor.—Town Council. Accepted:—

Electric wiring at the Town Hall (£113).—Bridger & Son.

Yarmouth.—Electricity Committee. Accepted:—

Switchgear (£2,750).—English Electric Co., Ltd.
Two water-tube boilers (£25,570).—Babcock & Wilcox, Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, January 1st. At 39, Victoria Street, S.W. At 7.30 p.m. Kinematograph Lecture, "The Manufacture of Ordnance" and "The Rolling Mills and Crucible Melting Department at the River Don Works of Vickers, Ltd.
Friday January 8th. Paper on "Some Notes on Salesmanship," by Mr. A. J. Simpson.

Electrical Power Engineers' Association.—Friday, January 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Automatic Boiler Control," by Mr. H. W. Holland.

Nottingham Society of Engineers.—Monday, January 4th. At the Victoria Station Hotel. At 7.30 p.m. Lecture on "Patents for Inventions," by Mr. E. Potter.

Royal Institution of Great Britain.—January 5th, 7th, and 9th. At 21, Albemarle Street, W. At 3 p.m. Lectures on "Old Trades and New Knowledge," by Sir William Bragg

National Association of Supervising Electricians.—Tuesday, January 5th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Paper on "The Ultimate Position of the Single-phase Motor," by Mr. W. A. Benger.

Roentgen Society.—Tuesday, January 5th. At 32, Welbeck Street, W. At 8.15 p.m. Papers on "A Combined X-ray Tube and Vacuum Pump Unit" and "The Industrial Uses of X-rays—the Present Position," by Mr. G. W. C. Kaye; and on "The Measurement of Radium During Radio-active Growth," by Mr. A. F. Dutton.

Institution of Heating and Ventilating Engineers.—Wednesday, January 6th. At Caxton Hall, Westminster, S.W. At 7 p.m. Paper on "Pump Circulation," by Mr. J. R. Preston.

Electrical Society of Glasgow.—Wednesday, January 6th. Paper on "Wiring Rules and Defects," by Mr. H. M. Stronach.

Institution of Electrical Engineers.—Thursday, January 7th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Past, Present and Future Development of Wireless Telephony," by Capt. P. P. Eckersley.

(North-Western Centre).—Tuesday, January 5th. At the Engineers' Club, Manchester. At 7 p.m. Lecture on "Co-operative Business Building for the Electrical Industry," by Mr. J. W. Beauchamp.

(Wireless Section).—Wednesday, January 6th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Frequency Variations in Thermionic Generators," by Lt.-Col. K. E. Edgeworth.

Edinburgh Electrical Society.—Friday, January 8th. At the Royal Society of Art, 117, George Street. At 8 p.m. Social evening.

Society of Technical Engineers.—Friday, January 8th. At the Queen's Hotel, Birmingham. At 7.30 p.m. Paper on "The Research Factor in Cable Making," by Capt. P. Dunsheath.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, January 9th. At 62, Wind Street, Swansea. Paper on "Electrical Costing Applied to Collieries," by Mr. C. E. Yates

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Tinned paper suitable for the manufacture of condensers.

BELLTONE (for cleaning accumulator plates).

We also have an inquiry for the present address of Marsdens (Live Publicity), Ltd., late of Bolton, and manufacturers or proprietors of Humannekin Turntables.

Notes.

Big Radio Law Suit in the United States.—Under the title "Sixty-Million-Dollar Radio Suit Filed by Fessenden," the *Electrical World* of December 19th states:—"Suit declaring triple damages amounting to $60,000,000 was filed December 3rd in the United States District Court at Boston on behalf of Prof. Reginald A. Fessenden, of Chestnut Hill, Mass., against the General Electric Co., Radio Corporation of America, Westinghouse Electric & Manufacturing Co., Western Electric Co., Inc., United Fruit Co., Wireless Specialty Apparatus Co., and International Radio Telegraph Co., under the Sherman Act and Clayton anti-trust law. The defendants are charged with lessening and finally destroying competition, restraining commerce and injuring the plaintiff through combination and control of radio apparatus manufacture and use. A list of between two hundred and three hundred inventions, title to which, it is contended, resides in the plaintiff, is appended to the bill."

Swiss Railway Electrification.—The Federal Railways of Switzerland, we learn, have nearly completed the electrification of the section between Geneva and Lausanne. This section has offered no technical difficulties beyond the raising of a foot-bridge near Allaman station, but the electrification work has been difficult owing to the traffic beyond and between the two cities, especially at Geneva, and the running of special trains. It is much to the credit of the electrical engineers that they have finished their work two months in advance of the scheduled time. Trial trips are being run by means of a testing-carriage (wagon d'essai) for the contact points and an overhead trolley for the wires, both drawn by an ordinary steam engine. Cable boxes have been established a kilometre apart along the line, and telephones have simplified matters where there have been breakdowns and unexpected traffic to cope with. It is estimated that electric traction will supersede ordinary locomotion for all trains on the section after January 5th, 1926.

R.A.F. Wireless School.—The Electrical and Wireless School near Winchester at Flower Down has now sent three entries of apprentices to the Central Trade Testing Board, and in no case has a lad failed. This is a "record" held by no other R.A.F. training centre. Sir Philip Sassoon, Under-Secretary of State for Air, recently inspected the school, some 1,100 strong, and the workshops, where 290 lads, 556 men, enlisted by direct entry, and 14 officers on a signals course, are being trained in the theory and practice of wireless. *The Times* explains that a wireless operator-mechanic of the highest grade must be a fitter, have a thorough knowledge of all electrical plant used by the R.A.F. and of the generators used in aircraft, be able to wire aircraft for wireless, operate and repair the instruments, and, in addition, be able to send and receive Morse clear or in code. The minimum standard required is reception for five minutes at 20 words a minute with not more than three errors, and to simulate actual working conditions in the air all practice is carried out with a definite amount of interference cutting the received signals. Actually 60 per cent. of the lads fulfilled the conditions, receiving at 25 words per minute. No other trade in the ranks has so many opportunities, and there are always at each entry examination more applications than the establishment at the moment calls for. Each lad receives three years' training.

The Arrangement of Cells in Series and Parallel.—Mr. W. F. Dunton, of Newcastle-on-Tyne, who nearly 20 years ago pointed out that the generally accepted rule for finding the best arrangement of cells in series and parallel, to give the largest current through a specified external resistance, under certain circumstances might be very misleading, observes that the rule referred to has recently been republished, and he agai takes up the cudgels on behalf of his own formula. He says:—

"The problem is to find what arrangement of n cells, in p parallel rows of s cells in series, will send the greatest current through an external resistance of R ohms, when each cell has a resistance of r ohms and an e.m.f. of e volts, n being any given number. Whatever value we give to s, the current will be $cs/(R + rs/p)$, $= (esp/r)/(pR/r + s)$; and, since esp/r is a constant (sp being the given number of cells), the current will be greatest when $pR/r + s$ is smallest. But this must be when $pR/r - s$ is numerically smallest; for the squares of these last two expressions differ by $4spR/r = 4nR/r$, and when two variables have a constant difference they must reach their lowest values simultaneously. We are thus led to the convenient and infallible rule that the greatest current will be obtained when s is as near as possible to pR/r."

The old rule says that sr/p (which is the resistance of the battery) must be as nearly as possible equal to R; it may seem that this is simply Mr. Dunton's rule expressed in another way, but the difference becomes clear when the rule is applied to actual cases. He also points out that the greatest current obtainable with a given number of cells may be less than that obtainable with a smaller number—it being understood that the cells are in each case arranged in a battery of the above-mentioned regular form, p parallel rows of s cells in series.

Mr. Dunton remarks that this question of battery arrangement is a comparatively unimportant special case of an important class of functions having the form of $ax/(b + cx^2)$. Such functions occur very frequently in engineering investigations; and he remembers a case in which a serious mistake was made in connection with lightning arresters, through the investigator not being aware that this expression had its greatest value when x was as near as possible equal to b/cx. The fact that this is where the greatest value occurs (with a, b and c constant and everything positive) can be proved in the same way as he proves his battery rule, if the numerator and denominator are first divided by cx.

A Severe Ordeal for a Storage Battery.—In connection with the recent failure of the dam at the Aluminium Company's power station at Dolgarrog, North Wales, we learn that at the time of the flood the Chloride storage battery was submerged in ten feet of water, and stood for over four weeks embedded in mud to a depth of over 6 in. above the tops of the cells. We are informed that although it has not been touched since that period it is still working satisfactorily, and is being charged and discharged in accordance with its normal routine. A certain amount of sand has fallen in through the vent holes of the cells, but this has not affected their working. Such a result is, we should think, without a precedent, and affords a striking instance of Chloride reliability.

Röntgen Apparatus in Sweden.—According to a German report from Stockholm, medical circles in Sweden have complained for a long time past that certain accessories for Röntgen apparatus, particularly tubes, are not obtainable in Europe in the same improved form as in the United States. The production of Röntgen apparatus in Europe is limited to a few firms owing to the existence of an international syndicate agreement, and in particular to the A.E.G. and the Siemens Company, while the sole right of manufacture in the United States is vested in the General Electric Company. The report states that, according to Swedish opinion, the accessories turned out by the American company are better than those supplied by the German firms. But in consequence of the existence of the syndicate agreement it is impossible for the Swedes to import the accessories from the United States, although there is a large demand for them in Sweden. In these circumstances Swedish medical men have presented a petition to the Government asking for the State to expropriate the patents concerned on the basis of Article 17 of the Swedish patent ordinance. The Swedish Board of Trade is said to have supported the proposal.

Venner Stop Watch Test.—We have received a copy of a report by the National Physical Laboratory on the Venner stop watch, a production of Venner Time Switches, Ltd. The instrument was examined in the "pendant up" position with the following results to the nearest 0.02 of a second. After indicated intervals of five and 10 seconds the errors were 0.04 second gain in each case; 20 sec., 0.02 gain; 30, O.K.; 50, 0.02 gain; 100, 0.02 gain; 200, 0.02 gain; and 300, 0.04 gain. The watch was found to run satisfactorily for one hour. A description of this instrument appeared in our columns on April 21st, 1922. It may be recalled that the seconds hand records 10 seconds in one revolution, and that each second division is divided into tenths, the latter measuring about 1/16th in. The minute dial records five minutes in one revolution, and each minute division is divided into sixths, so that each small division represents a complete revolution of the seconds hand.

Whitworth Society.—The third annual commemoration dinner was held at the Holborn Restaurant on Monday, December 21st, the anniversary of the birth of Sir Joseph Whitworth, Bart., with the president, Mr. Wm. Sisson, of Gloucester, in the chair, and about 70 members present. There are now 470 members on the roll. Full information can be obtained from the hon. secretary, c/o Institution of Mechanical Engineers.

Appointments Vacant.—Head of the Electrical Engineering Department, L.C.C. Hackney Institute (£480); lady demonstrator and saleswoman (£182) for the Southport Corporation Electricity Department; electrical engineer for the Cornwall Mental Hospital; electrical engineer and electrical inspector for the Public Works Department of the Government of Bihar and Orissa; assistant electrical engineer for the Singapore Harbour Board ($400 a month, dollar=2s. 4d.). (See our advertisement pages to-day.)

Local Societies.—SHEFFIELD ILLUMINATION SOCIETY.—We have received a copy of the syllabus of this Society for the session of 1926, which shows that an interesting series of lectures and visits has been arranged. The Society has now completed its first year, and excellent progress has been made, the membership being 111.

INTERMITTENT ELECTRIC FORCE.—At a meeting of the Royal Society of Edinburgh recently, an address on "The Intermittence of Electric Force, and its effects on Atomic Dynamics" was given by Sir J. J. Thomson. The theory discussed was that when a body is under the action of electric force, instead of receiving a continuous flow of indefinitely small increments of momentum, the increments it receives are each finite in amount and separated by finite intervals of time, called the time interval of the electric field. For events which last over a large number of time intervals the results are the same as those given by the classical theory of continuous force, but for events which can happen in a very short time comparable with the time interval of the field, an entirely different treatment is required, and the path of an electron in an electric field would not be of continuous curvature, but an irregular polygon with a very large number of sides. The electron staggers about irregularly, not necessarily retracing any previous path, but diverging in a way governed by the laws of probability.

When the number of sides of the polygon is very great the number of paths which differ appreciably from that given by the classical theory is a very small fraction of the whole number, but this is not true when the polygon has only a moderate number of sides. It was shown that the intermittence of electric force would lead to some spontaneous dissociation of a system consisting of electrons and positively charged particles, and that it would also lead to the production of Röntgen rays, when electrons passed near atoms, but that these rays would be very soft unless the electrons moved so quickly that the time they were in the neighbourhood of the atom was comparable with the time interval of the electric field in the atom. Since the time interval gets longer as the strength of the electric field diminishes, the waves will be reflected back at this stage, and thus the energy will be confined to a limited volume. The shorter the period of the waves the smaller will be this volume. This has an important application to light, as it shows that the energy must travel in bundles which do not spread out as they travel through space. This conception simplifies the dual theory of light recently brought forward by the author, as it ensures that the energy of the electrical waves in the unit of light shall be constant as well as the energy of the quantum.

ROLLING MILLS.—Mr. L. Rothera, of the English Electric Co., recently read a paper on "Speed Control in Relation to Modern Rolling Mill Drives" to the members of the West of Scotland Iron and Steel Institute in Glasgow. In the case of a sheet mill, Mr. Rothera showed that an increased rolling speed would increase the power cost and at the same time the output would be no greater. In a section mill, however, higher speed would result in a reduced cost and a greater tonnage output. The use of a higher rolling speed would not, within limits, increase the cost of either mill or drive, but more expensive handling apparatus would be necessary, and this would require to be set off against the larger output.

A Children's Party.—Over one hundred children of employés of the Glasgow Corporation Electricity Department who fell in the war were entertained by the Welfare Department to a Christmas treat last week. Bailie Councillor Dewar, Convener of the Electricity Committee, presented each child with a new shilling. Mr. R. B. Mitchell, general manager, and Mrs. Mitchell were present during the evening, the success of which was largely due to the excellent arrangements made by the committee, with Mr. A. M. Estcourt as secretary.

Large Variable-Voltage Transformers.—Six variable-voltage, single-phase transformers were delivered recently to the Philadelphia Electric Company by the Westinghouse Electric and Manufacturing Company; they are rated at 20,000 kVA each, and are oil-immersed, constituting two banks delivering 60,000 kVA to lines supplying power to Trenton and Bristol, N.J. The transformers will operate delta-connected on the low-voltage side at 13,800 volts, delivering power on star connection at from 69,000 to 76,000 volts. The variable delivery is made possible by four steps embodied in a tap-changing device designed for changing voltage under full load without shutting off the power or interfering with the transmission system or circuit-breakers. It is claimed that these are the largest transformer installations ever placed in operation which include tap-changing under load conditions. The specially designed tap-changing mechanism is mounted in a large steel cubicle attached to the top of the transformer tank at one side. The cubicle is off the ground, and is entered through a door which is locked to prevent the tap settings from being meddled with by others than those in charge. The transformer tanks are more than 15 ft. in height, with an overall clearance, including platform and bushings, of 24 ft. The tanks measure 9 ft. 5 in. in diameter. The two banks are being installed in the Richmond Station of the Philadelphia Electric Company as part of what will ultimately be eight 50,000-kVA generating and transmission units.

Arc Welding a Bridge.—The strengthening and repair of Holt Fleet Bridge spanning the River Severn at Holt, Worcestershire, by means of a special process of electric arc welding is being considered by the County Council as an alternative to rebuilding the bridge. Two French engineers, M. de Boulogne and M. Gueritte, have undertaken to inspect the bridge and to report to the Council on the practicability of applying the process. The Surveyor (Mr. F. C. Gettings) has interviewed the chief engineer for steel structures to the Paris, Lyons and Mediterranean Railway, and inspected work on bridges along that railway.

Research Contribution.—Stepney Borough Council Electricity Committee has recommended the Council to make an annual contribution of £25 to the funds of the British Electrical and Allied Research Association.

A New Electric Vehicle.—The City of Birmingham's Cleansing Department has added to its extensive fleet of battery-driven electric vehicles an unusual type which embodies a new idea in the design of such vehicles. It is a 5-ton tipping wagon, supplied by Messrs. Electromobile, Ltd., and its outstanding feature is the fact that it incorporates the four-wheel drive, each wheel being provided with a 2¾-h.p. driving motor. The transmission is through high-ratio compound gearing, the final drive being by means of teeth on a brake drum that forms part of each wheel. Braking is thus provided on each wheel, in addition to the usual form of electric braking operated by the controller. The vehicle marks a new stage in electric refuse-collecting vehicle design and its operation in Birmingham will be watched with interest.

Reduction of L.C.C. Tramway Rates.—According to the *Daily Sketch* a conference of London rating authorities has reduced the rates on the tramway track of the L.C.C. by one half. The L.C.C. claimed that, in view of the heavy losses on the tramways, there should be no rates at all. For the year ended March 31st last the deficiency on the L.C.C. tramways was £286,670. The local rates paid on the tracks amount to over £60,000 a year. It is estimated that the deficiency for 1925-26 will amount to approximately £200,000.

Transmission at 150,000 V.—*Eclairage et Force Motrice* reports that during 1925 the transmission pressure upon the new lines of the Cie. des Chemins de Fer du Midi was progressively carried from 60,000 to 150,000 V. These lines connect the railway company's sub-stations on the Dax-Toulouse line with the source of supply. It was intended to provisionally employ a pressure of 60,000 V, and eventually one of 120,000 V, but it was found that the system, parts of which are designed to carry 100,000 kW, was capable of withstanding 150,000 V. The outdoor transformer stations were supplied by the Cie. Electro-Mécanique. It is suggested that this is the first instance of the use of 150,000-V a.c. transmission in Europe, and it is stated that during tests a pressure of 165,000 V was applied, without any ill-effects, for half an hour.

Institution Notes.

Physical Society of London.—THE DUDDELL MEDAL.—The Duddell Medal of the Physical Society of London has this year been awarded to Mr. Albert Campbell, formerly of the National Physical Laboratory. The medal is awarded to those who have advanced the science of physical measurements by inventing instruments or parts of instruments of novel design. Mr. Campbell has won distinction for many new devices connected with the measurement of capacity and inductance. He was one of the first to introduce coils of small self-capacity, now so largely used in wireless; Campbell's system consists of a number of pancake coils separated from one another by small spaces and held rigidly together.

Mr. Campbell has invented instruments for the measurement of frequency; others, known as wave sifters, for the elimination of particular frequencies; instruments, called microphone hummers, for the production of small alternating currents; and vibration galvanometers for use in measurements employing alternating current. The instrument which has won him greatest fame is the standard mutual inductance, which forms the basis of most of the accurate measurements of inductance in this country. Mr. Campbell is well known for his skill as an experimenter, and has made two determinations of the ohm in absolute units.

Institution of Public Lighting Engineers.—At an emergency Council meeting, held at Leeds, at the termination of the second annual meeting and conference, votes of thanks were accorded to Mr. S. B. H. Langlands, J.P., the retiring president, and Mr. W. J. Liberty, the hon. secretary, and the latter was presented with a cheque on behalf of the Council. Mr. Leon Gaster, hon. secretary of the Illuminating Engineering Society, was admitted as an hon. member of the Institution, and it was confirmed that the third annual meeting and conference should be held in September, 1926, at Newcastle-upon-Tyne, under the presidency of Mr. R. Davison, superintendent of the public lighting of that city.

Institution of Heating and Ventilating Engineers.—PRIZE COMPETITION.—The Council of the Institution is offering prizes for original papers as follows: The Lumby Premium (10 guineas) for the best paper dealing with, or any subject connected with, heating or hot-water supplies; the Sirocco Premium (10 guineas) for the best paper on ventilation and the general application of fans, air washing and conditioning, dust and fume removal, mechanical draught, &c.; and the London Premium (five guineas) for the next best paper on any subject included in the above. The competitor must be either a student attending a technical institute or an assistant actively connected with the business of heating and ventilating in Great Britain and Ireland, and is not a principal or an employer. Papers should be not more than 7,000 words in length, and must be written under a *nom-de-plume*, the name and address of the author, in a separate sealed envelope, to be sent with the paper to the secretary not later than May 1st, 1926.

An Institution of Fuel Economy.—A new Institution has been formed, to deal in a scientific manner with the problem of preparing and utilising our fuel resources with much greater efficiency. This new organisation, which is called "The Institution of Fuel Economy Engineers," was inaugurated at a meeting of experts on Tuesday last week, at the Engineers' Club, London. Among those taking part in the proceedings were Dr. T. Barratt, Prof. Bacon, Mr. W. C. Goodchild (representing Sir Henry Fowler), Dr. R. Lessing, Messrs. E. W. L. Nicol, John Bruce, S.W. Bettoney, J. S. Gander, and A. C. Mahar. The first Council was elected, and it was decided to form sections in different parts of the country. It is hoped to make this new Institution the responsible organisation representing every section of fuel technology throughout the country. The secretary is Mr. H. L. Pirie, and the registered office of the Institution is 29, Sherwin Road, Lenton, Nottingham, pending the opening of London headquarters.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The Canadian *Electrical News* announces that Mr. JAMES MUIRHEAD has resigned from the position of chief inspector of electrical energy for the Province of British Columbia, which he has held for five years, to commence a private consulting practice. Mr. Muirhead was educated at Glasgow University and before joining the British Columbia Electric Railway Co., Ltd., in 1912, was successively with the Glasgow Corporation Tramway Department, the British Thomson-Houston Co., Ltd., Krumos, Ltd., and Bruce Peebles & Co., Ltd.

The French Académie des Sciences has awarded the Gaston Planté prize to M. J. BETHENOD, of the Ecole Supérieure d'Electricité, of Paris, for his work on "The Generation and Utilisation of Alternating Current at High Frequencies."

Mr. ROBERT INGLIS, late chief superintendent, Post Office Telegraphs, Glasgow, was entertained by his former colleagues on the occasion of his retirement and a presentation was made. Mr. David Miller, the new chief superintendent, presided.

Glasgow Electricity Committee is recommended to appoint Mr. J. IRVINE, at present book-keeper under the cashier in the Corporation Electricity Department, to the position of principal book-keeper at a salary of £350 per annum.

Mr. C. HOLMES WAGHORN, A.M.I.C.E., general manager of Walker Vehicles, Ltd., has resigned from that position and will shortly associate himself with another branch of the engineering industry. Letters addressed to him c/o Walker Vehicles, Ltd., Clare House, Kingsway, W.C.2, will be forwarded.

Mr. W. A. BROWN, who has been with the Pirelli-General Cable Works, Ltd., since its inception early in 1915, resigned his appointment as from December 31st, 1925. His private address is 87, Gloucester Road, London, S.W.7.

Mr. J. W. F. THELWALL, Commercial Secretary at Berlin, will be in attendance at the offices of the Department of Overseas Trade from January 4th to 9th inclusive for the purpose of interviewing British manufacturers and merchants interested in export trade with Germany. Interviews can be arranged by writing to the Department, 35, Old Queen Street, S.W.1, quoting Reference 6044 T.G.

Mr. ROBERT BRUCE has relinquished his position as manager of the electrical department of Engineering Supplies, Ltd., London, and has been appointed managing director of the Saxonia Electrical Wire Co., Ltd., of Roan Works, Greenwich, S.E.10.

In the course of his speech at the annual meeting of the Provincial Electric Supply Association recently, SIR HARRY RENWICK, the chairman, referred to the loss that the committee had sustained by the death of Mr. W. L. Madgen. He also mentioned the continued ill-health of the late secretary, Mr. T. W. Cole, who had been forced to relinquish all active work, but who carried with him into his retirement the best wishes of the committee and all who were associated with him.

Mansfield Electricity Committee has recommended the appointment of Mr. JOHN WHITE as electricity showroom attendant at £250 per year, rising by £12 10s. per annum to £300.

Mr. J. C. WESTHOVEN, the newly-appointed Deputy Director of Posts and Telegraphs, Victoria, who succeeded Mr. C. E. Bright, recently retired, took up his duties at the General Post Office, Melbourne, in November.

According to a copy of the *Sydney Morning Herald* just to hand the Sydney Electricity Committee has been discussing matters of management in a manner which reminds us of the controversy which formed the subject of editorial comments in the ELECTRICAL REVIEW for July 24th, 1925, page 123. Some weeks ago Mr. FORBES MACKAY left Australia to take up extended duties on behalf of the Department in London. From the paper now before us it seems that the Lord Mayor submitted to the Electricity Supply Committee in November a proposal that Mr. G. S. BOYD should be appointed acting deputy general manager during Mr. Mackay's absence. Some discussion followed, in the course of which Mr. Alderman McElhone, who took a leading part, said that if the proposal were adopted it would only create discontent and unrest amongst the senior officers of the power house as it entirely ignored precedent and the claims of a senior officer (Mr. Vine Hall). Mr. Maling, the acting general manager, is reported to have stated, in reply to questions by aldermen, that he had made the recommendation to the Lord Mayor that Mr. Boyd should be appointed to the position, though, on a previous occasion, Mr. Vine Hall, as senior officer, had acted as deputy general manager whilst he (Mr. Maling) was making investigations for the department abroad. A recommendation had been made by Mr. Forbes Mackay that Mr. Vine Hall should be appointed to that position. "But," added Mr. Maling, "I, as acting general manager, am now responsible for the management of the power-house and the department pending the return of Mr. Mackay, and any recommendation that Mr. Mackay may have made on the matter should have no bearing on what I, as acting general manager, now recommend." Later speakers called for the circulation of papers relating to the matter. The Labour aldermen present, being in a majority, forced the adoption of the Lord Mayor's minute, but agreed that the papers asked for should be circulated before the meeting of the City Council. Alderman W. P. McElhone said a great wrong was being done to a very valuable officer of the City Council for party reasons and through pique.

Mr. G. E. SMITH, engineer and manager of the Urban Electric Supply Co., Ltd., Dartmouth, since 1902, has relinquished his position in order to take up business in London. Mr. H. HAROLD, accountant, who has been with the company for 21 years, has been appointed manager.

This winter the demand on the Willesden Council's Electricity Department has exceeded 10,000 kW, and to mark this event the technical staff of the undertaking has made a presentation of books to the chief electrical engineer (Mr. A. W. BLAKE).

Obituary.—DR. T. VON MOLLER.—The death occurred on December 6th, at the age of 86 years, of Dr. Ing. Theodor von Moller, the founder of the electrical firm of K. & Th. Moller Gesellschaft, Brackwede, Westphalia.

DR. C. MICHALKE.—Dr. Carl Michalke, who had been associated for many years with the Siemens-Schuckertwerke, Berlin, and for the last 25 years was head of the company's technological bureau, died recently at Charlottenburg, aged 65 years.

DR. G. KLINGENBERG.—The death is announced from Berlin at the relatively early age of 55 years, of Prof. Dr. Georg Klingenberg, a well-known German electrical engineer and a director of the A.E.G., of Berlin.

MR. F. HANMER.—Mr. Frank Hanmer, joint founder of and for many years sole proprietor of Messrs. Powell & Hanmer, Ltd., of Birmingham, has just passed away.

Wills.—The late Sir BACHE EDWARD CUNARD, who was a director of the Chloride Electrical Storage Co., Ltd., and of the Lanarkshire Tramways Co., left unsettled property £13,123 gross and £12,638 net.

New Companies Registered.

Orion Lamps, Ltd. (210,506).—Private company. Registered December 19th. Capital, £2,000 in £1 shares. Objects:—To acquire the trade mark "Orion," No. 452,717, and to carry on the business of electricians, manufacturers of, dealers in, and agents for all kinds of electric lamps, radio tubes and apparatus, &c. The permanent directors are:—J. Kremenezky, 13, Wasagasse, Vienna 9, electrical engineer; T. R. Martin, 62, Wellington Road, Edgbaston, Birmingham, electrical engineer. No person, other than the first directors, connected with any person, firm, or company engaged in the manufacture of electric lamps, valves, heating and cooking apparatus or similar products, other than Joh. Kremenezky, of Vienna and Budapest, or person, firm, or company under Messrs. Kremenezky's control, shall be eligible to hold office as director or alternate director without the consent of all the directors. Registered office: Eldon Buildings, 15-17, Eldon Street, E.C.2.

Ramsbury Electric Supply Co., Ltd. (210,526).—Private company. Registered December 21st. Capital, £2,500 in £1 shares (1,500 ordinary and 1,000 preference). To adopt an agreement with the Ramsbury Electric Supply Co. for the acquisition of the business carried on by them, and to carry on the business of an electric supply company, &c. The directors are:—H. Smith, 73, Fellows Road, Hampstead, N.W.3, electrical engineer; S. G. Prince, Malt Street, Old Kent Road, S.E.1, electrician (managing director, with £260 per annum as remuneration). Solicitors: Ward and Melliur Smith, 35, Queen Victoria Street, E.C.4.

Pan-Electric, Ltd. (210,545).—Private company. Registered December 21st. Capital, £200 in £1 shares. Objects:—To carry on business as electrical, mechanical, civil and consulting engineers, electrical and general contractors, manufacturers of and dealers in electrical machinery, advertisement signs, signalling, telegraphic, telephonic and wireless apparatus, instruments of precision, &c. The first directors are:—J. E. Cochrane, 4, Lampard House, Royal Hospital, S.W.3; A. R. Greenaway, 35, Pearfield Road, Forest Hill, S.E.23, electrical engineer. Qualification, 1 share. Remuneration as fixed by the company. Secretary: A. B. Ford-Moore.

Western Radio and Supplies, Ltd. (210,419).—Private company. Registered December 16th. Capital, £500 in £1 shares. Objects:—To carry on wireless telegraphy and telephony, and photography business, &c. The first directors are:—C. H. Phillips, 11, Claude Place, Cardiff, engineer; H. F. Phillips, 5, Laytonia Avenue, Cardiff, engineer; R. C. Francis, 37, Westbourne Road, Penarth (all directors of Tressillian Motors, Ltd.). Qualification, 1 share. Remuneration as fixed by the company. Solicitors: Lewis, Morgan, Browne & Haslam, 31, High Street, Cardiff. Registered office: 18, Queen Street Arcade, Cardiff.

Official Returns of Electrical Companies.

Holophane, Ltd. (110,941).—Capital, £105,000 in 100,000 ordinary shares of 1s. each and 100,000 preference shares of £1 each. Return dated October 23rd, 1925. 100,000 ordinary and 60,757 preference shares taken up. £15,207 paid. £50,550 considered as paid. Mortgages and charges, nil.

Synchronome Co., Ltd. (120,465).—Capital, £2,000 in 1,400 ordinary and 600 preference shares of £1 each. Return dated November 4th, 1925. All shares taken up. £700 paid. £1,300 considered as paid. Mortgages and charges, nil.

Electric Supply Co. of Victoria, Ltd. (66,059).—Capital, £325,000 in 175,000 preference and 150,000 ordinary shares of £1 each. Return dated November 26th, 1925. 175,000 preference and 125,000 ordinary shares taken up. £50,007 paid. £249,993 considered as paid. Mortgages and charges, nil.

Yale Electric Power Co., Ltd. (60,493).—Capital, £20,000 in 3,300 preference shares of £1 each and 668 ordinary shares of £25 each. Return dated December 10th, 1925. 300 preference and 668 ordinary shares taken up. £15,300 paid on 300 preference and 600 ordinary shares. £1,700 considered as paid on 68 ordinary shares. Mortgages and charges, £5,567 7s. 9d. (bank overdraft).

Frinton-on-Sea and District Electric Light and Power Co., Ltd. (70,689.—Capital, £10,000) in 7,300 preference and 2,700 ordinary shares of £1 each. Return dated November 17th, 1925. All shares taken up. £10,000 paid. Mortgages and charges, £4,000.

Pacific and European Telegraph Co., Ltd. (36,683c).—Capital, £100,000 in £10 shares. Return dated November 12th, 1925. All shares taken up. £40,000 paid (being £4 per share called up). Mortgages and charges, £66,500.

Western Electric Distributing Corporation, Ltd. (79,057).—Capital, £140,000 in 70,000 preference and 70,000 ordinary shares of £1 each. Return dated October 15th, 1925. 52,655 preference and 54,510 ordinary shares taken up. £107,165 paid. Mortgages and charges, nil. Returns of allotments, made up to December 2nd, 1925, show a further 1,320 preference and 10,250 ordinary shares allotted for cash.

United Weldings and Electrical Co., Ltd.—W. H. Watson, of 29, Brown Street, Manchester, was appointed receiver on December 8th under powers contained in debentures dated March 25th, 1925.

Budleigh Salterton Electric Light and Power Co., Ltd.—Debenture dated December 8th, 1925, to secure £3,000 charged on the company's land at Budleigh Salterton, and the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Astro Dynamo Co., Ltd.—Debenture dated November 30th, 1925, to secure £800, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. U. Y. Weldon, 94, Alderman's Hill, Palmer's Green, N.13.

Paragon Electric Welding Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 7th, 1925, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

British Columbia Electric Railway Co., Ltd.

The annual meeting of the company was held in London on December 23rd, Mr. J. Davidson (deputy-chairman) presiding. In moving the adoption of the report and accounts Mr. Davidson said that in the absence of the chairman, Mr. R. M. Horne-Payne, he would read his speech. The increase in every department of the company's business reflected the general expansion and prosperity of British Columbia during the year under review. (The report showing this improvement was abstracted in our last issue, p. 1026.) During the year over 4½ million dollars had been spent on capital account, mainly for additions to power generating plants, transmission systems, rolling stock and extensions to the light, power and gas systems. It was the policy of the company to keep every branch of the services in a position to meet the requirements of the communities served; this involved looking some distance ahead and making timely provision for the growth of the demand. The Bridge River site mentioned in the report was capable of yielding at least 200,000 h.p., although this would not be developed in its entirety at present. There was no doubt, however, that the expansion of shipping and industry in Vancouver would necessitate an increasing supply of power. It would be noticed that the accounts had been presented in dollars, following the advice of the auditors, who considered that the consolidated accounts should be in the same currency as those of the subsidiaries. Referring to the company's earnings in Vancouver, the chairman said that it had been held that a public utility company was entitled to earn 8 per cent. on its entire capital; taking the whole of the capital employed in the company's undertaking the return earned was only between 5 per cent. and 6 per cent. The report and accounts were adopted, and the retiring directors, Mr. R. M. Horne-Payne and Sir Ernest Harvey, K.B.E., were re-elected. Mr. G. P. Norton paid a tribute to Mr. Horne-Payne, who, he said, had been responsible for the starting of the company 30 years ago. The undertaking had done an immense amount of work and had played an important part in the development of British Columbia.

German Companies.

The report of the *Bank of Electrical Values*, of Berlin, records a net profit of 853,000 marks, permitting of the payment of a dividend at the rate of 5 per cent. on the ordinary shares.

The German newspapers announce that the interim balance sheet of the *Dr. Paul Meyer A.G.*, for the period ended September 30th last, shows a loss of 2,115,000 marks. It is proposed to withdraw the preference shares for 500,000 marks, to reduce the ordinary shares from 2,500,000 to 500,000 marks and then to increase the ordinary capital by 3,000,000 to 3,500,000 marks. The amount thus released will be devoted to writing off the loss and making further provision for depreciation. It is considered that the productivity of the undertaking will be improved if it is possible to carry out a scheme for the relinquishment of a number of unprofitable types of manufactures, simultaneously with the extension of bulk production.

French Companies.

The *Société d'Exploitations Electriques* has decided to pay a dividend at the rate of 17.50 fr. gross per share for 1924-25 out of net profits of 1,943,000 fr.

The *Société de L'Union Electrique* reports that the net profits increased from 49,000 fr. in 1923-24 to 162,000 fr. last year, but it is not proposed to make any distribution.

The *Société Industrielle des Téléphones*, which has declared a dividend at the rate of 50 fr. per share for 1924-25, reports that the multiple automatic exchange at Vichy has been opened for the French Post Office. The works at Calais, although not having had many orders for submarine cables, has yielded satisfactory results, thanks to the production of enamelled wires, which has been established there. At the Clichy works the normal development of the new manufactures has continued and given encouraging results, but a much more serious effort remains to be made in order to bring the works up to full output.

The *Compagnie Générale d'Electricité*, which has maintained its rate of dividend at 70 fr. per share for 1924-25, states that the results were more satisfactory than had been anticipated, having regard to the French financial crisis. The profits were higher by 3,154,000 fr. than in 1923-24, although the production of the industrial establishments on the whole showed a slight decrease. It has been decided to increase the share capital from 75 to 90 millions of francs in order to acquire the undertaking of the Compagnie Générale des Câbles, of Lyons.

Indian Companies.—*Tata Hydro-Electric Power Supply Co.*—The report for the year ended June 30th last records an income of Rs. 52,22,745 and an expenditure of Rs. 21,78,115. After providing for depreciation and writing off special expenditure, there is a balance of Rs. 22,24,053, and to this is added Rs. 38,544 brought forward, making Rs. 22,62,608. From this is distributed a final dividend, making 8 per cent., free of tax, for the year on the ordinary shares and a balance of Rs. 3,77,718 is carried forward. In 1923-24 the ordinary dividend was 7 per cent.

Andhra Valley Power Co.—The total income of the company for the year ended June 30th last was Rs. 54,21,869, and the available balance, after deducting working costs, debenture interest, &c., was Rs. 14,28,011. This is being distributed as follows:—Writing off the previous year's deficit Rs. 4,77,584; writing off other expenses amounting to Rs. 1,00,000; depreciation, Rs. 5,00,000; dividend of 7 per cent. on the preference shares; carried forward Rs. 5,046.

Adelaide Electric Supply Co., Ltd.—The gross revenue for the year ended August 31st, 1925, was £616,353 and the operating expenses and taxation amounted to £309,265, leaving a net revenue of £307,088—an increase of 34 per cent. The balance, after writing off the costs of share issues and providing for debenture interest, &c., was £223,324. From this sum £65,000 was transferred to general reserve (making £215,000), the preference dividends were paid, and a final dividend of 6 per cent. (making 12 per cent. for the year) was declared on the ordinary shares, leaving £924, plus £47,191 (£48,115) to be carried forward.

The A.E.G. Dividend.—It has been left to the American prospectus of the A.E.G., dealing with the issue of a 6½ per cent. loan for the amount of $10,000,000 in debentures, to disclose the fact that the dividend for the year ended with last September will presumably be at the rate of 6 per cent., as compared with 5 per cent. in 1923-24. An abstract from the prospectus further states that the provisional accounts for the past year show a material increase in the net profits and a satisfactory situation.

British Insulated Cables, Ltd.—A statutory meeting of shareholders of British Insulated & Helsby Cables, Ltd., held at Liverpool on December 21st, Mr. James Taylor, J.P. (chairman) presiding, confirmed the resolution passed at the extraordinary meeting on December 4th to change the title of the company to "British Insulated Cables, Ltd."

Newfoundland Power & Paper Co. — Meetings of the debenture holders were called on December 21st to approve of the issuing of further debenture stock. The holders of the "A" debentures agreed to the arrangement by a large majority, but as there was not a quorum of "B" debenture-holders the meeting was adjourned.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

British Insulated and Helsby Cables.—333,333 ordinary shares of £1 each, fully paid, Nos. 1,000,001 to 1,333,333.

Mersey Railway.—£281,429 three per cent. "B" debenture stock

Marconi's Wireless Telegraph Co., Ltd.—The dividend on the 7 per cent. cumulative participating preference shares for the half-year ended December 31st is being paid to-day (January 1st).

Quebec Power Co. — The following dividends are announced:—$1¾ per share on the 7 per cent. preferred stock, and $1¼ per share on the common stock for the quarter ended December 31st.

Stocks and Shares.

MONDAY EVENING.

WE started our review of electrical stocks and shares a year ago by saying that 1924 would deserve to be long remembered as one of the kindest to which proprietors of supply shares had been treated. This followed upon a state of affairs not very dissimilar in 1923. But the 1925 period carried on a good work that has been continuous, now, for three years. The electricity supply industry of London received, last spring, a fresh charter which meant a new extension of life. Investment has appreciated the change, and has bought steadily when shares came in—which was not often in some of the cases. The result is that prices finished 1925 with a remarkably robust appearance, as the following table shows. We add the highest and lowest prices of the year in order to round off the comparisons between December, 1924, and those of to-day:—

ELECTRICITY SUPPLY SHARES.

Ordinary share.	Dec., 1924.	H.	L.	Now.	Rise or fall.
Brompton	1⅞	38/6	32/-	1⅝	— ¼
Charing Cross	45/6	50/6	44/-	48/9	+3/3
Chelsea	37/6	42/-	35/-	42/6	+5/-
City of London	47/6	50/3	45/3	50/9	+3/3
County	52/6	61/3	51/-	59/6	+7/-
Kensington	10⅜	13¼	10¼	13¼	+ 2½
London	33/6	38/3	32/6	33/6	—
Metropolitan	37/6	40/9	36/6	40/6	+3/-
St. James'	12⅝	15½	12⅝	15½	+2⅝
South London	2¼	52/-	44/6	2⅝	+ ⅜
Westminster	11*	47/9	42/-	46/6	+ ⅝

* £5 shares.

Manufacturing and equipment shares have also been a feature of strength in the Old Year. Something like a mild boomlet occurred during the summer, when optimism talked largely of possible increases in dividend. Several satisfactory announcements coloured the rumours, and the companies are known to be going ahead in profitable style. The present Government was expected to benefit cable and electrical equipment companies by tightening up the Safeguarding of Industries Act, but less has been done in this direction than some people hoped. The sensational rise in the price of raw rubber was used as an argument, by certain of the large trade users, for the apprehension that it might handicap the manufacturing firms, but the protest died a natural death: rubber, rubber shares, and equipment shares have gone on rising. Half-a-dozen representative examples in this market are included in the table that follows:—

MANUFACTURING.

Share.	Dec., 1924.	H.	L.	Now.	R'se or fall.
Babcock	2⅝	57/6	47/6	2 5/16	— 7/16
British Aluminium	29/3	39/-	27/6	38/-	+8/9
Callenders	2 1/16	3⅜	2⅞	3⅛	+ 7/16
General Electric	21/6	30/3	21/3	28/-	+6/6
Henleys	58/9	3⅜	2⅞	70/-	+ 11/16
India Rubber	17/6	23/3	17/3	21/3	+3/9

The engineering branches of trade, with others closely allied to them, have felt the effect of the industrial lassitude in most of the "heavy" departments. Vickers have lately declared for a capital reorganisation, and a writing-off of 13s. 4d. from each £1 ordinary share. Several more companies are expected to follow suit. But these misfortunes have passed over the heads of electrical undertakings, which have suffered only indirectly from the quietude of the Midlands, the North and the West of England.

Turning to the cable companies' stocks, the year has been uneventful. The annual reports and meetings served to demonstrate that cable business is reviving from the effects of post-war depression. The Eastern group maintained its 10 per cent. tax-free dividend on the four ordinary shares and stock in the quartette. Wireless competition is no longer regarded as a reason for nervousness. Indeed, the wireless shares are out of favour; prices are down rather heavily. A few spurts, none of them of any consequence, occurred in this section, but the rubber boom led to sales of Marconi shares in order that the money might be employed in the more popular market. United River Plate Telephones have risen substantially, taking into account the rights that accrued from the new issue of shares. Automatic and International Telephones are also features of strength, and our usual comparative columns bring out these changes:—

TELEGRAPHS, &C.

Stock or share.	Dec., 1924.	H.	L.	Now.	Rise or fall.
Anglo-American Pref	104½	106	101½	103	—1½
Eastern Extension	17	18⅛	16¾	18	+1
Eastern Telegraph	172½	178½	169	177½	+ 5
Globe Ord.	17½	18⅜	17½	18¾	+1½
Great Northern	29⅜	35⅜	29½	33	+3¼
Indo-European	32½	45¼	31	45½	+13
Marconi	33/9	36/6	21/3	22/6	— 9/16
United River Plate	6 15/16	7 13/16	6 11/16	7¾	+ 13/16
Western Telegraph	17	17¾	15¾	18	+1

The most noteworthy movement in our price-lists is the jump in Brazilian Tractions. The price started 1925 at 58. Upon the increasing traffics, the advantageous movements in the milreis and upon buying said to be for control purposes, the shares have gone ahead by leaps and bounds. Less dramatic, but very noteworthy, has been the rise in British Electric Traction ordinary, which stood at a shade under 100 twelve months ago. The Home Railway group makes a poor showing, and is the one market in the Stock Exchange that has been outstandingly dull for the greater part of the year. Labour demands and dwindling traffics have led to a general weakening of prices, although the final quotations are above the lowest of the year, as these figures illustrate:—

RAILWAY STOCKS AND SHARES.

Stock or share.	Dec., 1924.	H.	L.	Now.	Rise or fall.
Central London Ord.	74	75	64¾	68	—6
Metropolitan	83	83	64	69	—14
District	56	57	40	47	—9
Underground £10	3⅜	67/-	2	2½	— ⅛
" "A"	9/6	10/9	6/-	7/-	—2/6
" Inc.	100	102¾	94¼	98	—2

The Bank Rate has risen 1 per cent., to 5 per cent., during the year. This had an oblique reference to the return of the nation to a gold standard, but it exercised no more than a transitory influence over Stock Exchange markets. Business has been active, speaking generally, and the prospects for investment and speculative values are demonstrably good. Cordial wishes for a Happy New Year are politely offered to the patient reader of the weekly notes on Stock Exchange markets connected with electrical issues.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Dec. 28. 1925.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	13	14	59/6	—	4 14 1
Brompton Ordinary	1	10	10	1⅝	—	*6 3 1
Charing Cross Ordinary	1	14½	15	2 7/16	—	6 3 1
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2½	—	5 13 0
City of London	1	15	15	50/9	—	5 18 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	59/6	−6d.	5 0 10
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	7	24/6	+6d.	5 14 8
do. 7% Pref.	1	6	7	21/6	—	6 10 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13½	—	5 13 2
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	10	33/6	−6d.	5 19 5
do. do. 6% Pref.	5	6	6	5 5/8	+1/16	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	+1/-	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 5
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 3
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15½	+⅛	5 12 11
South London	1	15	15	2⅝	—	5 18 1
South Metropolitan Pref.	1	7	7	1½	—	5 12 8
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	46/6	+6d.	6 9 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8		30/6	—	5 5 0

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68	+1	5 17 8
Metropolitan	"	4	5	69	—	7 5 0
do. District	"	3½	3½	47	—	7 9 4
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A"	1/-	Nil	Nil	7/-	—	Nil
do. do. Income Bonds	6	6		98	—	*6 2 5

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	24⅞	—	6 0 8
Automatic Telephone	1	8	6	51/3	—	2 6 10
Chili Telephone	5	6	5	6 5/8	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 9 7
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18⅜	—	*5 6 8
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	33	—	6 13 4
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1⅛	—	9 17 10
Marconi Marine	1	10	7½	⅞	—	8 11
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	5	8	8	7⅞	—	5 3 3
Western Telegraph	10	10	10	18xd	—	*5 11 1

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref.	5	5½	5⅞	3½	—	8 9 2
do. do. 2nd Pref.	5	6	6	3 5/8	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16
British Electric Traction Ord.	"	6	6	119½	−⅛	5 0
do. do. 6% Pref.	"	6	6	105	—	5 14 3
Brazil Traction	100	4	4	84½	+1½	4 14 8
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	"	96/-	96/-	102½	+1	*4 13 2
do. do. Deferred	"	129/5	129/5	124½	+3	*5 4 5
do. do. Deb.	"	4¼	4¼	77	+1	5 10 5
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	3/6	−6d.	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	61½	−1	8 2 8
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	70½	−1½	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	51/3	—	*4 13 4
British Aluminium Ord.	1	5	10	38 -	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	¼	—	...
British Insulated Ord.	1	15	15	2¾	—	5 9 1
Brush Ord.	1	10	10	27/-	+9d.	7 8 2
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	9/-xd	—	4 9 0
do. 5% Deb.	Stock	5	5	85	+1	5 17 8
Electric Construction	1	10	10	33/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	18/6	−9d.	5 8 0
do. do. Pref.	1	6	6	21/-	—	5 14 3
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	7½	28/-	+6d.	5 7 2
Henley	1	15	16	3½	—	4 11 5
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1 1/16	—	*4 14 1
Johnson & Phillips	1	10	10	56/3	+1/9	3 11 1
Met-Vickers, Ord.	1	8	8	27/-	−6d.	5 18 6
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	34/3	+2/3	4 7 7
Telegraph Construction	12	20	20	27	—	*4 9 0

*Dividends paid free of Income Tax.

Electrical Wiring Installations.

A Comparison of Systems and an Analysis of their Costs.

By I. SCLAR, A.M.I.E.E.

(Abstract of Paper read before the DUNDEE SUB-CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper deals, in an unbiased way, with the commonest systems of electrical wiring and present practice, whilst the figures refer to average installations; there will be cases, of course, where the figures instanced will be well out, but a comparison of some of the merits claimed by the advocates of the various methods shows how the different systems affect the cost of wiring in practice.

The importance of the subject cannot be too greatly stressed, and insufficient consideration has been given to this subject, at least in proportion to the amount of capital, labour, and other direct and indirect interests involved in the electrical installation industry, and other industries depending upon it, and to the proportion that all these interests bear to the whole electrical industry. It is due to the want of this consideration and discussion that the electrical installation side has not advanced so much as other sections of the industry; though great forward strides certainly have been made, they are not in keeping with the large volume of business being done, or what has yet to come.

I agree that there is a lack of " push " about the contractor, but am of the opinion that there is a greater lack on the side of the electricity supply authority, in view of its more fortunate position; it usually has a monopoly of the goods it has to sell, which are all of the same type and class, so there is no quality competition. It can ascertain the exact cost of the one commodity it has to sell, whereas the contractor very seldom gets two jobs alike, and practically every estimate job contains elements of risks which affect the profit he has aimed at. However, we all agree that a lot more can be done by co-operation. When comparing the permanency of one system against another, the fact of the matter is that most installations have not been in existence long enough to enable reliable judgments to be made.

I have based my costs on the latest issue of the I.E.E. wiring rules and on standard materials at the standard trade prices ruling at the beginning of November. The I.E.E. rules may not be agreed with in their entirety, but they have common sense and sound principles which will make themselves recognised, through time, as a sure foundation for reliable work. If you demand a good article in sufficient quantities you will get it as cheaply as an inferior article. Permanency and upkeep are often lost sight of when comparing prices. The average life of a building, even of ordinary brick construction, is reckoned to be between 75 and 100 years, and if the electrical wiring installation is to last that time, a sound job must be made. It behoves us to take more care in the selection of a wiring installation, for permanency is often given too little consideration and in new building work our sense of proportion regarding costs is often misdirected.

The electrical installation costs for a new building may vary from about 3 to 10 per cent. of the total cost of the building. Taking 6 per cent., the difference between a good installation and an indifferent one may be, say, one-third of the price of the installation, only about 2 per cent. of the total cost of the building. Supposing the money is borrowed at 5 per cent., then a 2 per cent. difference would be, say, £20 on a £1,000 house, and the interest on this would be 20s. per annum; it is quite easy to run up a bill of 20s. a year on repairs of an inferior installation, as contractors cannot give much for £1 nowadays. Again, the depreciation on a cheaper installation will be at much greater rate.

In some housing schemes at the present time the cost of the usual installation per house is about £8 to £10 for the average type; supposing by cheaper and often admittedly less reliable methods of wiring we were able to reduce this cost to £5 per house, the actual saving in interest would only be about 5s. per year, which will hardly repair a broken flexible. The cry for cheaper installations is an exaggerated one, and we often hear the high initial cost of the installation blamed as being the means of allowing other sources of illuminant to be installed. The probable difference between a gas installation and a good electrical one is perhaps about two per cent. of the cost of the building, and when the advantages of electricity are taken into consideration this difference should never deter the installation of electricity.

The probablity is that the responsible party has been slow in pushing home the advantages of electricity, and I would say the supply engineer is entitled to do a greater share of the propaganda work as he stands to gain something if the deal is brought off. We don't seem to have enough confidence in the thing we are selling; contractors and supply engineers should act as if gas was out of it altogether. Gas companies are beginning to realise that they are fighting a losing battle; a great gas-mantle manufacturing firm is advertising electrical radiators. We may know the advantages of electricity, but we do not know the disadvantages of gas, and I would suggest that everyone connected with the actual sale of the commodities " electricity " and " electrical installations," should live a double life for a time.

" Safety-first " means the adequate earthing of all appliances and the easiest and most automatic way is to make use of the outer sheathing of an " earthed " system. This deals a severe blow to " insulated " systems, in that to conform to latest regulations an earth conductor is required to be run throughout the whole system. The only practical way to do this is to have an extra wire run under the insulated casing parallel with the current-carrying conductors, which, of course, adds considerably to the cost of the system, to say nothing of the danger of non-continuity at joint boxes, switches, &c., and the labour involved in making such an earth wire continuous. Earthing each appliance to the nearest earth-connected body, actually at the point where such earthing is essential to conform to regulations, would be impracticable, unreliable, and probably unsightly. The difficulty might be got over by using insulated switches and appliances, but there is a much greater factor of safety with a switch in a bathroom whose metal non-current-carrying parts are earthed, as surface leakage due to moisture would take the earth path before the comparatively higher resistance path of the human body.

The point I want to emphasise is that one might be able to run much longer with a faulty installation where the covering of the wires is insulated from earth-connected bodies, than with a system of insulated wires with an earth-connected enclosed covering. Accidents have occurred with cab-tire trailing cables in collieries, with an earth wire actually incorporated in the cable itself, due to a damaged live conductor charging some apparatus with fatal results. If the earth conductor had taken the form of an outside flexible metallic tube, the danger would probably have made itself felt and would have been removed.

A cable with a separate earth wire is not as safe as a cable with an enclosed surrounding earthed tube. As regards fire risks, there is always the danger of open sparking with the insulated system which might not be present with the enclosed earthed systems.

Is conduit or the lead-covered cable easier to make continuous so far as the earthing goes, apart from the extra mechanical protection of the one which is agreed upon? I recently carried out tests with the following result :—

Resistance per 1,000 yd. of lead sheathing = 8 ohms for 3/.036 twin cable.

Resistance per 1,000 yd. of h.g. welded ¾-in. enamelled conduit = 1.16 ohms.

Resistance of standard coupling for ¾-in. conduit = 0.0015 ohm, screwed tight and clean.

Resistance across a universal box, not B.E.S.A., = 0.003 ohm.

Tube was tapped into box at each end for about ½ standard length of thread to B.E.S.A. specification.

Resistance of conduit to an adaptable standard square box when connected by means of standard lock-nuts at each side of the box = 0.0035 ohm, but when threaded into the box = 0.002 ohm.

Resistance across tinned-brass joint box with 3/.036 cable and the bonding tightly made = 0.001 ohm.

Very erratic results could be obtained, as very much depended on the tightness of the threads and whether the enamel was properly scraped off. The tests on the conduit were carried out without cleaning the threads, just as the boxes and tubes are supplied from the makers and as they would be used by the average workman. I found that it was much easier to get consistent results across the lead-covered cable boxes, and that even a fairly slack connection gave practically the same resistance as a tight one, due to the clean contact with the lead; therefore, it seems easier to get better bonding at boxes with lead cable than with conduit, and a lot of the cry about bonding at boxes is exaggerated.

The resistance of the lead is about seven times that of conduit, but taking into consideration the greater resistance at couplings, inspection boxes, &c., for the same length of runs and with the same amount of care in both cases, the resistance of the bonding of the conduit job should be about half that of the lead-covered one, which means that with the same fault resistance in both cases there is more probability of the fuses blowing quicker with conduit than with the lead-covered system. Again, lead cable sheathing has a lower melting point than conduit, say about 1/5th, and therefore there would be a greater factor of safety against fire, especially in favour of conduit.

In order to form a basis for the comparison of costs, most installations can be split up thus :—

Part of installation.	Average proportion of cost.
1. Mains and sub-mains	5 per cent.
2. Lighting and switch points, lighting and heating plug points, *wiring only*, no switches, plugs, &c.	35 ,, ,,
3. Main and sub-main switches	4 ,, ,,
4. Main and sub-main distribution boards	6 ,, ,,
5. Branch switches, plugs and sockets ...	15 ,, ,,
6. Light fittings and radiators, &c., also lamps	35 ,, ,,

The above average figures deal with the installations at present being carried out in offices, dwelling houses, and shops, and allow for all the necessary labour. The important point to observe is that (1) and (2) are the only sections where the cost of the installation is materially affected by the system of wiring employed. The actual "wiring" cost made up of items (1) and (2) ranges between 20 and 50 per cent. of the total cost of the installation. The lower figure is applicable to high-class installations where there are many special plugs, switches, and fittings; the higher figure is probably a maximum for 90 out of 100 complete installations and refers to the very humblest, that is, the housing-scheme type, where the very plainest of fittings and shades are installed. Theatres, hospitals, schools, &c., where it would be dangerous if too many lights in one section failed at the one time, often require special consideration, and the more lights that are fed from each way to the board, so will the cost of the wiring be cheapened, but I may suggest that this cost is not affected to such great proportions as is often imagined. I have often found .003 cable specified by engineers, with the consequent extra expense of larger tubes, &c., for installations where the .002 size would be ample, and I can only conclude that this has been done through force of habit and not because of any advantage likely to accrue. Mains for lighting are regulated by their distance from the supply point and the total rating, and it is safer to assume that a diversity factor should not be taken into account and that the total loading may be on all at once. In the case of heating mains, there is less probability of all the radiator plugs being connected at any one time, and discretion can be used to cut down the size of these mains.

In most cases the mains do not form a great proportion of the total cost of the wiring, and it is cheaper to increase the size of the mains than to try and get over difficulties of voltage drop by increasing the section of the cables to the actual outlet points. For heating probably a 2-kW heater is the minimum and on a 250-volt circuit such a heater will take 8 amps., so that we are really restricted by the I.E.E. regulations to a maximum of two such heater points on the one circuit. We would probably find that a good policy here would be to use a 7/.036 cable to the first point and loop a 7/.029 cable to the next one in the same run.

Is it really necessary to keep all heating and domestic circuits separate from the lighting circuits, especially in view of a tendency to adopt one tariff for all purposes? A fuse to protect a 2-kW radiator is of no use to protect a lamp, and the smaller cables and flexibles to the lights, if they did not actually fuse, would heat up sufficiently to render their insulation unreliable for future use. However, neglecting safety, is there really any claim as regards a large saving in cables?

There will be a saving in mains, for the same mains that feed the heaters could feed the lights, though in practice this might not amount to much, as the actual cost of mains to a fuseboard is about 5 per cent. of the total cost. The proportion of cost of heating means to lighting mains is as 2 to 1 on an average, so that if we cut out the lighting mains and do not proportionately increase the heating mains, the saving in mains will only amount to about 2 per cent. of the installation total cost. In practice, in installations which might show considerable saving in mains (due to long runs) on the one main idea, it would be better for the sake of voltage regulation to keep the mains separate. To loop off the heating plugs, or to run the heating-plug circuits in the same direction as the lighting points, usually will require more wiring than feeding, say, 10 lighting points from one circuit and keeping the lighting away from the heating plugs. Again, to make provision for the future looping of heating plugs more heavy wiring would be required than would be necessary if we just wired for those heating plugs wanted at the time. Also the total first cost would be increased, and the object of the system would be defeated In this matter we are in a quandary, for if we want to conform to the I.E.E. regulations we should not connect more than two heating points, so that we could never reap the full benefit of the one circuit for heating and lighting. Though it looks all right on paper, in practice it turns out very different, for the reason that a house is built more or less in the form of squares, and not in one long line like a street.

While on the question of saving, a considerable one is gained by the elimination of the "drop down" to switch level; by using a ceiling switch we could save 40 per cent. on each light and switch point, or from 10 to 20 per cent. on the cost of a complete installation. On a housing scheme this method would save about 25 per cent. of the cost of the installation.

We will now compare the conduit, lead-alloy flat-twin and three-core, and flat-twin and three-core tough-rubber systems. There are many classes of conduit, which fact materially affects the cost and efficiency, but we will adhere to the heavy-gauge screwed type. The chief advantage of a conduit system is the good mechanical protection afforded, and the chief disadvantages are condensation, rusting of the conduit itself, and the supposed high initial cost due to the greater amount of labour required in erection. Is the extra mechanical protection as necessary as it is made out to be? It would be interesting if we could arrive at some idea of the amount of damage done by nails or other careless handling to the other systems, which might have been prevented if they had h d added protection equal to that of conduit. It is quite possible for an installation to test all right after completion, though it may have been damaged in erection and develop annoying faults later on. In this respect tough-rubber cable would have the advantage over lead. Condensation is greatly exaggerated, and where such faults have occurred it is more than likely that the system has been installed in an unsuitable situation where special provisions should have been made to begin with. In 99 cases out of 100 condensation is not likely to trouble average dwelling houses, offices, and other type of building.

Conduit usually calls for a greater amount of labour in erecting, but many of the so-called labour-saving, surface, lead-covered and tough-rubber systems really involve more labour than a conduit system. In fact, I will go so far as to say that the conduit surface job is the only proper surface job. I favour conduit by reason of its rigidity, as the pipes and outlet boxes support each other in such a way that the actual amount of fixing required is much less than with the more flexible systems.

The trouble with surface systems of the lead and tough-rubber types is the total unsuitability of most of the outlet and joint boxes designed. The chief reason for cable makers designing flexible cable systems is that they want to sell the cable required for these systems, but they would sell more if they advertised less in the exaggerated and ridiculous way they do, and designed practical outlet and joint boxes. There is no need for small joint boxes, as in nine cases out of ten they are hidden, and probably in the tenth case, if it is a surface system, a decent size joint box would not look so ugly in proportion to the many cables leading to it.

There is no need for cable makers to design all kinds of different boxes for the sake of claiming a patent system; they would sell their cable under the same circumstances if we had some sort of regularity in the type of boxes and fixings. The cable makers can combine for other purposes, so why can't they combine once more? If we are to conform to the I.E.E. rules we require an earth wire for the cab-tire cable, so that we will have 50 per cent. more joints to make.

From the following tables assistance may be derived in ascertaining the most economical system for a particular condition :—

Table I. Labour Charges for Wiring Only.

	Conduit.	Lead alloy.	Tough rubber.
(a) Concealed job—new house in course of erection :			
Cutting away and making roads ...	20	5	5
Measuring and cutting tube or cable and bending to position	35	10	10
Erecting cable or conduit with necessary fixings	20	25	25
Wiring conduit or cable	10	—	—
Bonding conduit or cable	—	5	—
Making joints	5	15	20
Making good	10	5	5
Totals	100	65	65
(b) Concealed job—house already built :			
Cutting away and making roads ...	35	15	15
Measuring and cutting tube or cable and bending to position	45	15	15
Erecting cable or conduit with necessary fixings	35	25	25
Wiring conduit or cable	10	—	—
Bonding conduit or cable	—	5	—
Making joints	5	15	20
Making good	20	10	10
Totals	150	85	85
(c) Complete surface job :			
Cutting away and making roads ...	5	3	3
Measuring and cutting tube or cable and bending to position	35	10	10
Erecting cable or conduit with necessary fixings	25	50	50
Wiring conduit or cable	10	—	—
Bonding conduit or cable	—	5	—
Making joints	5	15	20
Making good	3	3	3
Totals	83	86	86

Table II. Material Costs.

(i) *Conduit installation :*		
Conduit	35	
Cable, 600-meg. Association	57	
Boxes and saddles, &c., including switch and plug boxes, ceiling boxes, &c., all tapped for necessary switches and accessories	8	
Total	100	units.
(ii) *Lead-alloy system :*		
600-meg. Assoc. cable, twin and three-core...	78	
Boxes and fixings, bonding clamps, &c. ...	3	
Wood blocks, wood switch and plug blocks, &c., all bored and ready for accessories ...	2	
Protective sheathing at switch runs to I.E.E. regulations	7	
Total	90	units.
(iii) *Tough-rubber cable :*		
Cable, 2- and 3-core, with earth wire ...	104	
Boxes and fixings	2	
Wood blocks, &c., as before	2	
Protective sheathing	7	
Total	115	units.

Table III. Summary of Costs.

(i) *Concealed installation—house in course of erection*:

	Wiring labour.	Wiring material.	Total cost of wiring.
Conduit	100	100	200
Lead alloy	65	90	155
Tough rubber	65	115	180

(ii) *Concealed job—house already built*:

	Wiring labour.	Wiring material.	Total cost of wiring.
Conduit	150	100	250
Lead alloy	85	90	175
Tough rubber	85	115	200

(iii) *Surface job*: (*deduct* 6 *units from lead-alloy and tough-rubber for less protective covering*):

	Wiring labour.	Wiring material.	Total cost of wiring.
Conduit	83	100	183
Lead alloy	86	86	172
Tough rubber	86	111	197

Assume, for discussion, that the total cost of the rest of the complete installation is 300 units; then in the first case:

	Wiring.	Remainder of job.	Total cost.
Conduit	200	300	500
Lead alloy	155	300	455
Tough rubber	180	300	480

and thus the saving by using the cheapest method in place of the dearest is 9 per cent. In the second case:

	Wiring.	Remainder of job.	Total cost.
Conduit	250	300	550
Lead alloy	175	300	475
Tough rubber	200	300	500

which shows the saving by using the cheapest method in place of the dearest to be barely 14 per cent., whilst in the third case:

	Wiring.	Remainder of job.	Total cost.
Conduit	183	300	483
Lead cable	172	300	472
Tough rubber	197	300	497

indicating the tough-rubber cable to be the dearest in this case, and the cheapest system is only 2 per cent. cheaper than conduit. In the case of straight runs for long lengths of mains, or in large buildings served by large single units, the conduit system might work out considerably cheaper than any of the flexible systems, as the erecting and bending items of the work would be considerably reduced.

The above figures show that the conduit installation is more proportionately expensive than the others for the house already built where we want to hide most of the work; flexible systems are best employed on installations like these. The tough-rubber system, even allowing for an earth wire, is not very much dearer than the lead-alloy system, and manufacturers would be well advised to produce a suitable cable incorporating an earth wire. Such cable might require to be more durable, as it is in direct contact with the disintegrating forces, whereas v.i.r. cables have the added protection of conduit or lead sheathing.

As present practice goes, there is really very little difference in the final price of the installation, no matter what system we use; this being the case, we should aim for the best possible. The conduit system is too rigid and affords rather too much protection; the lead-alloy system is too flexible and not sufficiently protected; and the tough-rubber system (though made with more durable insulation) is not sufficiently protected and not as safe as the enclosed earth-conductor system. Therefore, an ideal system would be, say, a twin or three-core cable insulated with tough-rubber, and protected with galvanised layers of thin steel tape wound spirally, which armouring would in turn be protected with tough-rubber. Such a cable should be round, instead of flat, as the former shape is easier bent, handled, connected to fittings, and less liable to become twisted or kinked. It would be less flexible than a lead- or tough-rubber covered cable, but that is what is required, and yet more flexible than conduit. However, such a cable would be fairly expensive, but I think it would be suitable for a greater number of situations than any of the separate systems, and in view of a greater demand its price might come down to an economical level.

We all want cheaper installations, but we must not let that demand be conceded at the expense of efficiency and quality; there is a limit to simplicity, for very often the simpler an installation is, the less efficiently will it be carried out. If every Tom, Dick, and Harry is to carry out wiring work, contracting will deteriorate.

The electricity supply side does not assist the installation side of the industry as much as it ought to, and often retards it by silly pets and regulations. What is considered safe in the one town should surely be as safe in another! If power supply authorities' technical staffs cannot agree amongst themselves as to what is safe, how can they expect the half-savage, poor, uneducated contractor to know? Electricity supply authorities could not do better than work to the I.E.E. rules, and scrap all their own pet ones, as standardisation would lead to an immediate decrease in the cost of installations and do more good than blaming the contractor.

Super-Heterodyne Radio Receivers.

Some Notes on Theory and Practice.

(*Abstract of Paper read before the* JUNIOR INSTITUTION OF ENGINEERS.)

MR. A. E. BOWYER-LOWE, in a recent lecture on the above subject, explained that, while Major E. H. Armstrong undoubtedly did develop the idea, in fact, many had independently discovered the method, the credit for the invention must be given to Lucien Levy, of France, whose English patent was applied for on August 2nd, 1918 (eleven months earlier than Armstrong's), while Levy's French patent is dated August 4th, 1917, whereas Armstrong's date is December 30th, 1918 (seventeen months later). Levy's patent is the property of Standard Telephones and Cables, Ltd. (formerly the Western Electric Co.), to whom a royalty of thirty shillings is due from any amateur who constructs such a receiver, not only from British components, but foreign as well.

The dearth of information regarding super-heterodyne receivers in the British radio journals has resulted in those experimenters who are keen on this method of reception considering the super-heterodyne in terms of American practice, and in judging anything which differs as heresy. For instance, when his company introduced intermediate frequency transformers peaked at 150 kilo-cycles, *i.e.*, 2,000 metres, it received numerous letters pointing out that this must be a printer's error, as in the various writers' experience 30, 40, or 50 kilocycles should have been the wavelength chosen.

Theoretically we might choose any convenient frequency or wavelength for the beat note, or intermediate frequency, but there are practical limitations and several schools of thought on this point.

When dealing with super-heterodyne reception we have to think in kilocycles instead of wavelengths in metres, and any conversion table shows that the increase in frequency is not directly proportional to the decrease in wavelength, but increases very rapidly as the wavelength is shortened, a very important fact to remember. For instance, between:

200 and 250 metres there is a difference of 300 kilocycles
400 and 450 ,, ,, ,, ,, 83 ,,
550 and 600 ,, ,, ,, ,, 45 ,,

We change the frequency of the incoming signal (usually shorter, *i.e.*, greater wavelength) in order to use high-frequency amplification to better advantage, and if we were receiving one definite wavelength only, such as c.w. Morse signals, we could use transformers very sharply tuned so as to pass that wavelength only; but as we are mostly concerned with telephony where, in addition to the fundamental wavelength, we have to pass the side bands as well, transformers must be so designed as to pass from 5 to 9 kilocycles either side of the fundamental in order to avoid distortion. Now, while 5 kilocycles either side of 300 metres covers a wavelength range of 298½ metres to 310½ metres, or 13 metres, the same width of side bands at 1,000 metres gives a range of 34 metres, while at higher wavelengths still the ranges are:—

at 4,000 metres the range is 540 metres
at 7,000 ,, ,, ,, 1,750 ,,
at 10,000 ,, ,, ,, 3,450 ,,

Therefore, at the shorter wavelengths it is possible to use transformers which are more sharply tuned than when the higher wavelengths are used; in fact, it is difficult to make a good transformer at 30 kilocycles which should be sufficiently broadly tuned to eliminate distortion.

Unfortunately while it is theoretically possible to obtain higher amplification with longer wavelengths than with short ones, the large amount of wire that is necessary to obtain the required inductance results in a bulky and expensive transformer, so that the size of wire is usually cut down to a minimum, resulting in a loss due to high-frequency resistance and decreased amplification.

A partial solution to this difficulty was the introduction of steel cores which, by increasing the inductance, allowed of less wire being used, but such cores flatten out the tuning too much unless the wavelength is increased to a point where the flattening just covers the side bands, somewhere in the region of 30 to 50 kilocycles. At these frequencies amplification should be good, but steel cores are responsible for very great hysteris losses which not only create distortion of another kind, but cut down the amplification which theoretically should be possible. There is also the danger that the amplification curve may overlap into the audible frequencies and give rise to background noises.

Americans apparently do not mind distortion or noisy back-

ground so long as they can get distance, but this kind of reception does not find much favour here. The air-cored transformer was the only one possible under the circumstances, the choice of wavelength being the next consideration. We can set up a beat note by heterodyning the signal with a frequency either longer or shorter than the original, and as a consequence we shall be able to tune in a given station at two points on the oscillator dial. Using 30-kilocycle intermediate transformers these two points are very close together and it often happens that two stations are brought in together owing to the upper oscillator setting for one station being the lower setting for another. As we go lower with the intermediate frequency, however, the distance apart at which the same station comes in increases until at 143 kilocycles we have to move the dial through half its travel before one station appears a second time. At 143 kilocycles it is possible by careful design to obtain very high amplification, partly due to the fact that we can use comparatively heavy gauge wire, thereby lowering the high-frequency resistance, and partly due to the fact that the distributed capacity of the winding is low.

It is essential that the various transformers in a set be matched so as to pass the same band of frequencies, and at the lower frequencies this is a comparatively easy matter, because it does not matter within a few hundred metres exactly where the peak is, but as the frequency is raised matching assumes very much more importance and militates against the mass production methods of our transatlantic friends, as with high-amplification h.f. transformers it is a physical impossibility to ensure that every one shall peak at the same frequency; consequently every transformer has to be very carefully measured for frequency and sets sorted out which are alike, ordinary methods of measuring wavelengths not being sufficiently accurate.

After having taken all this care in matching it is essential that the wiring shall be carefully done, and it is necessary that the intermediate valves and second detector be matched for interelectrode capacity, the first detector be sensitive, and the oscillator valve capable of oscillating strongly without excessive plate current; further, and equally important, they must be free from noises of their own. The generally expressed opinion in America that any oscillator will do, is not borne out in the author's experience, as many types give rise to troublesome harmonics, involving the same stations appearing twice for each strong harmonic, which trouble is also apparent when using a combined detector and oscillator; in fact, the latest development of Major Armstrong uses the second harmonic of the oscillating detector valve to beat with the incoming frequency to provide the intermediate frequency.

Mr. Lowe found that as the plate voltage on the first detector valve was reduced the receiver became more sensitive and actually would operate quite well with no plate voltage at all, but subsequently he joined the plate of the first detector to the grid-filament circuit of the oscillator, which provided enough plate voltage, although alternating, and also serves to couple the two valves together, dispensing with the coupling coil.

He later found that this method was the same as that used by R. E. Lecault, under the name of "Ultradyne," who says that the incoming signal "modulates" the radio frequency from the oscillator, but the actual operation is the same as any standard superheterodyne, the main difference being the absence of an underlying direct current on the detector plate. Because the energy of the oscillator is fed into the plate circuit of the first detector instead of into the grid circuit, this method radiates to a much smaller amount than the ordinary method and certainly is distinctly more sensitive, especially on weak signals.

The output of the first detector to the intermediate frequency transformer is dependent on the product of the signal voltage and the voltage generated by the local oscillator, so that it is important that the oscillator be as good as it is possible to make, and that the frame aerial circuit should be of low resistance and free from losses. Stations up to three or four thousand miles can be received on a frame aerial only and distant reception seems limited only by the amount of noise present in the ether. Any superheterodyne which requires the use of an outside aerial is falsifying its title.

In answer to questions raised during the discussion which followed the lecturette, Mr. Bowyer-Lowe made it clear that the super-heterodyne set was not the type to use for local reception, nor could it be expected to give reproduction which would be considered entirely undistorted by a critical ear; it was purely for long-distance reception, for operating a loud speaker practically free from distortion, and without interference.

Magnetic Sheet Material.

Power Losses at High Flux Densities.

By C. E. WEBB, B.Sc.(Eng.), A.M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

AT the present time there is a marked tendency amongst designers of electrical machinery to employ higher flux densities in electrical sheet steel than have been customary in the past, and, in consequence, to demand guaranteed figures for the total power losses due to hysteresis and eddy currents at correspondingly higher densities. It is therefore a matter of increasing importance to obtain reliable and accurate knowledge of the way in which the power losses vary with the flux density at high densities, particularly in the special brands of sheet material which are now so extensively employed.

Of the two components (hysteresis and eddy currents) of which the total loss consists, the hysteresis loss is usually the more important, and is also the one concerning the law of variation of which there is more uncertainty. There is general agreement as to the validity of Steinmetz's empirical law that—Hysteresis loss in ergs per cm^3 per period $= \eta B^x$, where x is a constant index for any given material, having a value of approximately 1.6 for flux densities between about 4,000 and 10,000 C.G.S. units; but at higher densities surprising differences between the results of different investigators appear to exist, as is made evident in the author's brief survey of some of the principal papers bearing on the subject.

Some investigators find Steinmetz's law to apply closely up to the highest flux densities at which tests could be carried out, whilst others record more rapid variations of hysteresis loss with B in the region of B=10,000—16,000. The extent of the departure from Steinmetz's law also varies considerably, some observers finding a maximum exponent of approximately 2 and others obtaining values as high at 3.2.

In the paper a series of tests (both by a.c. and ballistic methods, carried out at the National Physical Laboratory) on a wide range of sheet materials is described, the results of which appear to confirm the increase in the exponent of B in the expression for the hysteresis loss at values of B between 10,000 and 15,000. They also show comparatively little difference between the various specimens of sheet material tested.

The construction of a new Lloyd square for tests at still higher flux densities, and a further, more detailed, series of tests (both a.c. and ballistic) on a representative specimen of each type of material, making use of this square, are then described. These tests were carried up to B=17,000 or 18,000 and, while confirming and extending the previous results of increased exponents of B for values up to 16,000, indicate a rapid decrease in the exponent at the highest values of B employed.

The test specimens were provided by Messrs. J. Lysaght, Ltd., and comprised samples of lohys, special lohys, high-resistance and medium-resistance grades. To summarise the conclusions deduced from the results recorded, it has been shown that:—

(1) In all the principal types of commercial sheet material in use at the present time, the rate of increase of the hysteresis loss with B is considerably greater at flux densities above B=10,000 than is indicated by Steinmetz's law, or than appears to have been generally realised. In most specimens over a small range in the neighbourhood of B=15,000 the variation is as rapid as the 2.5th power of B, and in some cases it exceeds the 3rd or even the 4th power of B.

(2) Above about B=16,000 the rate of increase falls off very rapidly and drops again to the 1.6th power or even lower.

(3) The eddy-current index at high flux densities is fairly constant and generally rather less than 2.

(4) The apparent values of hysteresis and eddy-current losses in ordinary commercial sheet material depend to a considerable extent on frequency. Experiments not recorded in the paper indicate that this is due to non-homogeneity of the sheet. These effects do not appreciably alter the exponents observed.

Discussion in London.

Mr. H. S. HOLBROOK commenced the debate with the remark that no one had hitherto explored the subject to the extent that the author had done. He explained that American and Continental manufacturers ran their transformer cores at over 20 per cent. greater flux densities than was customary in this country, and so they were able to produce smaller and cheaper plant; therefore, the paper was of practical value. Scale on alloy steels was one of their greatest troubles.

Mr. G. S. MARRIS, who was understood to say that he had been carrying out similar experiments at low densities, pointed out that in the subject of magnetisation so much was of an empirical nature that one hesitated to abandon anything which might be a guide. The author had shown that the Steinmetz

law was applicable only within the range for which it was originally put forward, which fact had been emphasised by the late Dr. Steinmetz himself in one of his books.

Mr. L. SIMMS said that the author had accomplished that which he had set out to do, but he (the speaker) was not so sure that the paper had put the matter beyond all doubt. He referred to the ways in which it was possible that errors might have been introduced in the testing apparatus and, in view of the fact that the coils and transformers were usually run at lower flux densities than rotating machinery, asked the author whether he could assure them that his results were equally applicable in both cases. There was considerable room for similar investigations at audio frequencies.

Mr. H. W. TAYLOR drew attention to the possibility of the use of silicon steels and high-resistance materials increasing the losses; at high densities they might be greater than if ordinary iron had been employed. The addition of silicon to steel, besides introducing advantages, increased the permeability at low density, and that might be the cause of the trouble experienced with increased losses in the completed machine. In this country they did not seem to be able to build machinery of equal quality with the same silicon-content material as was done in America. Continental steel makers gave much closer guarantees than English makers did, and it would therefore seem that the same quality of material was not being obtained in this country.

Mr. LL. B. ATKINSON was of the opinion that the use of the terms "exponent" and "index" was such that the second paragraph of the author's summary of other investigators' results could be read so as to have two meanings. That was the second time they had listened to considerable argument round a formula which would not fit the case; if Steinmetz's law was not true, he would have liked the author to have said so and to have attempted to evolve a new one that fitted the extended case.

Another speaker said the author seemed to know the B_{max} within 5 per cent., which, he thought, was too optimistic.

Mr. C. E. WEBB, in reply, indicated that the results which he had obtained were not meant to be directly applied by the practical man when designing a machine, but were rather a means of determining the fitness of material to be used. Between the limits of $B = 3{,}000$ or 4,000 and 10,000 the Steinmetz law was true, but he had not succeeded in devising a simple formula that would meet the extended case, nor were they likely to do so. Work was in hand on the determination of losses at audio frequencies.

Economic and Industrial Conditions in France.

Development of Natural Resources.

MR. J. R. CAHILL, Commercial Counsellor to the British Embassy, Paris, has furnished a bulky report,* revised to July, 1925, upon economic and industrial conditions in France, to the Department of Overseas Trade.

The introduction to the report presents a general survey of France's industrial power, and it is stated that her immense war losses have now been made good as regards both industry and agriculture, by a system of immigration from surrounding countries. In addition, every effort has been made to improve methods and instruments of production, and in this connection electricity has had a large share. It is noteworthy that the shortage of agricultural labour has been to a large extent compensated for by rural electrical development. The country's water power is being harnessed as rapidly as circumstances will permit, and many schemes have been accorded State support. As regards the supply of raw materials, the country's position has been improved by the acquisition of the Alsace-Lorraine ore, coal, potash and oil fields, and by the usufruct till 1935 of the Saar coal mines. Side by side with development of the northern coal fields, the production of electrical energy has proceeded at a rapid rate, and an appendix to the report gives a very exhaustive review of the activities of the mining companies, especially from the point of view of the production of electric power.

The war-time extensions of plant in the engineering industries have, in many cases, been converted to the production of peace-time necessaries, and are now engaged in efficient mass production. As regards organisation, the main features in recent years have been the enlargement of the units and the tendency towards combination. In the engineering industries several cases of large-scale consolidation exist; in the electrical industry one company runs nine factories, each engaged in the manufacture of a different series of products, and it has large participations in a score of other manufacturing concerns, as well as in many electricity distribution schemes. Two or three other electrical concerns also possess numerous factories and participate largely in distribution. Electrical material manufacturing concerns have also in some cases made working arrangements with steel producers. In addition to the opening of new works in France itself, extensions have been made by many firms into neighbouring countries.

The Electrical Industry.

The report states that the unbroken prosperity that has attended the French electrical industry since the war has been, and is being, fully maintained. This is attributable not only to railway electrification, and hydro-electric and other power developments, but also to the general advance in the utilisation of electricity in farm, factory, and home. The number of communes in France provided with electricity rose from 2,000 in 1911 to 10,000 in 1923, and to-day the number no doubt reaches 12,000. The development would have been more rapid had not many projects been handicapped by lack of funds. Like several other French industries, the electrical material industry is dominated by a few concerns. In addition, it is closely intertwined with undertakings engaged in the production or distribution of electricity, and it has thus secured a great permanent body of buyers of its products. The Thomson-Houston concern has a capital of 300 millions of francs, and it has special arrangements with the firms of Schneider and Jeumont in connection with the supply of railway electrification requirements. In 1921, with two other large electrical concerns, it formed the Compagnie des Lampes, which embraces several of the chief lamp concerns in France and Spain. It has interests, direct or indirect, with numerous electricity producing works, distribution undertakings, electric traction concerns, &c., and it also has close connections with American interests; in short, it may be said that the electrical industries of France appear to have followed closely the lines of German development in the same industries, the bulk of the undertakings being ranged in a few groups. For many interests these groups, far from being antagonistic, co-operate as regards production (*e.g.*, lamps) or as regards markets (*e.g.*, railway electrification). A long appendix to the report deals in detail with the operations and ramifications of the leading French electrical companies. This is not of a nature which permits abstraction, but it may be said that it shows the close connection between a great number of concerns.

Hydro-Electric Development.

The lack of capital, coupled with the instability of prices, has caused a deferment of many important water power schemes, and thus, whilst the erection of certain high power stations, *e.g.*, Eguzon on the Creuse, Brommat on the Truyère, and Pougny-Chancy on the Rhône, has been proceeded with for various urgent reasons, the larger schemes, *i.e.*, those of the Rhine and the Rhône, which, together, at a cost of six milliard fr., would provide an additional 1,700,000 h.p., have not been started. Accordingly only some 25 per cent. of the total resources has been made use of. The figures given in the report show that the total power in service is 775,210 kW; 339,690 kW was under construction, and 4,003,900 kW was projected. The greatest development has taken place in the south-eastern district of France, in which almost 60 per cent. of the total power is utilised. In Savoy and Provence more than 160 stations are actually in operation, while about a dozen are in course of construction. The Isère is the principal waterway in the district, and 87 stations have been built upon it; 230,000 h.p. has been developed in the south-west, and stations providing a further 100,000 h.p. are under construction. In the central region 79 stations provide more than 100,000 h.p., the Dordogne stations contributing more than one-third of the total. The Paris-Orleans Railway Co. is building three important stations in this region. Little progress was made during 1924 in the north-east and Alsace-Lorraine. Schemes are in hand, but in the meantime deferred, for utilising 800,000 h.p., whereas the total power in service scarcely exceeds 15,000 h.p. at present. Development has also proceeded very slowly in the north and north-west districts, but schemes are in hand for the harnessing of about 100,000 h.p. As regards the tidal power station at Aber-Wrach no progress has been reported during the past year. Full official sanction has been received to the scheme, and there is no doubt that the erection of the station will be undertaken in the near future.

The report also makes mention of the Rhine development, which, in addition to improving navigation, aims at developing about 700,000 h.p. Agreements have been drawn up and certain concessions have been granted. No progress has been made with the definite constitution of the company which was to take in hand the great Rhône scheme. The delay is said to be due to the increased cost of construction, a doubt whether the power will be cheaper than that produced by "thermic" stations, and the difficulty of providing the necessary financial resources.

* Stationery Office, 8s. net.

Railway Electrification.

The present French railway electrification programme of three systems covers about one-third of the French railway mileage, or between 2,000 and 2,300 miles each for the Paris Orleans, the Midi or Southern, and the Paris-Lyons-Mediterranean Railways. The first and second have continued their active work in this respect. The development in 1924 by the Midi Railway included the completion of the stretch of 190 miles from Toulouse to Dax, and, later, the line from Irun through Hendaye and Bayonne to Bordeaux (148 miles) was completed. A number of branches have also been electrified. The work already executed and to be carried out in 1926 will bring the total electrified mileage up to 685, and further progress will be made after this year. Three of the five hydro-electric stations in the Pyrenees are working, the other two being in course of construction. For the eastern section of the Southern Railway two at least of the group of six or seven stations have been completed. The Government has fixed the system for future electrification at 1,500 V d.c. The Paris-Orleans Railway has continued the first part of its programme, *viz.*, the electrification of a stretch of 312 miles from Paris to Brieve, but it appears to be behind the scheduled time. Eguzon station is in service, while the construction of three power stations on the Dordogne river is progressing. The stock delivered during 1925 included five high-power locomotives of the gearless type, developing 2,300 h.p. each; under test one of these attained a speed of 70 m.p.h. So far the Paris-Lyons-Mediterranean Railway is only operating a single section electrically, although its programme provides for the conversion of 2,044 miles. Work is proceeding on the 84-mile line from Culoz to Modane. Of the other main systems the State Railway appears to be the only one engaged in the electrification of any sections, and it is confining itself to the Paris region.

Telegraphs, Telephones and Radio.

The dispatch, by the Belin system, of written messages, introduced by the French Post Office in 1923, has continued. This method of telegraphy may now be employed between Paris and several French towns. The number of telephone subscribers has doubled since 1914, and is now about 600,000. Radio has made very rapid progress in France, which now possesses 40 stations in operation, with as many more in course of building, or planned. The Post Office has erected transmitting stations for telephony at several chief towns, and those at Paris, Strasburg, Lyons, Versailles, Bordeaux, Angers, and Toulon are already working or will be working shortly. The units of this network have an effective radius of 1,000 km. The organisation of the manufacturing industry for radio is very strong; the entire industry is concentrated in fact in the Compagnie Générale de Télégraphie Sans Fil, with a capital of 62.5 million fr., which controls or participates in practically all other French concerns and has large interests in Belgian, Italian, Polish, Jugo-Slavian, Swiss, and Czecho-Slovakian concerns, as well as in Brazil, Argentina, Chile, and the Far East.

The Electro-Chemical Industry.

In an appendix to the report a great amount of information upon this subject is given. The class of products turned out and the provision of the necessary power are dealt with in great detail. Particular mention is made of the Compagnie Produits Chimiques et Electro-Métallurgiques Alais, Froges et Camargue (Péchiney), the predominant concern in the electro-chemical and electro-metallurgical industries. Several large power stations have been erected by this company, but they are proving insufficient for the demands, and further new plants are being constructed. Another company which has erected important water power stations for electrochemical purposes is the Société d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine, which has seven stations of a total capacity of 32,000 kW.

General.

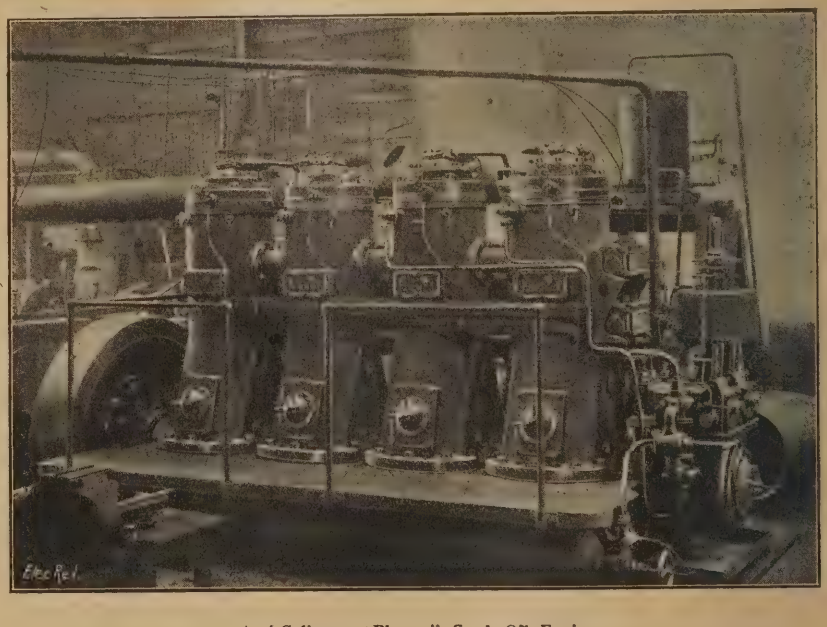
During 1925, as reported in our pages at the time, a lacuna in French company law was filled by the institution of limited liability companies, analogous in many respects to similar bodies in the United Kingdom. Two Bills were introduced by the Government in July, 1924, to amend the legislation with regard to patents and trade marks. The object of the first Bill was to bring the French patent law into agreement with the International Industrial Property Convention; it extends the period during which patents are valid from 15 to 20 years, and revises the scale of fees. The Bill with regard to trade marks also extends the period of validity from 15 to 20 years. It also recognises and protects collective marks, the legality of which had hitherto only been recognised incidentally. Foreigners may obtain the benefits of these Bills by complying with the same formalities as French citizens

The French State is taking a very active part in the promotion of foreign trade, and since the war it has created a Department of Overseas Trade (modelled in most respects upon the corresponding British Department), which directs the work of 54 commercial attachés in foreign countries and maintains exhibition offices in many cities. The department also works in close collaboration with the important national committee of foreign trade advisers, which is appointed from among the representatives of the export trades in France, and French merchants of standing in foreign countries.

An Improved Crude-Oil Engine.

Some Particulars and Test Results of the "Plenty" Heavy-Oil Engine.

We have received some interesting information concerning the recently re-designed "Plenty" heavy-oil engine, a product of the firm of Messrs. Plenty & Son, Ltd. This engine is of the vertical two-cycle type, employing a crankcase scavenge, and it is made in sizes ranging from 30 to 300 b.h.p. Although the engine is made in one-, two-, three-, four- and six-cylinder units, two sizes of cylinders only are employed, *viz.*—270 mm. bore, 300 mm. stroke; and 335 mm. bore, 390 mm. stroke. The new models, while still retaining the usual features of the previous ones, embody many improvements. The totally water-cooled head is retained and a hot spot in the form of a small plug is utilised for starting; either this may be heated by means of a blow lamp, or an electric starting device may be employed. The starting is effected by means of a pilot jet which impinges upon the hot spot. This is closed off as soon as the engine starts, and the main injector in the top of the head automatically comes into operation. The governing of the engine is effected by altering the length of the fuel pump stroke. The governor and the fuel pump gear are located at the end of the engine, a camshaft being placed across the engine and driven through spiral gears. The cams operate vertical rocking arms which are mounted on a hand operated



A 4-Cylinder "Plenty" Crude-Oil Engine.

eccentric fulcrum shaft, which serves to throw the rocking arms out of action for starting and stopping.

Interposed between the upper end of the rocking arm and the fuel pump plunger is an adjustable tappet. This is made in two halves, one half being free to move endways but not to rotate. This part of the tappet is threaded internally, and into it is screwed the second half. On its exposed periphery teeth are cut which engage with a sliding rack. The latter, which engages with all the tappets on a multi-cylinder unit, is coupled to a centrifugal governor. The governor itself is driven from an extension of the camshaft and is designed to deal with large and sudden variations of load without any external adjustment. The accompanying illustration shows a four-cylinder "Plenty" engine.

Some particulars of tests made on a 200-h.p. "Plenty" engine which was recently supplied to Messrs. Edmundsons, Ltd., for their Newbury power station, add to the interest of the above brief description. The engine was run at full load, 600-lb. brake load, at an average speed of 302 r.p.m. The b.h.p. measured was 201.5 and the fuel consumption for the period under these conditions was 94.5 lb., representing a consumption of 0.468 lb. per b.h.p.-hour. Under three-quarter load the b.h.p. was 152.5, and the fuel used per b.h.p. was 0.515 lb. The consumption at half load was 0.55 lb. per b.h.p. at a measured output of 102 b.h.p.

Developments in Electrically-Driven Centrifugal Machines.

The "Weston" Centrifugal Machine.

THE progress which is being made in this country in the beet-sugar industry emphasises the need for a reliable direct-driven electric centrifugal machine. The firm of Watson, Laidlaw and Co., Ltd., has made a considerable advance in this direction in the design of a machine in which, it is claimed, the electric motor and the centrifugal are each constructed efficiently on its own merits without necessitating the construction of the two elements in one frame. The electric motor is fixed on the framework above the centrifugal which it drives at the upper end of the centrifugal spindle through the medium of a combined flexible coupling and friction pulley, ensuring that the oscillation of the lower machine is not transmitted to the motor itself, thus permitting the rotor and stator air gaps to be kept to a minimum. The coupling and friction pulley combination is so constructed that, by a simple adjustment, the rate of the acceleration of the centrifugal may be varied to suit the particular class of sugar under treatment. The friction pulley enables the motor to run up to speed before the load is applied, thus permitting the use of a motor designed for starting by connection to the supply mains direct. The centrifugal spindle runs in ball bearings and carries a special conoidal rubber buffer. The combination of the ball bearings and this buffer is said to render the machine durable and easy running, with a minimum of oscillation, and with a much greater unbalanced load than has hitherto been possible. The buffer is self-adjusting and hence avoids the tightening of screws as it wears.

Another feature of the machine is a hollow hinged post with which the motor is fitted, enabling it to be raised and turned round, clear of the top of the spindle, without disturbing any of the electrical connections, thereby giving access to the bearings and buffer of the centrifugal spindle. Fig. 1 shows the motor disconnected from the other machine. The former is fitted with a special interlocking switch and brake gear, by means of which the operations of starting, stopping and applying the brake are made by one lever only; the act of applying the brake opens the motor switch so that it is not possible to start the motor when the brake is on or to apply the brake until the supply has been cut off. The motor is totally enclosed and hence protected from the moisture usually prevailing in a sugar-house. Either d.c. or a.c. motors of suitable design can be used with the Weston machine. The position of the motor on the frame at the top of the centrifugal renders unnecessary the provision of special foundations for it. Fig. 2 illustrates a vertical section of an electrically-driven centrifugal machine, and fig. 3 shows a complete unit.

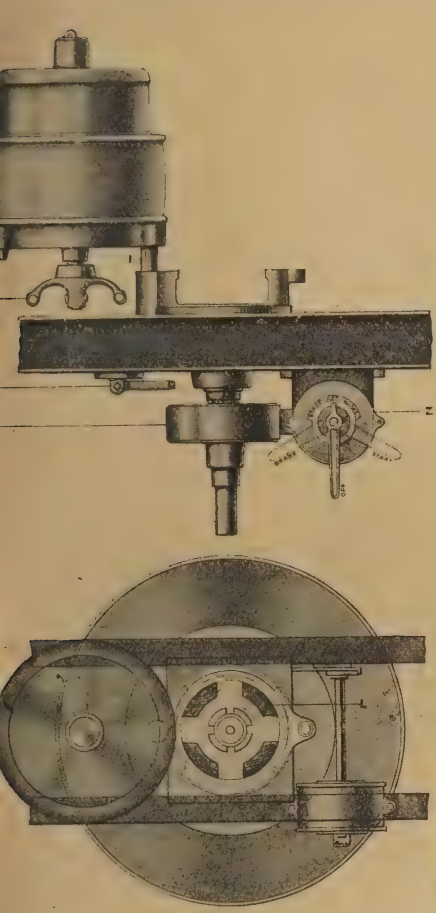


Fig. 1.—Machine with Motor Disconnected.

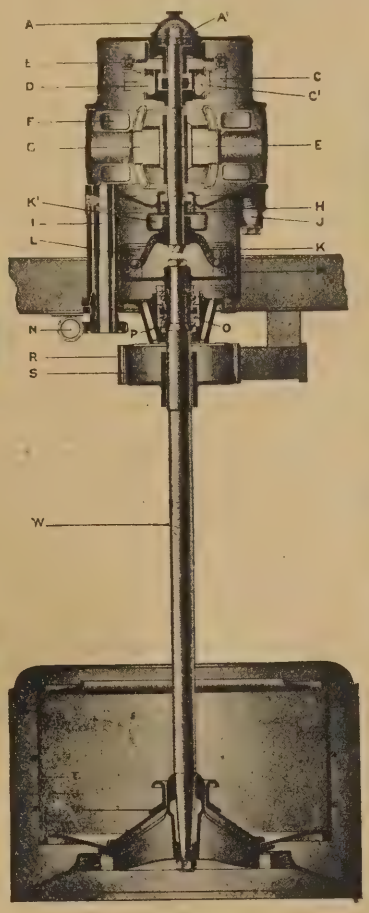


Fig. 2.—Vertical Section.

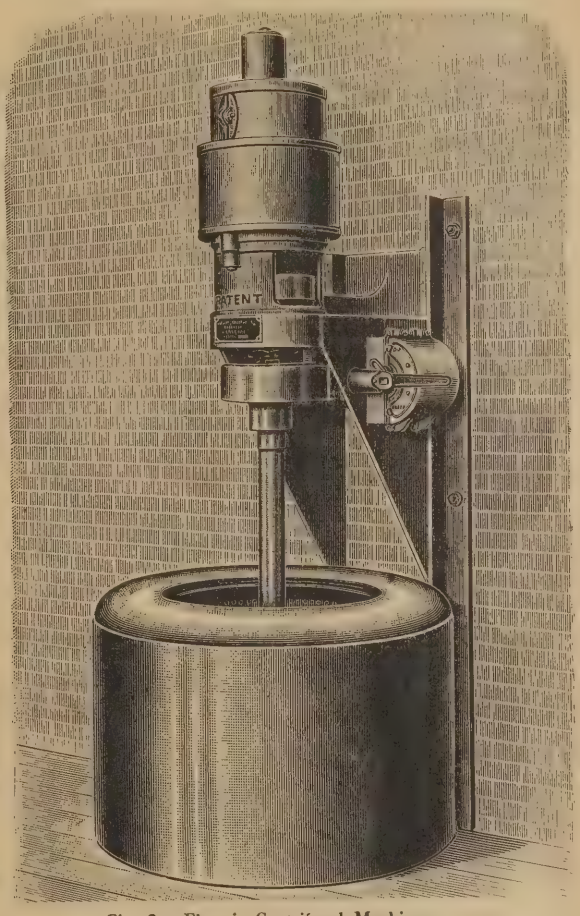


Fig. 3.—Electric Centrifugal Machine.

INDEX TO PARTS.

A, Cover of bearing; A', Top of ball-bearing; B, Brush-holder; C, Brushes; C', Commutator boss nut; D, Commutator; E, Motor spindle; F, Field coils; G, Armature; H, Lower ball-bearing; I, Patent hollow post; J, Motor attachment pin; K, Driver; K', Grease cup; L, Friction shoes; M, Coupling on centrifugal spindle; N, Worm and worm wheel; O, Ball bearing; P, Patent buffer; R, Brake; S, Brake pulley; T, Basket; U, Monitor case; V, Discharge valve; W, Centrifugal spindle; Z, Switch interlocked with brake.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A Speed-Indicating Relay.

According to *Power* a speed-indicating automatic relay, designed primarily for use with small, low-speed, vertical water-wheel generators operating under full automatic or remote supervisory control systems, has recently been placed on the market by the WESTINGHOUSE ELECTRIC & MANUFACTURING CO., U.S.A. It is mounted directly on the end of the rotor shaft, and is enclosed in a sheet-metal housing, having a removable top for inspection. Control energy is supplied through five slip rings, encircling the relay mechanism and insulated from it by a micarta tube. Through these five rings and their corresponding brushes any desired system of remote or automatic control can be connected. The relay operates on the centrifugal principle and assists other relays and contactors in controlling the station. It has three contact points—starting speed, synchronous speed and above-normal cutout-speed. When the generator is started, either automatically or by a distant operator, its increasing speed causes a vertically suspended governor weight, held against spring tension in the relay, to move outward, and as the speed approaches synchronism, contacts are closed, completing a circuit, which operates to throw the generator directly on the line. If, for any reason, conditions of other automatic apparatus are adverse to the generator's being connected to the line, and the breaker is thereby prevented from closing, the generator speed must decrease until the relay contact is established with the initial starting point before it can be started up. This assures safety to both the generator and its main control apparatus by ensuring that all starting operations are performed in proper sequence.

After the generator has been successfully connected to the load, should its speed increase to approximately 40 per cent. above normal, the third contact in the relay would automatic-

ally disconnect the machine, open the field switch and close the gates. The generator's speed must fall to the value of the first contact position before it can be re-energised.

An Improved Duplicator.

We recently witnessed a demonstration of duplicating work on the "Opalograph," an apparatus presenting a new departure in this work, which should prove a useful equipment in the drawing office. The main feature of it is a special opal glass plate to which the original is transferred and from which perfect copies can afterwards be taken, in any colour, of typewriting, handwriting, drawing, &c. The original is prepared in a special ink. A preserving fluid is first applied to the plate, after which the original is pressed to it, face to face, a frame press being provided for this purpose. The plate print is then fixed with a special fixing ink. Copies can then be taken from the print by the usual method. It is claimed that up to 300 copies can be taken from one fixing and that the original can be re-used, fresh preserving fluid and inks being applied. The apparatus is made in sizes to accommodate an original up to a yard square and is marketed by MESSRS. OPALO, LTD., 259, High Holborn, London, W.C.1.

Actino-Therapy Lamps.

The accompanying illustration, fig. 1, is of the "Westminster Junior," one of a range of actino-therapy lamps manufactured by the WESTMINSTER ENGINEERING CO., LTD., Victoria Road, Willesden Junction, N.W.10. It is claimed that the lamp gives a light of great intensity, rich in ultra-violet, luminous



Fig. 1.—Actino-Therapy Lamp.

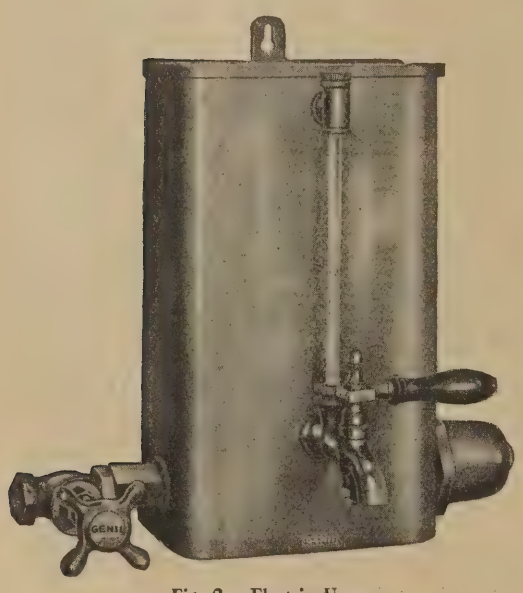


Fig. 2.—Electric Urn.

and heat rays. The proportion of ultra-violet rays can be varied by the use of various electrodes, such as tungsten, &c. It is also claimed that the lamp will burn for three hours without receiving attention. It is supplied with the necessary variable resistances or choking coils for use on d.c. or a.c. circuits as the case may be. Many of the leading hospitals are using "Westminster" lamps and, it is said, excellent results have been obtained in cases of rheumatism, neuritis, sciatica, lumbago, &c.

A New Design of Electric Urns.

The electric urn shown in fig. 2 is one of a new range of such apparatus recently marketed by Messrs. GEORGE NOBBS, LTD., 87-89, Cleveland Street, Fitzroy Square, London, W.1. The "Genii" urns are made in circular or rectangular patterns. The latter are designed for fixing to a wall or bulkhead. They are provided with a threaded boss for a cold-water feed, if required, or they may be filled from the tap by raising the top cover. The heating element consists of a "Genii" immersion heater equipped with a gun-metal terminal box. The urn illustrated has a capacity of 1¼ gallons, but similar designs are made with capacities up to 10 gallons.

An Improved Boiler Meter.

The accompanying illustration, fig. 3, shows the construction of the "Bailey" boiler meter, the latest production of INDUSTRIAL COMBUSTION ENGINEERS, LTD., Astor House, Aldwych, London, W.C.2. It is designed to record the steam-flow, air-flow, and the flue-gas temperature, and also to indicate the furnace draught. The steam-flow is indicated by a red line on a disk chart, which can read either in lb. of steam or as a percentage of the boiler rating. The measure of the flow of air through the furnace is recorded by a blue line which, for the best operation, should coincide with the red steam line; a space between the lines indicates the necessity for attention to the working conditions. The temperature of the flue gases is recorded by a green line which indicates whether or not the heating surface is absorbing the maximum amount of heat. The steam-flow recorder is operated by the differential pressure across an orifice in a Monel metal disk inserted between a pair of flanges in the steam pipe between the boiler and the header. The air flow element employs the same basic principles. The draught pressure drop across the boiler is applied to two bells sealed in oil and suspended from knife edges on a beam. The latter is supported on knife edges and carries a displacing member immersed in mercury. Any increase in the rate of flow of the gases is accompanied by a greater pressure difference which, acting on the bells, produces a motion of the beam, thereby drawing the displacing member out of the mercury reservoir. The member moves until balance is obtained. The temperature measurer is a nitrogen-filled bulb which gives a true average temperature in virtue of its sensitive-bulb section being long enough to extend entirely across the width of the boiler. The measurement of furnace draught, which is indicated on the side scale, is based upon the differential

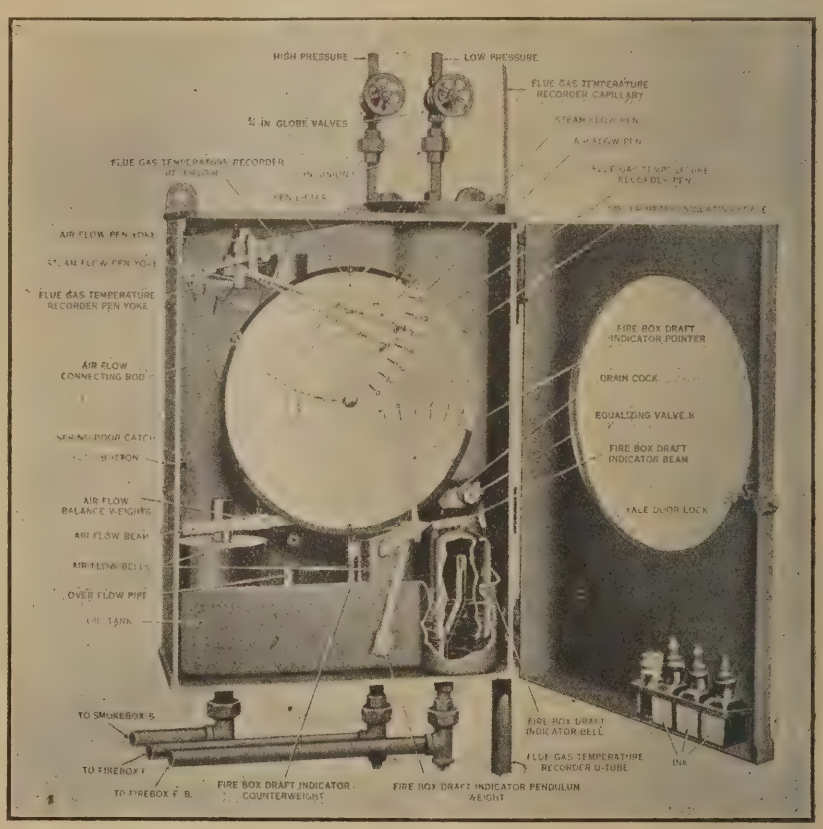


Fig. 3.—Modern Boiler Meter.

draught pressure between the furnace and the uptake to the chimney and is therefore taken across the gas passages of the boiler where the greatest dependable pressure-drop occurs.

A New Electric Safety Lamp.

We are informed that a new electric safety lamp, for use in collieries in which dust and fire damp have to be contended with, has recently been approved by the French Government. It is made by the Société d'Eclairage et d'Applications Electriques, of Paris, and is known as the "L.D.H." It utilises a 2.4-V alkaline battery with plates of iron, cadmium, and nickel, with an electrolyte having a free potassium base. The lamp, which gives a light of 1½ c.p., for 10 hours, is about 10 in. high by 3¾ in. in diameter, and weighs 5¾ lb.

Electric Supply Timepiece.

An interesting development in electric clocks, the "Telechron," has been introduced by the WARREN CLOCK COMPANY of America. For the successful operation of this device an a.c. supply of constant frequency is essential. The propelling force is in the form of a small synchronous motor, to which is suitably geared the clock movement, so that if the frequency of supply does not vary the correct time can be maintained. It is intended that the apparatus should serve as a master clock for any electric-clock installation. The clock is made in many models of cast bronze finished in verde antique.

Parliamentary News.

(By Our Special Parliamentary Reporter.)

Horley Electricity Order.—On December 18th, in the House of Lords, it was reported that the Special Orders Committee had heard evidence from the parties concerned and did not recommend that a further Parliamentary inquiry should take place; but should the Horley and District Electricity Special Order, 1925, be approved, the Committee recommended that it should be approved subject to the omission of Clause 8 and Schedule 5. Lord Donoughmore, the Chairman of Committees, moved that the Report be considered and adopted. He said that both parties were in agreement that no further inquiry was necessary. Certain salient points came up during the hearing before the Special Orders Committee. The first was that the scheme under the Order was still incomplete. A further Order, if not further Orders, would be necessary, and it was understood that they were in progress. It also became quite clear that the promoters of the Order desired to carry out their obligations through the medium of a bulk supply scheme and not through a small separate generating station, and they agreed to the deletion of Clause 8, which authorised them to set up a generating station, and to the deletion also of the schedule relating to it.

The report of the Committee was then adopted.

On December 21st Lord CLARENDON withdrew his opposition to the approval of the Order, stating that the Gas Company did not wish to proceed further with the matter. Lord PLYMOUTH then moved that the Order be approved, subject to the omission of Clause 8 and Schedule 5.

Lord ULLSWATER said that the House of Lords was asked to reverse its decision on the Bill on the *ipse dixit* of the Ministry of Transport, which had never heard the competing parties. The best solution of the whole difficulty would be that neither scheme should go through this session, and that at the beginning of next session both parties should start afresh and get a proper hearing before the tribunal of Parliament. Lord CARSON spoke to the same effect.

Lord DONOUGHMORE said that he felt that the House had no alternative but to accept the proposal of the Ministry of Transport, which, by the Act of 1919, that House had made the responsible agent of Parliament in these matters. In this case the Minister invited the Gas Company to appear at an inquiry, but the company refused because its Bill was then before Parliament, and it preferred to rely on that. He was given to understand that the appeal from the Electricity Commissioners to the Ministry of Transport was a real appeal. It was argued that the Ministry was absolutely independent and judicial, and reviewed the proceedings of the Electricity Commissioners. He hoped that experience might show in future cases that the appeal from the Electricity Commissioners to the Ministry of Transport was a real appeal and not merely a re-submission of the case from one room in an office to another room in the same office. The Gas Company all through these proceedings had been in the position that it could not itself go to the Electricity Commissioners and ask for the Electricity Order—though the Electricity Company could do so—and accordingly it had no remedy but to promote a Bill in Parliament. One difficulty had disappeared; the Act of 1925 for the first time made it unnecessary for a gas company to come to Parliament direct. It could go to the Electricity Commissioners for an Order in the same way as any other authority. He hoped, therefore, that the difficulty would not recur in future cases.

After further debate the Special Order was approved, subject to the deletion of Clause 8 and Schedule 5.

Special Orders relating to Blackburn, Helensburgh, Leyland, North Berwick, Pontypool, West Wilts, and Aylesbury were also approved.

Australian Wireless.—On December 21st, the Prime Minister informed Lord Apsley that the Australian Wireless Company had applied for a licence to operate a radio station in Great Britain for communication with Australia, but it had been informed that, in conformity with the policy adopted by the late Government and confirmed by the present Government, the operation of all the Imperial services in this country would be concentrated in the hands of the Post Office. A contract for the erection of radio stations for communication with Canada, South Africa, India and Australia was made by the Post Office on July 28th, 1924, and approved by resolution of the House of Commons. Those stations were approaching completion, and when they and the corresponding Dominion stations were available, direct radio services would be commenced.

Iron and Steel Trades Safeguarding.—On December 21st, Mr. BALDWIN, replying to questions, said that the application of the iron and steel trades to the Board of Trade for the appointment of a committee under the Safeguarding of Industries procedure was referred to the Committee of Civil Research, and its report had been received by the Cabinet. The Committee had given the subject prolonged and detailed consideration and had heard a large number of witnesses, representing employers and employed, engaged in the iron and steel industries and in allied trades. The evidence revealed a serious situation. The pressure of foreign competition, aided by long hours, low wages, and depreciated currencies, was being severely felt by our manufacturers, and had the Government been able to deal with the iron and steel industries in isolation it might have regarded the case for inquiry as complete. It was clear, however, that the safeguarding of a basic industry of that magnitude would have repercussions of a far wider character which might be held to be in conflict with the Government's declaration in regard to a general tariff. In all the circumstances of the present time the Government had come to the conclusion that the application could not be granted. The Government would keep those industries under close observation with a view to promoting their well-being should any other measures be deemed desirable. It was hoped that the loan for railway development in East Africa which was recently approved would be found helpful, and further similar projects were under consideration.

Wireless Operators in Ships.—On December 21st, Sir B. CHADWICK informed Mr. W. Baker that since November 26th about 24 ships conveying mails to destinations overseas had proceeded to sea without wireless operators, and about 14 others were without a full complement of operators.

Russian Electrical Notes.

Inferior Quality of Manufactures.—The question of the quality of various industrial products is engaging the attention of interested circles in Moscow from the users' point of view. In this connection a representative of the railways states that in 1924-25 23.5 per cent. of the deliveries had to be rejected, including special telephones, insulators, &c. At a conference held in Moscow at the beginning of December complaints were also made concerning the supply by the trusts of defective lamps, many of which had a very short life; unreliable motors, &c.

A High-power Lamp.—A report from Leningrad states that Prof. Hekkel, in co-operation with Prof. Bulgakoff and Prof. Mitkevich, claims to have constructed in an experimental laboratory a new electric lamp having a million candle power without a reflector.

A Large Radio Station.—The Low-Pressure Trust has prepared a scheme for the establishment in Moscow of a 1,000-kW radio station which is intended for direct communication with Europe, Asia and America.

Manufacturing Profits.—The accounts for the year ended September 30th, 1925, of the Central Electrical Trust, which has now been amalgamated with the Leningrad Electrical Machine Trust, have been published. According to the profit and loss account, as published in abstract in the Moscow official newspapers, the year closed with net profits amounting to 2,246,000 roubles. After placing 449,000 roubles to reserve, allocating 337,000 roubles to welfare purposes, paying the directors' fees, totalling 22,000 roubles, and income tax, a net surplus of 1,033,000 roubles remained.

Rural Electrification.—During the current fiscal year (1925-26) the Electric Rural Construction Undertaking intends to proceed with the construction of 44 rural generating stations and the electrification of over 11,000 peasant villages at a total expenditure of 2,300,000 roubles. In accordance with the development of its activity the undertaking proposes to extend the period of credit up to five years and in special cases to seven years, and the credit on the average will amount to from 75 to 80 per cent. of the cost of the installations. The general outlay on the electrification of the villages ranges from 60,000 to 132,000 roubles each.

Development of Production.—The Industrial Section of the State Planning Commission has had under consideration a report by the General Electric Commission concerning the specialisation and development of the electrical manufacturing industry in the year 1925-26, and in connection with the extension programme for the ensuing five years. As a result of the applications already made for deliveries in 1925-26 the report states that the demand of the country can be determined at 170,000,000 pre-war roubles (£17,000,000); the works under the control of the commission are expected to turn out manufactures of the value of 104,000,000 roubles. The Kolchugino cable factory is to produce goods to the extent of 21,000,000 roubles and the remaining, smaller, works products valued at about 5,000,000 roubles. These figures make a total of 130,000,000 roubles, representing the production of the Soviet undertakings. It will, however, be necessary to expend a sum of 15 millions of roubles on repairs and re-equipment and about 6 millions on new manufacturing undertakings in order to bring the total output capacity up to the 104,000,000 roubles in this year in the case of the works under the auspices of the commission, and to a capacity of 140,000,000 roubles in 1928-29.

Tramway Prospects.—A statement has been issued in Moscow concerning the future requirements of the tramways. It is calculated that about 1,500 cars will be needed this year (1925-26). According to information furnished by the General Metal Commission, the cost of constructing cars at Soviet works is much higher than the cost of German cars. The output capacity of the Russian works is put at 1,100 cars per annum. The State Planning Commission, before which the statement was placed, has fixed the number of motor cars to be ordered this year at 1,000, with 600 reserve motors. As

supplementary equipment will have to be obtained from abroad, the commission has expressed the desirability of limiting the needs in this respect to from 5,000,000 to 6,000,000 roubles. In connection with this question it is stated that the Moscow tramways earned gross receipts of 33,200,000 roubles in 1924-25, the expenditure having been 23,200,000 roubles. Out of the profits of 10,000,000 roubles the sum of 5,000,000 roubles has been assigned to the acquisition of new cars, &c.

A Breakdown at the Kaschir Station.—It is reported that in November a breakdown occurred in a 7,500-kW turbo-generator at the Kaschir station owing to an unknown cause. A reserve machine was at once brought into use. The repairs were expected to occupy three weeks. No interruption is stated to have taken place in the supply system of Moscow as a consequence of the defect.

The Five Years' Electrification Scheme.—Some particulars have been published concerning the position of the scheme of electrification of Russia which was originally prepared five years ago. It is stated that out of the 30 regional stations contemplated 14 have been built or are in course of construction; projects have been prepared in regard to three other stations, while 13 have not been commenced. The total capacity of the works built, in course of establishment, and projected, amounts to 712,500 kW, and the stations not yet begun represent a further 1,037,500 kW. The non-completion of the original programme is claimed to have been compensated for by the construction of two new regional stations which were not included in the former plan, namely, the Semo-Avchalsky and the Lyaninsky stations, and by some other stations of local importance. As to the conversion of main railways to electric traction, as was projected in the original scheme, it is admitted that this has not yet been commenced, as sufficient allowance had not been made for the radical reconstruction which was necessary before electrification could be proceeded with. At present the only work of electrification of railways is being undertaken in connection with the lines in Baku and the suburbs of Moscow. The total capacity of the stations of public importance and of those at industrial works which are considered as "regional" stations amounts to 480,400 kW.

Legal.

Theft of Electricity.

ON December 23rd, at Cardiff, Alfred Warren was prosecuted for fraudulently abstracting electricity from the Corporation's mains. It was stated in evidence that the defendant had removed the seals from the cut-outs in premises in Stuart Street, and the meter leads had been tampered with so that current did not pass through the meter. The defendant stated that he was engaged to install some lights in the house, and he found that the fuse box was not sealed. He did nothing to alter the fuse boxes. He admitted that he had not informed the Electricity Department that the installation was ready for inspection.

A fine of £3, or in default one month's imprisonment, was imposed.

Ridley v. J. Gledson & Co.

WE are informed that on December 17th, at Middlesbrough County Court, Messrs. J. Gledson & Co., electrical wholesalers, Newcastle, appeared in answer to a summons issued by Mr. C. E. Ridley, of Middlesbrough, to obtain payment of 5s. 6d., being the amount claimed for a sample. Messrs. Gledson & Co. stated that they had not ordered the goods, which were lying at sender's risk in their stores. The Judge, in dismissing the case with costs against plaintiff, stated that the sender's contention that the goods should have been returned could not be upheld.

Trade-mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 23rd. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Krone. No. 455,460. Class 4; and Electrax. No. 555,451. Class 8. Electric carbons.—The firm of C. Conradty, 9, Spittlertorgraben, Nuremburg. (S. Sokal, 1, Great James Street, Bedford Row, W.C.1.)

Desulphate. No. 463,727. Class 8. Accumulators and batteries.—T. W. Underwood, 45, Furneaux Avenue, Knights Hill, West Norwood, S.E.27.

Agelindus. No. 403,257. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Gesellschaft für Electricitäts Industrie, 8, Motzstrasse, Berlin, W.30. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

The Akk-e-Mmar, A.M.R. (lettering and design). No. 462,289. Class 8. Rectifiers for alternating current.—Auto-Mechanical Rectifiers, Ltd., 91, Tabernacle Street, E.C.2.

Faithful Service (lettering and design). No. 463,252. Class 8. Instruments and apparatus and parts thereof for use in radio-telephony and telegraphy, electric batteries, &c.—H. P. Taylor, trading as Paul Taylor, 147, Stamford Road, Kettering.

The Advance (lettering and design). No. 463,729. Class 8. Instruments, apparatus and parts thereof for use in radio-telephony.—Equipments, Ltd., 26-27, Avenue Chambers, Southampton Row, W.C.1.

Transadyne. No. 464,401. All goods in class 8.—Neutron, Ltd., 3, Warwick Court, Gray's Inn, W.C.1.

Arga. No. 463,335. Class 13. Electric incandescent lamps.—Naamlooze Vennootschap Philips Gloielampenfabricken, Eindhoven, Holland. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Pigellite. No. 464,325. Class 40. Copper wire covered with india-rubber or gutta-percha.—Pirelli-General Cable Works, Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

15,713. "Electrical structures." W. Dubilier. June 30th, 1923. (218,328.)
15,851. "Radio receiving systems." A. E. White (Electric Apparatus Co.). July 1st, 1924. (243,773.)
18,485. "Electrical condensers." F. K. Woodroffe and R. H. N. Dawson. August 2nd, 1924. (243,776.)
18,722. "Telephonic receivers." E. A. Graham. August 6th, 1924. (Cognate application 23,506/24.) (Addition to 221,856.) (243,781.)
20,292. "Wireless transmission and reception of photographs." N. Diamant. August 27th, 1924. (243,783.)
20,337. "Heating elements for electric heaters, radiators, cookers, and the like." F. B. Cox. August 28th, 1924. (243,784.)
20,368. "Mounting of incandescent filaments." Mullard Radio Valve Co., Ltd., and L. S. Harley. August 28th, 1924. (243,785.)
20,582. "Electromagnetic devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co. Inc.). September 1st, 1924. (243,787.)
20,676. "Secret service systems for rural and party-line telephones." H. B. Sherman. September 2nd, 1924. (243,791.)
20,685. "Folding or collapsible frame aerial." P. Rinkel. January 15th, 1924. (227,789.)
20,770. "Mechanical vibration filters." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). September 13th, 1923. (221,792.)
20,780. "Electrical condensers." G. W. Hale and Radio Engineering Co., Ltd. September 3rd, 1924. (Cognate application 29,602/24.) (243,794.)
20,879. "Automatic cut-out means for electric irons and the like." H. B. Irvine and H. Wooff. September 4th, 1924. (243,799.)
20,886. "Thermionic rectifier systems." E. Y. Robinson, C. R. Burch, and Metropolitan-Vickers Electrical Co., Ltd. September 4th, 1924. (243,800.)
20,930. "Supporting of electric insulators." R. L. Cleaver (C. S. Harrison). September 4th, 1924. (243,806.)
20,932. "Means for connecting the insulating and metal parts of insulators." W. H. Goodman and Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). September 4th, 1924. (243,807.)
21,038. "Electric signalling systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co. Inc.). September 6th, 1924. (243,815.)
21,177. "Sound-box diaphragms for use in telephones, loud speakers, acoustic apparatus, and the like." C. Lindstrom Akt. Ges. and F. Jokel. September 8th, 1924. (243,818.)
21,221. "Electric heaters for fluids." W. Stubbs and H. Stubbs. September 19th, 1923. (222,113.)
21,474. "Portable electric lamps." A. Trafford. September 11th, 1924. (243,828.)
21,533. "Solenoid-operated mechanism." British Thomson-Houston Co., Ltd., H. Trencham, H. C. Heath, W. P. Hamlyn, and H. E. Cox. September 11th, 1924. (243,829.)
21,749. "Joints of electric cables." C. J. Beaver and W. T. Glover & Co., Ltd. September 15th, 1924. (243,834.)
22,069. "Electric cable-connecting devices." A. W. G. Tucker and Ferranti, Ltd. September 18th, 1924. (243,839.)
22,883. "Switch mechanism and cable connections for electric motors." Mavor & Coulson, Ltd., and W. Lawrence. September 29th, 1924. (243,843.)
23,947. "Fixed condensers, more particularly for use in connection with wireless telegraphy and telephony." Igranic Electric Co., Ltd., and E. A. Bitton. October 9th, 1924. (243,852.)
23,971. "Electric heaters and process of manufacturing of same." Dr. M. Hauser. October 9th, 1924. (243,854.)
24,859. "Devices for use in connection with sparking plugs for internal-combustion engines." O. Gadiel and M. Apel. October 20th, 1924. (243,865.)
25,063. "Electric switch or commutator." C. E. Foster. October 21st, 1924. (243,866.)
25,142. "Electron discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co. Inc.). October 22nd, 1924. (243,868.)
25,568. "Electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (243,873.)
26,950. "Absorption brake dynamometers." Heenan & Froude, Ltd., and G. H. Walker. November 12th, 1924. (243,888.)
28,080. "Asynchronous electric motors." Forges et Ateliers de Constructions Electriques de Jeumont. December 27th, 1923. (226,791.)
28,156. "Electrically-heated pressing or smoothing apparatus." L. W. Skogh (*née* Wahlgren). November 24th, 1924. (243,894.)
28,163. "Ignition." C. Baxter. November 25th, 1924. (243,895.)
28,582. "Electric fires." P. M. Edinborough and Metropolitan-Vickers Electrical Co., Ltd. April 23rd, 1924. (Cognate application 10,572/25.) (243,896.)
29,264. "Means for securing and locking electric lamps in position." J. Illingworth. December 6th, 1924. (243,900.)
29,807. "Connectors for electrically bonding the rail joints in electric railways." J. G. Kjellgren. December 11th, 1924. (243,702.)
30,060. "Alternating-direct current converter with wide voltage regulation." J. L. La Cour. December 15th, 1923. (226,233.)

1925.

543. "Telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). January 19th, 1924. (227,824.)
953. "Electrical couplings." W. O. Kennington. January 12th, 1925. (243,918.)
1,092. "Filament for electric apparatus." Naamlooze Vennootschap Philips Gloeilampenfabrieken. May 21st, 1924. (234,442.)
5,093. "Coil-holders for wireless purposes." S. C. Price and Pressland Electric Supplies, Ltd. February 24th, 1925. (243,945.)
5,917. "Processes and apparatus for forming squirrel-cage windings for induction motors." M. C. Spencer. March 4th, 1925. (243,950.)
6,900. "Cores of compressed magnetic powder for induction coils and the like, and method of manufacturing the same." British Thomson-Houston Co., Ltd. (International General Electric Co. Inc.). March 13th, 1925. (243,953.)
7,263. "Meters for alternating current." Siemens Schuckertwerke Ges. March 19th, 1924. (231,167.)
8,047. "Electric jet wave commutators and interruptors." J. F. G. P. Hartmann. March 25th, 1925. (243,958.)
9,685. "Measurement of high alternating-current voltages." E. Haefely and Cie. April 16th, 1924. (Addition to 221,495.) (232,593.)
9,707. "Methods of removing coatings from conductors." British Thomson-Houston Co., Ltd. April 11th, 1924. (232,257.)
9,982. "Cables for transmitting electrical energy." L. N. Reddie (Pirelli and Co.). April 16th, 1925. (243,969.)
12,759. "Delay devices for electrical blasting fuses." W. Eshbach. September 13th, 1924. (239,827.)
14,238. "Shades or deflectors for electric lamps." F. Cox. June 2nd, 1925. (243,996.)
14,422. "Incandescent electrical lamps." Neue Gluhlampen Ges. June 3rd, 1924. (235,191.)
17,137. "Electric measuring instruments." International General Electric Co., Inc. July 4th, 1924. (236,582.)
17,153. "Variable electric condensers and the like." B. Hesketh. July 3rd, 1925. (244,009.)
21,193. "Means for automatically interrupting the current in electric furnaces if a fault occurs in an electrode." Rheinische Metallwaarenund Maschinenfabrik. October 22nd, 1924. (241,865.)

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Materials for the Electrical Industry.

DURING the year just completed the Copper market has, as usual, been subject to varying moods of optimism and despair, but throughout the period the price ruled moderate, values having fluctuated between about £59 and £68 per ton for cash standard, and £62 10s. and £72 for electrolytic, the quotation at the end of December being about £59 15s. for the former and £66 for the latter. The development of large low-cost properties in South America and in Africa, and improved metallurgical processes generally, resulted in output being maintained at a high rate. During the first eleven months of 1925 the production of the leading countries totalled 1,409,000 short tons, compared with 1,459,500 short tons in the complete year 1924. On the other hand, consumption has been very large, as can be imagined, considering the world tendency towards electrification of transport and industry. The importance of the wire-drawing trade is illustrated by the fact that of the total deliveries of copper in America for domestic and foreign markets, no less than 64 per cent. was in the form of wirebars. The leading feature of the market has been the remarkably sustained consumption in America, but Europe also took substantial quantities, Germany's imports, for instance, in January-October, being 192,000 metric tons, against 80,000 metric tons in the same period of 1924. The stocks of refined copper in America fell from 136,000 short tons on December 31st, 1924, to 68,000 tons at the end of November last (the latest figures available), the combined stocks of refined and rough copper showing a loss of 58,000 tons. Latterly, the chief factor has been the depression on the Continent, especially in Germany, where lack of capital and restricted credit facilities have had a very adverse effect, the financial unsettlement in France also being a disturbing element. The copper

market, therefore, closes the year in circumstances not of the happiest, but with hope lingering that 1926 will see improved economic conditions in Europe, accompanied by an enlargement of consumption.

Tin enjoyed active and prosperous conditions, cash standard fluctuating between £229 and £290 per ton, the quotation at the end of the year being at the top. The outstanding feature has been the large consumption, chiefly in America. Output has not responded as might have been expected to the highly remunerative price, mainly because new deposits of importance have not been discovered or brought into production, although new mining ventures are constantly being initiated, which may have effect later on. No doubt there was some increase, on balance, in 1925, but nevertheless consumption exceeded output and the visible supplies of metal were depleted by some 6,000 tons. The outlook depends largely on whether or not consumption in the United States will be maintained. If it is, higher prices will be inevitable.

The consumption of Spelter was so substantial during 1925 that for a long time the Continent was able to consume the bulk of its output, thus necessitating substantial purchases in America to fulfil the requirements of British consumers. The quantities thus absorbed, together with those used in the United States, resulted in a very sharp reduction in the American stocks, which were brought down from over 21,000 short tons at the beginning of the year to about 7,000 tons at the end of November. Latterly, conditions have not been quite so favourable, European consumption having been affected adversely by the economic troubles of Germany. Hence Continental spelter has been available more freely for our market, and values here declined, creating a considerable gap between price levels in the United States and London. The future rests largely on the development of affairs in Germany. During 1925 prompt metal fluctuated between £40 12s. 6d. and £33 10s., the quotation at December 31st being £38 12s. 6d.

On the whole 1925 proved a good year for the Lead industry, production having shown a substantial increase over last year, and having been probably something like 25 per cent. larger than in 1913. This state of affairs arose to a large extent from the remarkable activity in the electrical trades throughout the world, cable-makers having been uninterruptedly busy during the whole year. The demand for storage batteries was also maintained at a very high rate, while the building trade accounted for an excellent consumption of manufactured products. Somewhat strangely, the greatest activity in the market was seen during the summer months, while the shipping strike which ensued in the autumn and the long drawn-out struggle, resulting in delayed arrivals of badly-wanted metal, complicated the position here, involving, as it did, a shortage of supplies. This trouble having passed, the closing weeks of the year saw rather quieter conditions, with some slackening of demand here, and a setback in Continental business, due to the financial and political difficulties which have been rife there. Nevertheless, the outlook is not discouraging, for substantial buying has to be done by consumers here, and an improving tendency should be noticeable in Continental business.

In Rubber the past year was one of outstanding interest, partly owing to the very wide range of prices seen—from 1s. 4¾d. to 4s. 8d. per lb.— and partly because it marked the complete recovery of estates in Malaya and Ceylon from the disastrous effects of the post-war slump. The Stevenson restriction scheme worked uninterruptedly throughout the year, the exportable quota rising from 50 per cent. of standard in January, to 85 per cent. in December, while the Government has already announced that an extra release will be made at the beginning of February, 1926, bringing the exportable quota up to 100 per cent. of the standard. The stocks showed a steady reduction during the first six months of 1925, and the London reserves for a time stood at below 5,000 tons. American consumers were partly to blame for the price movements, for they chose to depress values when even a slight advance would have ensured larger supplies of rubber, and the growing popularity of the balloon tire and the record automobile production forced manufacturers to buy heavily later on at largely increased prices. The higher figures ultimately caused the release of more rubber, and during the latter part of the year the stringency of supplies was not quite so acute. Production during 1926 may possibly overtake consumption, and stocks may recover to more comfortable proportions, especially if the threats from America of the use of very largely increased quantities of reclaimed rubber prove to have a really substantial foundation.

The Electric Railway Outlook.

WHILST a good many orders for electric locomotives and other railway plant are, fortunately, being carried out by British manufacturers for important railways in the Dominions, the optimistic allusions of the Minister of Transport and of the Electricity Commissioners to the "coming" electrification of our main-line railways at home have been considerably discounted by the recent utterances of railway managers and directors, who are not yet convinced that the advantages to be derived from electrification are sufficient to justify the outlay involved. It may be alleged that the finances of the railway companies are not in such a prosperous condition that the directors can justifiably embark on any costly enterprise which does not offer the sure prospect of an immediate return; but they are able to spend large sums on new locomotives and rolling stock, and it is to be regretted that the bulk of this expenditure tends to perpetuate the existing system of traction. With our comparatively short hauls and dense traffic, the conditions are favourable to electrification, and the high price of coal affords an additional incentive. The plea that the adoption of electric traction would deprive the railways of a most profitable source of revenue—the haulage of coal—does not apply to their own case, for they themselves have to pay for the transport of the coal that they use for locomotion; moreover, they pay a large portion of the carriage twice, as they have to carry the coal whilst consuming it.

There is no doubt that large savings in fuel and maintenance costs would be effected by electrification, and the outstanding question is whether the additional capital charges would be covered by these economies and by the increase in the traffic which usually follows electrification. So far as we know, detailed estimates such as the railway managers must have had before them have not been made public; it would be interesting if they were revealed. The newly electrified sections of the Southern Railway have now been in operation for five months, but it is not usual for the railway companies to publish the traffic returns separately for steam and electrical operation; such classified returns would be welcomed.

X-Ray Apparatus.

LAST month the General Committee of the Coventry and Warwickshire Hospital unanimously decided to purchase some German X-ray equipment for the purpose of modernising certain British apparatus which has been in use for 15 years. Apart from the regrettable fact that a body entrusted with public money should be spending it on foreign plant at a time such as the

present, it is surprising that certain committee-men allowed themselves to make the statements with which they are credited in the local and other Press. The Chairman, while admitting that there was no question but that English apparatus could be obtained to do the work just as well, is reported to have said that it was very much heavier, more difficult to manipulate, and about three times more expensive.

Such statements as these are too serious to be ignored, for they convey a misleading impression of the facts and cannot be justified. How does the weight of such apparatus adversely influence its efficiency? Easy manipulation depends entirely on the dexterity of the operator, and this is the first time that we have heard of British outfits being criticised in this connection.

As regards price, it would be interesting to know by what method of calculation the figures quoted by the Committee were arrived at, for couches and screening stands are obtainable in the British market at very much lower prices than those instanced by the Committee. Moreover, no comparison is valid unless it is made on a fair basis, and as is pointed out in our "Correspondence" columns, it should not be forgotten that English manufacturers design their appliances with a view to securing the approval of the X-Ray and Radium Protection Committee of the National Physical Laboratory with respect to the adequate protection of both the patients under treatment and the operators of the equipment. In this respect British apparatus is acknowledged to be far superior, although compliance with the regulations necessarily adds somewhat to its weight and cost, and it is obviously unfair to disregard these facts when comparing it with plant made in a country where safeguards of the same standard are not demanded, or even considered necessary.

We know of no evidence that will justify the charge that English firms are conservative and "well behind Germans and Americans" in this line. This contention is indeed strange in view of the fact that practically the whole of the X-ray equipment in the great London hospitals and other leading institutions in this country is entirely British. Further, as was reported last week, Swedish opinion seems to be just the reverse. An international syndicate agreement restricts the Swedes to the purchase of European apparatus, but they have complained for some time past that certain Röntgen accessories, particularly tubes, are not obtainable in Europe in the same improved form as those made elsewhere. Hence, Swedish medical men have petitioned their Government for the State expropriation of the patents concerned in order that they may be able to import other than German manufactures.

It is a pity that ill-informed officials, by indulging in discussion such as that which took place at Coventry, should be able to do so much harm to an important and enterprising industry.

French Industrial Progress.

THE remarkable rate at which the use of electricity is growing in France was commented upon in the report by Mr. J. R. Cahill, which was reviewed in our last issue. He states that the *per capita* consumption of electricity is advancing at the rate of 20 per cent. yearly, and the electrical industry is kept busy meeting the growing demand. Railway and rural electrification, and the harnessing of water power, are all contributing to the industry's order book, while the domestic market is considered of almost equal importance. Electricity in mining, metallurgy and chemical production is another great source of revenue to the French electrical industry. It might be thought that a goodly share of this work would fall to foreigners, but it appears that the home industry has grown to such a stage of competency that the call for foreign goods is very small. The great electrical firms, by judicious association with large groups which employ electrical machinery, have secured to themselves permanent buyers of their products, reducing the chance of the foreigner to obtain orders to a minimum. It is calculated that a total of 2,000 millions of francs is invested in the electrical manufacturing industry, while it employs 70,000 persons. The electricity supply industry has a capitalisation of 4,500 millions of francs, and gives employment to over 25,000 workmen.

It is not to be wondered at that our exports of machinery to France have been gradually declining since 1921. In that year they were 59,037 metric tons, while in 1924 they were less than half of this. In 1913 the quantity was 47,731 metric tons. As regards electrical imports, it is shown that although there was an increase in the nominal value in 1924, there was actually a decrease—the depreciation of the franc causing a false impression. Exports of electrical goods from France showed a remarkable increase in 1924, the total weight being 23,600 tons, as compared with 16,800 tons in 1923, and 10,100 tons in 1913.

This information merely confirms the already well-known fact that as a market for general electrical goods, France is not likely to improve, being well able to look after herself in this respect.

India as an Electrical Market.

IN this issue we review a report by Mr. T. M. Ainscough, C.B.E., the Senior Trade Commissioner in India. It is pleasing to note that conditions are now more settled, and the financial position of the Government has been strengthened by improved trade. The prosperity of the country was, however, not reflected in the import figures, the explanation appearing to be that the percentage increase in the prices received by the Indian producer was not so great as that in the prices of imported goods. So far as the imports of machinery were concerned, during the period under review the position of British suppliers improved at the expense of the Swedes and Americans, although the total trade was smaller. In the case of imported electrical apparatus, there was also a decrease in the total and in the British share, while that of Germany showed an appreciable increase.

It would appear that a number of excellent opportunities for British electrical manufacturers will occur in the near future, as several important public works are being undertaken, one of the chief of which is the Punjab hydro-electric scheme. Railway electrification is also likely to be greatly extended, and Mr. Ainscough says that the excellence of the plant and materials already supplied for this type of work by British manufacturers has given the latter a good hold on the market.

Electricity on Motor-Ships.

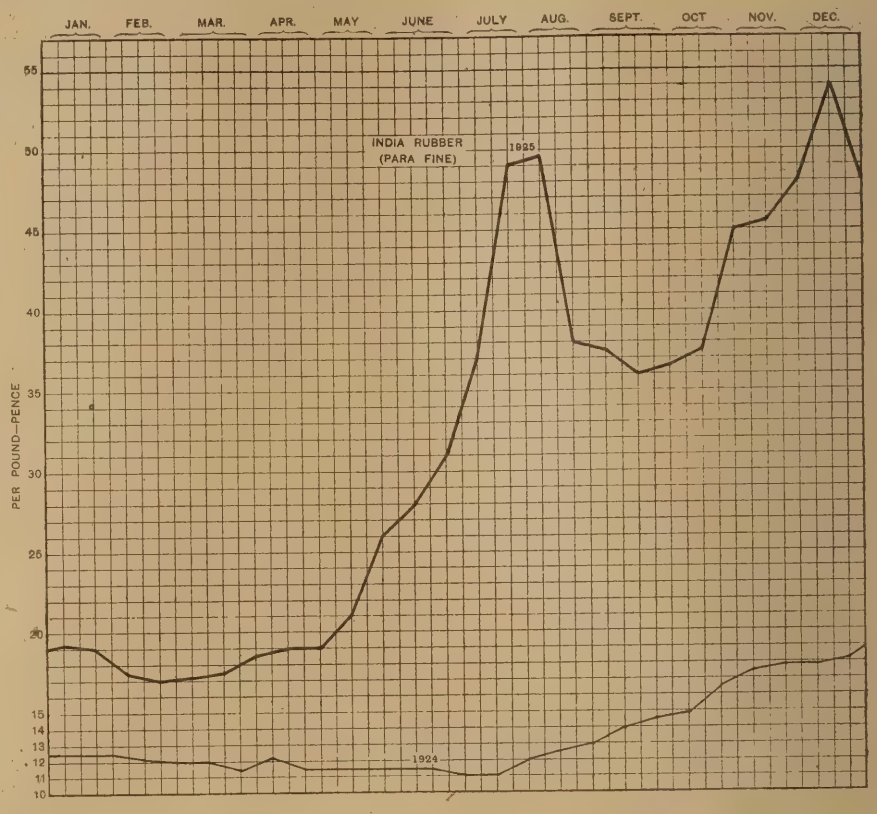
ALTHOUGH the advent of the all-electric ship may not be possible until the key is found to unlock atomic energy, substantial progress is being made in that direction. It is true that electric propulsion is not being adopted on British ships, but it is making headway abroad, and we hope to see it come into its own in the fullness of time. Meanwhile, it is gratifying to observe that the use of electricity for a wide range of applications is rapidly gaining popularity, particularly on board ships propelled by oil engines; as Mr. A. Regnauld shows elsewhere in this issue, not only is all the auxiliary machinery driven by electric motors, but also electricity is used for lighting, heating and cooking in some cases, and for ministering to the comfort of passengers and crew in a variety of ways, these services involving the consumption of about 15 per cent. of the total quantity of oil burnt. Besides giving employment to a large number of workpeople on shore, the development of the electrical department on board ship necessitates the employment of electricians, and it is a significant event that an engineer writes to *The Times* of December 31st drawing attention to the increasing importance of the electrician at sea. He states that the Board of Trade refuses to permit an electrician to rise above the rank of third engineer, and will not grant him a "ticket." Evidently the time is at hand when careful consideration should be given to these questions.

Copper, Lead and Rubber in 1925.

IN accordance with our usual practice, we reproduce herewith curves showing the course of copper, lead, and rubber prices during the past two years.

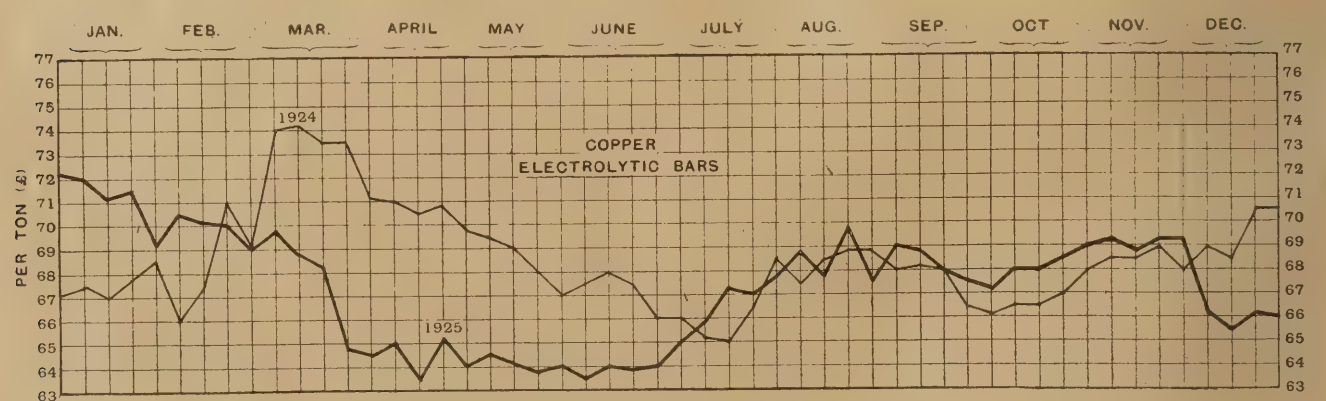
Generally speaking, the price of copper was lower in 1925 as compared with the preceding year, although it commenced the year £5 per ton higher. Upon the point representing the last week in February, the curves met, but from that date up to July there was a considerable difference, the price falling twice during that period of 1925 to £63 10s. per ton, whereas the lowest point reached in 1924 was £65. From July to the end of November the curves kept well together, but towards the close of the year another divergence commenced, and the end of December saw the reverse of the opening position.

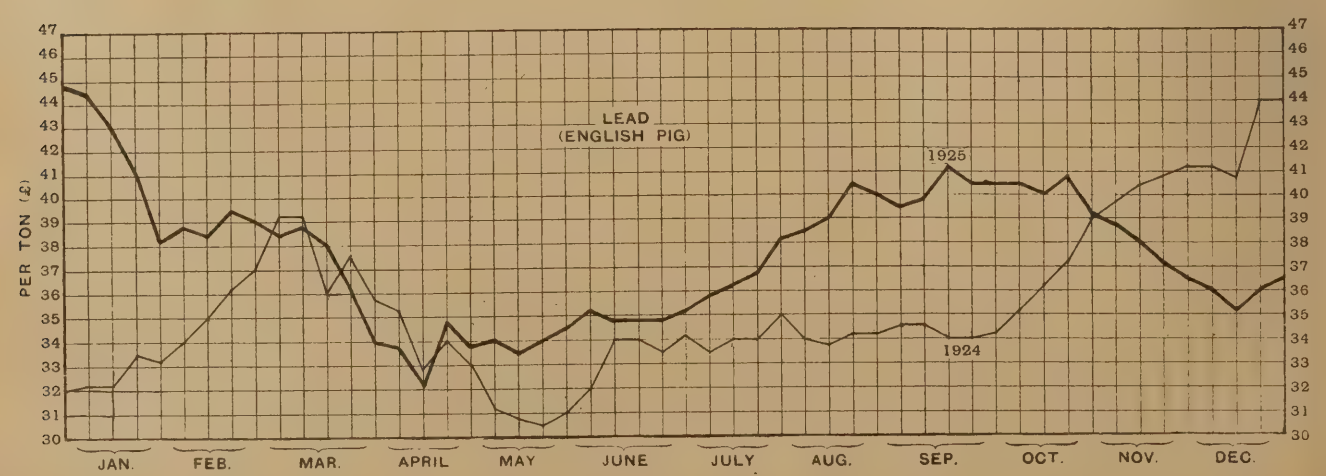
The level of lead prices during 1925 was generally above that of 1924. A very large difference at the beginning of the year soon dwindled until in early March the curves crossed and remained fairly closely together right up to July, except that the 1925 curve did not fall to the depth experienced in May, 1924. From July to the end of October the curves gradually separated and then returned. In the closing months of the year the price dropped fairly sharply in contrast to a steady rise at the end of 1924, and lead in the same way as copper finished considerably lower in price than it started.



The past year was a memorable one for rubber, and our curve (which is based upon the figures quoted in our fortnightly table for "para fine") showing the trend of its price during 1925 is in marked contrast to the comparatively uninteresting graph for the preceding year (or that for 1923). The rising tendency which set in towards the end of 1924 was slightly checked in the earlier part of last year. Rubber soon recovered, however, and with phenomenal resiliency sprang upwards to a very high peak in July-August. Thereafter a sharp relapse was experienced, but after hovering around 3s. per lb. for a few weeks there was a fresh upward movement, which took the price to 4s. 6d., followed by another relapse to 4s. 1d. at the close of the year.

On Monday last the highest prices paid for crude rubber were:—Spot 3s. 10d., January 3s. 9¼d., January-March 3s. 8¼d., and April-June 3s. 4½d. An increase in London stocks of crude rubber of 586 tons for the week, brought up the total to 6,129 tons against 29,206 tons a year ago.





Martyrs of Science.

By Dr. W. S. HEDLEY.

THERE has recently been announced the death of Mr. R. G. Blackall from exposure to X-rays, and reference has at the same time been made to the case of Mr. Wilson and Mr. Harnack, the former of whom lost his life and the latter lost both arms from the same cause. As a fellow-worker with the last two, though not a sharer in their heroism, may I be permitted to add a word of sympathy and appreciation and at the same time make comment upon the deplorable fact that we are to-day mourning a recent death due to a danger of which the cause was known, and known to be preventable, well nigh thirty years ago?

Let us get back to dates: Discovery of X-rays, November 8th, 1895. Taking Mr. Campbell Swinton's Radiograph of a hand (ELECTRICAL REVIEW, January 24th, 1896), as the beginning of X-ray work in England, and taking the report of Marcuse (Deut. Med. Work, July 2nd of the same year) as the earliest or amongst the earliest reports of X-ray dermatitis, there was a short period of about five months when the "New Photography" was practised in unsuspecting ignorance of the dangers that lay behind it—heroism had no place here. The danger becoming known, protective measures were at once devised. I find that I wrote in the ELECTRICAL REVIEW, November 12th, of the following year of "Ulcers of a very painful character, and slow to heal, following exposure to the action of the focus tube." Then follows a reference to the necessity for protective measures and suggestions of aluminium plates and envelopment of the tube in black cloth as worth trying against any ill-effects of the "soft" tubes of those days. And other devices kept pace with the increasing power and penetration of the tubes, until to-day we have the elaboration of the "radiographic couch" with its all-metal tube box lined with sheet lead, and its easily-moved protective screens and diaphragms to limit the field of action of the rays. Some of us have even known something of a ray-proof room for the safety of neighbours. Such devices, with our ever-growing knowledge of the output of the X-ray tube, ought to make serious X-ray accidents almost things of the past. It is further to be remembered that by their physical, chemical, and biological effects, the intensity of these rays can be measured, their quality tested by other means, and not least in importance is the process of so-called filtration by which unwanted rays may be filtered out and the operator left in possession of a "bundle" composed chiefly of rays exactly suitable for the work in hand.* May it be assumed—it is a large assumption—that every medical man who handles these rays for treatment upon the living body (and no others should handle them for this purpose) has a fair knowledge of the X-ray tube and the rays it emits, an instructed experience of "dosage" and its measurement by the "erythema unit,"† a practicable experience of the details of its application to the body, an appreciation of its possible dangers, and does he carry out his procedure with the same sense of responsibility that he would bring to bear upon a serious surgical operation? Has he worked in the X-ray room of his hospital? Has he attended post-graduate lectures? Finally, seeing that it is impossible to include such work in an already crowded curriculum, is he in possession of any certificate from a duly authorised body, of his fitness to practise this speciality?

So long as the human factor remains, there must, of course, be accidents, but by adopting such measures as the above it is reasonable to hope and expect that they will be minimised. My experience is that it is the demonstrator who all day long is exhibiting his ray-pierced hand to the crowd, that suffers most. I have a recollection of the early days that it was a showman in the streets of Toronto who became one of the earliest victims of X-ray dermatitis. Those early X-ray days bring back a crowd of X-ray memories. The X-ray arrived in England a comparatively unknown stranger, and was not always received with the warmth and welcome that its potentialities and importance deserved. I was in charge of the Electrical Department of the London Hospital at that time, and it devolved upon me to establish an X-ray section. I looked in vain for a home to lodge it in. Beginning with the house governor, I interviewed the whole staff and, without exception, they declared that, owing to increase of work, the hospital was already crowded to its doors, and this was only too true. At last I approached the chairman. He could only say the same, but I understood him to promise that he would "build one." In view of the possibility that he was getting a little playful at my expense, I retired. (I had good reason to change my estimate of that chairman when shortly afterwards I found myself in spacious and well-equipped quarters in a new building.)

Passing on from that interview, my way lay through one of the wards, and I heard in the corridor the rustle of a silk dress; I noticed that all the patients looked pleased and every member of the staff, male and female, sprang "to attention." It was my first interview with the then matron, Miss Luckes, of revered memory—I was not long in explaining my troubles—"Could she do anything about it?"—a gentle shake of the head plainly answered "No!" I then suggested that I had noticed a large light cupboard—another shake of the head. "Oh, that is the jam cupboard." I then hinted that perhaps other accommodation could be found for the jam—or that "I had noticed several convalescent patients who no doubt would see to its disposal, or, (hesitatingly) the jam might perhaps be left on the top shelves"—another shake of the head, this time of greater amplitude and intensity. "Oh, that would *never* do"—and she was gone. But I thought I saw a gleam of helpfulness in her eye, and I was not altogether surprised when on the next day I saw that that "cupboard was bare" and its door standing invitingly open. I was not slow to avail myself of the invitation, and lost no time in installing the scanty X-ray equipment of that day, *viz.*, my Apps 10-in. sparking coil, and accumulator to "drive" it, a "hard" tube, a "medium," and a "soft" one, a tube stand and a flourescent screen. Such was the genesis of the X-ray Department of the London Hospital.

Dr. Hedley was the writer of an article on "Twenty-five Years' Progress in Electro-Therapeutics," published in the Special Issue of the ELECTRICAL REVIEW celebrating the 25th anniversary of the Journal (November 12th, 1897).



Dr. Hedley, M.D.Ed., M.R.C.S., Eng., who is now living in retirement at Shorts Lodge, Liphook, Hants., was at one time Physician-in-Charge of the Electro-Therapeutic Department of the London Hospital, also, Brig.-Surg. Army. His writings include:—"Therapeutic - Electricity"; "Hydro-Electric Methods in Medicine"; "Current from the Main"; "Scope and Value of Electricity in Medicine," *Lancet*, 1896; "Insomnia in Neurasthenia," Ib. 1893; "Electric Radiant Heat Apparatus," Ib.

* It is not possible by filtration to make X-rays homogeneous, but when by the use of (say) a 0.5-mm. copper filter a certain degree of homogeneousness is obtained, we say the rays have become "homogeneous for biological purposes."

† This is the recognised unit for the biological effects of X-rays, but it recognises only surface effects and does not take account of the intensity falling on structures below the skin, therefore the quantimeter (chemical or electric) which determines the dose at various depths and during the entire exposure must be used.

Motor Coaches for Swiss Railways.

A New Type of One-Man Rail Car.

To meet the requirements of its service during periods when traffic is not heavy, the Lötschberg Railway Co., which operates the Berne-Lötschberg-Simplon section of the Swiss Railways, has recently put in operation two electric motor coaches of somewhat unusual design. The vehicles were built to meet certain special requirements, among which was one that the motors of the vehicles must be capable of developing an hourly output of about 500 h.p. at the wheel tires at a speed of 35 kilo-metres (21.7 miles) per hour, and another that the motors should be as far as possible similar to the spare motors kept on hand for its other electric locomotives, in order that they may be used in case of emergency. In view of these stipulations, it was decided to adopt motors of the type supplied by the Oerlikon Co. to the Bernese "Decree" Railways, which have been in use for a period of five years with complete satisfaction.

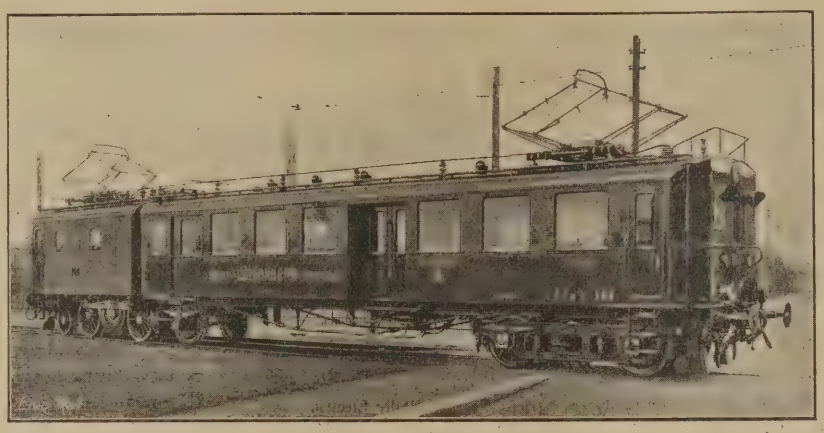


Fig. 1.—New Motor Coach for Swiss Railway.

The electrical equipment of the new coaches, which are somewhat similar in design to those supplied by the Oerlikon Company in 1912 to the Burgdorf-Thun Railway, is concentrated on a truck (fig. 1, left) fitted with a leading axle and two driving axles, the truck being coupled to the main frame carrying the passenger and luggage compartments.

The locomotive portion contains all the electrical control gear (fig. 2). The current, which is single-phase, 16⅔ cycles at 15,000 V, is led from the overhead collector gear through isolating switches to the main circuit breaker, which is constructed for outdoor mounting, and is arranged for electro-pneumatic closing and for automatic electric release. The second pole of the circuit breaker is connected to the h.p. terminal of the oil-immersed self-cooled transformer. In order to improve the cooling, the transformer is enclosed in a second casing, into which air is drawn through the roof; the air passes over the transformer and escapes into the motor compartment. The low-pressure winding has eleven tappings, which are connected to the motor as required for the various speeds, the highest pressure applied to the motor being about 500 volts; the twelve contactors are controlled electro-pneumatically, and are interlocked.

The fan-ventilated motor has ten poles, a one-hour rating of 518 h.p. at 21.7 m.p.h., and a continuous output of 425 h.p. at 24.2 m.p.h., the highest speed being 40 m.p.h. The two driving axles are coupled together by means of a triangular system of rods, and connected to the motor through a jack shaft; in this way it has been possible to use, not only similar motors to those of the locomotives referred to above, but also the same gearing. The driving wheels are 4 ft. 4 in. in diameter, the gear ratio being 1 to 3.78.

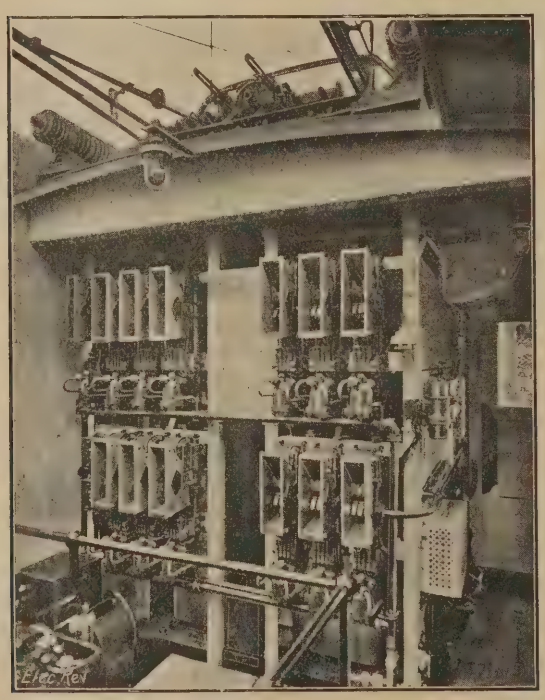


Fig. 2.—Control Gear Behind Driver's Cab.



Fig. 3.—Driver's Cab.

The motor coaches are built for multiple control and automatic acceleration, and are intended for one-man operation. Instead of having a "dead man's" handle on the master controller, the safety device is combined with a foot lever which is depressed by the driver during the operation of the motor coach. When the lever is released, the motor circuit opens after a given in-

terval, and the compressed-air brake is brought into action by a relay; if, however, the driver depresses within this interval a push button mounted on the other side of the driver's cab, the switching-off and braking are prevented. This arrangement was adopted in order to facilitate shunting operations, as the driver must then be able to look out from both sides of the cab (fig. 3). To permit the vehicle to be operated in either direction, the passenger coach is provided with a driver's cab at the opposite end to the locomotive.

The direct current at 36 volts for the control circuits and lighting is supplied by a 1-kW motor-generator set and a battery of accumulators. The train heating bus lines are connected to a tapping of the transformer giving 1,000 volts, through an electro-pneumatically operated circuit breaker. The heating current for the driver's cab is obtained from the auxiliary supply system, which serves the compressor set for the brake and the control gear, being connected to the 220-volt tapping of the transformer.

The Oerlikon Maschinenfabrik was responsible for the whole of the electrical equipment, the Swiss Locomotive and Machine Works, of Winterthur, for the chassis and underwork, and the Swiss Industrial Co., of Neuhausen, for the body work. The vehicles have a standard gauge of 4 ft. 8½ in., and are designed to work on a maximum gradient of 1 in 40. At a speed of 21.7 m.p.h., the tractive effort at the wheel rim is 8,800 lb. (one-hour rating), and at 24.2 m.p.h. 6,460 lb. (continuous). The coach is adapted to carry 60 passengers, although five sitting and 15 standing passengers can be accommodated in the luggage compartment. The overall length of the engine proper is 21 ft. 6 in., and of the complete vehicle 71 ft. 8 in.; the total weight of the motor coach is 60.1 tons, of which the electrical equipment is responsible for 15.4 tons.

Electrical Auxiliaries on Motor Ships.

The Rapid Development of the Motor Ship is Leading to the Extended Use of Electrically-driven Auxiliary Machinery.

By ALFRED REGNAULD, B.Sc.(Eng.), Lond., M.I.E.E.

A VERY notable feature of the shipbuilding industry during the few years which have elapsed since the cessation of the Great War has been the almost phenomenal development of the heavy oil engine as a means of propulsion. In Lloyd's Register of Shipping almost the whole of the merchant shipping of the world is classified, and, in addition to publishing its famous "register" every year, Lloyd's Register Society also issues an annual report covering its operations for the year and containing a review of the position of the merchant services of the world. The report covering the year ended June 30th, 1925, has recently been issued, from which it appears that whereas in July, 1919, there were 912 motor-ships of 752,606 gross tons classified in Lloyd's register (the figures for 1914 were only 297 motor-ships of 234,287 gross tons), in July, 1925, there were 2,145 motor-ships of 2,714,073 gross tons. These figures appear even more striking when it is mentioned that of the total tonnage classified during the twelve months ending June 30th, 1919, motor-ships only represented 2.02 per cent., while for the year ending June 30th, 1925, motor-ships classified represented 23.1 per cent. of the total. It is an ill wind which blows nobody any good, and while the economists may lament the rapid growth in the use of oil instead of coal for the propulsion of ships in view of its effect upon the coal mining industry, it is a fact that the development of the motor-ship has been accompanied by a corresponding development in the use of electrically-operated machinery for the various auxiliary purposes on board, such as air compressors, oil fuel, bilge and sanitary pumps, and cargo-handling gear.

On steam engine-driven vessels, with the exception of high-class passenger liners, it is generally considered advisable to employ steam for driving the bulk of the auxiliary machinery, both in the engine room and on deck. Steam is generally available from one or more of the main boilers for stand-by purposes, since it takes a considerable time to raise steam from cold when the vessel is preparing to leave port, while on vessels which stay for considerable periods either a donkey boiler is installed or one of the main boilers is scheduled off for supplying the steam to the auxiliaries. On motor-ships, on the other hand, there is no question of steam being required for stand-by purposes, as soon as the ship is moored, the main engines are completely shut down and one or more auxiliary Diesel-engine-driven generators are started up for supplying power for auxiliary purposes and for operating the cargo winches. In some of the earlier motor-ships steam-driven auxiliaries were employed, and even to-day on vessels which carry oil in bulk it is considered advisable to have steam available for warming the oil to reduce its viscosity for pumping purposes, but a study of the equipment of recent Diesel-engine-driven ships will show that the tendency is towards the complete adoption of electrically-driven auxiliaries.

A glance at the equipment of a few typical motor-ships will serve to indicate the extent to which electrical machinery is being employed at the present time, and will give some idea of the size and nature of that machinery. Consider, first of all, two typical cargo ships, one of small tonnage, used for coasting trade and trade as far as the Mediterranean ports, and the other a cargo liner, such as might be employed for trading to any part of the world. It may be noted in passing that the cargo ship forms the bulk of the mercantile marine of this, or, indeed, any other maritime country, and that it is on vessels of the cargo-carrying class that the widest market for electrical machinery will be found. The small coaster is a vessel 240 ft. long of 3,300 tons displacement, built for the fruit trade between this country and Spanish and Italian ports. She is propelled by a single six-cylinder Diesel engine which develops 1,250 b.h.p. at a speed of 120 revs. per min., giving the vessel a speed of about 11 knots. For operating the various auxiliary machinery she is equipped with three two-cylinder Diesel-engine-driven, direct-current generators of 50-kW capacity, the engines developing about 75 b.h.p. at 250 revs. per min.; at least one of these sets is available as a stand-by. The auxiliary machinery in the engine room comprises air compressors, fuel and lubricating oil pumps, bilge and sanitary pumps, jacket water circulating pumps, &c., all electrically driven, involving the use of about a dozen electric motors varying in size from 1½ h.p. for the fuel oil pump to 80 h.p. for the air compressor. In addition, there are on deck six electrically-driven winches of 16 h.p. each and a windlass driven by a 50-h.p. motor. All these, together with the steering gear, electric light fittings, wireless apparatus, and all the necessary switchgear and wiring, represent a fairly valuable electrical installation.

The second typical motor-ship is 412 ft. long and of 8,000 tons displacement, being propelled by an engine of 3,000 i.h.p. She was built for general cargo work all over the world. In this ship also there are three Diesel-driven generators for supplying current to the

auxiliaries, two of these being three-cylinder sets of 150 b.h.p. and the other a two-cylinder, 100-b.h.p. set, the generators being of 100- and 75-kW capacity respectively. The auxiliary machinery in the engine room is all electrically driven, being somewhat similar to that detailed above, but, of course, of correspondingly greater power, while additional motors are used for driving the machinery in a small workshop and a motor-generator which reduces the generator voltage from 220, at which value it is used for the bulk of the motors, to 110 volts for ship-lighting purposes. The deck machinery comprises 10 electric winches, six being of three tons lifting capacity and four of five tons capacity, together with a five-ton warping winch and a windlass, both electrically driven. The steering gear is of the electric-hydraulic type driven by a constant-speed motor of 12 h.p.

It will be of interest next to consider the electrical equipment of a large motor passenger ship. While, numerically, this class of vessel is not of the same importance as the cargo ship, the aggregate amount of power utilised and therefore the value of the electrical equipment on such a vessel is very much greater. Two large Diesel-engine-driven liners are being built for the services between Southampton and South American ports which are maintained by the Royal Mail Steam Packet Co. These vessels, one of which has already been launched and is expected to run her trials early in the new year, are 655 ft. long and of 22,000 gross tons. They are propelled by two eight-cylinder double-acting four-stroke cycle Diesel engines, each of 10,000 h.p., these units representing the largest marine Diesel units which have been constructed to date. The whole of the auxiliary machinery, with the exception of a steam-driven emergency air compressor, is electrically driven, and, in addition, the lighting and heating of the passenger accommodation, as well as the whole of the cooking, will be carried out by electricity. Current for all purposes throughout the vessel is obtained from four 400-kW generating sets, each driven by a four-cylinder, single-acting, four-stroke Diesel engine. There is, in addition, a 75-kW Diesel-driven generator for emergency purposes fitted in a compartment above the water line for use should the engine room be flooded. The engine-room auxiliaries include three manœuvring air compressors, each driven by a motor of 180 b.h.p., two refrigerating machines, each driven by a motor of 110 b.h.p., and all the necessary pumps and fans for use in conjunction with the refrigerating machinery. In addition, there are the necessary fuel oil, lubricating oil, ballast water, sanitary water, fresh water and bilge pumps, all electrically driven. A feature of these vessels is the deck cranes, which are hydraulically driven, the water under pressure being obtained from pumps which are situated in the machinery space, each being operated by an electric motor of 110 b.h.p. On deck, the electrical equipment includes a 135-h.p. warping winch, two 150-h.p. capstans, a 135-h.p. windlass, and the continuously-running motors for operating the electro-hydraulic steering gear. The watertight doors which are fitted in the various bulkheads are also electrically operated, the control being effected from the bridge, where an indicator shows whether any particular door is open or shut.

The electrical equipment in the passenger accommodation is on a correspondingly large scale, and comprises some 4,000 electric lamps, 500 cabin and ceiling fans, as well as about 500 heaters in the public rooms and cabins. In addition, there are 50 large electrically-driven fans which deliver fresh air through trunkways throughout the accommodation. The cooking throughout the vessels, both for the passengers and the crew, will be done by electricity, and, in addition to the cooking ranges, two large bakers' ovens, the grills, toasters, griddle plates, fish frvers, and salamanders are all electrically heated. Even in the hospital and the barbers' shops electrical equipment is employed comprising kettles, sterilisers, &c., while in the latter electrically-heated hair dryers and vibro-massage machines will be installed.

The Diesel-driven passenger liner *Aorangi*, belonging to the Union Steam-Ship Co. of New Zealand, which, it may be recalled, was completed at the end of last year and has since taken up her station on the service between Vancouver, New Zealand and Sydney, might have been taken as an example of a large passenger motor-ship—she is 580 ft. long and of 17,500 tons gross—but it happens that a number of her auxiliaries as well as the deck machinery are operated by steam. In spite of this, her electrical equipment is very complete, comprising four Diesel-driven generators of 300 kW each, three of which are required to carry the load, one serving as a stand-by. It will serve to illustrate the extent to which power is required on board ship for operating the auxiliaries if figures giving the fuel consumption of the *Aorangi* are quoted. On a recent voyage the total fuel consumption was found to be 43.6 tons per day for the main engines and 9.4 tons per day for the auxiliaries, the latter representing 17.7 per cent. of the total. It is not stated what proportion of the auxiliary consumption was used for steam raising, but, in any case, the figures may be regarded as a proof of the rough-and-ready rule that of the total power required on board ship about 15 per cent. is utilised for driving the auxiliaries.

With the development of the motor-ship the interesting fact emerges that approximately one-seventh of the total power utilised in operating the ships of the merchant services of the world will one day be utilised in the form of electrical energy. This represents an enormous amount of electrical equipment in the form of generators, motors, switchgear, &c., all of which can be economically and efficiently manufactured in this country. Lord Inverforth, in his recent presidential address to the Institute of Marine Engineers, gave it as his considered opinion that after long experience with steamships, when all allowances are made for the greater first cost of the motor-ship, it is, especially in running costs, a more economical proposition. He specially mentioned the electrically-operated deck machinery as being very economical, and quoted the average fuel consumption per day for electric winches as being 0.6 ton of oil as against for steam winches 1½ tons per day, with oil-fired boilers, and four tons per day with coal-fired boilers. Electric winches have often been criticised on the score of unreliability, but while this criticism may have been more or less justified in the past, it is certainly not justified to-day with any of the reputed makes. The same criticism might have been—and, indeed, has been—levied against all electrical machinery on board ship, but experience has shown that where care is taken in the design and manufacture to keep in mind the peculiar conditions under which such machinery is to operate, then electrical machinery is second to none, both in economy and reliability.

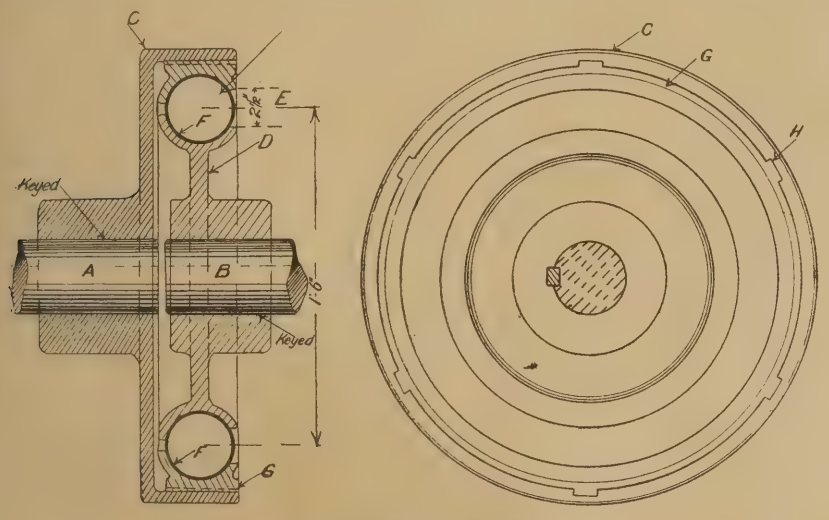
Variation of Radio Station Bearings.—The Radio Research Board (Department of Scientific and Industrial Research) has published the second part of its report upon an investigation into the variation of the apparent bearings of radio transmitting stations that is being carried out under the direction of Mr. R. L. Smith-Rose, of the National Physical Laboratory. Part II (Special Report No. 3, H.M. Stationery Office, 4s. 6d. net) deals with the progress of the investigation from March, 1922, to June, 1923, when observations on the longer waves of from 2,000 to 9,000 metres were discontinued at all the University and Service stations forming the original organisation. In July, 1923, the opportunity occurred for carrying out further observations at a station in higher latitudes than in England, *viz.*, at Lerwick, Shetland Islands. The discussion of the remaining observations carried out on the shorter wave-lengths down to those of 450 metres from 1922 to 1924 will follow in the publication of Part III. It is desirable again to emphasise the difference in effects which has been observed in working overland oversea: On the longer waves the situation of the transmitting and observing stations was such that all the paths of transmission less than 200 miles in length were entirely overland, which fact accounts for the abnormally large variations recorded at night for ranges of from 100 to 30 miles. For distances of less than 30 miles, the majority of the direction-finding readings are found to be accurate to within 2 deg. When the path between the transmitting and observing stations is entirely oversea, and free from any land or coastline effects, the errors in observed bearings lie within the above 2 deg. limits for all ranges up to nearly 100 miles. This accuracy is generally sufficient for most navigational purposes; also, for oversea working a 100-miles range is adequate for the ordinary application of radio direction-finding to marine navigation.

A Pneumatic Flexible Shaft-Coupling.

By J. T. TOWLSON.

THIS is a device designed to function as a driving member between such elements as a motor and a generator, more especially when the machines are not rigidly fixed on a common bedplate, and where there is an absence of "dead" alignment through the two machines. As is well known, such is the purpose of all flexible couplings, the particular requirements for these being that provision must be made for an "endwise," conjointly with a relative diametrical, movement of the two parts of the coupling. The allowance "endwise" is needed on account of the proclivity of d.c. armatures to develop an appreciable floating movement, while the diametrical allowance in the coupling provides against undue or abnormal strain, which would otherwise cause trouble, as a result of want of alignment of the two machines, *i.e.*, the motor and the generator.

The new pneumatic flexible shaft-coupling, it is claimed, possesses the requirements for a two-way movement in a convenient form. For such provision, an air-expanded tube, circular and continuous, is the main



Pneumatic Flexible Coupling.

factor. This tube, of pneumatic tire form, provides the driving medium between the motor and the generator.

Referring to the sketch, it will be seen that a space of (for example) 2½ in. is provided between the outside diameter of the inner ring and the inside diameter of the outer ring. Through this space the uninflated tube is pressed, and after it has passed into position it is inflated to the necessary pressure by the usual means and with the usual connections.

The qualities of the pneumatic tire, in which the pressure at a point is distributed throughout the whole of the tire, are here in full operation; alterations of relative position of the two parts of the coupling, as it is rotated, are freely and "sweetly" compensated for by the automatic flattening of the tube at the position of smallest space. End-wise movement has been generously provided for in the design, there being a floating ring interposed between the driver and the driven member. This ring, with its ample and positive "feather" drive, is allowed to slide freely in the outer ring of the coupling, and thus permits endwise movement of the respective armatures.

Referring to the sketches, A may be the driving shaft, and B the driven one, or *vice versa*. C is the outer ring, slotted as at H, and D is the inner ring. E is the 2½-in. space, by way of which the 4-in. tube (uninflated) is pressed into the circular space provided. F is the tube, shown inflated. G is the intermediate sliding and compensating ring. The driving power of the tube will vary as the pressure of inflation; it may be increased by corrugating the surfaces with which it is in contact. The coupling illustrated transmits 100 h.p. at 480 r.p.m.

London and Home Counties Joint Electricity Authority.

Report of Proceedings at the end of last year.

THE following is a brief *résumé* of the matters dealt with by the London and Home Counties Joint Electricity Authority on December 30th, 1925:—

Finance Committee.—It is understood that most of the schedules submitted by the London electricity companies to the London County Council for the purpose of identifying the value of the assets of the companies (which is necessary for the final settlement of the standard prices) are now being examined by the L.C.C.'s officers, assisted by Messrs. J. H. Rider and W. Cash.

The J.E.A. approves of the L.C.C.'s action in this connection.

General Purposes Committee.—The J.E.A. has agreed to the principle of remunerating its chairman.

Upon the suggestion of the Conference of Local Authorities owning Electricity Undertakings in Greater London, the J.E.A. is to consider the existing methods of valuation of electricity undertakings for assessment for rating purposes. The present system, it is claimed, inevitably leads to very serious inequalities and fluctuations in values, the effect of which is that the earning capacity of different undertakings is burdened unequally in respect of rates.

Technical Development and Works Committee.—The appointment of an advisory technical committee has been postponed until the technical reorganisation schemes for the London area have been fully considered.

The J.E.A. has received applications for special orders from (*a*) the County of London Electric Supply Co., Ltd., to supply the Parish of Merstham in the rural district of Reigate, and from (*b*) Callender's Cable and Construction Co., Ltd., to supply part of the Parish of Chessington in the rural district of Epsom; there is no authorised distributor in either area, but both are within the J.E.A.'s district. On the advice of Mr. J. H. Rider (technical adviser retained by the J.E.A.) formal objection is being made in both cases on the ground that Section 10 of the schedule of the London Order requires the J.E.A. to submit proposals to the Commissioners for the supply of areas within the district not now forming part of the area of any authorised distributor.

The application of the London Power Co., Ltd., for the Electricity Commissioners' sanction to lay new transmission mains from the Deptford power station and elsewhere is being considered by the J.E.A.'s technical adviser. No objection has been offered to the Westminster Electric Supply Corporation and the St. Marylebone Borough Council altering the system of supply to certain premises. Mr. Rider is to investigate at once the provision of bulk supplies in the western section of the J.E.A.'s area, together with the possibility of developing existing stations (where desirable) and the erection of a capital station. In this connection also Mr. Rider will take into consideration the Barnes Urban District Council's and the Kingston-upon-Thames Corporation's proposals for station extensions and bulk supplies respectively.

Committee Chairmen.—The following gentlemen will preside over the J.E.A.'s various committees during the ensuing year:—

Finance: Chairman, Mr. A. Emil Davies, L.C.C.; vice-chairman, Councillor B. J. Samels.

General Purposes: Chairman, Alderman C. R. Attlee, M.A., M.P.; vice-chairman, Mr. W. F. Marchant, L.C.C.

Technical Development and Works: Chairman, Alderman Duncan Watson, J.P., M.I.E.E.; vice-chairman, Lt.-Col. F. A. Cortez Leigh, M.Inst.C.E., M.I.M.E., M.I.E.E.

A Novel Power Scheme.—We learn from *Power* of a remarkable power scheme originating from Germany which provides for the erection of a steel tower 1,950 ft. high, to serve a double function as an electrical generator and a wireless station. As a generator it will have a capacity of 6,000 kW. Two enormous wind wheels will be provided which, it is said, will "stir" in the gentlest breeze. The cost of the tower is estimated at $1,000,000, and that of the electrical machinery at $500,000.

A 40,000-kVA Frequency Changer.—What is claimed to be the largest frequency changer ever built is approaching completion at the works of the Westinghouse Electric and Manufacturing Co., at East Pittsburg, Pa., U.S.A. It has a rating of 40,000 kVA at 300 r.p.m., 3-phase, 25 and 60 cycles. The design of the 60-cycle end of the machine incorporates an arrangement by which the stator may be shifted by means of a motor-driven rotating gear. This provision is for the purpose of adjustment of phase position, and thereby load adjustment. The machines are cooled by a closed ventilating system which includes air-washers.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The "Electrical Review" Index.—The Index for the last half-yearly volume of the ELECTRICAL REVIEW (July to December) is now being printed. Copies will be forwarded post free to those requiring them for binding or for reference purposes, if they will make application to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.

Electrical Exhibitors at Birmingham.—The following is the list of electrical companies and firms who had taken space at the British Industries Fair, Birmingham (February 15th to 26th) down to the end of last week :—

Barratt & Wakefield, Ltd.
Belling & Co.
Beuttell, A. W., Ltd.
Birmingham Electric Supply Dept.
British Electric Transformer Co., Ltd.
British Electrical Repairs, Ltd.
Burnand, W. E., & Co.
Cable Accessories Co., Ltd.
Castle Fuse & Engineering Co.
Chloride Electrical Storage Co., Ltd.
Coley & Swinnerton, Ltd.
Credenda Conduits, Ltd.
Crewe, Morgan & Co.
Daulby, S. J.
Edison Swan Electric Co., Ltd.
Electric Heating & Hardware, Ltd.
English Electric Co., Ltd.
General Electric Co., Ltd.
Hewittic Electric Co., Ltd.
Higgs Motors.
Imperial Engineering Co.
Jackson Electric Stove Co., Ltd.
K.F.M. Engineering Co., Ltd.
London Electric Wire Co. and Smiths, Ltd.
McGeoch & Co., Ltd.
Millington, E. H. & Co.
M.K. Electric, Ltd.
Manda Motors, Ltd.
Nobbs, Geo., Ltd.
Parsons, C. H., Ltd.
Premier Electric Heaters, Ltd.
Reeves & Co.
R.M.P., Ltd.
Sax, Julius & Co., Ltd.
Siluminite Insulator Co., Ltd.
Sturge & Baker, Ltd.
Tucker, J. H., & Co., Ltd.
Turnock, Geo.
Young, Osmond & Young.

New Showroom.—The Richmond Electric Light and Power Co., Ltd., has recently opened a new showroom in George Street, one of the principal thoroughfares of Richmond, Surrey. The new showroom is much more accessible and attractive than the company's original premises.

The Electrical Industry.—Sir Hugo Hirst, chairman and managing director of the General Electric Co., Ltd., expressed his views on the industrial position as follows in the *Financial News* on January 1st :—"The prosperity enjoyed by the electrical industry seems to me a good index of greater activity among most industries in the country. I am hopeful that the unostentatious policy of the present Government, working for political peace abroad and industrial peace at home, may continue to be successful and strengthen the confidence which is gaining ground in all classes of society, and which is the foundation of all further development. The continuation of industrial peace will bring about the right mentality, both of employers and employed, and I am sure will restore gradually normality even in the coal, steel, and shipbuilding industries, which are to-day still suffering greatly."

Meter Approved.—The Electricity Commissioners have approved of the construction and pattern of the meter known as the Sangamo-Ediswan D.C. Type "N H" Mercury Motor A.H. Meter, rated from and including 2.5 amps. to 1,000 amps.

Aiding Registered Contractors.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., is encouraging its present and prospective consumers to employ only registered contractors for their electrical work. This is done by means of two posters which are framed and hung in prominent positions in the showrooms of the company and its associated concerns. One of the posters impresses upon the reader the advantages obtained by employing registered contractors, while the other contains a list of such contractors in the company's area of supply.

For the Wireless Retail Trader. — "The Wireless Retailers' Handbook," of which we have already made brief mention, has now come to hand. *Bona-fide* wireless retailers can have copies free on application to the Wireless Retailers' Association, 70, Finsbury Pavement, London, E.C.2. Including advertisements, the pamphlet consists of 100 pages. The literary contents comprise particulars of the Association and its activities, also a number of articles and tables likely to be useful to retailers in the daily conduct of their business, on such subjects as price-cutting and the remedy, patent royalties and licences, the Shops' Act, British standard terms and definitions, table of the principal valves, &c.

Electrical Engineering in the North.—A special correspondent of the Manchester *Daily Dispatch* states that while general engineering in the area has only slightly improved, in certain sections, the outlook is certainly better. In the electrical branch order books are filling up, and, although there is not yet any marked call for extra workers, the regularity with which work required follows work completed is encouraging, and guarantees steadiness of employment.

Commercial Education.—The annual presentation of medals and prizes to the successful candidates in the Commercial Education Examinations of the London Chamber of Commerce will take place, under the presidency of the Lord Mayor, at the Mansion House on Friday, February 5th. The Duchess of Atholl, D.B.E., M.P. (Parliamentary Secretary to the Board of Education) will present the awards.

Social Events.—The annual dance of the Glasgow staff of the General Electric Co., Ltd., was held on December 28th. There was an attendance of over 300. Many original and novel ideas were introduced and Mr. G. A. Scott Walker and his committee were congratulated on the success of the function.

The St. James' Electric Rifle Club held its annual prize distribution on December 23rd, the chair being taken by Mr. F. J. Walker, the president, who welcomed Sir Alex. B. W. Kennedy, F.R.S., the chief engineer to the St. James' and Pall Mall Electric Light Co., Ltd. The prizes were distributed by Mrs. Andrews. The championship of the club was won by Mr. F. O. Andrews, who carried off the "Walker" and the "Deane" challenge cups and the rose bowl. The runner-up in the last two events was the hon. secretary, Mr. C. P. Fox.

The annual staff dance of the Sheffield Corporation Electric Supply Department was held on New Year's Eve, and was attended by a company of about 120.

American Electrical Vehicle Exports.—Figures just to hand show that 18 electrical vehicles valued at £4,768 were exported from the United States during October last as compared with only 8 (£1,001) in the preceding month and 18 (£4,885) in October, 1924.

Commercial Buildings in Demand.—MESSRS. LEOPOLD FARMER & SONS, London, report that during 1925 there was a constant demand for factory and commercial property, and in recent months that demand has considerably grown, due, in many cases, no doubt, to the progress of the Safeguarding of Industries measure, which has proved a great incentive for the acquiring of factories all over the country by British, as well as foreign firms. The increased activity in trade generally is also another important factor for the enlargement of works, and the establishment of new ones. At the present moment there are as many inquiries for factories as there have been for some years, if not more.

Lead.—Reporting on December 31st, 1925, Messrs. James Forster & Co. stated :—"Consumers have been buying fairly well lately, but not in any quantity to justify rising prices. Consumption has been about 'top notch' for months past, and cannot be expected to increase. Normal imports from Australia will, of course, follow after January, which will mean a return to about 8,000 tons per month, against 25,000 tons in October and November shipments. The course of the market greatly depends on whether the Continent recovers its absorption powers or continues to dump lead here which it has bought and cannot absorb."

To Avoid Competition in France.—Discussions have begun among the electrical manufacturing works in France with the object of reaching an agreement for the avoidance of "mutual competition" and for obtaining better selling prices.

Tradesmen Using the Royal Arms.—The *London Gazette* for January 1st contains lists of tradesmen in London and elsewhere who hold appointments to Royalty with authority to use the Royal Arms.

Trade Announcements.—For family reasons the business of MESSRS. E. P. ALLAM & CO., of 107-109, Gray's Inn Road, London, W.C.1, has been converted into a private limited liability company, under the style of E. P. Allam & Co., Ltd. There will be no alteration in the management and staff.

MESSRS. F. GILMAN (B.S.T.), LTD., of Smethwick, have purchased the business of Messrs. G. F. Clements & Co., Regent Street, Smethwick, manufacturers of boiler scaling tools. The business of that firm will now be dealt with from the main offices of Messrs. Gilman, Grange Works, Smethwick.

The GEAR GRINDING CO., LTD., Birmingham, has established, in Milan, Italy, the Società Italiana Rettifica Ingranaggi (S.I.R.I.). The works will be equipped and operated on similar lines to those employed in the Birmingham shops.

From announcements which are prominently made in our advertisement pages this week it will be seen that STANDARD TELEPHONES & CABLES, LTD. (formerly Western Electric Co., Ltd.), has entered into an agreement with the Birmingham Small Arms Co., Ltd., whereunder the products of the former company in connection with radio broadcast receiving apparatus, will be distributed by the two companies in the future. The Birmingham Small Arms Co., Ltd., has formed a new company (B.S.A. Radio, Ltd.), to develop the sale of such apparatus, and this new company, under an agreement with Standard Telephones & Cables, Ltd., has a range of apparatus in preparation. The manufacturing and distributing organisations of the two companies will be available to manufacture and market present and future products in pursuance of a common policy.

The announcement that the B.S.A. Company has entered the wireless field is the most interesting of recent trade events. While it will be of undoubted interest to the motor and cycle trade it will, we know, be of particular interest to the wireless trade. The B.S.A. trading policy which has been so popular with the cycle and motor-cycle trades will be followed in the company's connection with the wireless industry. Details of the B.S.A. radio products will be published later, but agents who are interested in the sale of wireless apparatus should send in their names to B.S.A. Radio, Limited, Small Heath, Birmingham, so that they can be entered on the company's trade register to ensure receiving full particulars of B.S.A. radio broadcast apparatus from time to time. Mr. J. W. Bryan, the firm's publicity manager, who has been closely connected with the company's sales departments, will be in charge of all matters relating to sales of B.S.A. Radio, Ltd.

THE PHOTECTOR CO., LTD., has removed to 711-715, Fulham Road, London, S.W.6.

MAGNUM ELECTRIC APPLIANCES have just opened larger premises at Magnum Works, Upper Elmers End Road, Elmers End, Kent, in consequence of increased business.

The premises of Mr. ALAN E. DENT, Russell Street, Nelson, were damaged by water used upon an adjacent fire on January 1st; Mr. Dent is therefore temporarily occupying premises at Croasdale Buildings, Nelson. He desires to obtain a fresh stock of catalogues and lists from factors and manufacturers.

Catalogues and Lists.—THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A pair of coloured cardboard cut-outs advertising "Marconi" valves.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Price List No. 2,071, dealing with the company's oil-immersed switch-fuses, and Publication No. 586, describing "Class XR" induction regulators. Both are well illustrated.

MESSRS. FRY & CO., LTD., Maskell Street Works, Rusholme Road, Manchester.—Price lists of "Efanco" cotton-covered instrument wires, and "Eiffel" inductance coils.

THE AUTOMATIC TELEPHONE MFG. CO., LTD., Milton Road, Edge Lane, Liverpool.—A set of three coloured showcards advertising the company's "Claritone" loud speakers and telephones.

MESSRS. CROMPTON & CO., LTD., Chelmsford.—List A.6, illustrating and describing the company's 3-phase induction motors of various sizes and for a number of frequencies.

THE BRITISH ELECTRICAL & MANUFACTURING CO., Clavering Place, Newcastle-upon-Tyne.—A priced and illustrated pamphlet advertising the "Orion" vacuum cleaner.

THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—An illustrated and priced catalogue of lighting fittings for offices, shops, restaurants, and public illumination.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A booklet directing the reader to the company's headquarters, giving railway, tramway, and omnibus routes.

THE GOODYEAR TYRE & RUBBER CO. (GREAT BRITAIN), LTD., Chelsea Wharf, Lots Road, S.W.10.—A booklet containing particulars of the company's transmission belting and data regarding the subject of belt drives.

THE STONEBRIDGE ELECTRICAL CO., LTD., Victoria Road, North Acton, W.3.—List No. 93, dealing with portable dynamometer precision and commercial instruments.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—A comprehensive price list of electrical materials, accessories, and appliances, including pumping sets, cables, domestic appliances, battery-charging switchboards, &c.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough.—An illustrated and priced pamphlet dealing with fixed condensers and grid leaks.

Calendars, Diaries, &c.—From the SUN ELECTRICAL CO., LTD., of 118-120, Charing Cross Road, London, W.C.2, we have received a set of refills slips for its desk calendar for 1926.

A Letts's "Quickref" Engineer's Handbook and Diary for 1926, containing much engineering data in tabular and other form, has been received from INTERNATIONAL COMBUSTION, LTD., of Africa House, Kingsway, W.C.2.

A wall calendar with monthly sheets for 1926 has come to hand from our contemporary the *Chemical Trade Journal*.

In accordance with their long-established custom, MESSRS. W. H. WILLCOX & CO., LTD., 38, Southwark Street, London, S.E.1, have prepared a hanging Date Remembrancer with monthly sheets for the coming year.

BROOKHIRST SWITCHGEAR, LTD., is very regular in its supply of calendar cards. We have received those for the first three months of 1926. The excellent views of Chester have been replaced by pictures of the company's products.

MESSRS. DOWNES & DAVIES, 1 & 3, Stanley Street, Liverpool, have sent us a calendar upon which appears a study in colour of "My Lady Fair." Monthly date slips are provided.

From MESSRS. ROPER BROS., 5, South Anne Street, Dublin, we have received a block of daily slips for 1926 to replace those which we received last year.

MESSRS. B. S. & W. WHITELEY, LTD., of Pool Paper Mills, Pool, near Leeds, have prepared a calendar with daily slips, each bearing a literary quotation.

MESSRS. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, London, W.4, have sent us a neat calendar for 1926 each monthly sheet of which has a picture of some charming house, or village or country scene.

From MESSRS. RD. JOHNSON, CLAPHAM & MORRIS, LTD., Manchester, we have received a wall calendar, above the date slips of which is a view, taken from the air, of the company's head offices and works. Accompanying it is a pamphlet containing a well-illustrated description of the company's new warehouse building.

The calendar of the LONDON MAGNETO REPAIRING & WINDING CO., LTD., of 78, Hampstead Road, Euston, London, N.W., illustrates in colour the welcome accorded to Muriel or Daphne on her arrival by car.

An artistic wall calendar has reached us from the LANCASHIRE UNITED TRAMWAYS, LTD.

THE BRITISH EBONITE CO., LTD., of Hanwell, London, W.7, has issued a small wall calendar with two-monthly removable slips, humorously illustrated.

THE ENGLISH ELECTRIC CO., LTD., of Queen's House, Kingsway, London, W.C.2, has prepared a daily block calendar with clear red figuring.

THE S.E.A. CO., LTD., of Lichfield Street, Hanley, has circulated a wall calendar with humorous illustrations depicting "Wireless Howlers"; two months to the sheet.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., of 5, Arthur Street, New Oxford Street, London, W.C.2, have sent us a wall calendar with monthly sheets boldly figured.

A "Utility" calendar with bold-figured daily slips has been received from Mr. Cecil Ridley, 35 and 37, Dundas Mews, Middlesbrough.

A view of a ruined riverside abbey appears upon the calendar sent us by MESSRS. DORMOR & HINES, 74, Old Christchurch Road, Bournemouth. The bottom forms a pocket for letters, &c., and has monthly date sheets.

A large-scale representation of a valve, in which appears the portrait of a pretty girl, forms the calendar of the MULLARD WIRELESS SERVICE CO., LTD. There is also a block of daily slips.

MESSRS. G. S. PECKHAM & CO., of 4 & 5, New Compton Street, Charing Cross Road, London, W.C.2, have prepared a very serviceable desk reminder for the entry of engagements. One page per week gives ample daily space.

MESSRS. MCWHIRTER & SONS, LTD., Wharf Street, Cardiff, have sent us one of their 1926 calendars consisting of a picture of a re-winding job and a block of daily slips.

An artistic calendar with a separate sheet for each month has been received from MESSRS. PHILIPS LAMP, LTD., 60, Wilson Street, Finsbury Square, E.C.2.

MESSRS. W. H. SUGDEN & CO., LTD., have issued a useful calendar comprising monthly sheets with space for notes against each date.

We have received, as usual, the COUNTY OF LONDON ELECTRIC SUPPLY CO.'s telephone card. This year's picture is a coloured view of the new Barking station.

Bankruptcy Proceedings.—J. BRODIE, electrical engineer, 59, High Street, Dunfermline.—Public examination at the Sheriff Court House, Dunfermline, January 7th. Meeting of creditors at Messrs. MacBain & MacDonald's offices, Commercial Bank Buildings, High Street, Dunfermline, January 21st.

H. E. CHECKLEY, plumber and electrician, 20, West Street, Morecambe.—Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester, released September 17th.

Company Liquidations.—BELGRAVIA ELECTRICAL CO., LTD., 23, Old Queen Street, S.W.1.—A meeting of creditors was held recently at the offices of Messrs. Annan, Dexter & Co., when the chair was occupied by the liquidator of the company, Mr. W. H. Lovatt. The liquidator said that a private meeting was held in November, when a statement of affairs was submitted. Since that time the assets and liabilities had not altered to any great extent. It was also agreed at the last meeting that Mr. Marquand, one of the directors, should offer the creditors 10s. in the £ in settlement of their debts. Soon after that meeting the company was put into liquidation, and Mr. Marquand had informed the liquidator that it was now impossible for him to make the offer of 10s. Mr. Gardner, representing creditors, asked if any particulars could be given with regard to the debenture for £500. The liquidator replied that the debenture did not become valid until January, 1926, and before that date he would repudiate the validity of that debenture. The only thing remaining for the creditors now was for the assets to be distributed amongst the creditors *pro rata*. The net assets were £188, and the total liabilities were approximately £700. No resolutions were passed, and the matter therefore remains in the hands of the present liquidator.

SEXTON-BARNES, LTD., 61, Borough Road, S.E.1, engineers and electrical and radio manufacturers.—A meeting of creditors was held on December 30th, at the offices of Messrs. Poppleton, Appleby & Hawkins; the chair was occupied by Mr. W. Baker, who represented the liquidator of the company, Mr. E. H. Hawkins. Mr. Baker presented a statement of affairs which showed liabilities of £1,482, all due to unsecured creditors, and net assets of £457. The chairman said that at a private meeting held recently figures were presented but no particulars with regard to the trading of the company were given, and it was decided to form a committee to go into the affairs of the company. The Committee came to the conclusion that it was impossible for the business to be continued, and accordingly the shareholders passed the necessary resolution for liquidation, with Mr. Hawkins as liquidator. The company was registered in December, 1924, with a capital of £200, divided into 4,000 shares of 1s. each. The gross profit

from the commencement of the business down to December 11th, 1925, amounted to £310. Against that the overhead expenses were £1,354, which resulted in a total loss on trading of £991. Mr. Baker said that he hoped to be able to effect a sale of the assets, in which case the creditors might eventually receive a small dividend. No resolutions were passed, and the matter therefore remains in the hands of Mr. Hawkins as liquidator, together with the committee of inspection appointed at the previous meeting.

The following are creditors :—

	£		£
Benjamin Electric, Ltd.	97	L.C. Engineering Supplies, Ltd.	62
Burgess, Frederick	26	Noble, E. A.	53
Cobalt Magnet Steel Co., Ltd. ...	82	Ormiston, P., & Sons	30
Crofts, Ltd.	21	Palmer, J., & Sons, Ltd.	32
Corfield, Ltd.	82	Pickering, G. F.	242
Dyson & Co., Ltd.	61	Sanderson Bros. & Newbold, Ltd.	46
Bankers	20	Sankey, J., & Sons, Ltd. ...	22
Lloyd, R., & Co., Ltd.	22	Tickle, L. B.	314

LOW TEMPERATURE CARBONISATION, LTD.—A petition for the winding up of the above-named company has been presented to the High Court by the Dursley Gas Light and Coke Co., Ltd., of Dursley, Glos., creditors, and will be heard in London on January 12th.

L. WEEKES, LTD.—Winding up voluntarily. Liquidator, Mr. B. T. Crew, George Street, Luton.

PREMIER ELECTRIC WELDING CO. (CLYDE), LTD.—Winding up voluntarily. Liquidator, Mr. T. L. McLintock, 216, West George Street, Glasgow. Meeting of creditors, January 8th, at the offices of the liquidator.

Unemployment. — There was a further decrease in the number of unemployed during the week ended December 21st, the total at that date being 1,102,400, a fall of over 25,000.

Local Exhibition.—BURNLEY.—The Corporation has decided to organise an electrical exhibition from January 28th to February 6th, and during the same period electrical films will be exhibited at the Pavilion Picture House.

The German Insulator Industry.—The Berlin correspondent of the Exchange Telegraph Co. states that the business situation in the porcelain insulator industry became worse in November and December. The November figures show a decrease of employment by 20 to 25 per cent., as compared with October. Compared with the two best business months of last year, July and August, sales dropped by almost 40 per cent. Special complaints are made concerning the export trade. The total export of technical porcelain last year decreased by about 50 per cent. compared with the previous year, although it is claimed that prices brought hardly any profit.—*Financial News.*

Shop-window Lighting.—The accompanying illustration shows a good shop-window lighting installation which has recently been carried out at Villiers, Shaftesbury Avenue, W. "Siemens" shop-window reflectors, in conjunction with "Siemens" gasfilled lamps, are employed to obtain the



Siemens Shop-window Illumination.

desired effect, and the whole of the light is concentrated on the displayed models, &c., making them stand out in bold relief. The firm responsible for the work was Messrs. Edward Wolf & Co.

For Sale.—Messrs. Veryard & Yates will offer by auction on January 14th and 15th, at 31a, Camden Street, Camden Town, N.W., large quantities of ex-Government wireless, electrical, medical, and surplus stores, &c. Eastbourne Corporation Electricity Department has for disposal one 400-kW Ferranti engine and alternator. (See our advertisement pages to-day.)

Callender's in Germany. — The Callender Kabel Gesellschaft is the name of a new company which has lately been formed in Hamburg to handle the Callender cable productions in Germany.

Italian Tariff Reductions.—The *Board of Trade Journal* for December 31st contains a list of articles which are to be subject to lower rates of duty when imported into Italy from Germany, under the provisions of the recent commercial treaty between the two countries. By virtue of the treaty existing between this country and Italy, British goods will also be accorded the same treatment. The list includes small-gauge copper wires, internal combustion engines, "rotary hydraulic engines," portable steam engines, boilers and economisers, electric heaters, electromagnetic separators, electric soldering equipment, ammeters, electricity meters, recording meters, incandescent electric lamp bulbs, electric cars, ebonite, gutta-percha, &c.

A "Cosmos" Window Display.—The accompanying illustration shows a striking display which has been arranged for retailers of "Cosmos" lamps by Metro-Vick Supplies,



A "Cosmos" Lamp Display.

Ltd. The central piece is very attractive, being done in eleven colours and gold, with the lamp shade in red batik. At night it is illuminated by a concealed "Cosmos" lamp.

Unemployment in Germany.—The Berlin correspondent of *The Times* states that the official figures of unemployment in Germany during the first half of December showed a very sharp increase. The number of unemployed persons in receipt of State support was 673,315 on December 1st, and 1,057,031 on December 15th. So far, the state of trade offers no immediate prospect of an improvement, and the obvious political complications likely to arise from a continued period of widespread unemployment are giving rise to disquieting rumours that Government action similar to that taken in the winter of 1923 (which included the enforcement of a system of working short hours) is again contemplated.

German Machinery Exports to N.S.W. — The *Board of Trade Journal* states that during September last German dynamo-electric machinery to the value of £2,204 was imported into New South Wales.

United States Electrical Exports.—The total value of exports of electrical goods from the United States during October last was $7,567,087, a gain of more than $500,000 over the preceding month's figure, and about $700,000 in excess of the October, 1924, total. The increase is stated to be principally due to the rise in the exports of radio apparatus which were valued at $1,317,846, as compared with $769,249 in October, 1924. The other increases included a.c. generators and accessories, self-contained lighting sets, switchboard panels, fractional-h.p. motors, primary batteries, domestic appliances, wiring materials and accessories, lighting fittings, insulating materials, and ignition equipment. Among the classes which showed decreases were d.c. generators, transformers, large motors (above 200 h.p.), storage batteries, telephone equipment, and railway signalling equipment.

Proposed Japanese Amalgamation.—Negotiations are said to be in progress for amalgamating the Kabe Tramway Co. (with a capital of 1,500,000 yen), the Seto Inland Sea Orossing Electric Power Co. (capital 5,000,000 yen), the Shimane Electric Co. (capital 1,000,000 yen), and the Akana Electric Co. (capital 100,000 yen), with the Hiroshima Electric Co. (capital 30,000,000 yen). Being sister companies, it is thought to be comparatively easy to effect the amalgamation. Upon the amalgamation, the Kabe tramway will be electrified and hydro-electric and steam power stations will be erected. For this purpose, the amalgamation will increase its capital to 50,000,000 or 60,000,000 yen.

The A.E.G. in Mexico.—It is announced that the A.E.G. has formed a firm under the title of the A.E.G. Latein-Amerika Bau A.G., with a nominal capital of 50,000 marks, for business transactions in Mexico.

German Wire Syndicate.—The Berlin correspondent of the Exchange Telegraph Co. states that the German Wire Syndicate negotiations have been concluded by the accession of certain outstanding manufacturers. The syndicate has been formed for a fixed term of five years. The Siemens and Halske Co. has received a Belgian order for the construction of electric cables on the line Herbesthal-Brussels.—*Financial News.*

German Firm Secures Spanish Electrification Contract.—The Santander-Bilbao railway company has awarded a contract to a German firm for the electrification of the line from Bilbao to Las Avenas.—*Reuter's Trade Service* (Madrid).

Book Notices.—"The Colliery Manager's Pocket Book, 1926." Pp. 512+132; illustrated. Edited by J. Vincent Elsden, D.Sc. (Lond.) and Hubert Greenwell, F.S.S. London: The Colliery Guardian Co., Ltd.—The book is really a practical treatise on mining engineering dealing with the civil, mechanical and electrical branches separately and at considerable length. The part devoted to "Electricity in and about Mines" dwells chiefly on the plant and apparatus employed in mining, principally from the point of view of safety; the various rules and regulations concerned, including the I.E.E. wiring rules, are cited. A separate chapter is devoted to coal and its by-products, reviewing its origin and formation, as well as coal sampling and treatment. A review of the mining progress made during 1925 and various statistics relating to coal mines for the year 1924 add to the interest of the publication, while much general information, a diary, and cash account provision should prove useful.

"The Lubrication of Uniflow Steam Engines," Gargoyle Technical Series, No. 22 (12 pp., 6 figs.). London: The Vacuum Oil Co., Ltd.—This is a guide to the selection of lubricants for the type of engine named, having regard to its design, construction, operating conditions, &c.

"Water Resources Paper No. 45, Surface Water Supply of Canada. Atlantic Drainage (South of St. Lawrence River), New Brunswick, Nova Scotia, and Prince Edward Island. Climatic Years 1922-23 and 1923-24." Ottawa: F. A. Acland (for the Dominion Water Power and Reclamation Service).

"Memoirs of the College of Science, Kyoto Imperial University." Index of authors and contents of Vol. VIII, Series A, Vol. IX, No. 3; November, 1925.

"Japanese Journal of Physics; Transactions and Abstracts of the National Research Council of Japan." Vol. IV, No. 1. National Research Council, Department of Education, Japan.

"Preliminary Report on the Central Electric Station Industry in Canada, 1924." (Pp. 5.) Ottawa: Dominion Bureau of Statistics.—This report contains a general review of the supply industry in Canada with statistics of capacity, transmission systems, &c., and financial results.

"Science Abstracts" (A and B). Vol. XXVIII. Part 12. December 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each.

Quarterly *Bulletin* of the Institution of Engineers, Australia. Vol. II. No. 8. October 31st, 1925. Sydney: The Institution.

German Foreign Loan.—It is reported from Berlin that the Osram Gesellschaft is raising a 5 million dollar loan through a syndicate of Dutch, Swedish and British banks. The loan is to run for a period of 25 years at 7 per cent. interest.

The Argentine Electrical Market. — The French Commercial Attaché at Buenos Aires has been drawing attention to the Argentine market for electrical material. This, he points out, is large, although French manufacturers have not yet been able to gain much interest in it. The Germans and the North Americans dominate the position, and, in the view of the Commercial Attaché, it would be difficult to dislodge them. In order to obtain contracts from public authorities it is necessary to submit the material for the approval of the Technical Electrical Department of the Buenos Aires Municipality. In addition, the Tramways Company has its own specifications. The city of Buenos Aires is extending very rapidly every year, and there are now large districts under construction which no electric light system has yet reached. One-half of the city is to be rebuilt; the work has already commenced and will be carried out slowly, and it is evident that a very large amount of electrical material will be required. The average monthly sales of motors are estimated at between 2,500 and 3,000, of all sizes. Of this total it is calculated that between 1,200 and 1,250 go from the United States, 1,000 to 1,150 from Germany, 300 to 323 from Great Britain, 150 to 175 from Sweden, and only five from France. The United States' makers possess a great advantage through keeping stocks on the spot. The Germans are not far behind the Americans in their active search for electrical orders. To maintain stocks of machines and spare parts is of great importance, as no manufacturer is likely to equip his works with motors where such a service is absent. Although no definite regulations are laid down in connection with private installations, as a general rule concerns like banks and hotels insist upon tests similar to those laid down by the electrical department of the municipality. Although owing to the cheapness of certain sizes of German and American wires and cables direct competition is difficult, the Commercial Attaché considers that business is possible by cultivating relations with the wiring firms and maintaining stocks of wire and cable. For motors, the demand for a.c. and d.c. types is about the same, but as in Buenos Aires the use of d.c. motors for 220 V of more than 3 h.p. capacity is prohibited, a.c. types for 440 volts have a better sale. The squirrel cage design seems to be superseding the slip-ring motor.

New Indian Companies.—Among the new concerns recently formed in India in connection with the electrical engineering business are the International Electric Co., Calcutta (23, Strand Street), capital 100,000 rupees; and Seshasayer Bros., Trichinopoly, Madras, capital 100,000 rupees.

Lighting and Power Notes.

Australia.—WAGGA (N.S.W.).—The *Industrial Australian and Mining Standard* reports that at a recent meeting of the Municipal Council, the proposed agreement between the Council and the Public Works Department regarding the linking of Wagga with the Burrinjuck hydro-electricity scheme was discussed. Previously the council had given power to the mayor to sign an agreement, but as the result of the last meeting the council revoked this decision, and decided that a competent consulting electrical engineer should be engaged to report on the agreement generally.

TASMANIA.—Important amendments have been made in the Hydro-Electric Power Commission Bill (Tasmania). The primary object of the Bill is to place the control of the Hydro-Electric Department under a commission of three members. The Bill gives the Commission very wide powers regarding the development of the supply of hydro-electricity in the State, and the control of the distribution.

Bangor.—STREET LIGHTING.—With the object of facilitating the movement of traffic in the narrow High Street, Mr. Price F. White, the city electrical engineer, is carrying out a scheme of overhead lighting supplementary to the existing lighting arrangements.

Belgian Congo.—HYDRO-ELECTRIC SCHEME.—Additional information is now available with regard to the objects of the recently-formed Société Générale des Forces Hydro-Electriques de Katanga. It is proposed to construct a dam below the Lufira Falls, near Katanga, in the Belgian Congo and to establish a hydro-electric station for the supply of power to the Société de l'Union Minière. Following the completion of the plant, other falls are to be similarly utilised.

Birmingham.—PROGRESS DURING NOVEMBER.—At a recent meeting of the Electric Supply Committee continued progress during November was reported. New consumers connected totalled 1,031, this being the first time in the history of the undertaking that the additional connections have exceeded a thousand in a month. These additions represent in the aggregate 15,000 lamps and 1,900 h.p. for power supplies. The consumption of electricity for all purposes continues to be at the rate of nearly 20 per cent. above last year's figures.

ELECTRICAL DEVELOPMENT.—An important report has been issued by the Corporation Electricity Supply Committee on the development of the electricity undertaking involving an estimated expenditure of £478,000. The report states that the boiler plant is of sufficient capacity to deal with a further 10,000-kW turbo-alternator set, and in view of the growth of the demand in the area the Committee has come to the conclusion that it would be advantageous to install this extra plant forthwith so that it can be ready for service in time for next winter's load. The estimate of the cost of this additional set, together with the necessary foundations, piping, switchgear, cables, &c., is £60,000. It is recommended that the installation be proceeded with. The Committee has carefully reviewed the position with regard to the existing sub-station equipment, and the need for strengthening a number of the plants, and building and equipping other sub-stations in the area of supply, in order to give satisfactory service and meet the requirements for the next two years, as far as it is possible to gauge them, and has prepared a scheme which involves additional plant at six rotary converter sub-stations and the provision of five additional sub-stations in the Ward End, Acocks Green, Selly Oak, Bradford Street, and Granville Street districts, involving an estimated cost of £158,000. It is pointed out that £300,000, previously sanctioned, will have been expended on the distribution system by May, and to provide for further extensions of mains to the end of September next an outlay of £250,000 is necessary. A large amount of business is done with manufacturers requiring substantial power supplies from the e.h.p. mains, and to provide the necessary equipment it is estimated that £10,000 will be required during the ensuing twelve months.

Birkenhead.—NEW ELECTRICITY CHARGES.—The Corporation Electricity Committee proposes to introduce a new system of electricity charges based on the rateable value of dwellings. If it is approved by the Town Council at the January meeting the minimum rateable value assessment will be £18 per annum. Consumers will have the choice of two scales of charges (1) 5 per cent., of the rateable value of the premises, plus ½d. per kWh for all electricity consumed; or (2) 2½ per cent., of the rateable value, plus 1d. per kWh for electricity consumed. Consumers must have installed electric fires or cookers and for a house not exceeding a rateable value of £30 the minimum installed load apart from lighting must be 2 kW, increasing according to the rateable value of the house. The existing system of charges will be continued where desired.

Bristol.—CHANGE-OVER.—The Electricity Committee has decided to proceed with the third part of the scheme for the change-over of the system of supply in the Stoke Bishop, Coombe Wingle, Westbury, Neuleaze, Upper Redland, Broad Weir and Barton districts, at a cost of £103,061 for mains, £15,550 for sub-station buildings, and £45,620 for plant.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—Statistics giving the amount of hydro-electric power generated in Canada during the past three years show that during each month of the past year approximately 10 per cent. more was generated than during the same month of the previous year, and 20 per cent. more than during the year before. The average power generated monthly during the past year was 21 million kWh. De-

velopment work at the Chute-à-Caron falls on the Saguenay River, Quebec, on which the Aluminium Corporation is spending over $100,000,000, will be completed by the end of 1926, according to an official announcement. Nearly 750,000 h.p. will be available.—*Reuter's Trade Service* (Ottawa).

Cheadle and Gatley.—LOANS SANCTIONED.—The Urban District Council has received sanction to loans of £4,026 for the Adswood and Ladybridge Road electricity scheme, £9,097 on account of expenditure on mains and services up to March 31st next, and £3,670 for electricity extensions in Styal Road.

Continental.—SWITZERLAND.—It is reported that the Officine Elettriche Ticinese, of Bodio, has been authorised to export up to the end of 1931 a maximum of 400,000 kWh per day to the Società Lombarda per Distribuzioni di Energia Elettrica and the Società Idrolettrica Piemontese Lombarda Ernesto Breda, of Milan. From the end of 1931 to the end of the concession the quantity of energy to be exported will be reduced to a maximum of 304,000 kWh per day.

SPAIN.—A new hydro-electric station has recently been completed by the Sociedad Electrica Industrial del Jucar at Franco de Lobo in the province of Albacete. The plant comprises two 1,900-h.p. turbo-generators, and two 1,600-kVA 6,600/66,000-V transformers. The company has now four power stations, representing a total of 95,600 h.p. and is supplying electricity to Madrid and to the district between Sagunto and Cartagena.

Dover.—ELECTRICITY IN BULK.—The Electricity Committee has received a report from the electrical engineer regarding an inquiry from the Deal and Walmer Gas Co. as to a bulk supply of electricity to Deal, and the town clerk is to inquire if the company is prepared to enter into a contract for a period of 30 years.

Eastbourne. — ELECTRICITY EXTENSIONS. — The Electricity Committee has before it proposals for the installation of a turbo-alternator, a boiler, pipe work, &c., and a cooling tower, at an estimated cost of £41,548; also new feeder cables, substations, transformers, &c., at a cost of £11,123. Meanwhile application is to be made for sanction to a loan of £15,000 for future extensions.

Guiseley (Yorks.).—STREET LIGHTING.—The Urban District Council has decided to enter into an agreement with the Electrical Distribution of Yorkshire, Ltd., for conversion of the local street lighting from gas to electricity.

Heckmondwike.—ELECTRICITY IN SMALL HOUSES.—The Urban District Council has received sanction to a scheme for wiring houses for electricity and for payments for this work to be spread over a number of years. The charge for electricity under this scheme will be 1d. per kWh more than for consumers who provide their own piping and appliances. The scheme is aimed especially to encourage electric lighting in small houses.

Jamaica.—HYDRO-ELECTRIC DEVELOPMENT.—According to *The Times Trade and Engineering Supplement*, a Government Commission has recommended that an expert should be employed to estimate the cost of the hydro-electric scheme which the Kingston Municipal Corporation proposes to install to the north of Kingston. The Crown Agents were recently instructed to place the order for the hydro-electric plant in England, but in view of the appointment of a Commission to go into the reconstruction of Kingston's thoroughfares, extension of the sewerage system, and construction of a dam within the corporate area, the Crown Agents were advised to defer taking action in the above direction. The Commission has further advised the Government that details of cost of a hydro-electric plant, circuits, &c., required in modern street lighting, should be obtained from a centre such as Halifax, Nova Scotia, where an up-to-date system has been installed. It would be advisable, the report states, that the most modern system should be provided for the Corporation's scheme. The Commission feels that the amount provided by the Corporation for the lighting project is insufficient, hence the recommendation for expert advice.

Japan.—ELECTRICAL DEVELOPMENT.—The Nagoya steam power station of the Toho Nenryoku K.K. has been completed. The plant includes one 35,000-kW generator, one of 1,000 kW, and four Babcock & Wilcox boilers. Another generating set is being installed.

The Shibaura works of the Tokyo Municipal Council, which were destroyed by fire are to be re-built at a cost of 2,168,000 yen. Work will commence early this year.

An official explanation of the position of the Shinanogawa power station scheme has been published. According to the report it has been decided to construct two power stations on the Shiano River instead of one as originally planned, of which, one at Senju is to be completed in about three years commencing in the fiscal year of 1927-1928.

Eastern Engineering reports that the Hiroshima Electric Co. is shortly erecting its second Eno-gawa water power station in view of the increased demand. The station will have an output of 11,000 kW and will be completed by June, 1927. The company is also building a steam power station with an output of 25,000 kW as a stand-by.

It is understood that the Kuhara Mining Co. has decided to construct water-power stations of about 100,000 kW, on the Shokawa, in Giju and Toyama Prefectures.

Kendal (Westmorland).—STORM DAMAGE.—During the storm on December 30th a Diesel engine at the electricity works was put out of action and the electric cables fused. Fire broke out at the local gasworks, and the gas mains at the County Hall burst, fire also breaking out there. The town was entirely without light.

London.—STEPNEY.—The Electricity Committee has instructed the borough electrical engineer to submit estimates for laying distributing mains in streets where they have not already been laid.

Lytham St. Annes.—ELECTRICITY SUPPLY PROGRESS.—During November 63 additional electricity consumers were connected and owing to the increased demand another transformer sub-station, costing £620, is now required. A bulk supply of electricity from Preston is promised for October next by which time an additional rotary converter will be added at the St. Annes station at a cost of £2,211.

Manchester.—LOANS SANCTIONED.—The Electricity Committee has received sanction to loans of £18,000 for buildings, and £32,000 for sub-station equipment.

Newport.—MAINS EXTENSIONS.—The Borough electrical engineer has prepared plans for the extension of mains at a total cost of £17,000.

Pwllheli. — ELECTRICITY SCHEME APPROVED. — The Town Council has decided to approve of the proposal of the Electricity Distribution of North Wales & District, Ltd., to supply electricity to the town. The transmission line has already reached the borough, and the Electricity Commissioners had threatened to dispense with the Council's consent unless it withdrew its claim for a deposit as security from the company.

Salford.—ELECTRICITY SUPPLY.—The Electricity Committee has recommended to the Corporation that application be made for sanction to a loan of £132,333, to cover the cost of mains and services in Salford and Prestwich, the erection and equipment of sub-stations, the provision of plant at Frederick Road power station, &c. The contract rates for the supply of electricity for motive power in the Urban District of Prestwich have been fixed at 5 per cent. above the contract rates in force in Salford.

Seaham Harbour.—ELECTRICITY IN BULK.—At a recent meeting of the Urban District Council a further report on the electricity scheme was considered, and it was agreed that the offer of the County of Durham Electrical Power Distribution Co. to supply power in bulk should be accepted. A Special Order has been applied for.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the St. Helens Corporation to supply electricity in part of the rural district of Whiston.

Applications have been made for Special Orders by the following authorities:—The Windsor Electrical Installation Co., Ltd., for the repeal of the New Windsor Electric Lighting Order, 1895, and part of the New Windsor (Extension) Order, 1920, for the cancellation, or amendment, of agreements between the New Windsor Corporation and the Company, and for authority to supply electricity in the borough of New Windsor, and the urban district of Eton; Mr. J. A. Purves, for the supply of electricity in the urban district of Bungay.

Stirling.—ELECTRICITY SUPPLY.—An application has been made by the War Office for a supply of electricity for Stirling Castle which is used as a barracks. According to the electrical engineer the cost of giving a supply by a feeder cable will be £980 and the probable revenue about £300. In addition to lighting, a large electric cooker may be installed. The electrical engineer is negotiating with the War Office regarding the matter.

Swansea.—WIRING OF SMALL HOUSES.—The Electricity Committee has adopted a report submitted by the borough electrical engineer (Mr. J. W. Burr) on the extension of the corporation's "free-wiring" scheme to property other than that owned by the Corporation. He proposed that the committee should extend the "free wiring" scheme to all properties having a ratable value not exceeding £20 per annum, providing that not less than ten houses are supplied from one service; that the consumers agree to pay 2d. extra per kWh for the first 50 kWh consumed per annum, for a given number of points (five), any additional points being allowed but a *pro rata* increase in the number of kWh to be paid at the higher rate to be made; ordinary meter rents to be charged; and the minimum consumption be ten kWh per point per annum.

Warwick.—POWER STATION FLOODED.—According to the daily Press, the recent heavy rainfall caused the River Avon to overflow. The Corporation power station was flooded and the electricity supply was cut off on January 2nd. The tramway service was also brought to a standstill.

Watford.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £10,669 in connection with the extension of the electricity supply to Bovingdon.

Wellington (Salop).—OBJECTION TO ORDER.—The Urban District Council has decided to raise objections to the application of the local Gas Company for an Order to supply electricity in the district on the grounds that the charges stated in the company's application are considered excessive, and that the Council holds an Order for the supply of electricity and is prepared to give a supply as soon as a bulk supply is available.

Wrexham.—LOAN.—The Town Council has applied for sanction to a loan of £12,000 for mains services, distribution feeders, underground boxes, switchgear, and transformers.

Tramway and Railway Notes.

Australia.—SYDNEY (N.S.W.).—According to the *Industrial Australian and Mining Standard*, the New South Wales Government has officially announced that the section of the Sydney city railway from the Central Railway station to St. James' station will be open for traffic in June of next year. The other extensions to Circular Quay, and thence along the western side of the city, are expected to be completed within five years to synchronise with the opening of the harbour bridge. It is proposed to push ahead with the work on the western side of the city before completing a section at a point near Bridge Street to Circular Quay. A start on the latter section, which is estimated to cost £200,000, will be made in about two years, when, it is considered, this section can be completed at the same time as the other sections. When the railway is finished, there will be five stations, namely, Museum, St. James', Quay, Wynyard and City. Later it is proposed to make further extensions. The eastern suburbs train will pass through St. James' station, and thence round the city to the City station. It is also proposed that at some future period the line shall be extended from the City station to North Strathfield. The idea is to give a service to Haberfield, Drummoyne, Hunter's Hill, and Ryde districts, lying midway between the Main Western suburban line, and the North Shore line.

Birmingham.—TRAMWAY IMPROVEMENTS.—The Corporation tramways department proposes to enlarge its tramcar service by purchasing 30 additional tramcars at an estimated cost of £75,000; and to build a new depôt to accommodate 105 cars at Selly Oak at a cost of £51,000.

Continental.—ITALY.—With a view to meeting the competition of North Sea ports, an agreement has been arrived at between the Transalpine Association and the railway companies concerned in Italian-German freight traffic for the development of the line between Venice and Munich. Contracts will shortly be signed for the electrification of the whole line on the Italian side, the German section between Munich and Kufstein having already been partly electrified. Italian engineers have started the electrification of the stretch from Brenner to Bozen; this will leave only the line from Bozen to Verona and from Verona to Venice (or from Trent to Venice) unelectrified. When the whole work has been completed, the time of the journey between Venice and Munich will be considerably shortened.—*Reuter's Trade Service* (Venice).

Japan.—RAILWAY ELECTRIFICATION.—The Minobu Railway's Ichikawa-Marutaki line is to be completed in about May, 1927, and will be opened to traffic a few months after that date. The line is to be electrified. The Marutaki-Fuji line of the railway, which has already been constructed, is also being electrified, and the work will be completed by about August, 1926. For the first-named line the necessary energy will be obtained from the Hayakawa Hydro-Electric Co., but it is reported that the company is considering the establishment of its own plant by harnessing the Fukushi, Tsuncha, and Fuji rivers. The scheme for the construction of an electric railway between Maita, Yokohama and to Misaki is progressing steadily; the cost is estimated at 13,000,000 yen.

Llandudno.—GREAT ORME TRAMWAY.—The *Electric Railway and Tramway Journal* reports that the Llandudno Urban District Council has decided not to exercise its option to purchase, in 1926, the undertaking of the Great Orme Tramway Co., which was opened 26 years ago. Proposals are on foot for the electrification of the tramway.

Salford.—TRAMWAY AGREEMENTS.—The Corporation Tramways Committee has decided to enter into an agreement with the Eccles Corporation with respect to the maintenance of the overhead electrical equipment of the Eccles tramway, for a term of 14 years from March 31st last. The Committee has recommended a scheme for the interchange of traffic with the Bury Corporation so as to permit of the through-running of Salford tramcars to the Bury market place and of the Bury Corporation tramcars to the Victoria Bridge terminus of the Salford system.

United States.—CINCINNATI.—According to the *Electric Railway Journal* submission of a bond issue to extend the rapid transit subway at Cincinnati, Ohio, into the centre of the city is being considered by the Rapid Transit Commission. A tentative estimate made by the engineer in charge of construction more than a year ago placed the cost of the proposed extension at $1,500,000, but that figure now is deemed inadequate because of higher cost of material and labour. The engineer has informed the Commission that the subway will be ready for the laying of the track as far as Norwood next spring, but that the extension in Oakley cannot be made unless additional funds are provided. It was announced that as soon as the subway was ready for operation the street railway would operate 'buses as feeders for the system.

RAILWAY ELECTRIFICATION.—According to *Electric Traction*, the proposed hydro-electric development at Lake Chelan, in connection with the electrification of the Great Northern Railway, work on which will commence as soon as plans are approved by the Federal Power Commission, is expected to result eventually in the electrification of the Great Northern line through the Cascades and for 400 miles eastward. The contract for the construction of the dam and plant has already been placed with the Washington Water Power Company.

Telegraph and Telephone Notes.

Belgium.—NEW TELEGRAPH CABLES.—The orders for the new cables, to which reference was made in this column last week, have been placed to the value of some 62,500,000 fr. with the Ateliers de Constructions Electriques de Charleroi, and with the Siemens & Halske Co., of Berlin, for the amount of 27,000,000 fr.

WIRELESS FOR FISHING BOATS.—In its report for the last financial year, the Société Ostendsche Reederij states that, as a result of experiments carried out by the Compagnie Internationale T.S.F. with wireless telephone apparatus capable of receiving and transmitting messages up to a distance of nearly 100 miles, it has been decided to equip the entire fleet of fishing vessels owned by the Company with such apparatus.

Empire Communication.—RUGBY STATION.—The high-power Government radio-telegraph station at Hilmorton, near Rugby, was opened for general traffic on January 1st. Its call sign is GBR and the wave-length is 18,000 metres, control being by land line from the Central Telegraph Office in London.

New Radio Services.—MARCONI AGREEMENT.—As a result of an agreement signed between Marconi's Wireless Telegraph Co., Ltd., and the Postmaster-General, on December 31st, the Company is now licensed to conduct services with Denmark, Sweden, Finland, Russia, Portugal, Jugo-Slavia, Bulgaria, Turkey, and Greece, and with all foreign countries outside Europe, in addition to present services. The Company hopes to establish "beam" services from England to Canada and South Africa in April, and India and Australia in August.

Storm Damage.—Following snow and ice before Christmas, recent gales and flood water have dislocated overhead lines of communication all over the country: On the Continent, too, the same conditions obtain; not for many years have storms wreaked such havoc among telegraph and telephone communications in France and Western Europe. Thirty-six large French towns have been totally isolated, while at one time 350 telephone lines to Paris were not working, Brittany being particularly affected.

Radio Notes.

India.—NEW COMPANY.—There is every prospect of a company being registered in January under the Indian Companies Act for the establishment of a broadcasting service in India, says the *Morning Post*. It was in March last that the Government of India announced its willingness to issue a licence to such a company for a period of ten years, and for the first five years of its licence the company was to have a monopoly of broadcasting. So far as can be ascertained, only one application was received for the broadcasting licence, and the Government has recently modified its conditions.

Irish Free State.—FIRST BROADCASTING STATION.—The first broadcasting station in the Free State at Dublin commenced operations on January 1st. It is owned by the Government and works on a 390-metre wave-length; its call sign is 2RN and its plant was supplied by the Marconi Co.

Licences.—STEADY INCREASE.—Since the Postmaster-General's first warning in August, 1925, that listeners who do not take out licences for their receiving sets run a risk of being prosecuted, more than 150,000 additional licences have been taken out, and there have been many prosecutions. According to the *Daily Mail*, the number of licence holders has increased as follows:—August, 1,423,000; September, 1,464,500; October, 1,509,520; November, 1,574,732.

PROSECUTIONS.—Tudor Laurence, of the Royal Aircraft Establishment, Farnborough, was fined £1 on December 31st for installing and working a two-valve set without a licence, and Frederick Blay, of North Kensington, was fined 15s. at West London Police Court on the same day, when he pleaded guilty. Three listeners living in Rotherhithe were recently fined at Tower Bridge for using crystal sets without licences, A. J. Jarvis, of Stratford, E., was fined £1, with £1 1s. costs, at West Ham on January 4th, and several other cases have been before the Courts.

Salvador.—NEW STATION.—The 500-watt broadcasting station which has been built by the Government Telegraph and Telephone Division was expected to commence operations at the end of 1925, says *Commerce Reports*. Its wave-length will be between 400 and 500 metres.

Siberia.—NEW STATION.—The Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Pa., U.S.A., has recently secured an order for a 20-kW broadcasting station for Vladivostock, Siberia.

Spain.—NEW STATION.—A contract has been entered into betwen the Government and the Compañia Ibérica de Telecommunicacion, of Madrid, for the erection of a broadcasting station at Málaga, the cost of which is estimated at between 50,000 and 70,000 pesetas. Although Málaga will not become a general distributing centre, the new station is expected to create a demand for radio equipment both in the adjoining provinces and in Spanish Morocco.—*Reuter's Trade Service* (Madrid).

Sweden.—NEW STATION.—According to *Commerce Reports*, during the past year over 100,000 receivers' licences have been issued, and it was expected that the figure would reach 120,000 before the close of 1925. The Royal Swedish Telegraph Administration has prepared a report on the radio situation, and has requested an appropriation of 1,050,000 crowns for the erection of a large broadcasting station to be located in the central part of Sweden. It is said that this station will broadcast on a 1,350-metre wave-length. Calculations show that approximately 2,000,000 persons live within a radius of 200 kilometres of the proposed site, and it is expected that the station will increase the number of receivers' licences issued by about 70,000.

Time Signals.—FRANCE.—Following the resolutions that were adopted at the International Time Commission at Cambridge in July, 1925, certain changes were made in the transmission of time signals from radio stations in France on January 1st. In May next another change will take place.

SPAIN.—The Radio Barcelona Co. proposes to establish a luminous time service by means of an electric lantern on one of the pylons which it has erected at Tibidabo, near Barcelona, to support the aerial recently installed for the new large station. In this way nearly all the province of Barcelona will be able to regulate its watches and clocks. The company is studying means of retransmitting the Eiffel Tower time.—*Reuter's Trade Service* (Madrid).

Transatlantic Tests.—The third annual transatlantic broadcasting tests will commence on Sunday night, January 24th. Canadian, American, Mexican, and Cuban stations will transmit from 3 to 4 a.m., G.m.t., every night throughout the week, following which British and Continental stations will transmit from 4 to 5 a.m., G.m.t.

United States.—RADIO INDUSTRY.—Mr. David Sarnoff, general manager of the Radio Corporation of America, in an address to the Boston Chamber of Commerce, said that statistics prepared by the Radio Corporation indicated that the business done by the radio industry in 1925 would aggregate approximately $350,000,000.—*Reuter's Trade Service* (Boston).

NEW STATION.—The Bound Brook station, the transmitting station of the Radio Corporation of America, was opened officially on January 1st, and, in connection therewith Daventry broadcast special greetings to America, which were picked up at Belfast (Maine) and relayed from there to all the associated American stations.

Accidents.—Following a breakdown early in December due to the aerial snapping under the weight of ice, the Daventry station of the British Broadcasting Co. has had five other mishaps, one of which was due to the interruption of power from the generators to the transmitter and another to a fault in the oscillator valve cooling-water system. The Birmingham station ceased operating for some time recently owing to a fire on the floor above the studio, while the London station has stopped transmitting for a few minutes on two occasions since Christmas. During the night of December 30th the smaller of the aerials on the Eiffel Tower, Paris, was carried away in a gale.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers and who may wish to tender for Army requirements of cables, electrical stores, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W., for Form 1, on which formal application for inclusion on the list of tenderers may be made. (See this issue.)

Australia.—MELBOURNE.—March 16th. Postmaster-General's Department. Battery-charging power board equipment.*

March 29th. State Electricity Commission. Transformers and auxiliary apparatus.*

Batley.—Installation of electric lighting at two West Ardsley branch stores of the Batley Co-operative Society, Ltd. Secretary.

Birmingham.—January 9th. Tramways Committee. 50 tramcar bodies. Forms of tender (£2) from Mr. A. Baker, general manager, Tramways Offices, Birmingham.

Blackpool.—January 23rd. Electricity Department. One 2,500-kVA phase and frequency changer. (January 1st.)

Bradford.—January 11th. Tramways Committee. Supply of electric trolley vehicles. Specifications from Mr. R. H. Wilkinson, general manager, Corporation Tramways, 7, Hall Ings, Bradford.

Croydon.—January 11th. Tramways Department. 12 sets of electrical equipment for tramcars. (January 1st.)

Dewsbury.—January 23rd. Town Council. Reciprocating electrically-driven sludge pumps with motors and electrical equipment for Mitchell Laithes sewage disposal works. Specification from Mr. H. Dearden, borough engineer, Town Hall.

Dundee.—January 15th. Harbour Trust. Electric lighting installation at New Wharf. Schedules from Mr. J. Hannay Thomson, general manager and engineer.

Eastbourne.—January 9th. Electricity Department. 12 months' supply of h.p. and l.p. paper-insulated cable. January 25th. One 2,500-kW turbo-alternator, with condensing plant and pipework, one water-tube boiler and economiser, feed heaters and piping, one water-cooling tower. (January 1st.)

Egypt.—CAIRO.—January 16th. Chief Electrical Engineer, P.W.M. Three passenger lifts at the Egyptian State Telephones and Telegraphs Building, Cairo.—*Reuter's Trade Service* (Cairo).

Chief Inspecting Engineer in London, Queen Annes Chambers, S.W. Supply of miscellaneous spares for electrical material, &c.—*Reuter's Trade Service* (Cairo).

Honley (near Huddersfield).—January 11th. Electrician's work at the premises, The Bridge, of Honley Industrial Equitable Co-operative Society, Ltd. Quantities from Mr. E. Heaps, secretary, Westgate.

Ilford.—The Electricity Committee has decided to invite quotations for an additional 1,000-kW La Cour converter and switchgear and a 500-kW rotary converter.

Ilkley.—January 20th. Electricity Department. Feeder cables, distribution cables, feeder pillars, and network boxes. (January 1st.)

Liverpool.—Corporation Waterworks. Pumping plant, consisting of a high-lift, electrically-driven, verticle-spindle centrifugal pump at the Dudlow Lane pumping station. Specification (2 guineas) from Mr. J. R. Davidson, water engineer, 55, Dale Street, Liverpool.

London.—SHOREDITCH.—January 27th. Electricity Department. One 50,000-lb. water-tube boiler, with economiser, forced and induced draught, &c.; one 10,000-kW turbo-alternator, with condenser, pumps, &c. (December 25th.)

BETHNAL GREEN.—January 19th. Board of Guardians. Three Lancashire boilers for the hospital, Cambridge Road. Specifications, &c., from Mr. C. F. Jones, clerk to the Guardians, Bishops Road, Bethnal Green, E.

METROPOLITAN ASYLUMS BOARD.—January 27th. Installation of electric lighting at the Darenth Colony, Dartford (approx. number of points, 2,300).

E.C. January 30th. Marryat & Place. 113,000 5-amp., 220-V, tumbler-type electric switches. (See this issue.)

LONDON COUNTY COUNCIL.—January 25th. 4,425 tons of standard steel girder tramway track rails, fishplates and fishbolts, and about 600 tons of conductor rails. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

Manchester.—January 12th. Tramways Committee. Steel girder tramway rails. Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

New Zealand.—WELLINGTON.—March 2nd. Public Works Department. Synchronous condenser and transformers for the Arapuni electric power scheme.*

30,000-V switch and protective apparatus for Lake Coleridge electric power supply.*

March 8th. New Zealand Government Railways. Two 25-h.p. variable-speed motors, one 125-kW motor-generator set and 17 400-V, 3-pole switches.*

DUNEDIN.—February 26th. Otago Harbour Board. Motors, control gear, and cable.*

Rumania.—BUCHAREST.—February 4th. Rumanian State Railways. Porcelain insulators, sleeves, and plates.*

Sheffield.—January 18th. Electric Supply Department. Erection of stores, ambulance room, on site of Neepsend generating station, Club Mill Lane. Particulars from Mr. S. E. Fedden, general manager and engineer.

South Africa.—JOHANNESBURG.—January 21st. Municipal Council. 106 current transformers.*

February 26th. Motor-driven air compressor, with electrical equipment.*

S.A. RAILWAYS AND HARBOURS. February 25th. Electrically-operated hoists for raising, &c., heavy locomotives, electrically-driven geared winches, &c.*

CAPE TOWN.—January 27th. Electricity Department. Oil-cooled transformers.*

Thurnscoe.—January 12th. West Riding Education Committee. Electric lighting installation at new school. Specifications from Education Department, County Hall, Wakefield.

Walthamstow.—January 27th. U.D.C. Electricity Department. Two water-tube boilers, mechanical stokers, economisers and pipework, &c. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bolton.—Education Committee. Accepted:—
Electric lighting installation at the new Devonshire Road Council Junior Mixed School.—James Morris.

Chorley.—Education Committee. Recommended:—
Electric lighting at school clinic.—Fisher & Co.

Hastings.—Electricity Committee. Recommended:—
H.p. switchboard (£460).—Ferguson, Pailin, Ltd.

Ilford.—Electricity Committee. Accepted:—
440 yd. .25 triple concentric cable (£330).—Hackbridge Cable Co., Ltd.

Tramways Committee. Recommended:—
200 tons of rails (£2,055); 200 pairs fishplates (£2,755).—Cargo Fleet Iron Co., Ltd.

India.—EASTERN BENGAL RAILWAY.—Accepted:—
Three 2-operator motor-generator electric arc-welding plants.—Alloy Welding Processes, Ltd.

Lamp Contracts.—The London and North-Eastern Railway Co. has placed contracts for the supply of train-lighting lamps with Edison Swan Electric Co., Ltd., and Metro-Vick Supplies, Ltd.

Contracts for 12 months' supply of "Mazda" electric lamps have been placed with the British Thomson-Houston Co., Ltd., by the London & N.E. Railway Co., the Dublin United Tramways, and the Aberdeen Line; the Siemens and English Electric Lamp Co., Ltd., has received a contract for the supply of vacuum and gasfilled lamps for one year from the Booth Steamship Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
No. 10 boiler unit (equipped for pulverised fuel firing).—Babcock and Wilcox, Ltd.; sub-contractors: Motors, Lancashire Dynamo and Motor Co., Ltd.; fans and grit catcher, Davidson & Co., Ltd.
(The plant includes the following sections:—Boiler (130,000 lb. per hour), superheater, economiser, air heater, combustion chamber with water-cooled walls, pulverisers and driers, draught plant, grit catcher and chimney, pipework, tools, and spares.)
A.c. motors for High Street depôt.—F. & A. Parkinson, Ltd.
Two 500-kW fully-automatic rotary converters for Burnage sub-station; two ditto for Blackley sub-station.—Harland Engineering Co., Ltd.
Electrical storage battery.—Tudor Accumulator Co., Ltd.

Education Committee. Accepted:—
Electric lighting, Burnage and St. Phillip's schools.—A. E. Sudlow & Co.

Tramways Committee. Accepted:—
Special trackwork.—Edgar Allen & Co., Ltd.; Hadfields, Ltd.; and Titan Trackwork Co., Ltd.
One steam meter.—Electro Flow Meter Co.
Belt sander.—Abur Machinery Co., Ltd.
Bosch stationary potential and lighting dynamos.—John Roberts.
Span-wire brackets.—John Spencer, Ltd.
Electric welding plant.—Equipment and Engineering Co., Ltd.
One 600-V "Erico" welder.—Forest City Electric Co., Ltd.

Preston.—Electricity Committee. Accepted:—
H.p. switchgear (£4,928).—Metropolitan-Vickers Electrical Co., Ltd.
Steam piping (£1,645).—Babcock & Wilcox, Ltd.
Materials for outdoor sub station (£238).—British Insulated Cabels, Ltd.

Sowerby Bridge.—U.D.C. Accepted:—
Electrician's work required in connection with the first batch of 20 scullery houses.—Oakley, Green & Wilson.

Sheffield.—The Electric Supply Committee has extended its contract with the British Electric Transformer Co. to include one oil-cooled 1,000-kVA Scott-connected transformer, one ditto, 500-kVA, two ditto, 250-kVA, and 10 ditto, 100-kVA, at a total cost of £3,069.

Salford.—Electricity Committee. Accepted:—
Supply of the undermentioned cable:—1,000 yd. .0025 sq. in. l.p. concentric paper-insulated, lead-covered cable (£108); 500 yd. .1 sq. in. ditto ditto (£117); 1,000 yd. .2 sq. in. ditto ditto (£368); 1,000 yd. .0025 sq. in. l.p. twin ditto ditto (£97); 500 yd. .01 sq. in. l.p. 3-core ditto ditto (£50); 500 yd. .0225 sq. in. ditto ditto (£59); 1,000 yd. .06 sq. in. ditto ditto (£212); 1,000 yd. .12, .06, .12 sq. in. ditto ditto (£308); 500 yd. .25, .25, .25, .12 sq. in. ditto ditto (£356); 500 yd. e.h.p. .1 sq. in. concentric paper-insulated, lead-covered cable (£116). Total, £1,792.—Nederlandsche Kabelfabriek (Holland).

Smethwick.—Education Committee. Accepted:—
Electric lighting installation at new secondary school (£1,095).—Henry Hope & Sons, Ltd.

Watford.—Electricity Committee. Recommended:—
5,000-V turbo-alternator (£22,000).—Brush Electrical Engineering Co., Ltd.
Two boilers, superheaters, &c. (£11,000).—Vickers, Ltd.

York.—FOREIGN ELECTRICITY PLANT.—At the meeting of the City Council on Monday last, Ald. Wragge moved that the decision of the Council to purchase a 6,000-kW turbo-alternator for £19,000 from Oerlikon, Ltd., be rescinded. After considerable discussion the motion was defeated by 24 votes to 8.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

KRYPTOL high-resistance powder.
Imitation coal, as used in electrical fires.
BILT-RITE American electric drills. (British agent's name wanted.)
Plaster indirect lighting fittings.

Reviews.

The Principles of Sound Signalling. By MORRIS D. HART, M.Sc., D.I.C., A.M.I.E.E., and W. WHATELY SMITH, M.A., M.Sc. Pp. 140; 14 figs. London: Constable & Co., Ltd. Price 12s. 6d. net.

In this work the authors deal with the production, transmission, and reception of sound on a purely scientific basis, bringing together in a convenient form the results of experimental and analytical research, some of which have been previously published elsewhere. First discussing the efficiencies of a system under the three heads above-mentioned, they point out that under the conditions obtaining in practice it is preferable to use a "figure of merit" for the performance of the system, and show how it assists the engineer in comparing and improving the apparatus employed. Commencing with reception, they proceed to consider the appliances available for the detection and intensification of sound waves; dealing with transmission, they reprint a paper from the *Proceedings* of the Royal Society, in which experiments with the hot-wire microphone were described and fully discussed, leading to the conclusion that "one of the essentials for the efficient production of sound is the avoidance, as far as possible, of a high intensity at any point within the system." In the following chapter the influence of the humidity and temperature of the atmosphere on transmission is briefly described, after which two chapters are devoted to the conditions prevailing at the source and to the apparatus available for sound production, of which the centrifugal siren is said to meet the requirements of theory most satisfactorily. Finally the whole problem is briefly reviewed in the light of the investigations described. Five appendices deal with specific aspects of the subject. The work is suitable for the use of those engaged in research, to whom it will be of great value, going far towards placing this very difficult subject on a basis of precision and clarity.

A Practical Treatise on Fourier's Theorem and Harmonic Analysis for Physicists and Engineers. By ALBERT EAGLE, B.Sc., A.R.C.Sc. Pp. xiv + 178; figs. 25. London: Longmans, Green & Co. Price 9s. net.

This book, written primarily for physicists and engineers, constitutes an endeavour "to give a fairly complete account of the practical method of analysing any given curve or set of observations into its harmonic constituents, if it be a periodic function, and of detecting any periodic component in it if it is not a periodic function," and we think we may safely say that the author has succeeded in this. It is written within the bounds of the elements of trigonometry and the calculus and an introductory chapter is presented on imaginary quantities, and a few theorems on the integrals and sums of trigonometric expressions, in order to clinch the matter. We think the author would have been better advised to use the modern j for the symbolic operator instead of i, particularly as the latter is now the accepted symbol for current in electrical engineering theory. Chapter I deals with periodic functions in general, which for the purposes of the practical mathematician, the author divides up into what he terms (*a*) analytic or natural functions, (*b*) artificial functions, and (*c*) empirical functions; the treatment is extended to cover four special classes of periodic functions, namely, sine-harmonic, cosine-harmonic, odd-harmonic and bi-symmetric functions. Chapter II opens with the statement of Fourier's Theorem and proceeds to a simplification of it for the four special classes enumerated above, from which the names given to the special classes are evident. Some examples of applications to electrical engineering theory are given, these embracing studies of the terminal voltage of a three-phase generator, the voltage wave form of an alternator of given field form, the R.M.S. value of a periodic curve and the form factor. We should like to have seen more similar examples which would, we are convinced, have been particularly interesting and useful to the electrical designing engineer. Chapter III treats of the representation of artificial functions by Fourier's series or more briefly and colloquially of harmonic analysis. This chapter first works out seven problems on the harmonic analysis of different even and odd functions, passing on to a short treatment of the differentiation of a Fourier's series and thence to a study of five further problems in wave form analysis; finally it deals with the problem of obtaining a general formula for the Fourier constants in terms of the discontinuities of a periodic function.

Chapter IV deals with the representation of periodic analytic functions by Fourier's series, and three typical problems upon this are worked out. An example is worked through in detail dealing with the direct summation of Fourier's series. Chapter V discusses the representation of empirical functions by Fourier's series, the first part being devoted to a study of the simplest Fourier series of a curve passing through 2p points per period. The author then proceeds to consider the construction of schedules which facilitate the determination of the harmonic analysis, and three sets of representative schedules are given. A graphical method of harmonic analysis is next given, while subsequently the chapter deals with the error of harmonic analysis, the determination of the amplitude of any selected harmonic, a simple method of harmonic analysis, a new method of harmonic analysis, and finally, interpolation formulæ for periodic functions. The theory of Fourier's series is described in detail in Chapter VI which, the author points out, may be entirely neglected by those whose interest in the subject is purely practical, but we think the serious student would make a mistake in doing this. The chapter

deals with one or two theorems on the convergence of infinite series, the relation between the Fourier co-efficient and the properties of a function, the convergency of a Fourier series and proof of Fourier's theorem by direct summation of the series.

Chapter VII, which is intended for the student of physics, deals with Fourier's integral theorem, which is first worked out in detail and which is subsequently shown to hold good provided the integrals are convergent. The theorem is shown as applied to odd and even functions, and one or two examples in physics are given of its applications.

Chapter VIII indicates the procedure to be adopted for the search for periodicities in observed data which is not periodic, and a simple way of applying the method recommended in practice is given. The treatise concludes with a brief historical survey of the subject in Chapter IX. The volume can well be recommended to mathematical students and to engineers mathematically inclined, but in a future edition we should like to see more attention devoted to graphical and tabular methods which would permit the average designing electrical engineer to obtain the desired results in a minimum amount of time.

Dynamo-Electric Machinery. By ERICH HAUSMANN, Sc.D. Pp. viii + 645; figs. 447. London: Crosby Lockwood and Son. Price 21s. net.

Professor Hausmann's book supplants Sheldon's D.C. Machines and A.C. Machines, published first over 20 years ago. As students we disliked these books. The present attempt to embody in one volume of some 600 pages "The Theory, Construction and Operation of Direct and Alternating Current Machines" is a much better effort. Text books such as this, intended for use in technical educational institutions, must be considered and judged by their value to students. It is difficult to envisage any one type of student for whom the method of treatment adopted here would be considered satisfactory. For the beginner, the space given to electrical laws and facts is inadequate, extending as it does to one short chapter of 23 pages. Magnetic laws and facts set out in the next chapter receive the same scanty treatment. The sections on structural elements of a dynamo then introduce direct-current machines, but the elementary student cannot be brought up to this stage on these summaries of electrical theory; while for the more advanced man, who has a good knowledge of this groundwork, they are unnecessary in a treatise on dynamo-electric machinery. The section of the book dealing with direct-current machines comprises chapters on armatures, field magnets, armature reaction and commutation, generators and motors. The characteristics and applications of the several types are adequately discussed, but some account should surely have been included of machine testing, even if descriptions of car-lighting equipments, automobile motors and many of the rather meaningless half-tone block illustrations had perforce to be omitted. The chapters on alternating-current theory carry the reader rather rapidly from the consideration of the production of a sine-wave, e.m.f., alternating current, power, &c., to the calculation of instantaneous current values in reactive circuits, the natural frequency of damped circuits and harmonic wave analysis. The mathematical equipment of the student for whom the greater part of the book would seem to be designed is likely to be too undeveloped for a proper appreciation of the subject matter here. A simple exposition of polyphase working, the relationships between phase and line values of voltage and current, together with polyphase power measurement is reserved for inclusion in the chapter on alternators, where it is interpolated between sections on wave shape and the rating of alternators. A satisfactory chapter is devoted to transformers, which gives their theory, method of testing, modern constructional methods and circuit connections. This chapter, however, should have come after and not before two-phase and three-phase working had been explained. Alternator construction, voltage regulation and its pre-determination, with a short account of the conditions of parallel running, are contained in one chapter, while that following is deemed sufficient for the disposal of all types of alternating-current motors. Herein induction motors are accorded a fairly liberal treatment, which includes explanations of the circle diagram and its experimental determination. The final chapter of 50 pages is little more than a summary of letter-press, diagrams and photographs of dynamotors, motor-generators, balancers, boosters, rotary converters, mercury vapour and thermionic valve rectifiers. A feature to be commended here, as in other American books, is the provision at the end of every chapter of a number of appropriate numerical problems. If the answers had also been supplied, the usefulness of these questions to the student relying on his own reading would have been increased. The book contains much valuable and advanced information, but it has scarcely the arrangement or completeness of a text-book.

Volta Centenary.—An international electro-technical congress, which will be attended by electrical engineers from all countries, will be held at Como in 1927 to commemorate the first centenary of the death of Alessandro Volta, the physicist, who died at Como on March 5th, 1827. Count Alessandro Volta (1745-1827), the Italian physicist, was born at Como, and afterwards became Professor of Physics there. He made many important discoveries in electricity. He produced the first voltaic battery, and his name is commemorated in this invention.

Forthcoming Events.

Society of Engineers.—Friday, January 8th. At the Queen's Hotel, Birmingham. At 7.30 p.m. Paper on "The Research Factor in Cable Making," by Capt. P. Dunsheath.

Junior Institution of Engineers.—Friday, January 8th. At 39, Victoria Street, S.W. Paper, "Notes on Salesmanship," by Mr. A. J. Simpson.

Institution of Electrical Engineers.—Monday, January 11th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Informal meeting. Discussion on "The Electrical Installation in the Rockefeller Building, University College," to be opened by Mr. W. C. Clinton.

(North-Eastern Centre).—Monday, January 11th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Ordinary meeting.

(North-Midland Centre).—Tuesday, January 12th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Ordinary meeting.

(Scottish Centre).—Tuesday, January 12th. At the North British Station Hotel, Edinburgh. At 7 p.m. Paper on "Electricity Supply Tariffs," by Mr. H. M. Sayers.

(South-Midland Centre).—Wednesday, January 13th. At the Grand Hotel, Birmingham. Annual dinner.

(Western Centre).—Monday, January 11th. At the Hotel Metropole, Swansea. Address by the president, Mr. R. A. Chattock, and annual dinner.

(Dundee Sub-Centre).—Thursday, January 14th. At University College, Dundee. At 7.30 p.m. Paper on "Atmospheric Electricity," by Mr. W. M. Mackay.

(Scottish Students' Section).—Friday, January 8th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "Earthing of Systems," by Mr. S. A. Knight.

(North-Western Centre, Students' Section).—Tuesday, January 12th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "Thermal Protective Devices," by Mr. E. C. Scott.

(South-Midland Students' Section).—Monday, January 11th. At the Temperance Hall, Temple Street, Birmingham. At 7 p.m. Exhibition of films.

Glasgow Corporation Electricity Department Engineering Society.—Monday, January 11th. At the Welfare Hall, St. Andrew's Cross Works. At 7.45 p.m. Paper on "Commutation," by Mr. P. Hunter.

Association of Mining Electrical Engineers (London Branch).—Tuesday, January 12th. At the Engineers' Club, Coventry Street. At 6.30 p.m. Paper on "Rescue Apparatus for Mines," including demonstration of certain apparatus, by Messrs. Siebe Gorman, Ltd.

(South Wales Branch).—Saturday, January 16th. At Cardiff. Annual dinner. Visit by the president, Mr. Theodore Stretton.

(Western District Sub-Branch).—Saturday, January 9th. At 62, Wind Street, Swansea. Paper on "Electrical Costing Applied to Collieries," by Mr. C. E. Yates.

Institution of Civil Engineers.—Wednesday, January 13th. At the Institution, Great George Street, S.W. At 6 p.m. Informal meeting. Discussion on "The Testing and Examination of Materials for Railway Construction," to be opened by Mr. F. J. Paice.

Institution of Engineers-in-Charge.—Wednesday, January 13th. At St. Bride Institute, Bride Lane, E.C. At 8 p.m. Paper on "Industrial Economics," by Mr. J. W. L. Rowe.

Institution of Engineering Inspection.—Friday, January 15th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Characteristics of Electric Lamps in Relation to their Testing," by Messrs. B. P. Dudding and G. T. Winch.

Institution of Mechanical Engineers.—Friday, January 15th. At the Institution, Storey's Gate, S.W. At 7 p.m. Discussion on "Novelties at the 1925 Engineering Exhibition."

Manchester Electro-Harmonic Society.—Friday, January 15th. At the Albion Hotel, Piccadilly, Manchester. Concert.

Electrical Development Association Conferences.—Friday, January 15th. At Caxton Hall, Westminster, S.W. Lecture on "Suggestion and Auto-Suggestion in Salesmanship," by Mr. Ll. B. Atkinson.

Electrical Trades Commercial Travellers' Association.—Friday, January 15th. At E.L.M.A. Lighting Bureau, 15, Savoy Street, W.C.2. At 7 p.m. Lecture, "Demonstration of Lighting," by Mr. W. E. Bush.

Notes.

The Batti-Wallahs' Society.—Sir Hugo Hirst, Bart., will address the Batti-Wallahs at their next luncheon, which is to be held at the Hotel Cecil on January 27th.

N.A.S.E. Economic Premiums.—The two cash prizes offered by Mr. F. Gill, M.Inst.C.E., M.I.E.E., president of the National Association of Supervising Electricians, for the two best papers dealing with economic questions (ELECTRICAL REVIEW, October 9th) have been awarded as follows:—Mr. C. W. Bullock, London, first prize £10, for a paper on "Industrial Relations" (between employer and employed); Mr. E. J. Davies, Nantyglo, Mon., second prize, £5, for a paper on "Economics in the Electrical Industry."

Boiler Explosion Report.—We have received a copy of the official report of the preliminary inquiry into an explosion which occurred in a water-tube boiler at the Lots Road power house, Chelsea, on September 19th last. The boiler was made by Messrs. Babcock & Wilcox. One of the cap-retaining clamps in a header at the front of the boiler was fractured and the cap forced off. The material at the fracture is said to have had an unsound appearance, and probably was in a fatigued state. The management is recommended to replace all the original or worn clamps by others of stronger form or section.

Fatalities.—It is reported that Horace Newcombe, a chauffeur, of West Bridgford, was killed recently by an electric shock. He was using a hand lamp while repairing a car, when the bulb broke and the current passed through his body. Artificial respiration was resorted to without success.

On January 1st, Alfred Gains, a porter, was cleaning a gutter upon the roof of a building at the Sutton (Southern Railway) station when he came into contact with a 6,000-V cable and was instantly killed. At an inquest held on January 5th, a verdict of "Accidentally electrocuted" was returned.

(*Continued on page 63.*)

The Comines Power Station.

A French Central Station using Pulverised Fuel.

By THEODORE RICH.

WHEN the war was over the bulk of the French people, both masters and men, recognised that the only method by which the ravages of war could be eliminated and the five years' loss of economic production could be made good was by enterprise and hard work. Although on the morrow of the Armistice the politicians of France dealt a blow at reconstruction by enacting an eight-hour law, yet apart from the return of the Briey iron ore district, the development of business in coal, iron and general industry has been in many ways remarkable.

In anticipation that the "searching the pockets" of the late enemy would be something more than the optimistic make-believe of professional politicians, very large sums of borrowed money were spent in the devastated areas, and the financial embarrassments of the present day are to a large extent due to the non-fulfilment of such pledges; all the same, the condition of the exchange is no criterion of the relative state of the national assets. A great deal of solid work has been done in the North-East, West, and South of France that will doubtless bear good fruit in the near future.

Power Requirements.

The district within, say, 15 miles of Lille, which includes Roubaix and Tourcoing, forms the Lancashire of France as far as textile industries are concerned; the atmosphere is somewhat similar, and British mill-wrights have left their stamp on the design of many works in the neighbourhood. Some of those who were in khaki in 1918 and saw the ruined buildings would be astonished at the way in which many things have been put right again, although mounds of brickwork covered with weeds, where houses used to be, can still be seen in the streets of many towns.

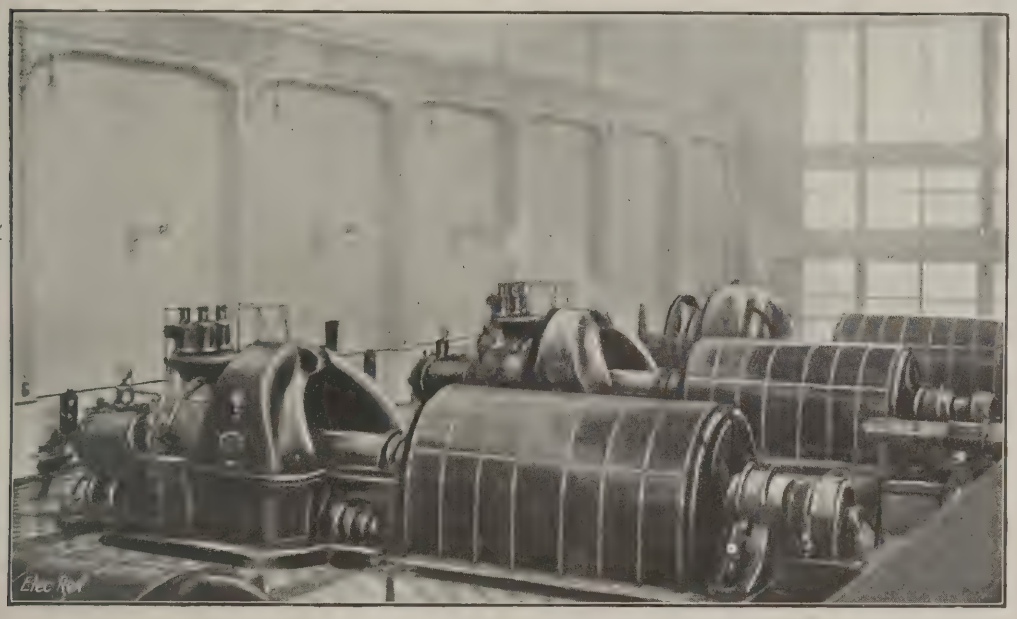


Fig. 1.—Interior of Turbine House, Comines Power Station.



Fig. 2.—Transporters and Coal Dump.



Fig. 3.—Front Elevation of Station.

Before the war a company, the Energie Electrique du Nord, supplied power, mainly in bulk, to various lighting, power, and tramway undertakings, and to some individual power consumers in a district stretching from the eastern and northern sides of Lille to the Belgian border behind Roubaix, and in some districts more to the west, from a power station of 40,000 kW at Wasquehal, near the centre of the district. This station is situated alongside a canal, and therefore the loss and inconvenience due to the use of cooling towers for the condensing water had to be contended with. In 1918 some of the plant was taken away by the Germans, and some of the remainder was wilfully damaged; it was, however, quickly put in order.

A New Power Station.

Not long after the Armistice it was decided to put down a high-power station to meet the increasing needs of the neighbourhood, and a convenient site at Comines was decided on because of its facilities for coal transport and for condensing water; it is situated about 10 miles from Lille and about the same distance from Roubaix, and within easy distance of Halluin on one side and Armentières on the other. The whole lay-out of the power station is based upon the use of generating sets of 25,000 kW, as being an all-round useful size of plant. The station is placed alongside a navigable river, the Lys, a tributary of the Scheldt, the river at that point forming the frontier with Belgium. Coal

is obtainable in the neighbourhood by rail or by barge, and also from Belgium or Germany, and from England *via* Calais, Dunkirk, or Antwerp if required. The basin of the river Lys, when added to that of its tributary the Deule, covers several hundred square miles, and the flow is assisted by the discharge from several descending canals, the water passing being at the minimum over 5 cubic metres per second. The site, which is practically level, lies about 1 metre above flood mark. The subsoil consists of clay running into brick earth; it is not suitable for taking heavy loads, and those parts of the station which carry great weights, for instance, the boiler houses and the turbine foundations, are supported on piles 7 to 8 metres long, many of these being made of armoured concrete.

The original lay-out of the station was planned to allow of extensions, especially with a view to the convenient location of condensing-water conduits. The turbine-house plan is perpendicular to the river, space being left so that when the power demands exceed the cooling capacity of the river flow, cooling towers can be put down between the turbine house and the pump house on the bank. There are two boiler houses; in the original installation there were ten boilers in one house, each with 1,000 square metres (10,760 sq. ft.) of heating surface, five boilers sufficing for each 25,000-kW turbine unit.

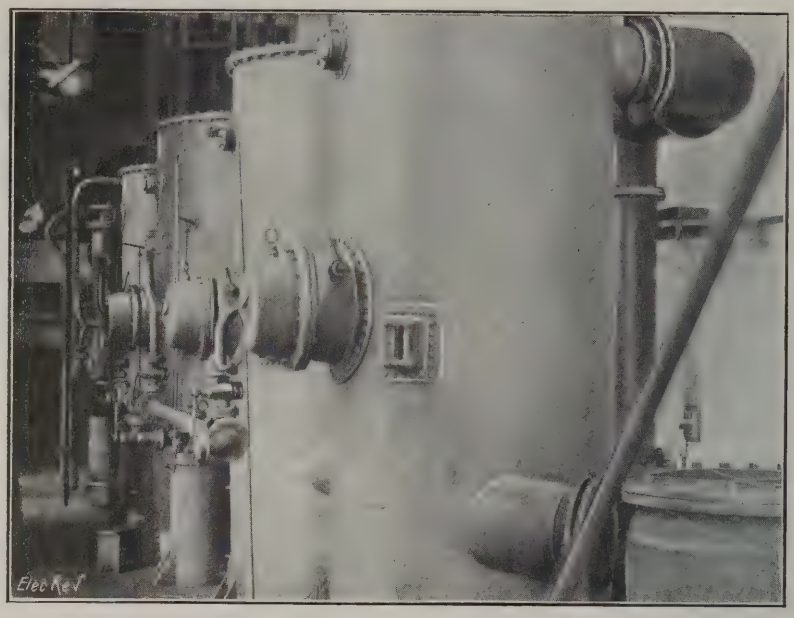


Fig. 6.—Kestner Evaporators.

In 1924 a new boiler house was built, in which two boilers have been installed up to date. The station supplies power by means of aerial lines along two main 45,000-volt trunk routes to two main disconnecting stations, one on the outskirts of Lille at La Madeleine and the other located between Roubaix and Tourcoing; in each case the final section, inside populated areas to the step-down sub-stations, consists of balanced single-core unarmoured cables. At the two main step-down stations the pressure is reduced to 10,500 volts; there are also some local aerial distributing lines at this pressure radiating from the Comines station. From the sub-stations 10,000-volt cables connect to the various bulk distributors and consumers, and connection is made to the original station at Wasquehal, so that the load can be sectionalised as desirable to suit the needs of the moment; in case of emergency such auxiliaries at Comines as are electrically driven could be supplied with current from this other station. Some details of the cable system will be given later.



Fig. 4.—Belt Conveyor in Roof between Economisers.



Fig. 7.—Pulverised Coal Feeders.

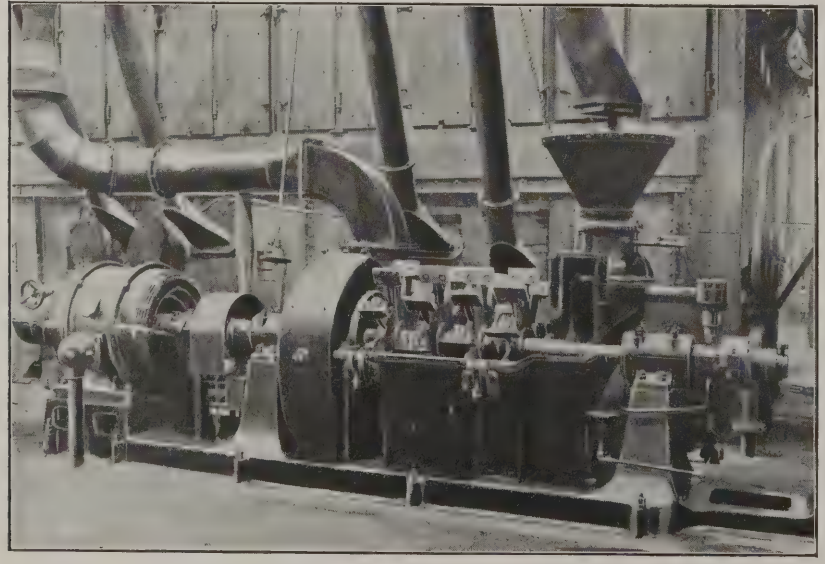


Fig. 5.—Pulveriser, Open.

The Buildings.

Armoured concrete has been used very largely in the construction of the buildings, and also for the coal bins over the boiler house. As is usual on the Continent, the buildings are roomy; there is ample space round the station, and further, owing to the facilities for the removal of ash, no space is necessary for ash dumping. The building for the transformers and switchgear takes up more floor space than the turbine house. The switchgear is of the conventional oil-tank type, the bus-

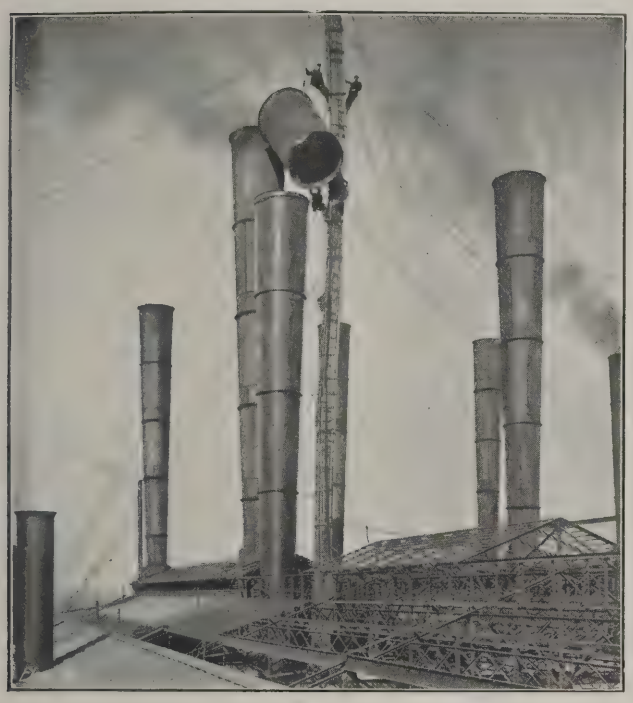


Fig. 8.—Erection of Prat Chimney in Progress.

bars and internal connections being largely of bare strip.

The station was at first equipped with three generating sets of 25,000 kW each, one of which was considered

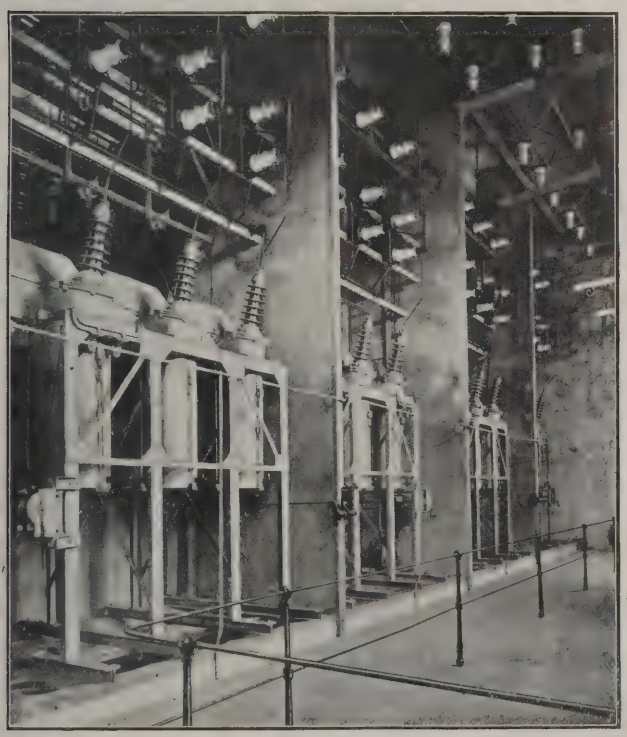


Fig. 9.—Main Oil Switches.

as reserve; the load, however, increased so rapidly that extensions were taken in hand in 1924, and a further set has been added in a lengthened turbine house, space being provided also for a fifth. At the time when the station was originally designed, some classes of electrical plant were difficult to obtain within the desired time for delivery, and this factor had some influence especially on the auxiliaries. Power stations as a rule are not beautiful, but the use of armoured concrete for the walls and the adoption of bold lines has in this case given the structure an appearance consistent with its object, namely, the supply of power; the buildings, as shown in fig. 3, despite the multiple chimneys, do not look so "tin-canny" as some other modern examples.

In order to deal more fully with certain features, the technical details will be given somewhat out of the usual sequence.

The 25,000-kW generating sets are arranged crossways in the turbine house at 13 metres (42 ft. 8 in.)

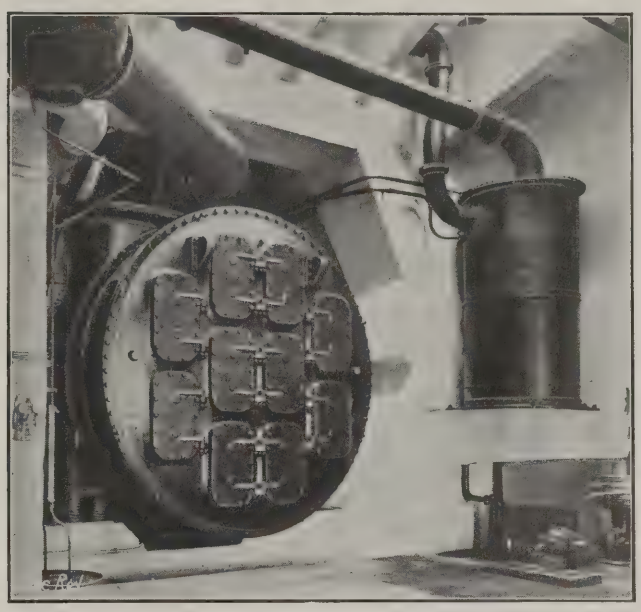


Fig. 10.—Condenser.

centres (fig. 1). They are of the Schneider-Zoelley type, running at 1,500 r.p.m. The steam end is arranged for

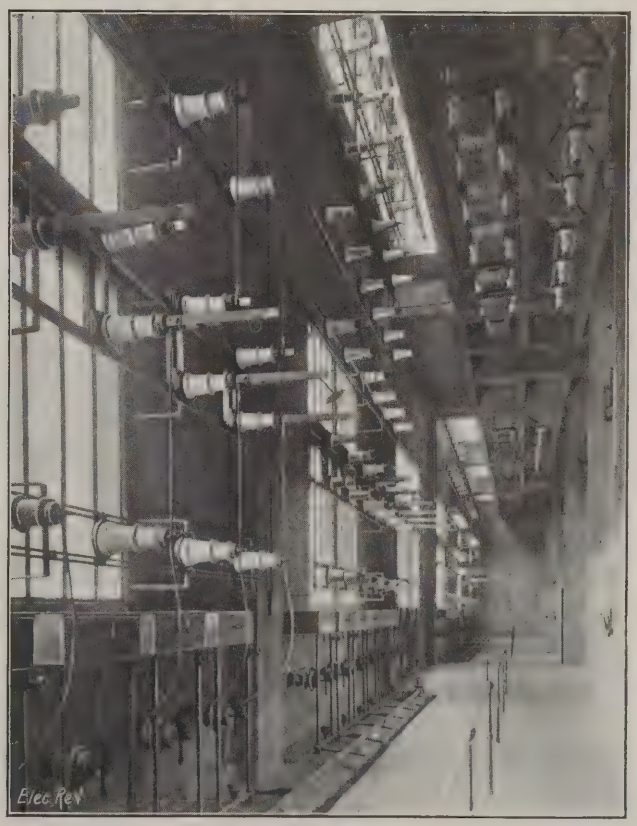


Fig. 11.—Section Links.

an effective pressure of 18 kg. per sq. cm. (about 260 lb. per sq. in.) at 350 deg. C. (660 F.) total temperature. The alternators are wound for 10,500 volts across phases; they are designed to give the normal output at a power factor of 0.8, with a rapidly falling characteristic so that they will stand a short circuit at full pres-

sure without injury. An exciter at 250 volts is coupled to each set. There is also a 160-kW asynchronous motor-generator set wound for 220 volts on the a.c. side, which acts as a reserve exciter for any of the generating sets. The cooling air for the alternators passes through water-jet filters, and is discharged under the boilers. The turbine house, which has a span of 24 metres (80 ft.), is served by an electrically-driven (220-volt d.c.) overhead traveller with a 60-ton main lift, and an auxiliary lift for dealing with weights up to 10 tons.

The condensers are of the Delas type, with their axes placed at right angles to the turbine shafts; the circulating water is delivered through sluice valves from two armoured concrete condensing pressure mains, one on each side, the discharge being into a rectangular conduit running lengthways beneath the turbine house under the axis of each condenser body. The reasons for this construction will be given later.

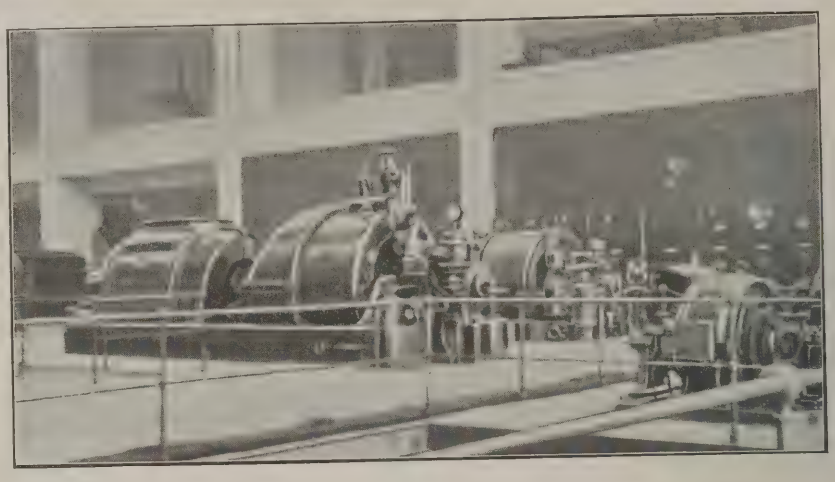


Fig. 14.—Auxiliary Turbo-Generators.

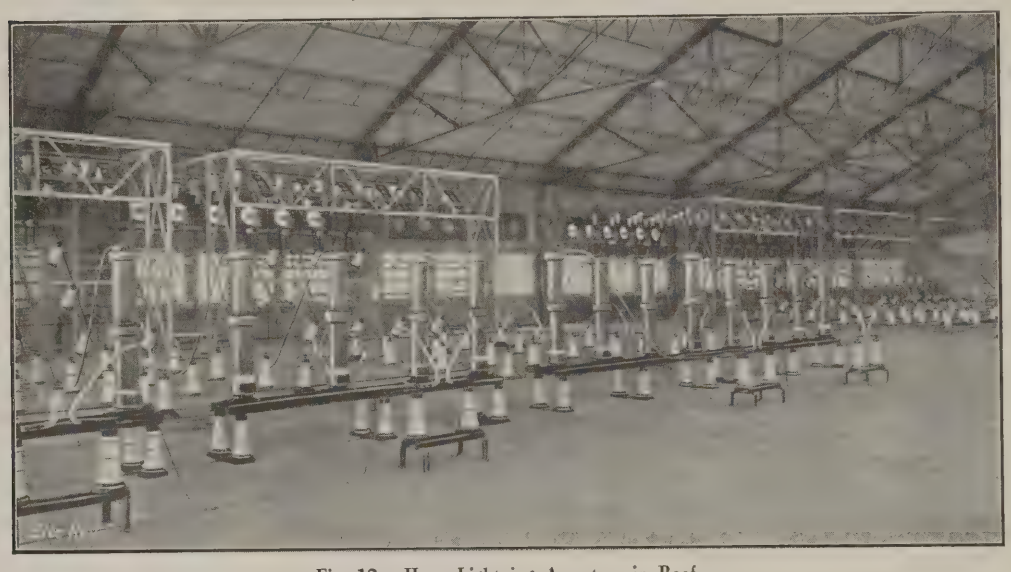


Fig. 12.—Horn Lightning Arresters in Roof.

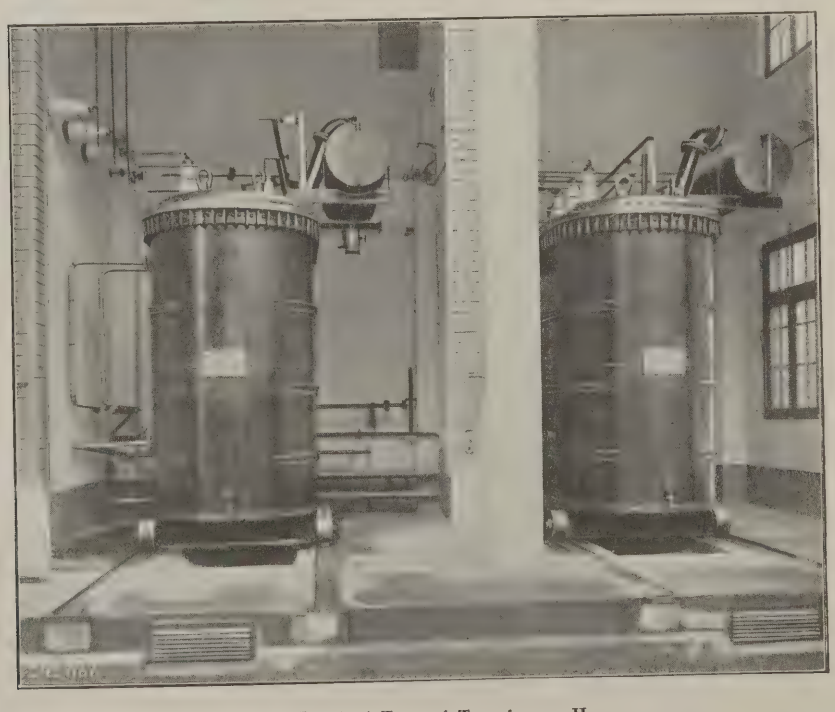


Fig. 13.—Standard Type of Transformer House.

Among the features of special interest at this station are the coal- and ash-handling arrangements, the use of powdered fuel on some of the boilers, the Kestner distillers, the circulating water system, and the arrangement of the switchgear.

The coal as a rule comes from a number of French collieries by rail or barge; each consignment is analysed, and after unloading is dumped in heaps according to analysis. It is about 15 to 16 per cent. volatile, and contains up to about 25 per cent. ash, being delivered unwashed; it has a heating value of 6,200 to 6,500 calories per kg. (ave. 11,500 B.th.u. per lb.). For the unloading, storage, and selection of the coal, three electrically-driven transformers are used with overhanging arms, 27.5 metres (90 ft.) total length, each fitted with a grab of 1.8 metres capacity (fig. 2). One of these is used for unloading barges and the other two for dealing with coal coming by rail. All three are used also for drawing coal from the dump. The transporter motors are d.c., 220 volts.

To deal with water-borne coal, a dock was constructed 85 metres long, 22 metres wide, and 3.25 metres deep; it is large enough to hold three 250-ton barges. The dock walls were made with ribbed armoured concrete slabs on the "Ravier" system, forming sheet piling, driven by means of a pile driver. The barges can be unloaded at the rate of 60 tons per hour.

The coal which comes by rail is delivered by the Nord Railway; the trucks are shunted, by means of a 120-h.p. 4-wheeled petrol-electric locomotive, into convenient positions alongside the coal dumps, three of which are arranged parallel to the dock. The coal is picked up out of the trucks by means of grabs, and any coal which remains in the corners of the trucks is shovelled or swept into pits, from which it is lifted later by the same grabs. In addition to the three transporters, there is a self-propelling electric jib crane running on railway tracks with

a radius of 8 metres (26 ft.), with a grab of 1 ton capacity, but which will lift 2½ tons as an ordinary crane when used without the grab.

Coal Mixing.

There are two types of stokers used—chain-grate and pulverisers; the different qualities of coal in stock are mixed in such proportions as experience shows to be most advantageous for each type of stoker. The coal required for consumption is lifted by the transporter grabs or by the crane grab and discharged into three self-propelled hoppers, which can be moved in a direction parallel with the coal dump sidings. Each hopper has a capacity of 40 tons, and its mouth is protected by steel grid bars placed 150 mm. (6 in.) apart to stop any large lumps; by means of a vibrating feeder, worked by a 15-h.p. enclosed motor, the discharge from each hopper can be regulated.

The hoppers discharge on to a belt conveyor 155 metres long, driven also by a 15-h.p. enclosed motor. By regulating the feed of the three hoppers on to the same belt, any desired mixture from any selected heaps can be obtained at will. The belt of the conveyor is 700 mm. wide (27½ in.), and its capacity is 80 tons per hour; on its way it passes over a Herrick integrating weighing machine. The coal, whether for the chain-grates or for the pulverisers, passes through a breaker driven by a 20-h.p. motor, which reduces it to pieces not larger than 30 mm. (1.2 in.) diameter; it is then delivered into the boot of one of two bucket elevators, which raises it to a level above the storage bins over the boiler house; one of these elevators is kept in reserve. The elevator works in a lattice-work tower (fig. 2), and delivers the coal on to a horizontal belt, with a capacity of 45 tons an hour; by means of a throw-off gear, which can be seen in fig. 4, the coal is delivered into any bin desired. The economisers can be seen to the right and left in the same illustration.

The transporters, the jib crane, and the crushers were supplied by the Société des Appareils de Levage, of Paris, and the belt conveyors, portable hoppers, and elevators by the Société des Transporteurs Mécaniques.

Ash Discharge.

The disposal of ash is a much more difficult matter than appears at first sight; ash is nasty stuff to deal with, it gets into bearings, when hot it tends to distort metal buckets or conveyor parts into all sorts of shapes, and at times it is corrosive. Under some conditions it is a great question how far elaborate ash-handling gear will pay for itself after allowing for maintenance.

At Comines, as at some other French power stations, the simplest appliances are used. The ashes from the chain-grate stokers fall into hoppers, and are emptied into small tip trucks on 60-cm. (2-ft.) gauge rails; the trucks are made up into trains and are hauled by an accumulator locomotive into a quenching shed, where water is turned on to jets on the top and sides of the trucks, actuated by an electrically-driven pump, and effectually cools the trucks and quenches the contents. The train is then hauled on to the wharf, where the ashes are tipped into barges; they are sold to builders and contractors for blockmaking, path-filling, &c., by the barge load at 3 fr. a ton, the cost of ash removal from boiler shoots to barges being about 50 centimes a ton. The ash dust which comes down from the pulveriser furnaces falls through a water-cooled outlet into a trough which is sluiced out from time to time. The amount of dust that comes down is compartively small, and the balance must of necessity go into the atmosphere in the form of very fine powder; as compared with sticky smoke, however, it is relatively unobjectionable.

(*To be concluded.*)

One-Man Car Report.—According to the *Electric Railway Journal* the report of the Railroad Commission on a one-man car accident on the lines of the Milwaukee Electric Railway and Light Co., showed that the number of accidents on one-man cars in Milwaukee was less than on two-man cars. The Commission found that the injuries sustained by the passenger in the case in question were due largely to a panic among the passengers.

Notes.

(*Continued from page 58*).

Appointments Vacant.—Linesman (77s. 5d.), for the Wolverhampton Corporation electricity department. Temporary overhead line assistant for the Worcester City Electricity Works. Meter reader and fixer for the Borough of Hornsey Electricity Department. Assistant clerk (£149) for the Beckenham U.D.C. Electricity Department. (See our advertisement pages to-day.)

The Engineer and Civilisation.—In his presidential address to the American Society of Mechanical Engineers, last month, Prof. W. F. Durand, of Stanford University, traced the history of the engineer from the skilled arrow-head maker of the stone age up to his successor of to-day, and discussed the place of the engineer and of engineering societies in the fabric of civilisation. He concluded:—

To sum up the whole matter, the engineer, either as an individual or as a collective type, is simply a link in the chain of human progress—a chain the links of which, in one form or another, run back into a past removed from our own time by tens of thousands of years, to go to no higher figures. With the trend of human progress as it now is, he seems, moreover, to be a very necessary link. He has taken upon himself the peculiar function of developing and translating into use for the needs of civilisation the constructive materials of the earth and the inorganic energies of nature, and in connection with the exercise of such function he has acquired peculiar and weighty duties and responsibilities.

There are naturally the duties of self-development and improvement, both individually and collectively, as organisations such as our own. This is the duty so well inculcated by the scriptural parable of the talents. Likewise there are the duties of friendship and of co-operation for the realisation of larger ends, and, again, both individually and collectively, as organisations.

And then it is peculiarly the duty of the engineer to see that, so far as in him may lie, these stores of nature, of which he is the custodian, are used frugally, with due regard to their limited supply, and having in mind the needs of future generations. Again, it is his duty to leave behind him some definite increment to that great store of knowledge through which we are able to enter into partnership with nature, and only by means of which we may hope more effectively to align ourselves with her laws and thus maintain an ever-ascending gradient of human progress.

Again we must, individually as we may, and collectively with definite purpose, endeavour to co-operate helpfully with agencies charged with the training of recruits for our ranks, to the end that there may be a continued and adequate supply to the younger strata in our guild, whence we may hopefully look for leadership and guidance in the future.

And, finally, since in the exercise of his functions as an engineer he must of necessity develop and employ habits of mind and methods of study which may be usefully employed in dealing with problems as they arise in all activities in life, therefore should the engineer stand ready to serve, not only in his chosen sphere, but wherever and whenever his habit of mind, his training and his experience may enable him to contribute a helpful element in this great co-operative enterprise which we call civilisation.

An All-Electric Experiment.—Subsequent to the publication of the article under the above heading in our issue of last week, we have been informed that the Woodlands Housing Society, Ltd., is a public utility society registered under the Industrial and Provident Societies Act, and is at the same time a subsidiary undertaking of the Bournville Village Trust for the development of a portion of the Bournville Estate. The estimate which appeared in the Electrical Review of July 24th last, to the effect that by putting in only one ordinary fire grate a saving of twenty pounds would be made, has proved a very close one, and is confirmed by final costs. In the case of the "all-electric" house the saving is said to be approximately sixty pounds. It is estimated that in the case of the one-coal-fire house the weekly consumption for lighting, for a family of 5-6 persons, will be 3 kWh, for irons, &c., 3 kWh, and for cooking all food, 35.5 kWh. It is interesting to learn that from actual tests taken in all parts of the country the following figures of total consumption per annum have been estimated:—In the case of the all-electric house, 5,350 kWh, and in that of the one-coal-fire house, 4,166 kWh. Over nine hundred people visited the house during the demonstration week.

Legal.—Llandudno Council *v.* Llandudno and Colwyn-Bay Electric Railway, Ltd.—The Council recently instituted proceedings against the company for its alleged failure to keep its permanent way in a proper state of repair. The case was due to come before the Llandudno Petty Sessions on December 21st, but upon that date counsel for both parties announced that they had come to an agreement and the summons was therefore adjourned *sine die*.

Fire Offices and the I.E.E. Wiring Rules.—The secretary of the Fire Offices' Committee, London, informs us that the Offices associatoed with the Committee, numbering over 90, have given their formal approval to the 1924 Edition of the Regulations of the Institution of Electrical Engineers for the

Electrical Equipment of Buildings, and adopted the Regulations as standard practice. A letter to this effect has been circulated amongst electricity supply undertakers, consulting and installing engineers and contractors, and architects, together with a list of the companies concerned.

Ancient and Modern Methods.—The accompanying picture, received from a correspondent, illustrates an interesting juxtaposition of the old and the new which has recently been brought about in British Cochin by the installation of a town lighting and power scheme. Technically, the scheme calls for no comment, and a very brief description of the equipment will suffice. The engines are Vickers-Petter verticals driving by ropes Crompton alternators—3-phase, 2,200 volts, 50 cycles. The high-pressure transmission is by overhead mains to pole-type transformers, from which distribution is effected on the 4-wire system, high-pressure and low-pressure mains being carried on the same poles wherever possible. The illustration shows, side by side, working products of the twentieth century B.C. and the twentieth century A.D. The peculiar type of



A Contrast Between Old and New Industries.

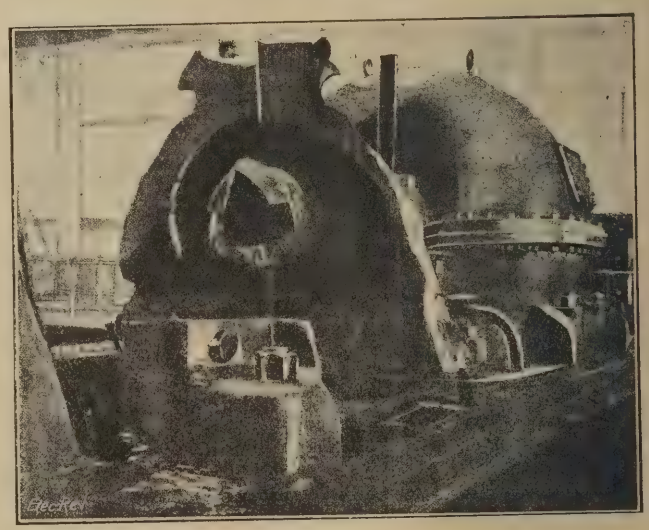
fishing-gear is essentially Chinese, and in India is found only on the Malabar Coast. Our correspondent has no information regarding the time or manner of its introduction into India. The electrification scheme has been carried out by the Crompton Engineering Company (Madras), Limited, which is also the licensee.

Radio Uses of Piezo-Electric Crystals.—Piezo-electricity is having some remarkable new applications. Certain crystals undergo a slight expansion or contraction when an electrical pressure is applied to them and, *vice versa*, produce a slight voltage when compressed or pulled. A piece of quartz crystal 1 or 2 in. long has a high natural frequency of the same order as the frequencies of currents used in radio communication; the frequency of vibration of the piece of quartz is extraordinarily constant and is very useful as a radio standard. In association with a small electron tube it acts as an oscillator or a generator of current, the frequency of which is that of the mechanical vibration of the piece of crystal. As the frequency thus produced is accompanied by numerous harmonics, the crystal is a standard giving several radio-frequencies; it is thus a remarkable supplement to the wave meters which have hitherto been used as standards of radio-frequency.

A study just completed by the American Bureau of Standards indicates that such a quartz oscillator has many valuable applications in radio work. Means of producing audio- as well as radio-frequencies were worked out. The crystals can be used to control or determine the frequency of a transmitting station and to hold it strictly constant, which will mean a great advance in radio-transmission technique. The crystals are also useful in accurate setting of receiving apparatus and for controlling the frequency of radio-frequency generators used in laboratory measurement work. The value of these various applications is particularly great at the frequencies above 2,000 kilocycles which are now rapidly coming into use. A preliminary paper on this work has been prepared and will appear in the *Proceedings* of the Institute of Radio Engineers. Part of the work resulted in the design of an outfit for use by the U.S. Department of Commerce radio inspectors and adapted to the rapid and accurate standardisation of frequency meters. It consists of two simple instruments, both being operated by dry batteries. Copies of specifications for "Portable Piezo Oscillator, Type N," and for "Portable Auxiliary Generator, Type O," together with directions for the use of the two instruments (letter circular 183), may be obtained upon application to the Bureau of Standards, Washington, D.C., by persons having actual use for them.

The Effect of Altitude on Electrical Installations.—In a recent issue of *Elektrotechnik und Maschinenbau*, Herr A. Lubowsky, of the Allgemeine Elektricitats Gesellschaft, Berlin, deals with the effect of altitude on electrical installations. Standard electrical engineering practice which is based on the conditions obtaining at average altitudes, may fail to give good results in very hilly countries owing to the reduction in the density of the air, its heat conductivity, the proportion of oxygen, &c. In the case of electrical machinery, as a result of the reduced air density, the efficiency of cooling diminishes. M. Lubowsky points out that, whereas German standard practice may be adopted for altitudes up to 3,280 ft., American and British regulations provide for a reduction in the nominal efficiency of a machine used at high altitudes, which for heavily-loaded machines is reckoned at 1 per cent. for each 328 ft. above 3,280 ft. The same rule applies to transformers, but in this case the normal output may be maintained by increasing the size of the oil receptacle. M. Lubowsky states that altitude has a negligible effect on the dielectric strength of materials utilised in high-pressure apparatus. This does not, however, apply to discharge pressures in the air which are reduced in proportion to the decrease in air density. It is agreed, however, that the normal strength of high-pressure apparatus decreases with an increase in altitude in the same proportion as the nominal power of a machine. In high-pressure transmission lines the section of the conductors should be such that no corona effect is produced. The working pressure should be reduced 1 per cent. for each 328 ft. increase in altitude, and thus a 100,000-V line transmitting at sea level would be only suitable for 50,000 volts at an altitude of 16,400 ft. At such an altitude the section of the conductors to transmit at 100,000 volts would require to be that of a 200,000-volt line at sea level. As regards cables, the effect of altitude is considered to be negligible. For starting gear and regulating devices other considerations than altitude have to be taken into consideration. The effective head of hydraulic turbines decreases as the altitude becomes higher; for a barometric pressure of 760 mm. the practical suction head is 6 metres, and for a pressure of 520 mm. (which corresponds to an altitude of 16,400 ft.), the available head is only 2.8 metres. With internal-combustion engines any diminution in air density owing to altitude results in less oxygen being drawn into the engine, resulting in a reduction of the power development of about 1 per cent. for each 328 ft. of altitude; at the same time fuel consumption shows an increase of from 0.5 to 1.2 per cent.

The Rand Turbine Failure.—The accompanying illustration shows the wrecked alternator after the breakdown at the Vereeniging power station of the Victoria Falls and Transvaal Power Co. on December 8th last (ELECTRICAL REVIEW, December 11th and 18th). The shaft at the point of fracture is about a foot thick. In an official statement by Mr. Bernard Price, chief engineer to the company, he said that the machine



The Wreck of a 10,000-kW Alternator.

broke its shaft, which allowed the rotating part to foul the fixed portion; this immediately burst the frame of the machine. A very rough estimate of the total cost of the damage to the machines, buildings, &c., was put at £50,000. The illustration is reproduced from the *Rand Daily Mail*.

Radio Direction-finding Aircraft.—The aeroplane flying on the experimental night service which Imperial Airways will inaugurate on January 15th will be fitted with a form of wireless compass which will direct the pilot towards his destination. According to the *Morning Post* the pilot will listen for signals in his head telephones which will vary in strength according to how much the machine departs from its true course. In order to use this particular method of direction finding, the aeroplane is being fitted with coils placed between the fabric of the wings. While the machine is on its way from Paris to Croydon receiving apparatus working in conjunction with the wing coils will pick up a reiterated signal from the Croydon wireless station. It is claimed that this will be the first time that this method of direction finding has been employed on a regular air service. Besides the wireless compass, pilots flying machines on the night service will be aided by ten illuminated points on the route.

Mysterious Noise at a Power Station.—A noise, described as resembling a "gentle fog-horn," has annoyed the residents in the vicinity of the new power station of the Hastings Corporation for some time, and has defied identification. Prof. A. M. Low has photographed the sound-waves with a Low-Hilger audiometer, and finds that the main audio-frequency wave is acting as a carrier for other waves, indicating that

there are several different sources of vibration at work. The noise appears to emanate from the boilers, but is also ascribed to vibrating machinery; whilst it can be heard two miles away, it is inaudible at places within half a mile of the power station.

Swedish Water-Power Development.—In the course of an article upon this subject in the December *Swedish Export* (the organ of the General Export Association of Sweden) it is stated that Sweden's potential water resources are about 8.8 million h.p. The Swedish waterfalls have been utilised to the extent of 1.4 million h.p. for industrial production on a large scale in districts where other natural resources are available. About three-quarters of the water power is situated in Norrland; this is undoubtedly a drawback in view of the sparseness of the population and the comparatively severe climate of that region. The annual production of hydro-electric energy in Sweden is estimated at 3,200 million kWh, or 500 kWh per head of the population.

Quick Repair Work.—A large rotor, weighing 30 tons, of a turbo-generator belonging to the London Electric Supply Corporation, Ltd., was shipped on November 12th by river and thence by rail to the Preston works of the English Electric Co. for repair. The rotor was completely dismantled, the copper re-annealed and the rotor re-wound, tested, and returned to the generating station in London in less than five weeks from the day it was dispatched. The English Electric Co. is to be congratulated on carrying out this difficult repair on a rotor which was not of its make, the actual time taken at the works being 22 days. When one considers the size of this piece of plant and the extreme difficulty of taking it apart, re-annealing the copper, and carrying out the necessary repairs, the company's feat may be counted a wonderful performance, and it shows what can be done in this country in spite of what one hears to the contrary. The railway companies also distinguished themselves in dealing with the transport of the plant so promptly, especially in view of the difficulty of procuring special trucks large enough for such a rotor, at a time when the railways were engaged in coping with their extra holiday traffic, to say nothing of the loading and unloading and barging of such a heavy piece of machinery on the River Thames.

Institution Notes.

Institution of Electrical Engineers.—EXTENSION OF ACTIVITIES OF THE WIRELESS SECTION.—The Committee of the Wireless Section of the Institution has further considered the proposal to form a new Institute of Wireless Engineers, and is definitely of the opinion that the interests of qualified professional wireless engineers are best served by the Institution of Electrical Engineers. The formation of a new Institute, it feels confident, is unnecessary, and will not be supported by representative and qualified professional wireless engineers. Engineers with adequate wireless qualifications can become Corporate Members, and other wireless engineers not reaching that standard are eligible as graduates and, as such, can attend all meetings of the Wireless Section as well as those of the Institution. With a view to improving and extending the activities of the Wireless Section, the following recommendations have been approved by the Council:—

While it is essential that the standard of qualifications for membership of the Institution should be maintained, more opportunity is to be afforded to the physicist engaged in wireless work to become a member of the Institution. Applications for membership of the Institution based upon the usual general scientific training and wireless professional qualifications are to be referred to a Wireless Section Membership Sub-Committee, which will guide the Membership Committee of the Council. The qualifications for membership of the Wireless Section are to remain as at present. The Wireless Section Committee is to get into direct touch with the Local Centre Committees and ascertain the possibility of:—(*a*) Starting local wireless sections; (*b*) stimulating efforts to produce local wireless papers and lectures at local centres. Each local Wireless Section, when properly constituted, is to be entitled to nominate one member to the Wireless Section Committee. A local Wireless Section is to consist of at least 15 members, who must already be members of the main Wireless Section. Wireless papers and discussions, in addition to appearing in the *Journal* of the Institution, are to be issued separately in the form of "Proceedings of the Wireless Section." The chairman of the Wireless Committee is to be an ex-officio member of Council, in the same way as are the chairmen of Local Centres, as soon as the necessary alterations to the by-laws can be made; in the meantime he will be invited to attend all meetings of the Council.

A.M.I.E.E. EXAMINATION.—The next examination will be held on April 15th, 16th, and 17th, 1926. Candidates must be either Students or Graduates of the Institution, or have lodged with the Secretary a duly completed form "E" for election as Associate Member. Entry forms for the examination, which must be completed and returned by February 1st, and particulars regarding election to membership of the Institution may be had on application to the Secretary, the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2.

MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—On Monday, January 18th, there will be an open meeting at the University of Liverpool, at 7.30 p.m., when the Faraday Lecture on "Illumination and Light" will be delivered by Mr. A. P. Trotter, M.I.E.E., with lantern slides and experiments. The public will be admitted, tickets being obtainable from the hon. secretary. Members of the Institution should apply for tickets, as admission will be by ticket only.

SOUTH MIDLAND CENTRE.—The annual dinner, postponed from November 27th, will be held on Wednesday next, at the Grand Hotel, Birmingham. There is a long list of speakers, and during the evening a special presentation to the president of the Institution, Mr. R. A. Chattock, will be made by the chairman, Mr. F. J. Moffett.

The programme for the second half of the session includes the following meetings and papers:—

January 27th.—"The Power Losses in Magnetic Sheet Material at High Flux Densities," by Mr. C. E. Webb.

February 12th.—Joint Meeting. Discussion on "Road Transport and its possible Developments." Speaker for "Electricals": Mr. C. O. Silvers.

February 17th.—"The Electrification of the Paris-Orleans Railway," by M. Parodi, Chief Electrical Engineer.

March 10th.—"Electro-Farming, or The Applications of Electricity to Agriculture." Kinematograph by Mr. R. Borlase Matthews.

March 31st.—"Power Factor and Tariff," by Mr. E. V. Clark. "Power Factor Improvement," by Mr. E. W. Dorey.

Radio Society of Great Britain.—OFFICERS.—The 12th annual general meeting of the Society was held on December 16th and the following office holders were elected for 1926:—*President*: Sir Oliver Lodge. *Acting Vice-President*: Brig.-Gen. Sir H. C. L. Holden. *Hon. Treasurer*: Prof. Ernest Wilson. *Hon. Secretary*: Maurice Child. *Members of Council*: O. F. Brown, Capt. Ian Fraser, O. W. Nicholson, J. H. Reeves, Earl Russell, Major T. Vincent-Smith, Dr. R. L. Smith Rose, and H. Bevan Swift.

A Wireless Institution in Ireland.—It is proposed to form, at an early date, an Irish Centre of the Institute of Wireless Technology, with the objects of promoting the general advancement of radio technology, and procuring the recognition of the status of the Institute by the Government, by public and local authorities, and other bodies in the country.

Junior Institution of Engineers.—At a meeting held on January 1st, six films were shown illustrating some of the work carried out at the River Don Works, Sheffield, of Messrs. Vickers, Ltd. The information imparted by these films as to the methods of production in a big steelworks proved of great interest to a large audience.

Diesel Engine Users' Association.—ELECTION OF OFFICERS.—Mr. E. W. Johnston (King's College Hospital) has been elected president of the Association for the year commencing January 1st, 1926. Messrs. F. A. Greene, M.I.E.E., and C. F. Mounsdon, A.M.I.E.E., have been elected to fill the vacancies on the General Committee, and Messrs. Percy Still, M.I.E.E., and Geoffrey Porter have been re-elected joint honorary secretaries.

At the December meeting the secretaries' annual statement was presented, concerning the progress made in the work of the Association, the increased interest in which was evidenced by the large number of publications which were sold to non-members during the year, this item amounting to £160. Towards the end of the year the final specifications for heavy-oil engines for electrical purposes were issued by the British Engineering Standards Association, on a committee of which the Diesel Engine Users' Association was represented, as well as the Incorporated Municipal Electrical Association.

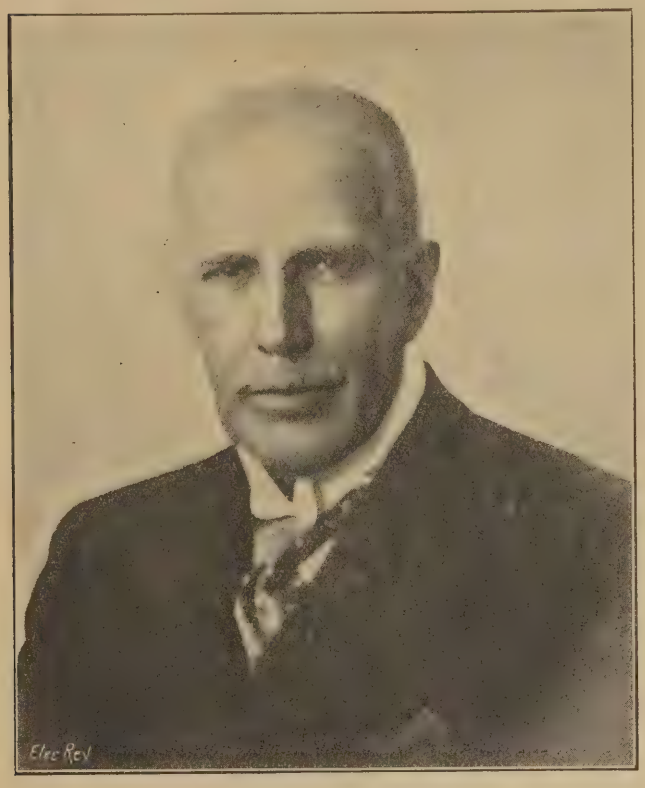
Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

New Year Honours. — In the New Year Honours List there is less than there has been for a long while to interest the electrical profession and industry. Baron D'Abernon, H.M. Ambassador in Berlin since 1920, who becomes a viscount, is chairman of the Contraflo Engineering Co., Ltd., and a director of Parsons' Foreign Patents Co., Ltd. We congratulate Prof. T. Hudson Beare, F.R.S.E., M.Inst.C.E., M.I.M.E., &c., Professor of Engineering and Dean of the Faculty of Science at Edinburgh University, upon receiving the well-merited honour of knighthood.

As we reported some time ago, the successor to the late Sir Adam Beck in the post of chairman of the Hydro-Electric Power Commission of Ontario is Mr. C. A. MAGRATH, whose portrait accompanies this note. Mr. Magrath was born in Ontario in 1860. He adopted the profession of surveyor, and in this capacity was engaged in surveying land in the North-West. He attained the standing of Dominion Topographical Surveyor—the highest rank which can be reached by Dominion surveyors. For a number of years he was associated with Sir Alexander T. Galt and his son, who carried out a considerable amount of development work in Alberta, constructing railways, mining coal, and executing irrigation schemes. In all these enterprises Mr. Magrath played an important part, and in 1891, upon the incorporation of Lethbridge, he was unanimously acclaimed the first mayor. For several years he was a member of the Territorial Assembly of the North-West Territories, and in 1908 he became a member of the Dominion

House of Commons. He represented that body at the Coronation of the present King. Upon the conclusion of the Boundary Waters Treaty between Great Britain and the United States in 1911, Mr. Magrath was appointed a member of the International Joint Commission, and in 1914 he was appointed Canadian chairman of the Commission, a post which he held up to the time of his appointment as chairman of the Hydro-



Mr. Charles A. Magrath,
Chairman of the Hydro-Electric Power Commission of Ontario.

Electric Power Commission of Ontario. During the war he acted as Dominion Fuel Controller with great success, and he has been and still is active in a number of other departments of public life.

The permanent staff and employés at the Bangor City Electricity works recently presented Mr. Price F. White with an oak bureau to celebrate the twenty-fifth anniversary of his appointment as manager of the works. Mr. Goodwin, the assistant manager, presided, and the presentation was made by Mr. John Jones, the oldest member of the staff, who is 76 years of age.

Stirling Town Council has appointed Mr. Alex. Brewster as electrician for the ensuing year.

Mr. R. J. Millard has left the Electrical Apparatus Co., Ltd., and has joined the staff of Brookhirst Switchgear, Ltd.

Mr. E. H. Parsons, A.M.I.Mech.E., A.M.I.E.E. ("The Buffs," Reserve of Officers), late chief electrical and mechanical engineer to the British Empire Exhibition, has been appointed electrical and mechanical engineer adviser to the Chief Engineer of the British Forces in Iraq.

Mr. R. P. Sloan, the chairman and managing director of the Newcastle-upon-Tyne Electric Supply Co., Ltd., informs us that Mr. H. A. Couves, M.I.E.E., has been appointed general manager of that company and the following of its associated companies:—Cleveland and Durham County Electric Power Co.; Cleveland and Durham Electric Power, Ltd.; County of Durham Electric Power Supply Co.; County of Durham Electrical Power Distribution Co., Ltd.; Houghton-le-Spring and District Electric Lighting Co., Ltd.; and the Northern Counties Electricity Supply Co., Ltd. Mr. Couves, who joined the Newcastle company some 20 years ago, has occupied the position of chief of the Power and Construction Departments during the greater portion of that period.

Capt. A. D. Gange, of Messrs. Siemens Bros. & Co.'s cable ship *Faraday*, has recently retired from that position after 22 years in the company's service, 17 of them as captain. Capt. Gange is a lieut.-commander (ret.) of the Royal Naval Reserve, He is succeeded by Capt. Allan.

On the occasion of his leaving the employ of Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board to take up a position with the Yorkshire Electric Power Co., Mr. James Halkett was presented with a slide rule and fountain pen by the chief engineer and members of the staff.

Mr. E. R. Peacock has resigned from the position of president of the Barcelona Traction, Light and Power Co., Ltd. He retains his seat on the board, and will continue to act as chairman of the Bondholders' Committee. Mr. H. Malcolm Hubbard, vice-president, has been appointed chairman of the company, and Mr. F. Fraser Lawton, general manager of the subsidiaries in Spain, has been appointed president, and will continue to manage the Spanish subsidiaries.

Mr. Justus Eck has retired from the position of director of the Photector Co., Ltd.

Mr. V. Delebecque has joined Messrs. "Manda" Motors, Ltd., London, as general manager.

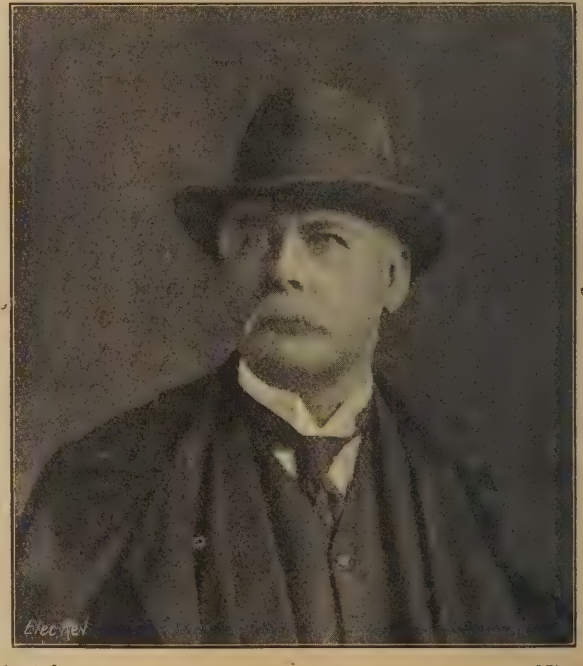
We regret to learn that, owing to serious illness, Mr. A. P. Lundberg (who, by the way, is now in his 95th year) was unable to be present at what was an interesting domestic function in connection with his firm—A. P. Lundberg & Sons, of Liverpool Road, N. Bonuses have been offered to the employés for many years past for good time-keeping, and an average of about 20 per cent. of the workers usually qualify for the honour. This Christmas an exceptional opportunity arose in the celebration of a 21 years' "No time lost" record, and as an appreciation of such a feat Mr. Ernest G. Burrell was presented by the firm with an inscribed gold watch. Mr. G. C. Lundberg, M.I.E.E., made the presentation on his father's behalf.

Mr. J. W. Sutton has retired from the position of manager of Messrs. George Kent, Ltd., after 60 years' service.

It is stated that Senatore Marconi will be one of the first members of the new Italian Academy of "Immortals."

On leaving the works of the British Insulated Cables, Ltd., Helsby, to take up another appointment, Mr. J. P. Higham, a member of the technical staff, was presented with a leather suit case by Mr. T. G. Briant, on behalf of the staff.

Obituary.—Mr. J. M. M. Munro.—We regret to learn that Mr. John M. M. Munro, F.R.S.E., M.I.E.E., died at the residence of his son, Mr. Donald Smeaton Munro, Edinburgh, on December 30th after a short illness. Mr. Munro was born in 1853 and became interested in telegraphy at an early age. Shortly after the invention of the telephone he commenced the manufacture of telephone instruments, and, we are informed, erected in 1877 the first complete practical overhead telephone line in Glasgow. In 1878 he invented and put on the market an incandescent electric lamp with a metallic filament; this received favourable attention in France and other countries. In 1880 his firm (Anderson & Munro) installed arc lamps at the offices of the *Glasgow Herald*, and in the following year it assisted Sir Joseph Swan to display his lamps to Sir William Thomson (Lord Kelvin) and others, later arranging a public exhibition of arc and glow-lamp lighting. Before the close of that year (1881) installations were being carried out at Selkirk, Hawick, and Renfrewshire with wiring systems devised by Mr. Munro. Other pioneer work done by the firm was the lighting of a steamer and the partial lighting of collieries. A great many country house lighting sets were installed, many driven by water power and running to this day.



Lafayette] [*Glasgow.*

The Late Mr. J. M. M. Munro, F.R.S.E., M.I.E.E.

Mr. Munro was a prolific inventor, among the patents standing to his credit being those for a quick-break lever switch, a zig-zag armature winding, a gravity-balance volt and ampère-meter, an integrating wattmeter, concentric wiring, perforated interchangeable wall sockets and lampholders, and a public fire-alarm system. As a consulting engineer he carried out many important works in the Glasgow district, and in 1892 he was called to Norway to advise on large hydro-electric schemes for the lighting of Christiania and elsewhere; in this connection his plans were approved by the late Lord Kelvin. Since 1910 he had acted solely as a consultant among his later jobs being the change-over to bulk supply of the Bo'ness Town Council and the extensions at Cambuslang of the Lanark County Council. During the war Mr. Munro was attached to the Royal Flying Corps, when he had charge

of the construction and testing of seaplanes. Mr. Munro was one of the founders of the Scottish Section of the I.E.E., and was an associate member of the Institution of Civil Engineers. The funeral took place on December 31st in the Dean Cemetery, Edinburgh.

DR. GEORG KLINGENBERG.—By the death of Dr. Georg Klingenberg on December 7th, in Berlin, to which we briefly referred last week, electrical engineering in Germany has lost one of its leading agnts and one whose name will long be remembered in connection with electricity supply operations.



The Late Dr. Georg Klingenberg.

Born in Hamburg in 1870, Dr. Klingenberg was educated at Osnabruck and Charlottenburg; at the latter place he became assistant to Prof. Slaby, a position which he held for some years. Although he devoted much attention to the theoretical side of electricity and engineering, as quite a young man he showed a strong desire to engage on the practical side of electricity supply development, and struck out into what at that time were entirely new directions. Thus in 1894 a central electric station in which superheated steam was utilised was built to his designs at Brettstedt, while in 1895 he prepared plans for a station at Marne, which was notable as being the first on the three-wire 2 x 220-V system, this being followed by increasingly large installations at Stettin, Charlottenburg, Halle, and Potsdam. Further evidence of his active brain came in 1896 when he made a notable contribution to the subject of the influence of high voltages on economical electricity transmission, and it was not long ere Klingenberg's name became well known far beyond the confines of his own country. Being able to demonstrate that his ideas were sound, it was notable, although under the circumstances not surprising, that by 1902, when he was only 32 years of age, he was appointed a director of the great Allgemeine Elektricitäts Gesellschaft, of Berlin, and the commencement of his association with this concern is generally considered to mark a new era in central electricity generating station design and construction. With the A.E.G. resources behind him, Klingenberg set out to thoroughly overhaul every section of central station work and design, from the method of storing and handling the coal to the distribution of the current, boiler-house arrangement coming in for a large share of his attention, as a result of which the *E. T. Z.*, to which we are indebted for the accompanying portrait, claims that the construction costs of power stations were reduced to less than half and their efficiency considerably increased. As further evidence of Dr. Klingenberg's unceasing activities, it may be mentioned that over 70 electric power stations have been built to his designs; of these a third are in foreign countries, one of the most notable being the four plants of the Victoria Falls Power Co. in South Africa, with a total capacity of 288,000 h.p. Another important installation was the Golpa power station of 128,000 kW, near Bitterfeld, Germany, which, when completed, was the largest steam-operated plant in the world. Dr. Klingenberg has not lived to see the completion of what was to prove his last and greatest work—the super power station on Lake Rummelsburg to meet Berlin's ever-increasing demand for electric power. Commenced in July last, this plant is to be completed by next autumn. Honours were showered upon him by the German Government and by the various technical institutions and scientific bodies. He had occupied the position of president of the Verband Deutsche Elektrotechniker, and there was hardly a technical commission or committee upon which he did not serve. It will be remembered that Dr. Klingenberg visited this country just prior to the war and put forward suggestions as to the way the problem of London's electricity supply should be tackled.

MR. R. T. BROWN.—Mr. Robert Thomas Brown, late of the West India and Panama Telegraph Co., Ltd., passed away at Westcliff-on-Sea on December 25th.

The funeral took place on December 30th of MR. ROBT. A BIRTLES, who had occupied the position of Chief Inspector of the Blackpool Corporation Tramways for 20 years. He entered the service of the Corporation in 1899 as a conductor. He was promoted to driver and then inspector and in six years rose to the position of chief inspector.

New Companies Registered.

Lydbrook Cables, Ltd. (210,609).—Private company. Registered December 23rd. Capital, £50,000 in 10s. shares. The objects are:—To carry on the business of chemical, civil, electrical, mechanical, mining, and radio engineers, manufacturers of cables and wires of all kinds, whether insulated or not, manufacturers of insulating materials, india-rubber and gutta-percha, vulcanisers, manufacturers of all electrical equipment and appliances, &c. The subscribers (each with one share) are:—F. B. Turner, 3-4, Clement's Inn, Strand, W.C.2, solicitor; J. F. H. Templer, 13, Inglis Road, Ealing, W.5, solicitor's clerk. The first directors are to be appointed by the subscribers. Qualification, 10 shares. Remuneration as fixed by the company. Solicitors: Brown, Quayle & Bentley Turner, 3-4, Clement's Inn, W.C.2. Registered office: Lydbrook, Glos.

Burndept Wireless (Dublin), Ltd.—Registered in Dublin as a "private" company on December 14th, with a nominal capital of £5,000 in £1 shares. The objects are to adopt an agreement, dated December 4th, 1925, between Burndept Wireless, Ltd., Aldine House, Bedford Street, Strand, London, and Thomas Hempenstall, 12, Suffolk Street, Dublin, on behalf of Dixon & Hempenstall, and carry on business of manufacturers of, and dealers in wireless, telegraph, telephone, optical, and photographic apparatus, &c. The first directors are:—W. Burnham, Chislehurst, Kent; T. Hempenstall, "Woodfield," Rathfarnham, Co. Dublin; C. Neild, 3, Mountain View, Ranelagh, Dublin. Secretary: John Love. Registered office: 17, Dawson Street, Dublin.

Moreland Electric Welding Co., Ltd. (210,650).—Private company. Registered December 24th. Capital, £4,000 in £1 shares. Objects: To acquire the business of electric and other systems or means of welding, electricians, mechanical engineers, &c. The subscribers (each with one share) are:—J. L. Walters, 19, The Walk, Cardiff, solicitor; T. A. Tyrrell, 42, Loftus Street, Cardiff, clerk. The first directors are C. G. Moreland (permanent director and chairman), and others to be appointed by the subscribers. Remuneration, as fixed by the company. Secretary (*pro tem.*): T. A. Tyrrell. Solicitors: Phœnix & Levinson, 8, Dumfries Place, Cardiff. Registered office: Dumfries Chambers, 8, Dumfries Place, Cardiff.

Hendon Electric Lamp Co., Ltd. (210,709).—Private company. Registered December 29th. Capital, £1,995 in 1,900 20 per cent. preferred ordinary shares of £1 and 1,900 deferred founders' shares of 1s. each. The objects are to acquire the business of a factor, agent and dealer in connection with electric lamps, and all other descriptions of electrical goods, &c., carried on by Mrs. K. E. Falcke at 104, Southampton Row, Holborn, as the "Hendon Electric Lamp Co." The subscribers (each with one share) are:—C. D. Falcke, A.M.I.E.E., 104, Southampton Row, W.C.1, electrical engineer; M. E. Cavendish, 52C, Fulham Park Gardens, S.W.6, manufacturer's agent. The first directors are to be appointed by the company or subscribers. Qualification, £10. Secretary: T. P. Jones, 9, Ferndale Road, Gillingham, Kent.

Holophane, Ltd. (210,826).—Registered on January 1st as a "public" company, with a nominal capital of £100,000 in £1 shares. The objects are to acquire the business of Holophane, Ltd. (incorporated in 1910), together with all or any of the assets, including trade marks, numbered 215,730 and 215,063, and liabilities in connection therewith, to adopt an agreement with the said old company and its liquidator, to acquire and turn to account interests in any invention relating to illuminating, appliances, toolmaking, brass and metal founding, and the production, treatment, storage, application and use of electricity, and of any apparatus therefor; to carry on the business of an electric light company; to manufacture illuminating appliances and light globes, &c. Minimum cash subscription, 7 shares. The first directors are:—Lord Ernest Hamilton, 87, Elm Park Gardens, S.W.10 (director of Khedivial Mail Steamship and Graving Dock Co., Ltd.); Otis A. Mygatt, 156, Boulevard Haussmann, Paris (director of Société Anonyme Francaise Holophane); Major Robert Woodhouse, 9, Wilbury Grove, Hove (director of Barclay's Bank, Ltd.); Lawrence E. Jones, M.C., 15, Clevelands Gardens, W.2, barrister; Herbert H. Thompson, Rowhiti, Devonshire Avenue, Sutton, Surrey (director of Holophane, Ltd.); Mons. André Froget, 156, Boulevard Haussmann, Paris (director of Société Anonyme Francaise Holophane). Remuneration, £200 per annum (chairman, £300), and 15 per cent. of the surplus profits earned by the company in each year remaining after paying 12 per cent. on the ordinary shares in respect of such year, but exclusive of any sum brought forward from any previous year. Maximum additional remuneration in any one year, £2,500, divided between them. Secretary: J. Wyatt Ife. Solicitors: Herbert Reeves & Co., 42, Old Broad Street, E.C.2. The registered office is at Elverton Street, Vincent Square, Westminster.

E. A. Langrish & Co., Ltd. (210,825).—Private company. Registered January 1st. Capital, £15,000 in £1 shares (7,500 8 per cent. cumulative preference and 7,500 ordinary). Objects:—To carry on the business of manufacturers, factors and importers of, agents for and dealers in electrical and wireless plant, machinery, apparatus, accessories and equipment, electrical engineers and contractors, &c. The subscribers (each with one share) are:—D. H. Raphael, 55, Ellesmore Road, Chiswick, W.4, clerk; H. W. Clayton, 28, Sackville Street, W.1, clerk. The first directors are not named. Save as provided by contract to the contrary, the shares (initial or otherwise) shall be under the control of the directors, who may allot or otherwise dispose of the same to such persons on terms and conditions and at such times as the directors think fit and with full power to give to any person the call of any shares either at par or at a premium and for such time and consideration as the directors think fit. Provided that after 5,800 ordinary shares shall have been allotted, E. F. Lyons shall have the right of subscribing and receiving an allotment of 500 ordinary shares at par and subject thereto no allotment exceeding 65 per cent. of the ordinary shares to be issued from time to time shall be made in favour of any single or joint shareholder or shareholders. Solicitors: J. J. Edwards & Co., 28, Sackville Street, S.W.1. Registered office: Primrose House, 26/7, D'Arblay Street, Wardour Street, W.

Featherstone & Davey, Ltd.—Private company. Registered in Dublin December 18th. Capital, £1,000 in £1 shares. Objects: To carry on business as electricians, electrical contractors, electrical and mechanical engineers, &c. The directors are:—L. Featherstone, 73, Kenilworth Square, Rathgar, Dublin, electrical engineer; J. A. R. Lloyd, 73, Kenilworth Square, Rathgar, Dublin, electrical engineer. Registered office: 43, Fleet Street, Dublin.

W. A. C. Pulverisers, Ltd. (210,637).—Private company. Registered December 24th. Capital, £8,000 in 7,000 10 per cent. cumulative preference shares of £1 each and 4,000 ordinary shares of 5s. each. Objects: To carry on the business of licensees, manufacturers and vendors of the W. A. C. Pulveriser as formerly carried on by A. J. Henderson, J. W. S. Asquith, A. J. Jack, and W. A. Cloud as the "W .A. C. Pulveriser Co.," and to carry on the business of mechanical, electrical, motor, gas, hydraulic, sanitary, construction, civil, consulting, and general engineers, &c. The subscribers (each with one preference share) are:—A. J. Henderson, 6, Wells Road, Regent's Park, N.W., consulting engineer; E. H. Clifton, 6, Hatfield House, Great Titchfield Street, W.1, gentleman; W. A. Cloud, 54, Airedale Avenue, Chiswick, W., mechanical engineer. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Secretary: E. H. Clifton.

E. L. Bentley Company (210,593).—Registered as a "private unlimited" company on December 23rd, with a nominal capital of £100,000 in 40,000 10 per cent. cumulative preference shares and 50,000 ordinary shares of £1 and 400,000 deferred shares of 6d. each. The objects are to acquire all or any part of or any share, percentage or interest of and in the copyrights of Bentley's Telegraph and other codes, Scott's Code and other codes, and the goodwill of the business carried on in connection therewith, and to carry on the business of codists, manufacturers, compilers, publishers and printers of codes and other publications, &c. The subscribers (each with one ordinary share) are:—P. H. Bentley, Grove End, Bagshot, mechanical engineer; W. H. Bentley, "Sunny Cot," Upland Road, Sutton, telegraph codist. E. L. Bentley is permanent governing director. On his death, P. H. Bentley, H. B. Bentley, and W. H. Bentley, if living and hold 100 shares each, shall become permanent directors, with £1,200 each per annum as remuneration. Secretary: G. Bradley, 71, Queen Street, E.C. Solicitors: Kimber Bull, Howland, Clappe & Co., 6, Old Jewry, E.C.

A. G. Lewis & Co., Ltd. (210,624).—Private company. Registered December 24th. Capital, £1,000 in £1 shares. Objects: To acquire the business of a wholesale wireless dealer carried on by A. G. Lewis at 1, Beach Cliff, Penarth, Glam. The permanent directors are:—A. G. Lewis, "The Bungalow," Beach Cliff, Penarth, Glam., wholesale wireless dealer; R. Olney, 18, Princess Street, Barry, Glam., electrical engineer. Registered office: 7, Pembroke Terrace, Cardiff.

Helsby Cables, Ltd. (210,738).—Registered as a private company on December 29th with a nominal capital of £2 in £1 shares. The objects are:—To carry on the business of manufacturers of and dealers in wire cables and lines of all kinds, electricians, engineers, suppliers of electricity and electrical machinery and equipment, &c. The directors are:—J. Taylor, Colomander, Mold, North Wales, manufacturer; J. A. Smith, 1, Sefton Court, Croxteth Gate, Liverpool, director of British Insulated & Helsby Cables, Ltd. Solicitors: Hill, Dickinson & Co., 10, Water Street, Liverpool.

J.M.O., Ltd. (210,713).—Private company. Registered December 29th. Capital, £100 in 1s. shares. Objects: To carry on the business of engineers, advisers, experts, consultants, contractors and the like in connection with wireless telephony or telegraphy, &c. The first directors are:—Jose M. Ortega (permanent managing director), Upper Wandle House, Wandsworth, S.W.18; Mrs. Florence M. Ortega, Upper Wandle House, Wandsworth, S.W.18. Qualification, 1 share. Remuneration as fixed by the company.

G. W. M. Electrical Co., Ltd. (210,701).—Private company. Registered December 29th. Capital, £100 in 5s. shares. Objects: To acquire the business of wholesale and retail dealers in and manufacturers and factors of electrical, radio and motor accessories now carried on at 43, Grafton Street, Tottenham Court Road, W.1. The permanent directors are:—A. B. Gregory, 29, St. Albans Road, Seven Kings, Essex; B. G. Williams, 6, Parliament Hill, Hampstead, N.W.; E. Morgan, "The Poplars," Mawneys Road, Romford, Essex. Secretary: E. Morgan. Registered office: 43, Grafton Street, Tottenham Court Road, W.1.

R. L. S. Syndicate, Ltd. (210,614).—Private company. Registered December 23rd. Capital, £5,000 in £1 shares (4,000 ordinary and 1,000 deferred). Objects: To acquire the benefit of an agreement between C. G. Moller and J. Balfour Brown for the acquisition by the latter of certain British and foreign patent rights of S. G. Moller's patent rotary luminous sign. The first directors are:—F. V. Spooner, The Cavalry Club, 127, Piccadilly, W. (managing director of Slogasigns, Ltd.); J. Balfour Brown, 193, Mitcham Lane, Streatham, S.W.16 (director and secretary of Slogasigns, Ltd.). Qualification, 10 shares. Secretary: J. Balfour Brown. Registered office: 20, Grosvenor Gardens, S.W.1.

E. P. Allam & Co., Ltd. (210,698).—Private company. Registered December 29th. Capital, £6,000 in £1 shares. Objects:—To acquire the business of an electrical engineer, contractor and manufacturer, carried on by E. P. Allam at 107 and 109, Gray's Inn Road, W.C.1. The directors are:—E. P Allam, "Norton Garth," Gidea Park, Essex, electrical engineer; E. B. Allam, "Norton Garth," Gidea Park, Essex, electrical engineer. Qualification, £10 shares. Secretary: E. T. Sheppard. Solicitors: Cohen, Dunn, Page and Moore, Audrey House, Ely Place, E.C.1. Registered office: 107 and 109, Gray's Inn Road, W.C.1.

Electrolines, Ltd. (210,743).—Private company. Registered December 30th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrician and manufacturer of and dealer in wireless fittings now carried on by A. E. Finch at 5, Denmark Street, Bristol, and to carry on the same and the business of opticians, optologists, spectacle, opera glass, field glass and optical lantern makers, &c. The first directors are:—C. Jarrett, Maybury Villas, Keynsham, Somerset; E. Lewis, Sonoma, Abbots Leigh, near Bristol; A. E. Finch, 9, Denmark Street, Bristol. Solicitors: David Johnstone & Co., Bristol.

Detex Distributors, Ltd. (210,751).—Private company. Registered December 30th. Capital, £2,000 in £1 shares. Objects:—To adopt an agreement with Detex, Ltd., for the sole selling agency in the U.K. and Ireland of "Detex crystals," and to carry on the business of wireless agents, manufacturers, importers and exporters of and dealers in wireless instruments, parts and goods, &c. The subscribers (each with one share) are:—L. E. Parsons, 108, Victoria Street, S.W.1, insurance broker; C. A. E. Knust, 108, Victoria Street, S.W.1, insurance broker. The first directors are:—L. A. Bennett, W. T. Asher and R. Eiser. Qualification, 25 shares. Remuneration as fixed by the company. Secretary: W. T. Asher, 196, Ribbledale Road, Streatham, S.W.16.

Official Returns of Electrical Companies.

X. L. O. Co., Ltd.—W. C. Norrington-Wood, of 22, St. Stephen's House, Westminster, S.W., was appointed receiver and manager on November 27th, under powers contained in debenture dated July 9th, 1925.

Frederick Braby & Co., Ltd. (2,537c).—Capital, £660,000 in 42,500 ordinary, 17,500 preference, and 6,000 employés' shares of £10 each. Return dated September 1st, 1925. 39,500 ordinary, 14,500 preference, and 4,500 employés' shares taken up and fully paid. Mortgages and charges, £31,000.

Telephone Manufacturing Co., Ltd.—Particulars filed of £10,000 debentures and premium of 2 per cent. authorised December 3rd, 1925, and covered by trust deed dated February 17th, 1922, and endorsement thereon, dated December 16th, 1925, and ranking *pari passu* with £300,000 already registered, the whole amount being now issued. Property charged: The premises comprised in said trust deed. Trustees: London City and Midland Executor and Trustee Co., Ltd., 5, Princes Street, E.C.2.

Electric Light and Power Contracts Finance Corporation, Ltd.—Particulars filed of £50,000 debentures and premium of 5 per cent. authorised by resolutions of November 30th and December 3rd, 1925, charged on the company's assets, present and future, including uncalled capital, the whole amount being now issued.

Electric Reduction Co., Ltd. (54,724).—Capital, £50,000 in 16,200 preference and 33,800 ordinary shares of £1 each. Return dated November 23rd, 1925. 16,200 preference and 28,800 ordinary shares taken up. £18,000 paid on 13,000 preference and 5,000 ordinary shares. £27,000 considered as paid on the remainder. Mortgages and charges, £25,000.

Implitico, Ltd. (138,160).—Capital, £3,000 in £1 shares. Return dated December 2nd, 1925. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Empson Electrical Engineering Co., Ltd. (188,208).—Capital, £2,000 in £1 shares. Return dated August 7th, 1925. All shares taken up. £500 paid. £1,500 considered as paid. Mortgages and charges, nil.

Kidderminster and District Electric Lighting and Traction Co., Ltd. (59,972).—Capital, £100,000 in 5,000 preference and 5,000 ordinary shares of £10 each. Return dated June 30th (filed November 4th), 1925. 3,000 preference and 4,700 ordinary shares taken up. £77,000 paid. Mortgages and charges, nil.

Newton Bros. (Derby), Ltd. (139,711).—Capital, £76,000 in 75,000 ordinary and 1,000 employés' shares of £1 each. Return dated October 14th, 1925. 75,000 ordinary shares taken up. £30,000 paid. £45,000 considered as paid. Mortgages and charges, £62,000.

J. G. White & Co., Ltd. (66,568).—Capital, £350,000 in 400,000 ordinary shares of 5s. each and 70,000 ordinary and 180,000 preference shares of £1 each. Return dated October 9th, 1925. 400,000 5s. ordinary and 180,000 preference shares taken up. £200,000 paid on 150,000 preference and 200,000 ordinary shares. £80,000 considered as paid on 30,000 preference and 200,000 ordinary shares. Mortgages and charges, nil.

St. Austell and District Electric Lighting and Power Co., Ltd. (66,382).—Capital, £20,000 in 13,000 preference and 7,000 ordinary shares of £1 each. Return dated October 19th, 1925. 3,000 preference and 6,152 ordinary shares taken up. £9,002 paid (being £1 per share on 3,000 preference and 5,552 ordinary, and 15s. on 600 ordinary shares). Mortgages and charges, £1,850.

Baxter & Caunter, Ltd.—Satisfaction to the extent of £300 on February 23rd, and to the extent of £400 on December 3rd, 1925, of debenture and mortgage, both dated June 23rd, 1924, securing £5,000. (Notice filed December 23rd.)

Specialities (Liverpool), Ltd.—C. M. Delby, of 51, North John Street, Liverpool, ceased to act as receiver or manager on December 17th, 1925.

Lustrolux, Ltd.—Debenture dated December 10th, 1925, to secure £5,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: O. W. Porritt, Torside, Helmshore, Lancs. Also second mortgage debenture of the same date to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to above debenture). Holder: W. L. Turner, Abbey Manor, West Kirby, Cheshire.

Reflex Radio Co., Ltd.—Particulars filed of £1,000 debentures authorised December 15th, 1925, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Izzard Brothers, Ltd.—Particulars filed of £1,500 debentures authorised December 15th, 1925, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Walker, MacEwen & Co., Ltd.—E. L. Holford, of 41, Nightingale Road, Wanstead, E.11, was appointed receiver on December 22nd, 1925, under powers contained in debentures dated November 30th, 1922.

Walbar Engineering Co., Ltd.—Debenture dated December 11th, 1925, to secure £250, charged on the company's property, present and future, including uncalled capital. Holder: H. Langley, 96, Lightcliffe Road, Huddersfield.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Marconi's Wireless Telegraph Co., Ltd.

The directors have announced that it is not proposed to pay an interim dividend on the ordinary shares. The preference dividend for the latter half of 1925 was paid on January 1st. The passing of the interim ordinary dividend is due to circumstances which are set forth in a circular issued to the shareholders, and to the necessity of conserving to the utmost the cash resources of the company to meet the great programme of expenditure. The circular reads as follows:—

"Shareholders have from time to time been informed that the company was engaged in negotiating with the Postmaster-General a licence for the conduct of telegraph services between Great Britain and foreign countries. The directors are glad to be able to state that these negotiations have now been brought to a satisfactory conclusion and that the agreement embodying the terms of the licence was signed yesterday (December 31st). In addition to the services which the company has been conducting with France, Spain, Switzerland, Austria and the United States, it is now licensed to conduct services with the following European countries: Denmark, Sweden, Finland, Russia, Portugal, Jugo-Slavia, Bulgaria, Turkey and Greece, and with all foreign countries outside Europe. Your directors feel sure it will be a source of gratification to the shareholders to know that after so many years of discussion, the company is at last in a position to proceed with the establishment of a world-wide wireless telegraph service.

"The Beam stations which the company is erecting for the British Government and for the Governments of the Dominions and India, are making satisfactory progress. It had been hoped that the Canadian and South African stations would be ready for working by the end of 1925, but their completion has been delayed by the illness of Senatore Marconi and Mr. Franklin. In spite of this handicap, Senatore

Marconi and his staff have been able, since the work of construction commenced, to make some important improvements in short wave communication which are to be embodied in the new stations. These changes have involved further delay, but your directors are confident that the result will be to make the stations more efficient and to secure for the company a larger revenue than was originally anticipated. The directors are of opinion that the Beam services between this country and Canada and South Africa should be ready for working in April next, and that the services with India and Australia will be in operation about the middle of August. A Beam station is being erected at Dorchester for communication with the United States and with South America. A corresponding station is being built in Brazil for the account of the consortium of the four Wireless Companies operating in South America. The company is also constructing stations connecting Portugal and her Colonies and linking up Portugal with the rest of the world.

"This programme of construction involves the expenditure of approximately £1,000,000 sterling. At no time in the history of the company has so much work been in hand in connection with the establishment of telegraphic services.

"At the last general meeting the managing director stated that the Board had determined to make such reductions in the company's expenditure as were possible without reducing the efficiency of the company's organisation. Reductions have already been made, and continue to be made at every possible opportunity, but the full effect will only be partially reflected in the accounts of 1925. A good deal has already been done to carry out the undertaking given at the last general meeting to close down those subsidiary companies which appeared to the Board not likely to become profit-earning in any reasonable period of time and the Board has also taken the necessary steps to reorganise other subsidiary companies whose results up to the present have been unsatisfactory. The sales side of the company's business continues to show satisfactory results.

"The preparation of the company's case for submission to arbitration in connection with its claim against the Government for the use of its patents by the fighting forces, before, during and since the war, has made a considerable advance, but the amount of work involved is so great that it is impossible to give any definite date when this will be completed. No effort is being spared by the company or the Government Departments to expedite the hearing.

"In consequence of your Board's efforts to effect a reduction in expenditure on the telegraph services, a lightning strike took place on November 2nd. The matter was referred by the company to the Engineering and Allied Employers' London and District Association, and a provisional agreement was arrived at whereby the telegraphists returned to duty pending further discussion. These discussions have not yet led to a satisfactory settlement. A strike has also taken place of the operators in the employ of the Marconi International Marine Communication Co., Ltd., in which company the Wireless Company is a large shareholder. This strike was declared by the same Union as was responsible for the lightning strike at Radio House and is still proceeding."

Tata Power Co. In their report for the year ended June 30th last, the directors state that they have acquired practically all the land required for the works, except the transmission line, for which 60 out of 76 miles has been acquired. The progress on the dam has been satisfactory, and it is hoped that the masonry will be of sufficient height by June, 1926, to permit of the supply of power. Sufficient pipes have been received to allow of two generators being put into commission. About half of the generating station has been completed and some machinery has been received. At the receiving station a commencement has been made with the erection of switchgear. At the end of the year under review the unpaid calls amounted to Rs.137 lakhs, but since then Rs.13 lakhs has been paid up.

Leicestershire and Warwickshire Electric Power Co.—It is reported that the company is seeking Parliamentary powers to raise its capital by the creation of £500,000 in £1 ordinary shares, and to increase its borrowing powers by £122,970. It also seeks to obtain the power to further increase its borrowing powers by means of Special Orders. The company also proposes to divide its £10 ordinary shares into £1 shares.

Edison Swan Electric Co., Ltd.—At an extraordinary general meeting on January 4th resolutions were confirmed authorising the sub-division of the unissued £1 ordinary shares of the company into shares of 4s. each.

C. A. Vandervell & Co., Ltd.—It is reported that more than 75 per cent. of the holders of each class of share have accepted the offer to purchase their holdings made by Messrs. Thomson, McLintock & Co.

It is stated that the offer was made on behalf of Messrs. Joseph Lucas, Ltd., and that there will be no change in the management of the concern.

Crompton & Co., Ltd.—An interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended September, 1925, is payable on January 9th.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

Telephone Manufacturing Co.—£10,000 eight per cent. cumulative income bonds of £100 each, Nos. D1 to D100 (registered).

Stocks and Shares.

MONDAY EVENING.

IN the endeavour, usually made at this time of year, to forecast in some rough shape the manner in which Stock Exchange markets may be expected to move, the natural temptation is to lean to the optimistic side. Everybody hopes for the best. Common or garden charity dictates a sympathetic desire that prices may rise for the sake of those people who hold the stocks and shares. Nor, speaking "big and large," as the modern repetition of an old phrase says, is there any tangible reason for anticipating that prices should proceed in a way other than satisfactory to the holders of securities. Despite the 5 per cent. Bank Rate, money is the reverse from being tight. The course of trade, national and international, is still too sluggish for it to demand any but normal supplies of cash with which to finance its requirements.

The prospect for the prices of Home Railway and London Traction issues is not encouraging. The Underground group approaches the limit of its present capacity for expansion. "Pirate" 'bus competition has an influence upon the takings of the Combine. The latter is run by men of energy, experience, and imagination. Yet the return upon the large amount of capital invested in this group is meagre, and there will be no such adventitious Wembley aid as the last two years have provided. It is to be hoped, however, that a start will be made this year in the reorganisation of the capital account of the Underground Electric Railways of London, hitherto hung up by the divergence between the London and the New York rates of exchange.

Brazilian Tractions are not likely to enjoy another such dramatic rise in value as that which occurred in 1925. The bull bases his impression of further advance upon the persistent report of American-Canadian interests buying the shares for control. Confident anticipation of a rise in the dividend is always a factor, and so is, of course, the consideration that the company is doing well. The Mexican group of utility companies must depend for their progress upon the political and financial march of events in the country. Contrary to a general hope, the recognition of Mexico by Great Britain has led, so far, to little change in the immediate outlook.

British Columbia Electric stocks can be looked upon as sound speculative investments. The company goes ahead, in Vancouver, with the same steady persistence as characterises the soundly-managed British Electric Traction Company at home.

The New Year is bound to witness important developments in connection with the London electricity supply industry. Optimism talks with no hesitating tongue of the dividend declarations so soon to be announced in respect of 1925. Again, the far-reaching changes that will come about so shortly by the operation of the new Parliamentary Acts are thought likely to benefit share prices. Some of these have been put up well ahead of the actual event. If the various rearrangements of capital result in the provision of additional shares in which to deal, this will be of distinct advantage to a market which, for years past, has suffered from the disability of a restricted supply of stock with which to satisfy would-be investors. The group will be extended by the admission into it of shares, &c., in various provincial undertakings. Rumour plays with the idea that Americans are already endeavouring to obtain a footing in British electricity supply, through the medium of lighting and power undertakings well outside the London area.

While the cable companies, embarked upon a policy of strict retrenchment of expenses, can be expected to maintain earnings and dividends, it is hard to say what the immediate future holds in store for the wireless concerns. One of the few Stock Exchange disappointments last year was furnished by the gradual dwindling in the price of Marconis. A strike of wireless operators was a kind of last straw, but prices have now descended to such low levels as seem to make a sale indiscreet. The rubber boom, which formed the outstanding feature of last year's markets, laid a check upon the previous hectic rush in the shares of various cable equipment companies. This check proved to be little more than temporary. Prices in the cable section, and in that for electrical manufacturing shares, are very hard. The buying has been mainly of the investment order, and the shares purchased were paid for by the supporters. This suggests the possibility of further improvement, although there are not wanting cautious folk to indicate the substantial character of the rise as a reason for not anticipating much more advance at present. There is, however, a spice of speculation in this particular department owing to the rapidity of changes which take place in the realms of labour, politics, trade, and finance. "One never knows," says the Stock Exchange platitude.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Jan. 4 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	13	14	59/6	—	4 14 1
Brompton Ordinary	1	10	10	1½	+1/16	*5 18 6
Charing Cross Ordinary	1	14½	15	2 7/16	—	6 3 1
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2½	—	5 13 0
City of London	1	15	15	50/9	—	5 18 1
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	59/6	—	5 0 10
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Edmundson's Ordinary	1	7	7	24/6	—	5 14 8
do. 7% Pref.	1	6	7	21/6	—	6 10 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13¼	—	5 13 2
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	10	33/6	—	5 19 5
do. do. 6% Pref.	5	6	6	5 5/16	—	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 5
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15¼	−¼	5 14 9
South London	1	15	15	28	—	5 18 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 6
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	48/-	+1/6	6 5 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	−6d.	7 13 10
kshire Elec.	1	8		30/6	—	5 5 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	4	5	69	—	7 5 0
do. District	,,	3½	3½	47½	+½	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2¼	—	Nil
do. do. "A"	1/-	Nil	Nil	7/-	—	Nil
do. do. Income Bonds		6	6	98	—	*6 2 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	,,	1½	1½	24⅞	—	6 0 8
Automatic Telephone	1	8	6	51/3	—	2 6 10
Chili Telephone	5	6	5	6 5/8	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 9 7
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18⅝	−⅛	*5 3 11
do. do. Pref.	10	6	6	11	—	8 4
Great Northern Tel.	10	22	22	33	—	6 13 4
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1⅛	—	9 17 10
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	5	8	8	7 13/16	+1/16	5 2 5
Western Telegraph	10	10	10	18	—	*5 11 1
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	8 9 2
do. do. 2nd Pref.	5	6	6	8 3/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	78½	—	6 16 3
British Electric Traction Ord.	,,	6	6	119½	—	5 0 0
do. do. 6% Pref.	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	85	+½	4 14 2
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	96/-	96/-	104½	+2	*4 11 1
do. do. Deferred	,,	129/5	129/5	127½	+3	*5 2 0
do. do. Deb.	,,	4½	4½	77	—	5 10 5
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	3/6	—	Nil
London United Tram. Deb.	Stock	4	4	42½	—	9 8 4
Mexico Trams, 5% Bonds	—	5	5	61½	—	8 2 8
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	70½	−1½	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	51/3	—	*4 13 4
British Aluminium Ord.	1	5	10	38/-	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	... ...
British Insulated Ord.	1	15	15	2 13/16	+1/16	5 6 3
Brush Ord.	1	10	10	28/-	+1/-	7 2 10
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	9/3xd	+3d.	4 6 6
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/3	+9d.	5 3 11
do. do. Pref.	1	6	6	20/6	−6d.	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	+6d.	5 8 4
do. Ord.	1	5	7½	29/3	+1/3	5 2 7
Henley	1	15	16	3½	—	4 11 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1 3/8	—	*4 14 1
Johnson & Phillips	1	10	10	56/3	—	3 11 1
Met-Vickers, Ord.	1	8	8	27/-	—	5 18 6
do. Pref.	2	8	8	2⅞	—	6 14 9
Siemens Ord.	1	—	7½	35/-	+9d.	4 5 9
Telegraph Construction	12	20	20	27	—	*4 9 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

	CHEMICALS, &c.	Price January 5th.	Fortnight's Inc. or dec.
a	Acid, Oxalic per lb.	5½d.	...
a	Ammoniac, Sal per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ,,	...	...
a	Borax ,,	£25	...
a	Copper Sulphate ,,	£25 10s.	...
a	Potash, Chlorate per lb.	4d. to 4½d.	...
a	,, Perchlorate ,,	5½d.	...
a	Shellac per cwt.	£15 15s.	...
a	Sulphur, Commercial ,,	£8 10s.	...
a	,, Roll ,,	£8 10s.	...
a	Soda, Chlorate per lb.	3½d. to 3⅝d.	...
a	,, Crystals per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks per lb.	4d.	...
	METALS, &c.		
b	Aluminium, Ingots per ton	£120 to £125	...
b	,, Wire per lb.	1/9 to 2/6*	...
b	,, Sheet ,,	1/6 to 2/-	...
p	Babbitt's Metal and Anti-friction Metal—		...
	Grade I per ton net	£257	£5 inc.
	Grade II ,, ,,	£182	£3 inc.
	Grade III ,, ,,	£101	£2 inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c	,, Tubes (solid drawn) ,,	1/- to 1/0½	...
c	,, Wire, basis ,,	10⅝d.	...
c	Copper Tubes (solid drawn) ,,	1/1	...
c	,, Bars (best selected) per ton	£90	...
c	,, Sheet ,,	£90	...
c	,, Rod ,,	£90	...
d	,, (Electrolytic) Bars ,,	£66 5s.	...
d	,, ,, Sheets ,,	£148 10s.	...
d	,, ,, Wire Rods ,,	£76 5s.	...
d	,, ,, H.C. Wire per lb.	9 7/16d.	...
f	Ebonite Rod ,,	2/3 to 2/8	
f	Sheet ,,	2 3 to 2/6	...
n	German Silver Wire ,,	2/2	...
h	Gutta-percha, fine ,,	6 6	...
h	India-rubber, Para fine ,,	3/10	2d. dec.
i	Iron Pig (Cleveland Warrants) per ton.	nom.	...
l	,, Wire, galv. No. 8, P.O. qual. ,,	£12	...
g	Lead, English Pig ,,	£37	£1 inc.
g	Mercury per bot.	£15 to £15 5s.	...
e	Mica (in original cases) small per lb.	3d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ,,	10/- to 20/- & up.	...
p	Phosphor Bronze, plain castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/3	...
p	,, ,, rolled strip & sheet ,,	1/9½	...
p	,, ,, wire ,,	1/8½	...
o	Platinum per oz.	£26	...
d	Silicium Bronze Wire per lb.	1/0½	...
r	Steel, Magnet, in bars ,,	7½d.	...
a	Tin, Block (English) per ton.	£287 to £287 10s.	30s. to £2 inc
n	,, Wire, Nos. 1 to 16 per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co. Ltd.
o C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lloyd's Register Scholarship.—A scholarship is annually awarded by Lloyd's Register of Shipping, worth £100 a year for three years, to a junior engineer or apprentice, as the result of a competitive examination. Particulars can be obtained from the Institute of Marine Engineering, 85-88, The Minories, London, E.1. Application must be made before March 10th.

A New Electrically-operated Fire Vehicle.—The latest turntable ladder fire vehicle introduced by Messrs. Tilling-Stevens Motors, Ltd., Maidstone, constitutes a formidable British challenge in a field hitherto successfully held by Continental makers, and again exemplifies the adaptability of the Tilling-Stevens petrol-electric propelling plant to duties requiring a supply of electricity. Known as type TTL2, the new vehicle utilises a T84 petrol-electric chassis with a four-cylinder engine developing 50-60 h.p., coupled direct to a compound-wound dynamo which supplies current to a series-wound motor driving the worm back axle through a propeller shaft. Consisting of one main and three sliding sections, the ladder is elevated by a motor with a vertical armature driving, through two sets of enclosed worm gear, a horizontal shaft with which are connected a pair of drums bearing twin steel-link elevating chains. The final 2 ft. of extension is accomplished at half speed, this being obtained by the introduction of resistance in the circuit. A dial indicator calibrated at 5-ft. intervals is provided in front of the operator, and is furnished with means whereby, when the ladder has attained any pre-determined height, the current is automatically cut off from the motor. A separate motor is employed for the operation of the ladder turntable, which is mounted directly above the back axle.

Conditions and Prospects in India.

Important Public Works.

MR. THOMAS M. AINSCOUGH, C.B.E., Senior Trade Commissioner in India and Ceylon, has forwarded a report on the conditions and prospects of British trade in India* to the Department of Overseas Trade. In a general review of the fiscal year 1924-5, Mr. Ainscough says that a general improvement was shown and the progress towards normal conditions was satisfactory. This improvement was very greatly contributed to by the improvement in the political situation and the subsidence of agitation. It is stated, however, that although the general economic condition of India is steadily improving, the import trade remains depressed and the future is still obscure. Competent observers have repeatedly emphasised the truism that so long as the Indian *rayat* is only receiving increased prices of little more than 30 per cent. for his produce, he cannot afford to purchase normal quantities of imported goods at rates varying from 100 to 170 per cent. higher than those ruling before the war.

So far as the engineering trades are concerned, the future largely depends on the progress of important public works, such as railway, irrigation, harbour, dock, canal, and hydro-electric schemes. In the iron and steel trade British exports are adversely affected by Continental competition, and to a lesser degree by the recent Indian protective tariff upon steel.

Foreign Competition in Import Trade.

In certain directions German competition in the import market has become prominent. In 1913-14 the German share of Indian import trade was 6.9 per cent. In 1923-24 it was 5.2 per cent., and during the following year it rose to 6.3 per cent. Mr. Ainscough says that he can find no foundation for the statement that the Germans are re-introducing extended credit terms and are giving better facilities than their British competitors. The share of Belgium in the import trade has remained fairly steady, at between 2.3 and 2.8 per cent. Over 60 per cent. of this consists of iron and steel manufactures which compete seriously with British products. American exports, after advancing steadily during and immediately after the war, declined considerably between 1920 and 1924, although they rallied slightly during the year under review. One of the principal items supplied by the United States is electrical instruments and apparatus, and American competition is also very keen in electrical machinery and in those types of machinery and tools where the large domestic market of the United States has enabled the American makers to standardise, and so reduce prices.

Electrical Imports.

The following table reproduced from the report shows the total imports of electrical machinery and the countries of consignment for the past three fiscal years :—

Countries of consignment.	1922-23. Rs. (lakhs).	1923-24. Rs. (lakhs).	1924-25. Rs. (lakhs).
United Kingdom ...	2,00	1,64	1,77
Germany	6	4	4
United States	38	41	15
Other countries	16	13	6
Total	2,60	2,22	2,02

It is considered most satisfactory that British manufacturers have increased their share of the trade at the expense of American and Swedish competitors. This, it is stated, is very largely due to the splendid service given by the Indian branches and agencies of the leading home stores, most of which employ highly qualified engineers and salesmen, who are continually touring the country and keeping in close touch with every project. Competition among them is very keen, and there is a great deal of price cutting, but the result is that foreign competition is not allowed to become really serious. The falling away in the total trade is largely due to reduced imports of motors, generators, transformers and turbo-generators. The unclassified imports, however, rose by nearly 29 lakhs. The most serious decline was in the case of motors, the value of which fell from 72 lakhs in 1913-14, to 40 lakhs in 1924-25. The development of railway electrification in India, which is dealt with subsequently, will provide an increasing market for electrical plant. British makers have supplied machinery, cables and apparatus for the first section of line to be electrified in India, *viz.*, the G.I.P. local service in Bombay.

The total value of imported electrical apparatus in 1924-25 was 197 lakhs, as compared with 226 lakhs in 1923-24. The most important item was electric wires and cables, which were valued at 67 lakhs as against 70 lakhs. By far the largest proportion of this apparatus came from the United Kingdom; Germany occupied the second place in 1924-5, supplanting the United States in this position.

Indian Stores Department.

It is the avowed policy of the Government of India to develop the purchase of stores as far as possible in India, granting a preference to articles manufactured, or partly manufactured, in the country and utilising the activities of the recently created Indian Stores Department, to stimulate the local manufacture of such articles. This department has already carried out a good deal of work, and it is stated that a notable advance has been made in the direction of authorising the purchase in India, from the branches and agencies of foreign manufacturers established in the country, of engineering plant and machinery, whether stocks are held in the country or not, and the department has thus been enabled to purchase at economic prices in India a considerable quantity of engineering plant and machinery which otherwise would have had to be purchased from England. The purchases covered by the department consist of a wide range of stores, and include complete electric power plants, railway materials, &c. During the past year the engineering branch purchased plant and materials for electrical installations to the value of Rs. 10,32,060. It is of interest to note that one item in which the United States has a monopoly is locomotive headlights. The report says that it is most unfortunate that British makers have not specialised in this type of fitting. One or two firms have been in negotiation with the Railway Board, but it seems doubtful whether they will be able to produce a suitable article and have it tested before the American lights are installed. The Director-General of the Department of Posts and Telegraphs, in his report for 1923-4 states that a tentative order for 100 tons of hard-drawn copper wire was placed in December, 1923, with the Indian Cable Co. of Jamshedpur (a concern managed by a British company) and that satisfactory deliveries were made during 1924. The Calcutta Pottery Works has increased its output of insulators, and it is hoped that in the near future this firm will be able to meet the entire requirements of the department for insulators, the annual value of which is about 5 lakhs. The services of the Indian Stores Department in Delhi-Simla are now being utilised to an increasing extent, and such items as oils, electric light and fan fittings, and various other stores, are now purchased through this agency.

Hydro-Electric Development, &c.

Work on the Lloyd Barrage made satisfactory progress during the year under review; a considerable quantity of plant arrived and was erected; the power house to supply electrical energy to works and township buildings, was in course of construction; and the first power unit was to be erected shortly. The report contains a list of plant which it is intended to purchase during the year 1925-6. This includes electric derrick and "Goliath" cranes, centrifugal pumps with electric motors, motors and starters, three 500-h.p. Diesel engines and alternators, transmission lines, township lighting equipment, &c. Considerable extensions are being carried out at the Port of Calcutta, and a great deal of up-to-date cargo handling machinery is being installed. The hauling gear of the sliding caissons and the capstans and penstocks at the entrances to King George's Dock will be operated hydraulically, but all other equipment will be operated electrically. For the supply of electrical energy the Port Commissioners have recently entered into a contract with the Calcutta Electric Supply Corporation, which is building and equipping a 12,000-kW generating station in the vicinity of King George's Dock. In case of accident in connection with this source of supply, current will be available from the present source, *viz.*, the Corporation's station at Cossipur, nine miles away, whence it is conveyed at a voltage of 30,000, transformed by the Calcutta Electric Supply Corporation to 6,000 volts, and by the Port Commissioners to a working voltage.

During 1925 the Punjab Legislative Council made the necessary grant of funds for the first year for the Punjab hydro-electric scheme (known as the Mandi project). With the exception of one or two minor details all the preliminary work has been carried through, and the engineer in charge hoped to commence work in the autumn of 1925. The project makes use of the snow-fed waters of the river Uhl, which joins the river Beas in Mandi State. The water will be carried through 2½ miles of 9-ft. diameter tunnel through solid granite, and then dropped through a fall of 1,800 ft. to the first power station, where 36,000 kW can be generated. The construction of a comparatively small dam on an excellent site will increase the available power to 70,600 kW. From this point the water can be taken through three miles of open duct and dropped through a second fall of 1,200 ft., generating another 40,000 kW, making a total development of 118,600 kW, which is more than sufficient to meet the present demand in an area extending from Delhi in the south to Sialkot and Lyallpur in the north. There is also a third fall of 750 ft. which can be developed later if required, but this has not yet been surveyed. There is a sufficient market for power at present in existence to justify the first stage of the project and many promises have already been received to meet the annual expense for the first five years. The Government intends, therefore, to proceed at once with the construction of the first stage of the scheme, but to limit the transmission of power to certain towns. The construction of the project necessitates the provision of permanent railway communication with the power station. A meter gauge tramway will therefore be constructed from the existing rail head at Mukerian through the Kangra Valley, which has for many years been in need of improved communi-

* Stationery Office. 5s. 6d. net.

cations. The first stage of the project also includes a fund for assisting mill owners to install electrical equipment in mills on the hire-purchase system, at cost price, thereby encouraging the rapid replacement of steam by electricity as soon as the scheme has been completed. The cost of this first stage, including the tramway, local distribution, and the mill-owners' fund, amounts to Rs. 557 lakhs. It is expected that the scheme will take about 2½ to 4 years to construct. In the second stage of development, it is proposed to extend the transmission system so as to supply Simla, Ambala, Patiala, and other towns. This will render necessary the erection of a dam. The third stage of the scheme will carry power as far as Saharanpur, Meerut and Delhi. British manufacturers of the types of plant which will be required are advised to place themselves in touch with Lieut.-Col. B. C. Battye, D.S.O., R.E., Chief Engineer, Hydro-electric Circle, Punjab Government, Benmore, Simla.

Railway Electrification.

The first line to be electrified in India, reference to which has been made, was opened for service on February 3rd, 1925. The electrified section of the G.I.P. railway runs from the Victoria terminus, Bombay to Kurla, *viâ* the Harbour branch. In 1904 the problem of increasing the capacity of the G.I.P. suburban line received consideration, but the schemes now in progress did not take definite shape till 1913, when a well-known firm of consulting engineers advised the electrification of certain sections. The work was held up by the war, but projects for the electrification of the harbour branch and Mahim Chord, and of the Bombay-Thana section were accepted by the Secretary of State in August, 1922, while approval of the scheme from Thana to Kalyan was received in June, 1923. The work has been carried out by British engineers and the plant and equipment was almost entirely supplied by well-known British firms.

The B.B. & C.I. Railway Co. is also engaged on an extensive scheme of suburban line electrification in Bombay. Important contracts have been awarded to British firms, and the work will be pushed forward as rapidly as possible. In Calcutta the electrification of the suburban section of the Eastern Bengal and East Indian railways is also being considered. There is little doubt that railway electrification in India will be greatly extended in the future. Mr. Ainscough says that British manufacturers have secured a strong position by the excellence of the material and plant supplied on the first contracts.

Radio-Telegraphy and Telephony.

In March, 1925, the Indian Radio Telegraph Co., Ltd., was registered, with an authorised capital of 3 crores of rupees. The company was formed to erect radio-telegraph and telephone stations under Government concessions. It is intended in the first instance, to erect a station at Kirkee, near Poona, for the purpose of transmitting and receiving messages to and from Great Britain. It will be of the "beam" type, and the British Government has agreed to erect a similar station in England. The station was expected to be ready for service nine months from the date of the final approval of the plans by the Government and the acquisition of the site.

Broadcasting in India is still in its infancy and has not yet been carried out on a commercial scale. Radio clubs have been formed in some of the principal cities and experimental programmes are transmitted. Certain definite recommendations have been made by interested parties, to the Government, and as a result of these the Government has stated its willingness to grant a licence to a broadcasting company, subject to certain conditions.

So far the bulk of imports of radio apparatus has been of British origin; at present no apparatus is made locally, but possibly sets may be assembled locally from imported component parts. The foreign competition so far encountered is mainly from the United States, France and Germany.

Radio Apparatus in Latvia.—Under Clause 5 of the regulations governing the purchase and use of radio apparatus, issued by the Latvian Government, foreign radio sets and accessories may be acquired if such apparatus is not made in Latvia or is made in insufficient quantities. Periodical lists of this permitted apparatus will be published. A translation of the first list, supplied by the Department of Overseas Trade, includes "receiving apparatus with not more than four valves, as well with 2-4 valves (*sic*), without re-generation on first or second valves," in addition to a great number of parts and accessories, as transformers, valves, telephones, loud speakers, condensers, &c.

Power Station Radio Communication System.—The Italian Government has recently granted a concession to the Società Italiana Ernesto De Angeli, of Milan, to establish six wireless transmitting and receiving stations in connection with the electric power station at Ardesio (Bergamo) and at the transformer and distribution-sectionising stations at Ponte Nossa (Bergamo), Casellazzo (Milan), Legnano, and Milan. The purpose of the stations is to transmit by radio operating instructions to the engineers in charge at the different stations. The concession, which is run for a period of ten years, authorises a wave-length of 1,000 metres for the Bonate Supra and Castellazzo installations and 1,750 metres for the others. Messages are only to be transmitted between the hours of 7.30 and 9.30 a.m. and between 4 to 6 p.m., although in cases of emergency messages may be transmitted at any other time. The installations are stated to be the first of their kind in Italy.

The Import Trade of Siam.

THE following figures, showing the imports of electrical and similar goods into the port of Bangkok during the year ended March, 1925, are taken from the recently-issued official trade statistics; the figures for the year ended March, 1924, are included for the purposes of comparison, and notes of any increases or decreases are given. Imports stated to be from Singapore and Hong-Kong are for the most part the products of other countries shipped *viâ* these two ports:—

	1923-24. Ticals.	1924-25. Ticals.	Inc. or dec. Ticals.
Lamps.—			
Total	392,000	591,000	+ 199,000
From Singapore	59,000	88,000	+ 29,000
,, Hong-Kong	32,000	46,000	+ 14,000
,, United Kingdom ...	62,000	80,000	+ 18,000
,, United States	26,000	37,000	+ 11,000
,, Japan	80,000	76,000	− 4,000
,, Germany	78,000	203,000	+ 125,000
,, Sweden	36,000	45,000	+ 9,000
Electrical goods and apparatus.—			
Total	1,151,000	796,000	− 355,000
From United Kingdom ...	287,000	279,000	− 8,000
,, Germany	328,000	127,000	− 201,000
,, United States	118,000	119,000	+ 1,000
,, Singapore	22,000	19,000	− 3,000
,, Sweden	27,000	22,000	− 5,000
,, Italy	31,000	23,000	− 8,000
,, Holland	54,000	22,000	− 32,000
,, France	17,000	22,000	+ 5,000
,, Japan	32,000	86,000	+ 54,000
Manufactures of copper.—			
Total	71,000	55,000	− 16,000
From United Kingdom ...	32,000	19,000	− 13,000
,, India	6,000	3,000	− 3,000
,, Germany	20,000	12,000	− 8,000
,, France	5,000	500	− 4,500
Scientific instruments and apparatus.—			
Total	217,000	249,000	+ 32,000
From United Kingdom ...	84,000	77,000	− 7,000
,, Germany	23,000	32,000	+ 9,000
,, France	6,000	10,000	+ 4,000
,, Japan	23,000	39,000	+ 16,000
,, United States	28,000	35,000	+ 7,000
,, Denmark	7,000	1,500	− 5,500
,, Belgium	10,000	—	− 10,000
Prime movers, other than locomotives, marine, military, and agricultural machinery.—			
Total	321,000	165,000	− 156,000
From United Kingdom ...	129,000	75,000	− 54,000
,, United States	132,000	6,000	− 126,000
,, Germany	15,000	32,000	+ 17,000
,, Denmark	28,000	6,000	− 22,000
Machine tools.—			
Total	142,000	186,000	+ 44,000
From United Kingdom ...	89,000	71,000	− 18,000
,, United States	1,000	46,000	+ 45,000
,, Denmark	7,000	6,000	− 1,000
,, Germany	14,000	55,000	+ 41,000
Machinery, unenumerated, including detached parts, and not including agricultural, textile, or sewing machines.—			
Total	1,291,000	1,765,000	+ 474,000
From United Kingdom ...	539,000	602,000	+ 63,000
,, Japan	1,000	4,000	+ 3,000
,, United States	152,000	102,000	− 50,000
,, France	23,000	27,000	+ 4,000
,, Denmark	485,000	810,000	+ 325,000
,, Germany	29,000	139,000	+ 110,000
Railway material.—			
Total	1,739,000	1,949,000	+ 210,000
From United Kingdom ...	163,000	154,000	− 9,000
,, Belgium	1,008,000	357,000	− 651,000
,, France	569,000	1,417,000	+ 848,000
Cars or trucks for railways or tramways.—			
Total	675,000	241,000	− 434,000
From United Kingdom ...	600,000	202,000	− 398,000
,, United States	4,000	32,000	+ 28,000
,, Belgium	46,000	4,000	− 42,000
Rubber manufactures, other than tires.—			
Total	220,000	374,000	+ 154,000
From Singapore	128,000	279,000	+ 151,000
,, United Kingdom ...	53,000	50,000	− 3,000
,, United States	6,000	15,000	+ 9,000
,, Japan	8,000	4,000	− 4,000
,, Germany	8,000	9,000	+ 1,000

NOTE.—Tical = 1s. 10½d.

The Performance of Radio Amplifiers.

Summary of the Radio Research Board's Experiments.

(*Abstract of Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper by Mr. H. A. Thomas, M.Sc., describes the researches carried out at the National Physical Laboratory for the Radio Research Board. A standard method of testing the amplification and input impedance of an amplifier is described, and the theory of the load introduced by the amplifier as well as by reaction is shown to agree with the observed results. Unfortunately, any combination of valves used for amplifying, note-magnifying, and/or rectifying, is commercially regarded as an amplifier. Such an arrangement will be termed an "amplification system," and the term "amplifier" will be applied only to a combination of components fulfilling the purpose of pure high- or low-frequency amplification. Unless otherwise stated, the terms will include all battery and output connections, *i.e.*, the complete assemblage. The performance of any amplifier must be expressed in terms of three distinct properties :—(1) Its voltage amplification; (2) its effect upon the circuit to which it is connected, and (3) its distortion of wave-form, but the experimental work carried out has been insufficient for an attempt to be made to correlate any one property with any other. Valve noises, which in a multi-stage audio-frequency amplifier usually determine the limiting number of cascade valves, are not dealt with, being more a matter of valve design.

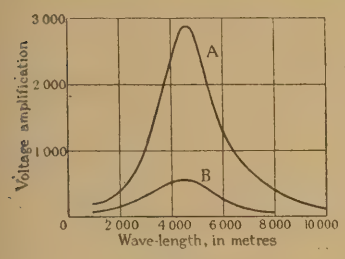


Fig. 1.

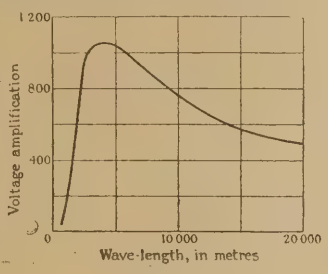


Fig. 2.

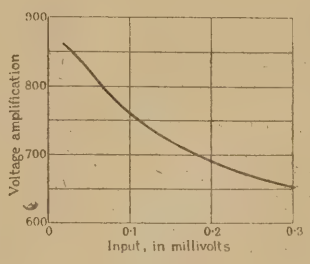


Fig. 3.

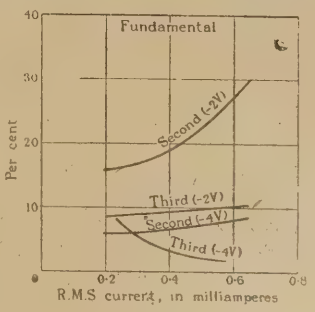


Fig. 4.

Section I. deals with the measurement of voltage amplification and the results obtained show that so far as high-frequency amplification is concerned, apparently the net effect of the many factors which can only be approximated in design gives very variable figures for amplification. As an example two apparently identical 3-stage amplifiers, transformer coupled, gave the results shown in fig. 1. In curve A it is apparent that retroaction effects combine to increase the overall amplification, whereas in curve B the phasing is such as to reduce the amplification. Since such retroactive effects form an inherent property of any amplifier and are dependent upon inter-electrode capacities, stray lead capacities and leaks, it is reasonable to expect large variations between amplifiers built to similar specifications.

Fig. 2 gives the overall voltage amplification of a 6-stage resistance-capacity amplifier, which shows that below 4,000 m. the shunting effect due to the self-capacity of the anode resistances seriously reduces the amplification. The more gradual fall at higher wave-lengths is attributed to the fact that the coupling condensers are not large enough at the lower frequencies. Fig. 3 gives the amplification of a 6-valve untuned transformer-coupled amplifier with various inputs on the grid, from which it will be observed that the amplification appears to fall with increasing input. It has been stated by several authorities that the voltage amplification falls with weak inputs, but the inputs for which this effect is claimed are of the order of a few microvolts and are smaller than any input measured here. The curve in fig. 3 may therefore bend back to the origin, but no measurements have been taken to confirm this. The evidence for this effect may depend upon distortion which will seriously affect the r.m.s. value of the current and may not be a genuine reduction of amplification of the fundamental. The discrepancies arising due to a neglect of the harmonics present may be very serious. The behaviour of the detecting valve departs only very slightly from the theoretical square law; in fact, this law can in most instances be assumed.

The measurement of the voltage amplification of a low-frequency amplifier presents less difficulty. The inter-electrode impedances at low frequencies are large and their shunting effects almost negligible. Induction can be entirely eliminated with care, and measurements to less than ½ of 1 per cent. can be obtained. Several standard audio amplifiers were tested at a frequency of 1,000, and it was found that the overall amplification of several cascade stages was less than the product of the individual stages. A special experimental 2-stage amplifier was built with which very consistent results could be obtained. The effect of the high-pressure condenser of several microfarads was very pronounced, the amplification falling considerably when a smaller condenser was used, probably due to the resistance of the h.p. battery. Inserting a small capacity of 100-1,000 $\mu\mu$F between the two windings of the transformer slightly increased the amplification, due te the increase in the electrostatic coupling between the windings; a capacity of 1,000 $\mu\mu$F increased the amplification by 5 per cent. These tests show that it is possible to construct a 2-stage amplifier in which little loss takes place, if the components are judiciously separated. The maximum may be obtained, if separate high-pressure batteries be used for each stage without the use of a high h.p. condenser. Separate low-pressure batteries produce an increase of 4 per cent. in overall amplification.

The input impedance of an amplifier is studied in Section II; the amplifier may be considered as a resistance and capacity in series forming a load across the resonant system. The value of this capacity appears to be sensibly constant under all conditions, whereas the value of the resistance is dependent upon the value of the tuning inductance. The effects due to reaction can be expressed in terms of the known theoretical conditions.

In Section III distortion in audio-frequency amplifiers is considered and the following conclusions are drawn, remembering, however, that they are provisional only; considerably more experimental work is necessary to confirm the general conclusions so far obtained.

(i) The effect of *increasing output* is to modify the wave-form seriously. In general, the harmonics increase in magnitude far more rapidly than the fundamental.

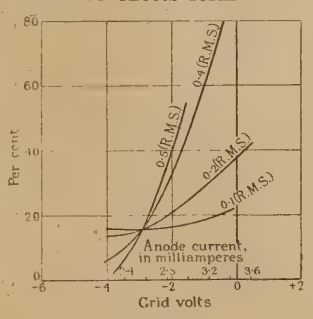


Fig. 5.

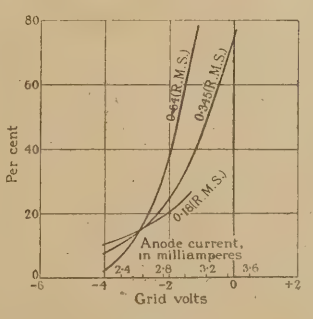


Fig. 6.

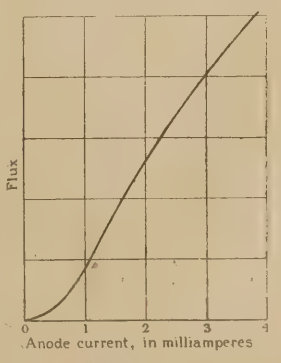


Fig. 7.

(ii) As the *frequency* is lowered, the distortion becomes much more serious. It is safe to say that at 150 p.p.s., the fundamental may be almost completely eclipsed by the harmonics with outputs of about 1 mA.

(iii) The effect of *negative grid bias* is to reduce the magnitude of the second and third harmonics and to introduce small harmonics of a higher order.

(iv) The *form factor* remains sensibly constant under most conditions.

(v) That the rapid growth of the higher harmonics (the fourth, fifth, and sixth) produces a critical distortion was noticed in many cases. The shape of the Lissajous figure quite appreciably changes with a very small increment of current beyond a given critical value. The form factor and other ratios are seriously upset in this case, and do not fall into the final inferences with smaller outputs.

(vi) In fig. 4 the percentages of the second and third harmonics are given for various outputs with different grid potentials; the rate of growth of the harmonics is much greater than that of the fundamental, thus demonstrating the rapid wave-form change as the amplitude of the sinusoidal input is increased.

(vii) In fig. 5 the ratio of the actual peak to the fundamental component peak is plotted for various output currents and

mean grid potentials and is expressed as a percentage greater than unity; the curves all intersect at a point corresponding to a mean negative grid potential of 2.9 volts. This means that the wave-form is *not altered* by increasing the magnitude of the output, and this condition is valid only at this point. Further, there is *definite distortion* leading to an error of 18 per cent. *which apparently cannot be removed by reducing the signal amplitude.*

(viii) The ratio of the actual peak value to the peak of a sine wave of the same r.m.s. value is plotted in fig. 6, from which a precisely similar result is obtained at the same mean grid-voltage condition. It seems probable that this condition is one defined by the normal d.c. anode-current component in the primary of the transformer, rather than any loading effect on the secondary, due to grid-filament impedance, which will be very large in all the cases considered. This grid voltage corresponds to 2.6 mA primary current. In Section I it is shown that the transformer voltage ratio is materially affected by the normal d.c. anode current, thus supporting this opinion. The shape of the *B-H* curve for the transformer is shown in fig. 7, from which it will be seen that the polarising flux brings the normal working point just at the beginning of the saturation bend. It is not easy, however, to observe any definite properties at this point.

It is apparent that the error between an r.m.s. determination of output and a fundamental wave determination as given by a resonant instrument may be often as much as 20 per cent. Further, the grid variation is much in excess of the theoretical as given by an r.m.s. measurement.

The general observations point to peak values giving the chief measure of output sound effect upon the human ear, and if this can be established it is clear that much modification will be necessary in our measurements of signal intensity.

Mining in other Countries.

Electric Power Plant in the Tropics and in South America.

(*Abstract of Paper read before the* ASSOCIATION OF MINING ELECTRICAL ENGINEERS.)

AT a recent meeting of the London branch of the above-named Association, Mr. H. M. Morgan described electric power plant at a group of collieries in the tropics, and also that at a group of metalliferous mines in South America, where the conditions are very different.

Tropical Collieries.—Steam, superheated to a total temperature of 500 deg. F., is generated by Lancashire and Babcock and Wilcox boilers; the latter are provided with Green economisers, chain grate stokers, and balanced draught. The large grates enable inferior fuel to be burned and, so far as is possible, the boilers are fed with condensate, and the make-up pit water has to be treated. As native labour is used it is advisable to render the plant as fool-proof as possible.

The generating station commenced in 1909 with one Belliss-Vickers set; two others were added later, and condensing plant has since been installed. The fourth set is a 500-kW, 2,200-volt, Belliss-G.E.C. condensing machine with a directly-coupled exciter, all the engines being capable of producing their full output at a reduced steam pressure—a useful feature for remote plant. The load is now normally carried by a Parsons reaction, 6,000-r.p.m., turbine driving a Mather and Platt, 1,430-kVA (at 0.7 p.f.), 2,200-volt, 25-cycle alternator at 750 r.p.m. through single-reduction cut gear, the exciter being directly coupled.

All the auxiliary plant is motor driven and the condenser air (steam) ejector has an intermediate condenser. The results in cheaper power production have been most marked, but at tropical collieries high atmospheric temperatures and a definite heavy rainy season have to be contended with. The condenser cooling water temperature has been as high as 98 deg. F., while that of the water pumped from the colliery workings has reached 94 deg. F. In the wet season with a dry bulb temperature of 84 deg. and the wet bulb thermometer at 81 deg., it is impossible to cool satisfactorily; Korting spray nozzles are used for water cooling purposes.

The cost of power, including labour, coal (a poor quality, picked out and charged at the average cost price of the whole output), stores and depreciation, is about 1¼d. per kWh for the non-condensing Belliss sets, say, at 350 kW; ¾d. per kWh for the condensing Belliss set, say, at 450 kW; and ½d. per kWh for the turbo-generator, say, at 800 kW.

The slate switchboard is by Erskine, Heap & Co., Ltd., whilst power transmission is by overhead lines at 2,200 volts throughout. Lightning arresters and choke coils are placed at every overhead bare transmission line end, of the horn and multigap types; in all cases there is a resistance in the earth circuit. The multigap type is preferred, but the arresters have not given full protection. At rare intervals there has been some damage to switchgear and joint boxes.

The poles are tubular or are rails; those for the 0.6 sq. in. (19/0.202 wires) line are 32 ft. long, 10½ in. diameter, reducing in two steps to 8¼ in. at the top. One conductor is carried on the pole top and two on a cross arm, giving 2 ft. 6 in. centres between conductors. The span is 270 ft. and the sag is about 9 ft., so that with the poles planted 5 ft. the minimum height of line above ground at centre of span is about 17 ft. The conductor weighs 2.4 lb. per foot. At bends towers are used made up of four poles well braced, and the terminal towers are also made up of four poles, but stronger than the angle towers. Disk strain and pin type insulators are used.

The end and angle towers are good for stresses of 12,000 lb. due to conductors. Single poles are good for a load of 2,240 lb. downwards and 1,100 lb. sideways at 2 ft. from the top. The disk strain insulators were subjected to a test pull of 12,000 lb. The pin type insulators were designed for a 1,000 lb. side pull applied at the conductor groove.

The type of cable most widely used is paper insulated, lead sheathed and double wire armoured. Formerly bitumen in various forms was used; it was all right at 440 volts, but gave trouble at 2,200 volts, and is not now used. In shafts the cables are rubber insulated and armoured. Junction boxes are usually of the "disconnecting link" type with glands arranged with a mechanical lead sheath seal, so avoiding wiped lead joints.

Electricity is supplied at 2,200 volts to the motors or to transformers which give a medium pressure of 440 volts for motors below 50 b.h.p. Transformers are of the core type, oil cooled, and vary in size for motors from 20 to 100 kVA and for lighting from 1½ (single phase) to 15 kVA (Scott connected).

The control gear for motors is of "mining" type, the equipment including voltmeter and ammeter, three-pole oil-break switch with two overload trips and one low-voltage release. Tank lowering gear is fitted which isolates the switch. The starting gear for motors is usually a liquid Sandycroft type interlocked in the case of haulage motors with an oil-break reversing switch for stator currents. The motors are commonly of the enclosed pipe-ventilated type with a temperature rise not exceeding 55 deg. F. on full load and with insulation chiefly of mica for withstanding a moist hot atmosphere. Motors for pumps and endless haulages are rated continuously and have brush-lifting and short-circuiting gear. Motors for intermittent haulage are one-hour rated and have extra heavy sliprings and brushes for continuous use. Recent motors have ball and roller bearings and means are provided for testing the air gap.

South American Mines.—The South American plant that is dealt with provides power for hoisting, pumping and milling at a group of metalliferous mines at a great elevation (from 12,000 to 14,000 ft. above sea level) in dry bare mountainous country where low temperatures are the rule. Fortunately a railway now reaches the area, so that heavy weights can be transported, though this was not always so.

The most convenient source of power is oil, and Diesel engines are the best prime movers. Beginning with two engines, the station now has four duplicate Diesel engines of the English Electric Co.'s make. Each has four cylinders and drives at 214 r.p.m. a 28-pole, 150-kW Peebles generator, three-phase, 660 volts, 50 cycles; neutral not earthed.

The b.h.p. of each engine is 326 at sea level, but only about 210 at 12,800 ft. above sea level, where the barometer reads about 19 in. Hg. and water boils at 190 deg. F. If the engines could be supplied with air at sea level pressure (say, 15 lb. per sq. in. absolute) they would give their sea level output, but when this plant was investigated it was found that of the 116 extra h.p. that the engine would give, 55 h.p. would be used in compressing the inlet air, leaving 61 h.p. as the gain. The cost of the compressor would be high and the money would be better laid out in purchasing a larger Diesel engine.

The thermal efficiency is reduced for the complete engine by having to drive the compressor for injection air, but, even so, the overall thermal efficiency is 34 per cent. The mechanical efficiency is about 72 per cent.

The distribution is extensive, and at various pressures: 660, 2,200, 6,600 and 11,000 volts. The overhead bare copper lines are carried on light steel tubular poles spaced about 40 metres apart and arranged for a minimum height of wire of 16 ft. above ground line. The wires are 16 in. apart for 2,200 volts; 16 in. apart for 6,600 volts; and 30 in. apart for 11,000 volts. An earth wire is carried on the pole tops and the conductors are supported on insulators on single brackets bolted to the poles.

Lightning storms are severe, and arresters of the oxide film type (General Electric Co., of America) have been called for recently, but not yet tried. As additional protection there is the earth wire, choke coils and a short length of cable between overhead line and transformers, whilst the end turns

of the transformers are specially reinforced as to insulation (Johnson & Phillips' standard practice).

The motors are for 600 volts, of the slip-ring and squirrel cage types mostly enclosed pipe-ventilated.

An interesting item of plant is a three-throw vertical sinking pump for 400 g.p.m., 300 ft. high (rams 9½ in. by 11 in. stroke at 50 r.p.m.). The motor is enclosed pipe-ventilated and drip-proof, of the squirrel-cage type, started by an auto-transformer which is mounted on the pump frame. The motor runs at 720 r.p.m. and is of 50 b.h.p.; between it and the pinion is a centrifugal clutch so that the motor starts light and gets hold of its load on attaining speed. The first pair of gears are laminated to minimise backlash. The pump is by Frank Pearn, and the motor by the Lancashire Dynamo and Motor Co.

Discussion in London.

The branch president, Mr. J. W. GIBSON, said he had had experience of some of the peculiarities of the Indian coal referred to, with a 26 per cent. ash content. He believed there had been cases in which this coal had been powdered and fired as powdered fuel successfully. Could that coal be used successfully in Lancashire boilers without forced draught? The description of the three-throw pump was very interesting; he, himself, was handling a similar problem, and would be glad of information with regard to laminated gears.

Mr. A. C. SPARKS said the most startling thing in the paper was the 2,200-volt overhead transmission line, which was the largest he had ever heard of. In some of the big lines in this country there was only two-thirds the dead weight of copper that there was in the line referred to in the paper. The tension of the wires was low, and he asked if difficulty had been caused by the phases blowing together. Again, there appeared to be no switches installed in the line.

Mr. W. F. BISHOP said he had never come across an overhead transmission line with a conductor of the size mentioned by the author. Had the author experienced any trouble with the cable, due to the acidity of the water in the pits? He believed that considerable trouble had been experienced in that connection in some of the Mysore fields, and special precautions had to be taken to overcome the difficulty. Apparently, however, the author had rubber-insulated cables.

Mr. H. M. MORGAN, replying, said he would not like the impression to go out that 26 per cent. was the usual ash content of Indian coal. That was the worst that had been found, and his analysis had shown the ash content to be 12 per cent; the coal was very free burning, and did not clinker at the ordinary temperature of the Lancashire furnace, but it would clinker in a Babcock & Wilcox furnace because the temperature there was higher. It was a very favourite coal; in Bombay it was dear, and for that reason it was used only as a "sweetener" for some of the other coals. Powdered fuel plant had been installed at the Mint, Hyderabad, but for some reason it was not a success there. With Babcock chain grates, one could use the worst coal one had got in the sizes which the grates would take, which were generally down to about 1½ in., and there was no need to pulverise. It cost about 2s. or 3s. per ton to pulverise, and why should he do it if it were unnecessary? He had pulverised some Indian coal and had made a short test with it, which was successful, but the test was not long enough to enable a conclusive decision to be arrived at. Lancashire boilers could be run without forced draught; most Lancashire boiler plant had 70- or 80-ft. chimneys, which would give all the draught needed to burn the coal successfully.

The dead weight on the transmission line poles, referred to by Mr. Sparks was within the weight for which the poles were designed, and there was a margin of safety. Regarding the phases blowing together, he agreed that the tension of the big cable was small; there were 90-yard spans, and a sag of 9 ft., which looked quite a lot, and the people concerned were rather afraid of the phases blowing together, but the line had experienced one stormy period without that occurring. There were tornadoes and cyclonic winds blowing in all directions, and the three wires might blow together, but he would expect all three wires to swing in the same direction at the same time and so keep apart; at any rate, they were heavy, and would have to cover a good arc before they would come together. If there were signs of trouble in that connection, it could be overcome by placing insulated spacers between the wires in the centre of each span. If transformers had been provided for that line it would have been a much better job, of course; it would have been cheaper, and there would have been better regulation and protection. All the feeder panels were equipped with a three-phase switch, with overload trips, but the slide was not sufficiently detailed to show them. He had not had trouble with the cables through acidity in the workings, chiefly because the cables could be kept dry. There was not very much trouble with ice, because the rainfall was small, and, although the temperature was low, there was a fairly strong sun. There were very strong wind storms and lightning storms, but there had been no trouble with the transmission lines, which were very small.

A High-pressure Cable Testing Outfit.

Messrs. Watson & Sons' Valve Rectification Apparatus.

THE experience gained in the manufacture of electro-medical and X-ray apparatus, which frequently employs very high voltages, has enabled Messrs. Watson & Sons (Electro-Medical), Ltd., to produce equipment for high-pressure cable and overhead line testing by means of hot-cathode valve rectification of h.p. alternating current. Although embodying a principle that has hitherto not been taken advantage of for this purpose, the plant seems to have passed the experimental stage, for it is claimed that such outfits have been satisfactorily used by municipal authorities, and one of the leading cable manufacturers.

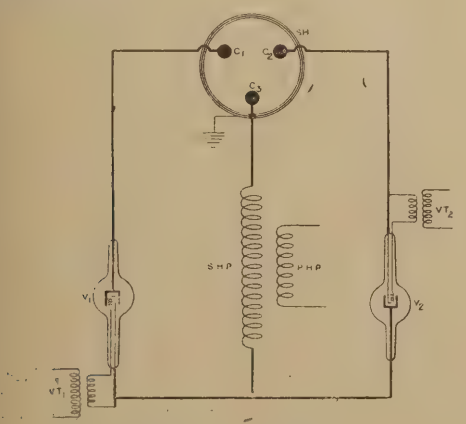


Fig. 1.—Diagram of Connections.

The principle upon which the hot-cathode valve depends for its operation is the fact that the highly evacuated space within a glass bulb containing two metal electrodes, one of which is made incandescent while the other remains comparatively cool, possesses uni-directional conductivity, so that current will pass through the valve only when the heated electrode is negative. The amount of current which can be rectified by such a device increases with the temperature of the heated electrode, but remains constant so long as the temperature of the latter remains constant.

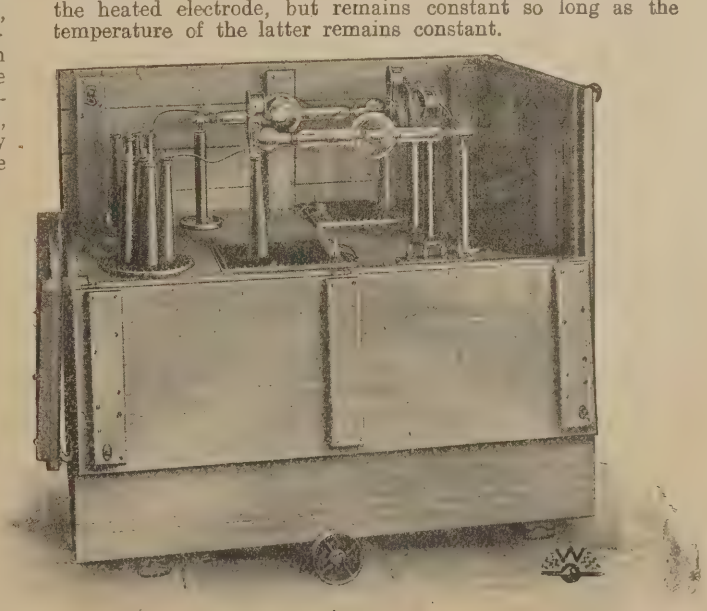


Fig. 2.—Control Cabinet and Rectifying Valves.

The essential parts of the one-ton testing outfit illustrated herewith are (*a*) the main h.p. step-up transformer, which weighs approximately 13 cwt., its overall dimensions being 51 by 30 by 63 in., and it is capable of a continuous output of 5 kVA at a secondary pressure of 75 kV r.m.s. (either terminal to earth) when connected with an a.c.

supply main or petrol-electric generating plant; and (*b*) two valve rectifiers with tungsten wire cathode filaments, two small transformers to furnish the heating current for the filaments, and means for controlling the voltage output of the plant, all of which is contained in the cabinet shown in fig. 2, which weighs approximately 7 cwt. and measures 41 by 63 by 57 in. Fig. 3 is an end view of the cabinet; the control gear proper comprises a 1-75-kW auto-transformer, a choke coil for intermediate adjustment, various meters, resistances, and an electrostatic 0-150-kV voltmeter in a

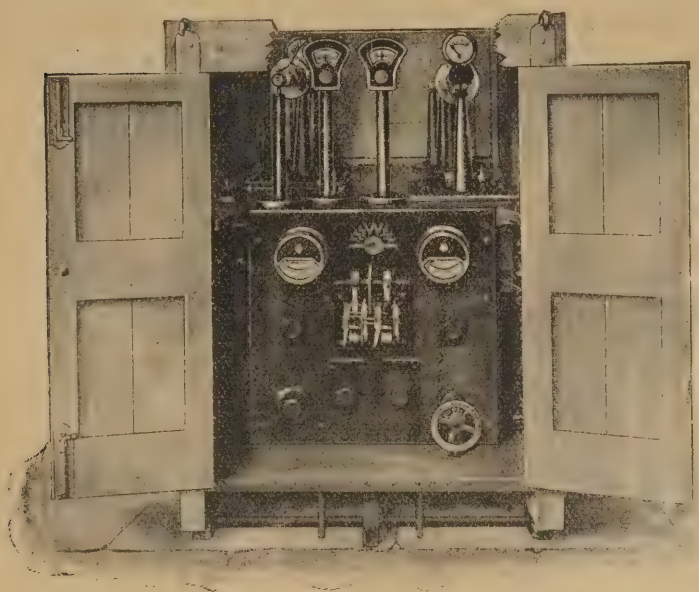


Fig. 3.—Control Cabinet ; end view.

separate carrying case. Direct current for testing is obtained by the rectification (by means of the valves) of the a.c. delivered by the main transformer and the utilisation of the capacity of the cable itself under test.

The diagram (fig. 1) indicates the method of connecting up the equipment; up to 150,000 volts may be applied between two cores and 75,000 volts between one core and earth. It will be seen that one end of the h.p. secondary winding of the transformer SHP is connected to the sheath SH of the cable, whilst the other end is connected to the anode of one of the valves and to the cathode of the other V_1, V_2. The cathode of the first valve is connected to one core of the cable, and the anode of the second to the other core C_1 C_2. The filament-heating transformers are marked VT_1 and VT_2.

When in operation, one-half of the sine wave from the transformer flows through the first valve and charges one core to a potential to earth equal to $\sqrt{2}v$, where v is the potential produced by the transformer. The second half of the wave flows through the other valve and also charges the second core to a potential to earth equal to $\sqrt{2}v$. Thus, between cores, there is a p.d. equal to $2\sqrt{2}v$, and at the same time there is a p.d. between cores and earth equal to $\sqrt{2}v$; usually the core not under test is connected to earth (C_3, fig. 1). These values are theoretically correct, but in practice, owing to leakage in the cable, which is, of course, a variable factor, the test voltage attained being usually a few per cent. below the value $2\sqrt{2}v$.

The method of connection to test one core at high voltage (up to 100,000 V) to earth is similar, except that C_2 and the sheath are earthed instead of C_3. With this method of connection it is possible to test one core to earth at a potential equal to $2\sqrt{2}v$, in which case use is made of one of the cores of the cable as a floating condenser, and the potential to earth on this core during test will be $\sqrt{2}v$. It will be noted that the anode of V_1 is connected to C_1—the core under test, one end of the h.p. winding SHP is connected to the cathode of V_1 and the anode of V_2, whilst the other end of the winding is connected to the "floating" capacity C_3; the cathode of V_2 is connected to the sheath of the cable.

Besides the 2-valve outfit referred to above, a single-valve model is obtainable capable of producing a test voltage up to 60,000 V between cores or from one core to earth. It is realised that apparatus of this kind is not an everyday commodity; only large commercial concerns or public authorities are likely to require it and, therefore, anything in the nature of mass production is not only undesirable, but quite impossible. Moreover, the circumstances in which the apparatus is to be used usually call for certain modifications. The above particulars must, therefore, not be regarded as a hard and fast specification, for we understand that the manufacturers are prepared to modify the equipment in any direction to suit the requirements of the user, and that they will be pleased to advise intending purchasers with regard to the manner in which adjustments may be made to render the apparatus most suitable for their purpose.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

"Lotus" Coil Holders.

We have received samples of the two- and three-way coil holders which are made by Messrs. Garnett, Whiteley & Co., Ltd., for outside panel and inside baseboard mounting. The moving block system comprises three sets of machine-cut gears that reduce the speed eight times. The gearing is hidden in the base under metal disks, all metal parts being nickel

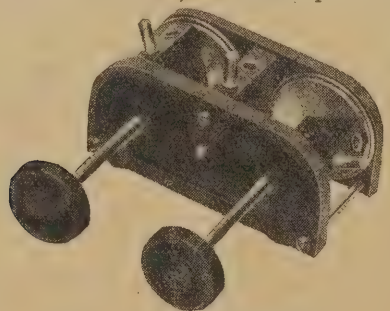


Fig. 1.—"Lotus" Coil Holder.

plated, while the side plates, coil holders, and handle knobs are Bakelite mouldings. The dimensions of these holders are about 2¾ by 2¼ in., while the depth, including the extension arms and knobs, is 4½ in. Fig. 1 illustrates one of the holders, the samples of which that were sent us being well made and enabling smooth and fine adjustment to be carried out.

Interesting Hospital Installations.

That broadcast radio entertainment is a boon to hospital patients is clearly demonstrated by the large number of institutions that have been equipped for the purpose. In most cases a multi-valve receiving outfit is employed with central control, in contrast to which practice an interesting installation has recently been completed in the Birmingham General Hospital. It consists of 45 B.T.-H. "Bijou" crystal receivers and 200 pairs of headphones. Four receivers are fitted in each ward, and six pairs of headphones are taken from each set, a connection being brought to each bed; indoor aerials are employed. This decentralised control system has proved very successful in practice: Since only six beds are connected to a particular instrument, that is the maximum number that would be affected by a temporary defect, and the possibility of defects arising in a crystal set are, of course, very remote, while it is possible to maintain a continuous service without any running cost whatsoever. The cost of the installation was very generously borne by the public in response to an appeal by the *Birmingham Gazette*, and the work was carried out by Messrs. Beresford Brothers, Birmingham, under the direction of the British Thomson-Houston Co., Ltd.

The Lincoln County Hospital installation was carried out on very serviceable lines by the Lincoln Wireless Co., Ltd. It is composed of a Marconiphone long-range V.2 receiver, with two amplifiers (voice and power types), which feed 126 'phone and 10 loud-speaker points, which are fed through specially designed "Ideal" line transformers. Another feature is the fact that the loud-speaker points also possess what is described as a unique form of compensating gear, whereby the balance of reproduction is not upset should the arrangement, or number, of loud speakers be varied from time to time. Three loud speakers of the "Mellovox" type have been supplied, and the 126 'phone points have been fitted with Sterling "Lightweight" headphones.

A Constructor's "Super-Het" Set.

There has been recently placed on the market by the General Electric Co., Ltd., a group of components which will enable anyone to construct a long-range selective "super-het." The group comprises the following:—Three intermediate-frequency transformers; filter; filter-tuning condenser; oscillator and terminal board covering approximately 200-600 metres; the full-sized blue print, which can be used as a template for marking off both the front and the rear of the panel, and the detailed book of instructions should enable even the most inexperienced constructor to build a first-class 6-valve receiver. Those who de-

aire to embody "Gecophone" components additional to the group mentioned will find them all suitable for mounting on ¼-in. to ⅜-in. panels, and it is suggested that the most suitable valves to use with such a set are Osram D.E.3, which have a filament current of 0.06 amp.

The "Siftron."

The current output of a receiving set or amplifier comprises two components. One is uni-directional and upon it is imposed the second component, which is alternating in character, providing the means whereby the diaphragm of the loud-speaker is caused to vibrate and emit sound. The continuous component serves no useful purpose in reproduction and its exclusion from the telephonic windings would be advantageous, because the pole pieces that influence the diaphragm are already polarised by permanent magnets and any additional constant force tends only to unduly stress the diaphragm. For a loud-

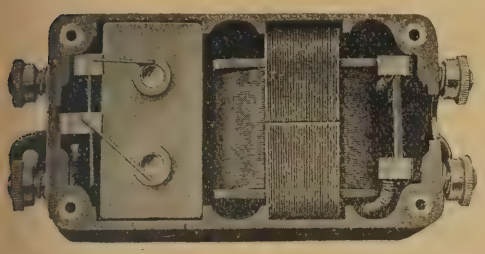


Fig. 2.—The "Siftron."

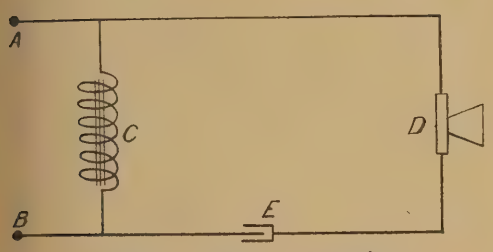


Fig. 3.—Diagram of Connections.

speaker that has its armature, reed, or diaphragm "balanced" by the application of initial magnetic effort, further energisation is not merely superfluous, but actually prejudicial, for the pole pieces will become supersaturated and the a.c. component will not vary the magnetic field to the same extent as would be the case were the direct component eliminated. The desired end may be attained by the use of the simple device shown in fig. 2 with its top cover removed. It is a product of Messrs. Alfred Graham & Co., comprising inductance and capacity housed in a Bakelite casing, and weighs 1¼ lb., its dimensions being 5 in. over terminals by 2¼ in. by 2¾ in. In fig. 3 A and B represent the output terminals of a receiving set or amplifier; these leads are bridged by an inductance C—a coil of relatively high impedance offering comparatively small resistance to the flow of direct current, but obstructive to alternating current. Across this impedance there are connected the windings of the loud speaker D in series with a condenser E of appropriate capacity, which is virtually an open path to a.c., but presents a closed door to the flow of d.c. Therefore the continuous current component flows through C, which constitutes a by-pass as it were, and the variable component through the coils of the loud speaker D *via* E. Thus the loud speaker input is in the form of modulated current only, and the instrument is enabled to function with the best effect. Such an arrangement is a sifter or filter circuit which, incidentally, offers the further advantage that it is unnecessary to join-up the loud speaker in any particular sense or direction. The values of the components have been accurately determined, and the "Siftron" is interposed between a receiving set and the loud speaker without altering any internal connections.

The Measurement of Coal.—In a paper read before the Manchester branch of the Institution of Civil Engineers, Mr. J. E. Lea, B.Sc., M.I.Mech.E., dealt with the question of the measurement by flow of solids, particularly coal. He showed that however much any mineral material might be broken or pounded up, its "homogeneousness" persisted, and, within fairly close limits, the weight per cubic foot of such broken and mixed up loose material did not vary very much under ordinary conditions. Also that for graded coals of any size, equal volume actually meant equal weight; a cu. ft. of ordinary mixed coal or slack, under ordinary conditions, did not weigh much more, if anything at all, than a cubic foot of graded nuts or peas. Mr. Lea also claimed that a given weight of actual coal occupied the same space whether wet or dry. Measurement by volume, he said, entirely ignored either the presence or absence of moisture, and therefore in many cases it was a truer measure of the actual coal than measurement by weight.

A Double-Bogie Electric Locomotive.

A Combined Battery and Trolley "English Electric" Shunting Engine.

FOR several years past the Castner-Kellner Alkali Co., Ltd., has been employing a combined battery-driven and overhead trolley collector locomotive for shunting duty about its Runcorn works, and so satisfactory did it prove to be that another was ordered from the English Electric Co., Ltd. The new locomotive recently commenced service and is illustrated in fig. 1, fig. 2 being an interior view of the driver's cab.

A part of the works' track, including a gradient and curve, is equipped with an overhead trolley line, the locomotives being driven by their batteries on the other parts of the track. The overhead line consists of a positive feed and a negative return wire, the voltage between the two wires being 190 volts d.c. Current is collected from the wires by means of two pantographs placed side by side on the roof of the locomotive and operated by compressed air.

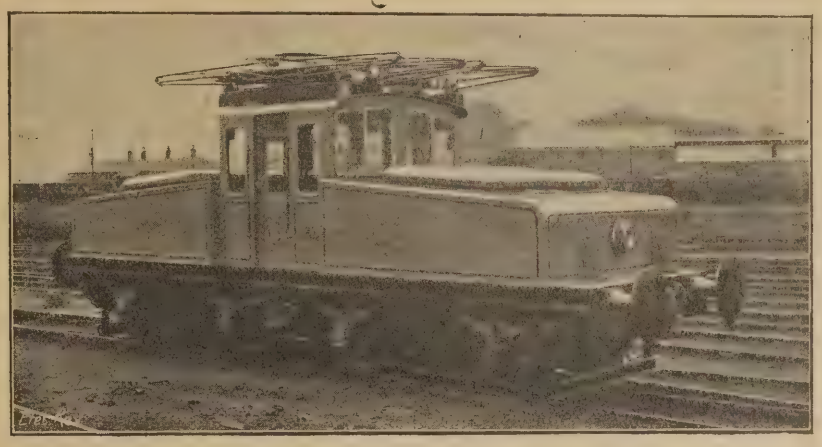


Fig. 1.—A Battery-Trolley Electric Shunting Locomotive.

The "N.I.F.E." battery on the locomotive was manufactured by Batteries, Ltd., Redditch, and consists of 146 cells of the nickel-iron type, having a capacity of 650 ampere-hours at the four-hour rate of discharge. The battery is carried in two halves in compartments in front of and behind the cab. Each half battery is in two iron crates fitted with lifting eyes so that it can be lifted bodily from the locomotive for repairs.

The locomotive is of the unarticulated, four-axle, double-bogie type; the cab is central and has large windows to pro-



Fig. 2.—Interior of Driver's Cab.

vide ample vision for the driver. Each axle is driven by a 42-h.p. series railway motor through spur gearing running in oil. The four motors are of the 200-volt DK 75C self-ventilating type. Two drum, series-parallel, controllers are fitted in the cab, one for each direction of travel, and all controls are duplicated so that the driver can control the locomotive from either driving position. The change-over-switch has three positions (trolley, battery, and charge), and is fitted in the cab, interlocks making it impossible to move this switch when

the locomotive is in motion. In the same way, the main controllers are locked when the battery is being charged.

The Westinghouse motor and air-compressor are mounted in the cab and the compressed-air cylinders are fitted at the ends of the battery compartments. The two air-operated pantographs are controlled by a valve placed beside the Westinghouse brake control; straight air and hand-operated screw pattern brakes are provided.

The voltmeter, ammeter, and ampere-hour meter are mounted on a panel between the windows, as are also the switches controlling the head, tail, and instrument lights.

All eight wheels are sanded by means of Westinghouse ejector valves and sand boxes placed on each bogie, the operation being controlled by foot-operated air valves placed beside the controllers at both driving positions and making sanding possible in both directions of travel.

The leading particulars are as follows:—

Type	0-4-40
Track gauge	4 ft. 8½ in.
Total adhesive weight	38 tons
Weight per driving axle	9.5 tons
Diameter of wheels	36 in.
Length over buffers	30 ft. 10 in.

Tractive effort on tread of wheels:—

(*a*) Continuous	10,000 lb.
(*b*) One hour	16,000 lb.
(*c*) Maximum	20,000 lb.

The Tungstone Accumulator.

A Cell with Machine-made Parts.

A NEW lead storage cell has been placed on the market by the TUNGSTONE ACCUMULATOR CO., LTD., for which many advantages are claimed. It is put forward especially for use on motor-cars, for starting, lighting, and ignition; and for the high-pressure batteries of wireless sets. For the former purpose it is made in two standard sizes: 12-volt, 54 plates, weighing 89 lb. complete without acid, and 6-volt, 27 plates, weighing 48 lb., the capacity being 50 Ah at the 20-hour rate of discharge in both cases. For wireless sets a 60-volt battery weighing (without acid) 23 lb. and having a capacity of 3 Ah is made.

The essential feature of the new cell appears to be the adoption of mechanical processes as completely as possible in the manufacture of the plates and containers. The component parts are made by the Tungstone High-pressure Die-Casting

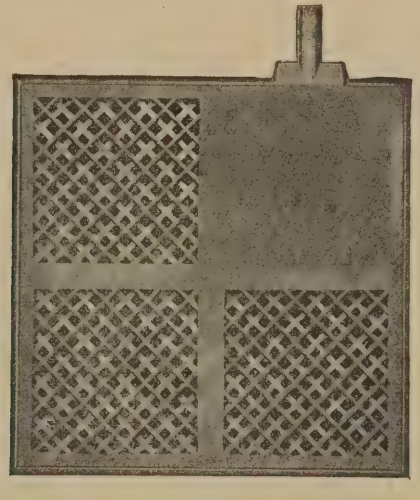


Fig. 1.—Four-section Tungstone Plate, one Section Pasted.

Co., with special automatic machines, and are of standard dimensions so as to be interchangeable. The basis of the design is a grid unit of pure lead, die-cast under high pressure, the present standard size being two inches square; the grid has evenly-spaced diagonal lattice ribs, with a strong frame, all of pure lead. These grids can be used singly, but for the larger cells are built up into plates by welding their frames together with antimonial lead; for this purpose semi-circular grooves are provided in the outside edges of the grids, so that when two grids are placed together a hollow channel of circular section is formed between them, into which molten antimonial lead is forced, permanently joining the grids. At the same time the groove round the periphery of the built-up plate is filled with antimonial lead, binding the whole together and providing increased conductance. It is claimed that this combination of pure lead for the active plate in contact with the paste, and antimonial acid-resisting lead for the supporting frame, is highly advantageous, increasing the life and efficiency of the cell.

The plates are pasted with pure lead oxides, with no inert admixture, in a patent pasting machine; the grids are totally immersed in the paste during this operation, and the paste is simultaneously fed under pressure to both sides of the grids, without exposure to the air, a process which, it is claimed, is entirely novel, and can be applied to any size of plate. Incidentally, the risk of lead poisoning is materially reduced by the extended use of machinery in the manufacture of the plates.

The patent Tungstone container is made of antimonial lead by die-casting in one piece, and is claimed to be immune from the infirmities that overtake containers of other materials, besides withstanding continued vibration. The lids are also die-cast with bosses to receive rubber pads, and vent plugs, in one piece.

The sections are built up of plates having lugs cast integral

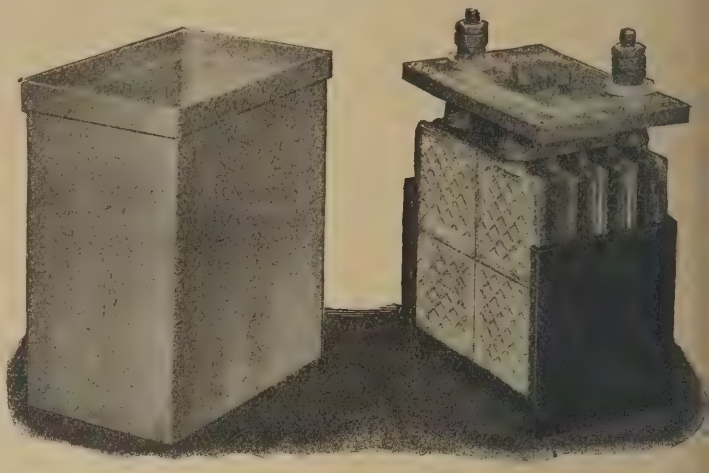


Fig. 2.—Container and Plates, with Lid and Ebonite Rests.

with the die-cast antimonial lead frames, the lugs passing through die-cast holes in bridge pieces; lead "burning" is not required, and any plate can be renewed without the use of heat. The bridge piece carries a strong terminal post, to which the coupling link is attached by a lead-coated Vislok nut. The sections are supported inside the container by a removable ebonite plate-rest and spacer at each end, grooved to receive the individual plates. There are no separators between the plates, and therefore the whole of the space is available for electrolyte, which is dilute sulphuric acid of sp. gr. 1,285, rising to 1,800 when fully charged. The lid fits snugly o a narrow ledge die-cast on the inside of the container, and can only be put on in the right way.

For use as car starting and lighting batteries, the cells are assembled in a wooden box with a sliding lid, fitted inside with rubber buffers; any complete cell or set of plates can be lifted out without disturbing the remainder.

The plates are formed at the makers' works and are given a partial first charge. The batteries are all sent out dry, and are filled with acid by the purchaser; after a rest of two hours they are charged at the full rate for five hours.



Fig. 3.—Standard 12-volt Car Battery.

The wireless cells each consist of a pair of plates two inches square in a glass container encircled with rubber bands, the containers standing on a rubber mat. An ebonite lid is sealed on the container, with an ebonite vent plug. The cells are coupled together with antimonial lead connectors, burnt on to the lugs, and provided with sockets for wander-plugs. Used on a 3-valve set, the 60-V battery is estimated to require fully re-charging about every six months; it is delivered dry and partially charged, and may be used without charging, two hours after filling with acid, but should be fully charged after a month's working.

Tungstone cells are all-British in design and manufacture.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

C.T.S. Trailing Cables.

We note a reference in your current issue, in a paper by Mr. I. Sclar, to accidents having occurred with cab-tire trailing cables with an earth wire incorporated in the cable, and he suggests that if the earth conductor had taken the form of an outside flexible metallic tube, such accidents would not have happened.

Mr. Sclar is evidently not aware of the fact that the present standard practice in trailing-cable design is to have a braid of tinned copper wires *surrounding* all live conductors, so that these can hardly be damaged without this earthed braiding cutting off current.

St. Helens Cable and Rubber Co., Ltd.
J. H. C. BROOKING, *General Manager.*

Slough, *January 1st*, 1926.

The Salaries of Combustion Engineers.

On reading the article on "The Combustion Engineer" in your issue of December 25th, my sympathy went out to Mr. C. F. Wade, who, a chartered engineer, has apparently always had the misfortune to meet engineers (?) who will persist in condemning turbine pumps and who will try to run their boilers in series; under such circumstances one can quite understand his nominating a "chemist with engineering inclinations" to such an exalted position. May I, however, point out that the chemistry of combustion engineering is very seldom the lot of the average chemist, but is it so very simple that any engineer may render himself quite conversant with it in a very short period? Combustion engineering is not simply a case of chemistry—to be a good combustion engineer one must first be an engineer; all the principles involved demand that such be the case—take the turbine pumps, for instance.

That there is much room for improvement is not disputed. Some time ago I spoke of a method that is daily gaining popularity; I was saved from annihilation at the hands of eminent engineers by Mr. D. Brownlie and Mr. Leonard Harvey. May I suggest that if engineers were allowed to have the necessary boiler-room instruments and if more notice were taken of their suggestions, the necessary improvement would be attained without adding to the staff a highly paid chemist of doubtful engineering ability. For the greater part engineers have to operate their plants with no other instruments than the gauge and water column. I am speaking as a shift engineer who, after a marine shop training on the Clyde, joined the power plant field in America. I have been right through the mill in a large American power plant, and in the process of becoming shift engineer in charge had to pass through as boiler-room superintendent and combustion engineer. In American practice the shift engineer is often termed "chief engineer," and in any case is in absolute charge of the station and the personnel thereof during his shift. It would be interesting to learn whether there are chemists at such stations as Dalmarnock or Barking to see that the shift engineer in charge does not attempt to put the boilers in series.

As I am an honours graduate and hold the diploma of America's largest college of combustion engineering, may I be permitted to sign myself

Another Combustion Engineer.

December 26th, 1925.

Whilst there is a certain amount of truth in some of Mr. C. F. Wade's statements, as set forth in his article on December 25th, it is equally obvious that a few of them ought not to go unchallenged.

To put the theme of the article into a nutshell is to infer that, in matters pertaining to combustion, the average charge engineer is a "dud," and his chief a bigger one for appointing him. Furthermore, he should command a lower salary than an engineer who has taken, say, Mr. Wade's full course on combustion. In addition, this student of combustion—or shall we say, expert?—is to be in sole charge of the steam generation, whilst the charge engineer will nominally be responsible for the whole plant.

On this showing I am afraid Mr. Wade's notions of power-station efficiency will not meet with universal approval among operating staffs, as such proposals would immediately cause discontent and thus lead to inefficient results. I assert that the charge engineer of to-day, who has had over 15 years' experience as a charge engineer, and has kept himself *au fait* with all necessary technical literature, will produce better combustion results than any other class of engineer, who has learnt all he knows about combustion from a 12 months' course by correspondence. In a 6,000-kW station not 20 miles from Sheffield, having a maximum load of 3,000 kW, the coal figures per unit generated are often below 2 lb. with a load factor of 20 per cent., and these figures are not obtained by any chemist, B.Sc., or combustion student, but by experienced charge engineers who have been at the game all their lives, and have gained their notions of combustion from everyday routine.

If Mr. Wade deplores the low salaries chiefs offer his students, he ought to remember the old adage—the market value of an article is just what it fetches.

J. G. T.

December 29th, 1925.

Service in Emergency.

As a member of the Institutions of Mechanical and Electrical Engineers, I have received (although employed in the electricity supply industry) two similar inquiries as to what I would be prepared to do and where I would like to go in case of national emergency.

Surely the Institutions and/or the Government would be better employed, if continuity of electricity supply is their aim, in persuading (or possibly legally compelling) undertakings which are not at present parties to the National Joint Board for Electricity Supply and the National Joint Industrial Council to join these schemes, for it is doubtless more satisfactory to eliminate the possibility of a national emergency than to provide, or try to provide, for dealing with it when it arrives.

In the provinces, municipal undertakings and supply companies generally are sound-minded, but there are some, in the London area especially, which have ideas of their own, which in the opinion of the majority are not conducive to industrial peace, and with the advent of the super-station and the ambition of its owners to spread its tentacles far in all directions, to my mind the limitation of dividends and the control of tariffs are not more important than the question whether the undertakings concerned are prepared to abide by the decisions of properly constituted Whitley Councils with regard to the conditions of employment of the staff and manual workers.

A.M.I.E.E., A.M.I.Mech.E.

London, *January 4th*, 1926.

Overhead Distribution.

The intervention of the Christmas holidays prevented my answering Mr. S. E. Glendenning's letter of December 19th, last week. As I have no intention of continuing this correspondence, which can be of no general interest, I would simply say:—

1. The printing error certainly fogged the original statement somewhat.
2. I was under the impression that Mr. Glendenning's original complaint was mainly on account of the guard wires, where the line has had to cross the telephone wires owing to the difficulty in obtaining wayleaves. Now, apparently, the mangled trees are having his sympathy. I would suggest that he visit Brundall early in May, when he will probably find that the mangled trees only exist in his imagination.
3. An e.h.p. overhead line across country, keeping two fields off, is excellent in theory. I hope Mr. Glendenning will some time have the opportunity of planning such a line, and will personally deal with the wayleaves. Farmers would welcome lines of trees through their fields, I have no doubt (?).
4. The six-mile line from Norwich conveys current at 6,600 volts; convert this to 400 volts between phases, and there is every probability that it would have been placed overhead instead of underground, on account of cost.
5. I decline to split hairs on the question of interest on capital on the two systems, but as a member of the I.E.E. Mr. Glendenning can surely work out to his own satisfaction the actual cost of overhead *versus* underground, for any given set of conditions.

Finally, I hope that with the long-promised Government assistance for rural distribution schemes, there will be ample opportunity in the near future for both overhead and underground systems to be employed.

G. Redgment.

Norwich, *January 2nd*, 1926.

Assisted Wiring.

With reference to Mr. H. T. Young's letter in your issue of January 1st, may I point out that to find a name for a complaint does not contribute to the removal of its cause. Influenza is a case in point.

I am glad to see that Mr. Young and the contractors whom he knows are generally in favour of this development, and will co-operate with it. But there are others (Mr. Young admits that he knows one) who are not in favour of it, and others still who damn it with faint praise and hypothetical objections.

Mr. Young asks who has been chiefly responsible for developing the installation side of the industry in the last thirty years. I would rather ask who, or what, has been responsible for the disastrous fact that it has *not* developed to anything like the extent it should, and that even otherwise backward countries are far ahead of us in the domestic use of electricity.

I have no experience of conditions in the United States. It may be that the American wiring contractor, like the American workman, has different ideas from ours as to the amount of work he ought to do.

I do not follow Mr. Young's remarks as to gas showrooms. Does Mr. Young really think that there are none, or that, if there are, they are not visited? I write in a London suburb, and within a 1d. 'bus ride of where I sit there are three really

palatial gas showrooms. A postcard or a telephone call to any of them will bring a representative ready to quote very low rates for any gas installation required. Of course our commodity is immeasurably superior to theirs in many respects, but do not let us delude ourselves into thinking that they do not know how to sell it, or that they make the mistake of over-charging for the consuming devices because they have no installation contractors to compete with them. The truth is that their policy is just the opposite.

The great British public cares nothing about a monopoly of it gives good service.

My *nom-de-plume* provides its own explanation and justification, and I again sign myself unrepentantly,

A Manufacturer's Salesman.

January 2nd, 1926.

X-ray Apparatus.

Our attention has been drawn to certain remarks made by the chairman of the General Committee of the Coventry and Warwickshire Hospital with regard to X-ray apparatus.

According to the *Birmingham Post*, this gentleman is reported to have stated that British X-ray couches are heavier, more difficult to manipulate, and just about three times as expensive as the German models.

The chairman did not apparently vouchsafe the simple explanation of this disquieting fact, *viz.*, that British radiologists demand a degree of "protection" for the operator against the harmful effect of the rays which is considered to be quite unnecessary in Germany. The X-Ray Protection Committee has accordingly drafted a series of recommendations with which British manufacturers are usually asked to comply, and frequently to more than comply, but which the foreign maker can disregard.

If the apparatus to be supplied to the Coventry and Warwickshire Hospital is to be as well protected and as universal as the best British product, then it is *not* a fact that the latter is one whit more heavy or cumbersome, but if these considerations are disregarded the remarks of the chairman are not altogether incorrect. Even so, the cost of the very best British X-ray couch is not £270, or anything like it, and, quality for quality, British manufacturers have nothing whatever to bemoan; in fact, there are few industries that have held their own so well.

Newton & Wright, Ltd.
R. S. WRIGHT.

London, *December 29th*, 1925.

[This matter is referred to in our leading columns.—EDS. ELEC. REV.]

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 30th, 1925. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Marconite. No. 464,176. Class 1. Insulating varnishes.—Marconi's Wireless Telegraph Co., Ltd.

Hicycle (lettering and design). No. 462,945. Class 6. Portable electric machine tools and current generating machines for operating such tools.—Chicago Pneumatic Tool Co., New York. (W. Brookes & Son, 5, Chancery Lane, W.C.2.)

Mippophone. No. 453,067. Class 8. Instruments and apparatus for use in radio-telephony.—M. I. Vaughton, 88, Vyse Street, Birmingham.

Operadio. No. 463,632. Class 8. Radio receiving sets and parts thereof.—The Operadio Corporation, Chicago. (Boult, Wade & Tennant, 112, Hatton Garden, E.C.1.)

Silvotone. No. 563,967. Class 8. Instruments and apparatus for use in radio-telegraphy.—W. S. Life, 32, West Street, Southport.

Pipsopan. No. 463,973. Class 8. Radio receiving apparatus.—A. J. A. Archdale, 32, Dawson Crecent, Torquay.

Annulex. No. 463,948. Class 11. X-ray vacuum tubes for surgical or curative purposes.—C. Anderson, 47, Red Lion Street, High Holborn, W.C.1.

Ebonoid. No. 463,828. Class 50. Hard rubber goods of the nature of vulcanite or ebonite.—Clayton Rubber Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

13,791. "Electric discharge devices, such as thermionic tubes and the like." Dr. E. F. Huth Ges. June 5th, 1923. (217,230.)

13,937. "Systems for the propagation and reception of Hertzian waves." L. Levy. June 6th, 1923. (217,245.)

14,130. "Electrical connectors." J. D'A. Clark. June 11th, 1924. (244,136.)

14,264. "Closed circuit electrical regenerative motor systems." W. P. Durtnall. June 12th, 1924. (244,137.)

14,459. "Wireless distant control apparatus." E. Fiamma. June 14th, 1924. (244,139.)

19,217. "Testing and measurement of audition." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). August 13th, 1924. (244,147.)

20,993. "Electric discharge tubes." F. S. McCullough. April 3rd, 1924. (231,821.)

21,099. "Vibrating devices, particularly applicable to siphon recorders." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). September 6th, 1924. (244,154.)

21,217. "Electric welding systems." British Thomson-Houston Co., Ltd. (General Electric Co.). September 8th, 1924. (244,155.)

21,370. "Method of transmitting speech by high-frequency waves." E. Habann. October 2nd, 1923. (222,848.)

21,379. "Sound-reproducing and amplifying apparatus, such as phonographs and loud-speaking apparatus for wireless telephony." G. G. De Andia-Yrarrazaval. September 10th, 1924. (244,162.)

21,398. "Sound boxes for electrical transmission for loud-speakers, telephones and the like." C. Lindstrom Akt.-Ges. July 26th, 1924. (237,544.)

21,411. "Process of, and apparatus for the electric transmission of images." A. Dauvillier. November 29th, 1923. (225,516.)

21,435. "Impulse transmitters for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd. March 15th, 1924. (230,779.)

21,436. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 28th, 1924. (231,419.)

21,486. "Means and methods for electrodepositing nickel, cobalt, or nickel alloys." E. Potter (Madsenell Corporation). September 11th, 1924. (244,167.)

21,487. "Means and methods for electrodepositing nickel, cobalt, or nickel alloys." E. Potter (Madsenell Corporation). September 11th, 1924. (244,166.)

21,508. "Receiving apparatus for high-frequency signalling systems." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. September 11th, 1924. (244,169.)

21,509. "Telephone instruments." W. S. Stephenson and G. W. Walton. September 11th, 1924. (Cognate application, 14,815/25.) (244,170.)

21,510. "Multiple aerial for wireless signalling systems." C. Lorenz Akt.-Ges. September 11th, 1923. (221,818.)

21,591. "Magnet structures for telephone receivers and the like." W. J. Palmer. September 12th, 1924. (244,175.)

21,952. "Space discharge tube systems for the manipulation of high-frequency currents." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). September 17th, 1924. (244,190.)

22,258. "Metal-enclosed electrical switchgear." Ferguson, Pailin, Ltd., S. Ferguson, and G. Pailin. September 20th, 1924. (244,193.)

22,419. "Electrical apparatus for the measurement of the level and flow of liquids and the height or movement of a body." G. F. Shotter. September 23rd, 1924. (244,195.)

22,429. "Thermionic valves." S. Hector. September 23rd, 1924. (244,196.)

22,859. "Frames or casings for panel boards for supporting wireless or other apparatus." W. Walker and Radio Communication Co., Ltd. September 27th, 1924. (244,200.)

22,964. "Crystal detectors for wireless apparatus." F. J. Rundle. September 29th, 1924. (244,201.)

23,107. "Automatic telephone instruments." Sterling Telephone & Electric Co., Ltd., R. H. Dougan, and J. R. Penney. September 30th, 1924. (244,202.)

23,772. "Loud speakers." A. H. Watkins. October 8th, 1924. (244,210.)

23,938. "Crystal rectifiers for radio reception." British Thomson-Houston Co., Ltd., and J. Hutt. October 9th, 1924. (Cognate application, 729/25.) (244,214.)

24,236. "Electrolytic rectifiers." A. B. Muntyan. October 19th, 1923. (223,561.)

25,371. "Wireless receiving apparatus." J. W. Combe. October 24th, 1924. (244,227.)

25,545. "Electrical operation of railway points and signals." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. October 27th, 1924. (244,230.)

25,564. "Electrical condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier). October 27th, 1924. (244,231.)

26,053. "Alternating-current relays." L. H. Peter and Westinghouse Brake & Saxby Signal Co., Ltd. November 1st, 1924. (244,234.)

26,071. "Devices for use in connection with telephonic reception." W. M. Manning. November 1st, 1924. (244,237.)

26,648. "Variable electric condensers." J. R. Barnhart. April 9th, 1924. (232,166.)

26,951. "Metering of calls in telephone systems." Siemens Bros. & Co., Ltd., D. A. Christian and W. G. Patterson. November 11th, 1924. (Addition to 200,928.) (244,244.)

27,939. "Electrical switches." R. Woods. November 21st, 1924. (244,247.)

28,143. "Electric connection fitting." M. J. Railing and F. G. Quance. November 24th, 1924. (244,249.)

28,397. "Electro-magnetic inductance coil holders or mountings." E. Whiteley and Garnett, Whiteley & Co., Ltd. November 27th, 1924. (244,251.)

30,530. "Radio transmitting circuits." Telefunken Ges. für Drahtlose Telegraphie. December 22nd, 1923. (226,556.)

30,799. "Insulator structures for electrostatic condensers and the like." I. P. Rodman. March 8th, 1924. (230,417.)

1925.

389. "Selecting switches for use in telephone systems." Siemens and Halske Akt.-Ges. and K. Giese. January 6th, 1925. (244,281.)

949. "Grid leaks, anode resistances, and the like." M. Koopman. January 12th, 1925. (244,284.)

2,539. "Switches for electric water-heating apparatus." K. F. Henneman and P. Kerkhoven. December 1st, 1924. (Addition to 206,834.) (243,663.)

2,584. "Wireless receiving apparatus and condensers therefor." S. Williams and L. Williams. January 29th, 1925. (244,294.)

3,420. "Electric induction motors." British Thomson-Houston Co., Ltd. February 9th, 1924. (228,928.)

6,635. "Protective device for compensated asynchronous motors." Deutsche Werke Akt.-Ges. March 12th, 1924. (230,830.)

8,368. "Dynamometers." Dr. M. Kurrein. March 29th, 1924. (231,524.)

9,167. "Electric drive for machine tools, particularly planing machines." Siemens-Schuckertwerke Ges. April 7th, 1924. (231,904.)

10,950. "Pneumatic power transforming apparatus." H. Wade (Soc. d'Electricité et de Mécanique Procédés Thomson-Houston et Carels Soc. Anon.). April 27th, 1925. (244,330.)

11,688. "Alternating-current bell." M. B. Richter. August 5th, 1924. (238,188.)

13,464. "Production of oscillating currents by static transformers and the like." Telefunken Ges. für Drahtlose Telegraphie. May 23rd, 1924. (234,517.)

14,465. "Brush gear for dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd. June 24th, 1924. (236,182.)

14,828. "Manufacture of electric lamps and similar electric devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 7th, 1924. (235,229.)

14,875. "Adding or differential watt-meter relay." Measurement, Ltd. September 11th, 1924. (239,828.)

16,643. "Rectifiers for wireless reception." S. J. Eintracht and E. J. Dickins. June 29th, 1925. (244,348.)

16,871. "Incandescent cathode X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 20th, 1924. (Addition to 208,108.) (243,310.)

16,782. "X-ray tubes and installations for operating same." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 25th, 1925. (244,3[illegible])

21,674. "Electrical gas purification." Lodge Cottrell, Ltd. (formerly Lodge Fume Co., Ltd.). (Metallbank und Metallurgische Ges.). August 29th, 1925. (Addition to 177,117, as modified by 238,480.) (244,372.)

23,234. "Telegraph signalling systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). August 7th, 1924. (Divided application on 241,327.) (244,025.)

23,506. "Electric rectifiers." International General Electric Co. Inc. September 26th, 1924. (240,453.)

25,647. "Telephonic apparatus." V. A. Foot. September 6th, 1924. (Divided application on 243,102.) (244,384.)

The

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Hidden Dangers.

THE idea that electricity in some form or other may be applied to the body with beneficial results has possessed the layman ever since that mysterious agency has been available to his hand; and the temptation to apply such treatment to himself, without the advice of a medical man, has frequently been too powerful for him to resist—with fatal results in some cases. A notable instance of this tendency was the popularity of the "Harness belt" some 30 years ago, a device which was shown by this journal at the cost of a series of hard-fought libel actions to be electrically useless; the vendors of the belt had reaped a rich harvest from the simple folk who put their faith in the marvellous healing properties claimed for the belts, which professed to contain electric batteries of the "Voltaic pile" type, but were often not completely connected up to form an electric circuit, and in any case had no curative value at all, such benefits as the wearers experienced being due not to electricity, but to faith and flannel.

The Harness belt, however, was at least harmless, except to the pocket of the purchaser (though many poor wretches whose lives might have been saved by proper medical attention were deluded to their destruction by specious promises of betterment), the same cannot be said of some of the powerful and effective instruments that are now available to the public. That electricity in therapeutics has proved itself of immense value in a variety of ways is, of course, beyond question; but we wish to emphasise the fact that such treatment should never be undertaken except under competent medical supervision.

Experimenting with X-rays has entailed painful consequences to many an amateur, and apart from the danger of X-ray burns which may result in the loss of limbs and eventually of life, there are strong reasons for restricting the use of this very potent radiation to the hands of experts worthy of that trust. That a word of warning is not superfluous may be gathered from recent correspondence in the lay Press regarding the use

of X-rays in shoe shops, for the purpose of revealing to customers the disposition of the bones of their feet when correctly fitted with suitable footwear. The intention is good, but the operation is unnecessary; and though the makers claim that the apparatus is so designed as to safeguard against any harmful effects to either the customer or the operator, the fact remains that the element of danger is present, particularly to the latter, who is constantly exposed to the effect of any stray radiation that may occur. Such effects are cumulative, and may not be revealed for many years after the mischief has been done. Nor is it at all certain that all the dangers associated with X-rays have yet been identified.

In our last issue Dr. W. S. Hedley outlined the history of the use of X-rays in therapeutics, and described the elaborate precautions that had been adopted to guard against the dangers surrounding the X-ray tube—in spite of which from time to time we still have to record another martyrdom; and he gravely questioned whether every medical man who handled these rays in a professional capacity was fully conversant with their properties and their attendant risks. In his opinion no-one but a qualified man should apply the X-rays to the living body.

Again, according to the *Weekly Dispatch*, only last week a man who was in the habit of treating himself with "artificial sunlight" fell asleep in the act, and was exposed to the radiation, presumably containing ultra-violet rays, for an hour and a half; he woke up to find that his skin had peeled off, and has been seriously ill ever since the mishap. Many people treat themselves in this way, and are liable to similar consequences. It is indeed fortunate that radium is too expensive to become the plaything of hypochondriacs—its unsuspected capacity for burning the skin was the cause of some serious occurrences in the early days, when a man would innocently carry a tube containing it in his waistcoat pocket.

In another direction the uncontrolled use of electricity presents real risks: we refer to the electric toys which are now exposed for sale. Some of these are intended for connection to the lighting circuits, which are more often than not at a pressure of more than 200 volts. A lamp is to be inserted in series with the toy, but it should be realised that when the circuit is open, though there is no current, the full pressure is present up to the point of interruption. Moreover, the lamp may be replaced by some ingenious substitute which removes even that safeguard. In any event, the practice is altogether too dangerous, and it should be made a criminal offence to place such toys in the hands of children, who are thus exposed to the double risk of fire and fatal shock.

The Electrical Trade Section at Birmingham.

We are pleased to report that so great has been the measure of support promised in connection with the Birmingham Section of the British Industries Fair that a large extension to the permanent exhibition buildings at Castle Bromwich has been found necessary. The progress of the Electrical Trade Section, to which we have made frequent reference, is partly responsible for this, and in addition the general engineering trades of the country are participating on a much larger scale than on any previous occasion. The enlargement that has been decided upon is to take the form of an entirely new building on vacant ground between two existing buildings which are at present connected by two corridors. With these three buildings thrown together there will be one vast display hall with an area approximating to 100,000 sq. ft., a considerable part of which will be occupied by the Electrical Trade Section. This section is, as our readers know, the outcome of a conference held at the Birmingham Chamber of Commerce, and electrical companies and firms have come forward in very satisfactory numbers—taking considerable space for both trade and working exhibits. We gave a list of exhibitors last week, and this has to be supplemented by a number of others including, we understand, Messrs. Veritys, Ltd., the Hackbridge Electric Construction Co., Ltd., and Callender's Cable & Construction Co., Ltd. In addition to the trade exhibits there will be a worthy demonstration by the Birmingham Corporation Electric Supply Department, while there is also a permanent electricity supply transforming plant provided by that department in the exhibition buildings.

Every effort is being made to add to the practical electrical interest of the occasion (February 15th to 26th) by the organisation of a series of electrical conferences on subjects connected with electrical development, and invitations to be present at some of the functions have been issued to the associations representing the electrical manufacturers, the contractors, the wholesalers, municipal electrical engineers, consulting engineers, the cable-makers, the lamp manufacturers, also the electric power companies, the chief officials of the London electric supply companies, the Provincial Electric Supply Committee, and, of course, representatives of the I.E.E. The fact that Mr. Chattock, the president of the Institution of Electrical Engineers, is Chief of the Birmingham electricity undertaking, which is so closely interested in the Castle Bromwich Fair, is a very happy coincidence.

It will be gathered from the foregoing that all goes well with the arrangements for ensuring a successful electrical twelve days next month at Birmingham. By the date of the visit of the Duke of York, on or about February 18th, there will probably be a live electrical trade market in existence which large numbers of our readers would do well to enter in their diaries straight away.

French Power-station Practice.

In France, as elsewhere, power-station practice has developed in the direction of the use of larger generating sets. Steam pressures have gone up, but not to the same extent as in Germany. The American system of very large generating sets made up of two or three pressure-stage turbines on parallel shafts has not made headway, and the output of 3,000-rev. turbines has not been pushed as far as with us. The Ljungström turbine, which in medium sizes has proved to be a remarkably economical machine in this country, has not been used in France to any extent. In output, the largest stations are those of Gennevilliers and Saint Ouen, near Paris; the former is of 340,000-kW capacity, and the latter is being enlarged to the same output. Whilst Gennevilliers contains more innovations, perhaps St. Ouen would appeal more to British engineers.

We continue in this issue the description of a station at Comines, near Lille, the design for which was prepared after the Armistice. The layout is arranged for 25,000-kW generating sets, the steam pressure being approximately 300 lb. with 700 deg. F. total temperature. The generators, working at 10,500 volts, are coupled to single-phase transformers, which raise the voltage to 45,000, at which pressure the switching is done. Power is taken by overhead mains to the outskirts of Lille and Tourcoing and is carried finally to the main sub-stations by single-core cables. Among the interesting features may be mentioned the analysis and mixing of the coal from various collieries, the simple appliances for ash disposal, the adoption of two armoured concrete condensing pressure mains to avoid deep trenching in bad ground for the construction of open channels, the use of distilled water from quadruple-effect evaporators for boiler and transformer cooler make-up, the successful use of pulverised low-grade coal, and the simplicity of the switchgear. The station, as a whole, strikes one as being a well-thought-out engineering job, and a credit to those responsible for it. The French, who are leaders in the use of armoured concrete, believe in light and air where power-station buildings are concerned, and a new lay-out facilitates this practice, of which Comines is a good illustration.

Australian Industrial Progress.

A large part of the report by Mr. R. W. Dalton, Senior Trade Commissioner in Australia, which we review in this issue, is devoted to the consideration of the Commonwealth's industrial expansion. This is being sedulously fostered by a system of tariffs which, whether strictly economic or not, has certainly encouraged the establishment of Australian factories—some of them by well-known English concerns. It is not clear from the report how the Australian electrical industry is faring, but it is certainly true that imports of electrical goods, particularly from Great Britain, continue to increase, so that it may be said that the rate of expansion of the home industry is lower than the rate of growth of the demand.

Mr. Dalton endeavours to make clear the conditions governing the preferential admission of British goods into Australia, a matter regarding which there is a great deal of misapprehension. Another useful feature of the report is the advice as to agencies—not a simple matter in a country with an area of nearly three million square miles, and only about six million inhabitants.

An important factor in the engineering trade, although it is not mentioned in Mr. Dalton's report, is the bias for products of a certain country inevitably gained by the student who later becomes a purchaser of machinery or an adviser to purchasers. In the case of Australian student engineers, America fully realises her opportunities, and American manufacturers provide numerous facilities for young Australians who are embarking upon an engineering career. The Sydney correspondent of the *Daily Telegraph*, commenting upon this matter recently, said that British firms appeared to be less eager to afford these facilities. One obstacle which confronted the Dominion student in England was the reluctance of firms to pay a living wage, while there was no difficulty in securing this in the United States. The assertion is rather a sweeping one, for we believe that there are firms in this country who realise the value of early impressions gained by students, and afford the latter facilities of the kind mentioned. At the same time there is plenty of room for improvement, and we urge electrical manufacturers to give their fullest and most sympathetic attention to the matter.

Commercial Matters.

We are glad to note that certain of the institutions and associations are to some extent filling the gap that has long existed in the programmes of electrical discussions. Technical debates are essential for technical men, and the more there are of them the better it will be for engineers. But there are thousands of men connected with the electrical trade and industry who have little interest in purely technical subjects. For several years we have had evenings devoted to what are described as salesmanship conferences, and there have been attempts to promote non-technical discussions at informal meetings of the Institution of Electrical Engineers. But we are convinced that there are many men on the commercial side of the industry who would welcome an opportunity of putting their heads together regarding the matters that are vital to them in their everyday business-getting efforts. Is it that they have no platform? Or that there are few of them possessed of initiative or gifted with the ability to express themselves? Or are they afraid of giving something away?

Mr. J. W. Beauchamp went to Manchester last week to a meeting of the North-Western Centre of the I.E.E. to lecture on co-operative business building for the electrical industry, and we understand that he directed attention to some of the directions in which the industry is neglecting opportunities—a fine subject in connection with our admitted backwardness in pushing domestic electric apparatus such as the electric washing machine, the household refrigerator, the vacuum cleaner, and—in another department—industrial heating. To-night the British Electrical Development Association holds a meeting, open to all and sundry who wish to listen to an instructive talk from Mr. Ll. B. Atkinson on "Suggestion and Auto-Suggestion in Salesmanship." Our selling methods are an important matter to the commercial man whose business it is to deal with the trader and with the buyer, and if the men who are daily in the thick of the fight could be induced to get on their legs and let their tongues run freely there might be more life and vivacity in trade—who knows?

The Junior Institution of Engineers listened to an address entitled "Notes on Salesmanship" from Mr. A. J. Simpson, the chairman, on Friday last, a brief reference to which appears in our "Business Notices" to-day. The title is a very comprehensive one; perhaps for the purposes of useful or practical discussion it will ere long be found to be too broad, and will be split up into details. The points touched upon in our report show how full of interest the subject may become when we try to look at it as a practical trade subject. Perhaps we need to come down from the clouds a bit when we discuss such matters. There are salesmen and salesmen, just as there are buyers and buyers. There is room for all sorts, and if we try to set up an artificial standard of qualifications, we may discourage good men who never can conform to it. Many of the best qualifications of a business man are those gained by practical experience roughing it on the road and for a time inside the works where the goods are produced. Add to such experience personality, energy, and tact, and little more is needed for the sale of most manufactures.

Overhead Line Regulations.

Travellers on the Continent cannot fail to observe that there the overhead electric light and power line is as common a feature of the country villages and roadsides as in this country it is rare. This is due, probably, to the fact that here more than anywhere else the use of underground mains has been almost universal and public opinion has not been accustomed to overhead conductors for electricity supply.

At present our regulations for low-pressure lines (not exceeding 650 V d.c. and 325 V a.c.) specify that allowance shall be made for a wind of 50 miles an hour at right angles to a line at 22 deg. F. coated with ice having a radial thickness of $\frac{1}{4}$ inch, and that the pressure shall be calculated on the whole projected area of ice-coated line. In this country all these four conditions might occur simultaneously, say, once in ten years at a few exposed localities. To cope with this remote contingency not only must the cost of all such lines as are constructed be very heavy—in thousands of cases it will forbid their construction absolutely. Again, the minimum height must not be less than 20 ft., though bridges need not be higher than 17 ft. The importance of reducing the minimum height for electric lines to 17 ft. is far greater than might appear; not only would it reduce the overturning moment on the poles, due to wind pressure, and thus enable lighter as well as shorter poles to be used—it would also facilitate negotiations for crossings with the Post Office, and the aggregate saving would be very considerable. Precautions have to be taken to earth broken wires and to trap leakage. For higher pressures the regulations are still more stringent, especially where lines run along or across public roads and railways, or near other overhead lines, or near buildings, including those served.

In country districts, too, the enforcement of the urban regulation restricting pressure variations to a maximum of 4 per cent. up or down is inappropriate. Wider variations must necessarily be allowed. The essential is to cheapen the supply to the country dweller, even at the expense of uniformity of pressure and reliability of supply. It is well to aim at perfection, but foolish to reject everything that falls short of that ideal.

Electricity Supply in Great Britain.—IX.*

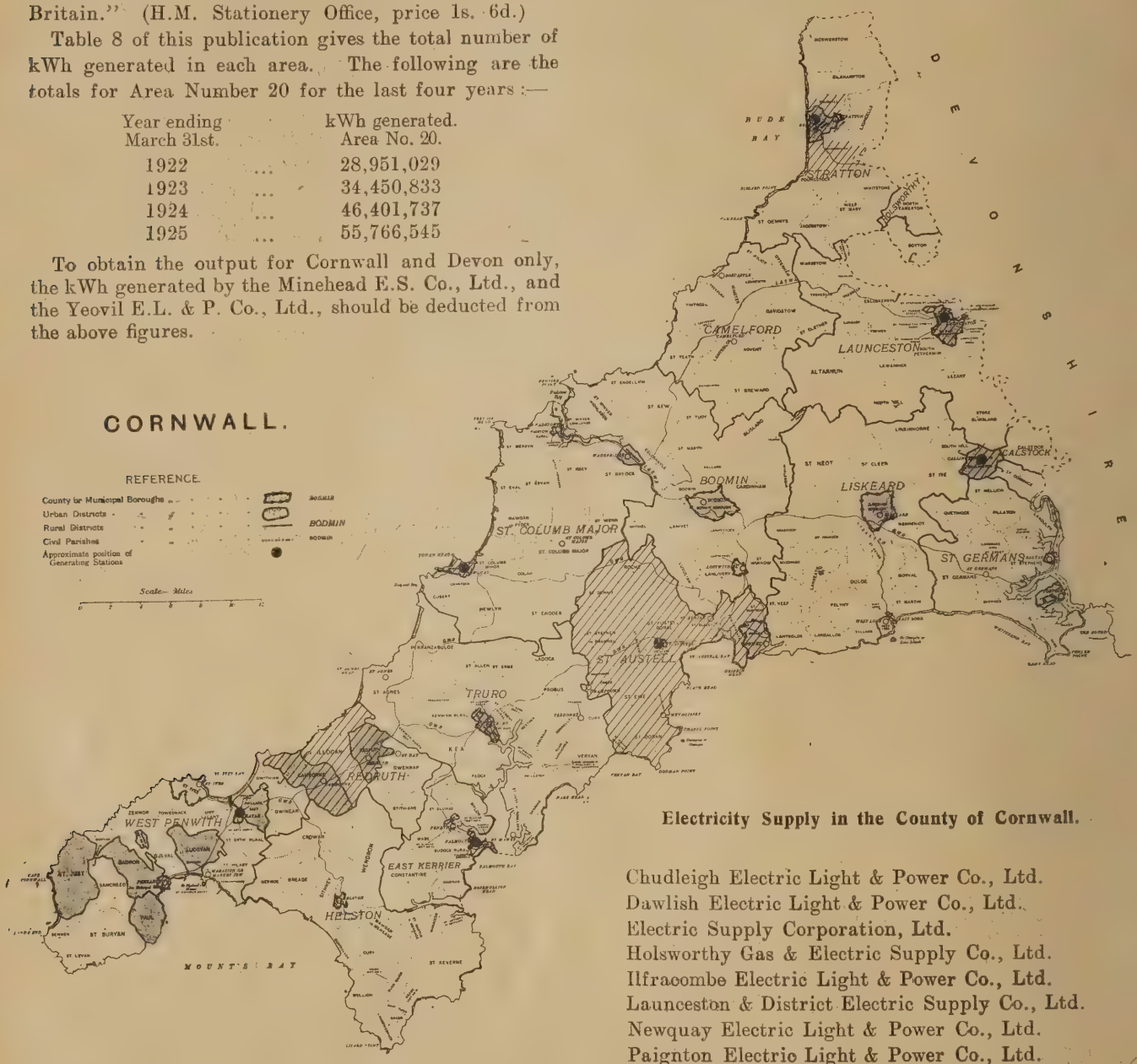
Cornwall and Devon.

No part of either Cornwall or Devon has yet been included in any Electricity District, but these two Counties, together with such parts of Somerset as are not included in the Lower Severn Electricity District as provisionally determined by the Electricity Commissioners, form Area Number 20 in the Annual Analyses and Summaries of "Generation of Electricity in Great Britain." (H.M. Stationery Office, price 1s. 6d.)

Table 8 of this publication gives the total number of kWh generated in each area. The following are the totals for Area Number 20 for the last four years :—

Year ending March 31st.	kWh generated. Area No. 20.
1922 ...	28,951,029
1923 ...	34,450,833
1924 ...	46,401,737
1925 ...	55,766,545

To obtain the output for Cornwall and Devon only, the kWh generated by the Minehead E.S. Co., Ltd., and the Yeovil E.L. & P. Co., Ltd., should be deducted from the above figures.



Electricity Supply in the County of Cornwall.

In addition to the Cornwall Electric Power Company, which has certain powers over nearly the whole of the County under the Cornwall Electric Power Act, 1902, there are 27 other authorised undertakers (whose areas are shown hatched on the maps) holding statutory powers for electricity supply in Cornwall and Devon.

The following is the list:—

Local Authorities.

Barnstaple Corporation.
Crediton Urban District Council.
Exeter Corporation.
Plymouth Corporation.
Sidmouth Urban District Council.
Tiverton Corporation.
Torquay Corporation.
Truro Corporation.

Companies.

Bideford & District Electric Supply Co., Ltd.
Brixham Gas Company.
Bude Electric Supply Co., Ltd.
Budleigh Salterton Electric Light & Power Co., Ltd.
Callington & District Electric Supply Co., Ltd.
Camborne Electricity Supply Co., Ltd.
Chudleigh Electric Light & Power Co., Ltd.
Dawlish Electric Light & Power Co., Ltd.
Electric Supply Corporation, Ltd.
Holsworthy Gas & Electric Supply Co., Ltd.
Ilfracombe Electric Light & Power Co., Ltd.
Launceston & District Electric Supply Co., Ltd.
Newquay Electric Light & Power Co., Ltd.
Paignton Electric Light & Power Co., Ltd.
Penzance & District Electric Supply Co., Ltd.
St. Austell & District Electric Ltg. & Power Co., Ltd.
Seaton & District Electric Light Co., Ltd.
Teignmouth Electric Lighting Co., Ltd.
Urban Electric Supply Co., Ltd.

With regard to the Company undertakers, it should be noted that the Electric Supply Corporation, Ltd., has undertakings each with its own generating station at Exmouth, Falmouth and Totnes. Similarly the Urban Electric Supply Co., Ltd., has an undertaking with its own generating station at Dartmouth, also supplying Kingswear; as well as separate undertakings at Illogan and Redruth, obtaining a bulk supply from the Cornwall Electric Power Company.

The Power Company also gives a bulk supply to the Camborne E.S. Co., Ltd., and to the Penzance and District E.S. Co., Ltd., and is arranging to supply in bulk to the Truro Corporation.

* Parts I-VIII of this series appeared in the ELECTRICAL REVIEW of October 9th, 16th, 23rd, and 30th, November 13th and 20th, and December 11th and 25th, 1925.

We understand that Crediton Urban District Council will obtain a bulk supply from Exeter Corporation.

All the other undertakers possess generating stations, as indicated on the accompanying maps.

The generating station of the Cornwall Electric Power Company is situated at Hayle, and Torquay Corporation's new power station is at Newton Abbot.

These maps, which were prepared by the Ordnance Survey Department for the Boundary Commission of 1917, are used by permission of the Controller of H.M. Stationery Office. Since 1917 the following alterations have been made:—

(1) The Parish of Forrabury and the Parish of Minster have been united to form the new Parish of Forrabury and Minster.



Electricity Supply in the County of Devon.

At the present time there does not appear to be any application for new territory in Cornwall, but the Fifth Annual Report of the Electricity Commissioners gives particulars of several applications in Devon. Another application which includes part of this County appeared in the London *Gazette* of May 19th, 1925 (page 3386). The area applied for in the County of Devon is there described as the Urban District of Axminster, the Parishes of Axminster Hamlets, and Chardstock, in the Rural District of Axminster. This area has been hatched on the map, as well as the other areas applied for previously.

The 1921 Census gives the following particulars for the Administrative Counties of Cornwall and Devon and the associated County Boroughs:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
2,539,531	1,030,319	251,828	15,845

(2) The Parishes of Budock Urban, Falmouth Borough and Falmouth Town have been united to form the new Parish of Falmouth, co-extensive with the Borough of Falmouth.

(3) The Parishes of Lawhitton Urban, Saint Mary Magdalen, Saint Stephens by Launceston Urban, Saint Thomas the Apostle Urban and the Hamlet of Saint Thomas Street have been united to form the new Parish of Dunheved otherwise Launceston, co-extensive with the Borough.

(4) The Parishes of Tor Moham and Saint Mary Church have been united to form the new Parish of Torquay, co-extensive with the Borough of Torquay.

(5) Parts of the Parishes of Saint Austell Rural and Saint Mewan have been added to the Urban District of Saint Austell and the Parish of Saint Austell Urban.

X-ray Dermatitis Cure.—It is reported by the *Daily Mail* that Professor M. d'Arsonval, in a communication to the French Academy of Science, claims that growths caused by X-rays can be cured rapidly by high-frequency electric currents.

The Comines Power Station.

A French Central Station using Pulverised Fuel.

By THEODORE RICH.

(*Continued from page* 63.)

Boiler House Equipment.

The boiler equipment is distinctly interesting because with the same type of boiler, chain-grate stokers have been put into competition with pulverisers. The boiler house is in two bays, each 62.5 metres (about 204 ft. 5 in.) long and 28 metres (about 91 ft. 8 in.) wide, placed at right-angles to the turbine house, from which it is separated by means of a sort of alleyway used for pipes, pumps, distiller and tanks (see figs. 15 and 16).

The first section to be built contained 10 boilers, and two boilers have been so far installed in the new boiler house which is placed alongside the former. The main boiler floor is of armoured concrete, and the same construction is used for the coal bins. The house is founded on piles; owing to the fact that each boiler, with economiser, stack, bin, &c., weighs something like 600 tons great care had to be taken to get ample support for the armoured concrete stanchions which carry such a load. The main boiler floor is 5 metres (16 ft. 4 in.) above the basement and general ground level; two expansion joints are arranged lengthwise in the floor.

Each boiler house has coal bunkers of a total capacity of 600 tons, roughly one day's supply. There are 12 Babcock & Wilcox marine type boilers each with 1,000 square metres (10,764 sq. ft.) heating surface, each capable of producing 30,000 kg. (66,100 lb.) of steam under normal conditions, and 40,000 kg. (88,160 lb.) when forced; the normal steam pressure is 21 kg. per sq. cm., or approximately 300 lb. per sq. in.

Each boiler has a superheater of 500 sq. metres (5,382 sq. ft.) surface. The total temperature of the steam is 350 to 370 deg. C. (about 660 to 700 deg. F.). The boilers are fitted with water-level indicators, whistling alarms, and pressure gauges with illuminated dials. A dial pyrometer is fitted to the superheater. The feed is controlled by Copes automatic boiler level regulators. A Green economiser of 560 tubes, each 13 ft. long, is fitted over each boiler, the gases leaving at a temperature of about 200 deg. C. (392 deg. F.). Induced draught apparatus on the Louis Prat system with a double cone chimney reaching to 30 metres (154 ft.) above the economiser house floor, is arranged for each boiler unit, two fans being fitted to each chimney, each driven by a 21-h.p. motor running at 720 r.p.m. A 2½-ton monorail electric traveller made by the firm of Sevory-Bedu is arranged to run down the boiler house, while each line of economisers is served by a 2-ton Morris traveller, so that the tubes can be handled if necessary.

Eight of the ten boilers of the original installation were fitted with triple chain grate stokers, having a combined operating surface of 31.35 square metres, the stokers being driven by a 7.5-h.p. motor; the grates are fitted with a mechanical arrangement of the Besmer type for the removal of slag. Forced draught is applied by three fans per boiler, each giving 750 cubic metres of air per minute, driven by a 21-h.p. motor at 720 revs.

Pulveriser Plant.

Two boilers in the original installation were fitted with pulverisers, on the "Turbo" unit system, the two boilers so far placed in the new boiler house being on the same system. The coal having been broken to a size not exceeding about 1 inch cube before being delivered to the overhead coal bins falls down shoots into the pulverisers. Two pulverisers are placed on the boiler floor in front of each boiler, each being driven by a three-phase induction motor, of 90 h.p., at 1,450 revs. Fig. 5, p. 60, shows a pulveriser opened up. The coal enters by means of a trunk and passes through a variable feed arrangement. There are four beater wheels in series on a shaft revolving at high speed; a fan is placed on the main shaft, at the delivery end. The coal is broken by impact and not by grinding action against the walls. Air is sucked through the machine by the fan, the passage of this air tending to drive the coal towards the wheels, while centrifugal force tends to drive it outwards; by regulating the air supply the fineness of the product can be increased. The coal is sucked out by the fan and blown up a rising leg and comes down again dividing into three branches which slope into the boiler casing (fig. 7); there are, therefore, with two pulverisers, six burners per boiler. They deliver the coal into the furnace; the latter is of such an internal height and dimensions, 180 cubic metres (6,345 cubic feet) capacity, that complete combustion is obtained before the gases pass into the tubes.

When the first two boilers were installed three pulverisers were fitted to each boiler; as a result of adjustment and experiment the pulverising capacity of each machine was increased from 2 tons to 3 tons per hour without increasing the power absorbed, and two were then used per boiler. The normal quantity of coal dealt with by each pulveriser is 2½ tons per hour or 5 tons per boiler. The furnace temperature is 1,300 to 1,400 deg. C. (2,370 deg. F. to 2,550 deg. F.) with 14 per cent. carbon dioxide. The pulverisation is carried to an extent which will pass 65 per cent. through a grid of 200 mesh per lineal inch, 90 per cent. through 100 mesh and 100 per cent. through 50 mesh. The fire brick lining is 57 cm. (22.4 in.) thick, with a layer of diatomite, and then a 5 cm. (2 in.) cavity. The brick, which will resist 1,750 deg. C. (3,180 deg. F.), has a composition of 38 per cent. alumina. The brick linings of the first two boilers installed have been in use for four years, and have given no trouble worth mentioning. The pulveriser boilers are being worked for about 5,000 hours per year.

Each boiler is fitted with two auxiliary fans driven by 16-h.p. motors, but these, however, are only put into use when the boilers are being forced beyond the normal output of 30,000 kg. (66,000 lb.) of steam per hour. Like the boilers with chain-grate stokers, two Prat system induced draught fans are arranged alongside the chimney, but the operation of these is not necessary for combustion, they are only set to work when the dust is being blown out from among the tubes. The operation of the boilers with pulverisers has not given rise to any boiler troubles. There have been no tube failures; the use of distilled water for make-up feed may, however, be one factor in this matter. After experience with two boilers in the original boiler house it was decided to use pulverisation for the extension. The director of central stations of the Energie du Nord Co., M. Orango, holds the opinion that the ample combustion space has a great deal to do with the satisfactory operation. It is found that with this type of stoking apparatus steam can be got up very quickly; the losses through banking up can, therefore, be largely reduced. Practically all the carbon in the fuel is burned up.

Comparison with the Chain Grate Stoker.

A good deal of harm has been done to the cause of many engineering developments, by claims that this or that scheme is a sort of universal pill suitable for all situations, results being heralded which do not pan out in practice. At Comines the coal is delivered from various seams and collieries; it is analysed on arrival and mixed so as to give what experience has shown to be the best results for each type of stoker. The ash content is high, up to 25 per cent., the coal being unwashed; the heating value is about 11,500 B.th.u. per lb. and the volatile matter 15 to 16 per cent. The coal from the dump is handled in a similar way in both cases, it comes down from the bunkers in trunks to the

chain grates and to the pulveriser. The space required in a boiler room does not materially differ with the two systems, as room has to be allowed for chain grates to be drawn out, and the two pulverisers stand in line in front of each boiler. Under conditions ruling at Comines it is found that for each boiler the pulverisers take from 150 to 180 horse power, or about 2.5 per cent. of the output of the boiler, neither the auxiliary fans nor the Prat induced draught ventilators being usually required.

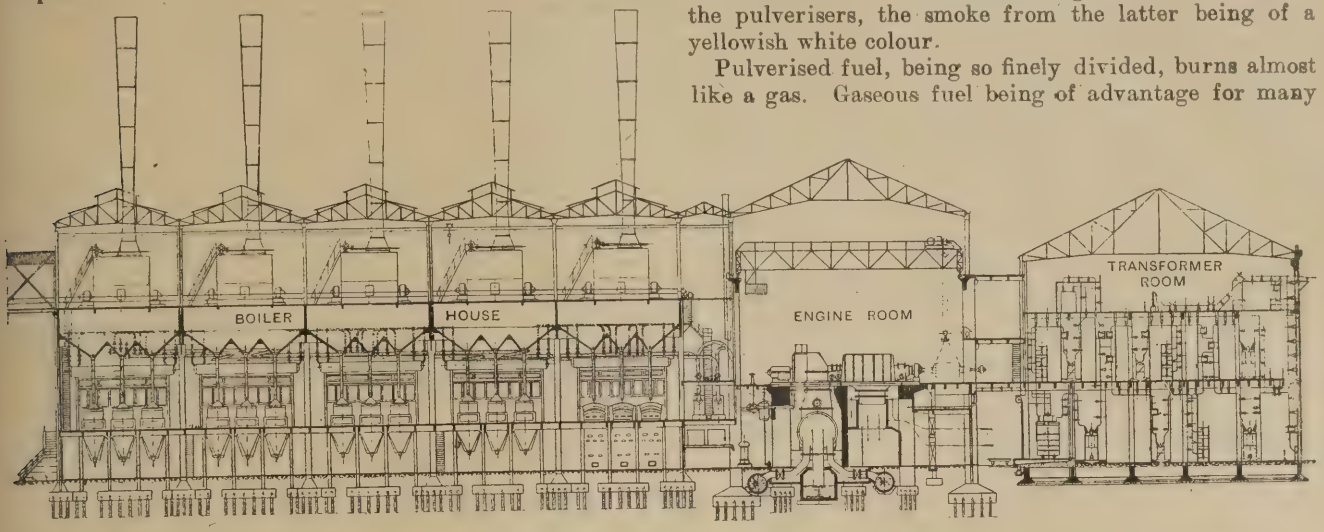


Fig. 15.—Comines Power Station: Sectional Elevation.

With the chain-grate stokers for about the same evaporation the power required is as follows:—Chain grate drive, 7.5 h.p.; three forced draught fans of 25 h.p. each, 75 h.p.; two Prat induced draught fans, 20 h.p. each—total 122.5 h.p., or about 1.9 per cent. of the power of the boilers. The boiler efficiency under test conditions comes out at about 84 per cent. with pulverised fuel and 80 per cent. with chain grates, while under normal running conditions the proportion is about 80 per cent. to 74 per cent. There is also the point that one man drives two pulveriser boilers while one man is put on to each one fitted with chain grates. These figures show that under the circumstances which exist at Comines regarding fuel and operating factors, where efforts are made to get the best results out of each type of stoker, after allowing for the increased power consumption of the pulverisers over the chain grate stokers and fans, there is an ample margin of economy for the former over the latter. It is understood that so satisfied are the users that when the chain grates require renewal they will be replaced by unit system Turbo pulverisers.

Comines power station lies a few hundred yards outside the town of the same name. Except in the direction of the town it is surrounded by open fields. There is but little smoke from the chain grates and less from the pulverisers, the smoke from the latter being of a yellowish white colour.

Pulverised fuel, being so finely divided, burns almost like a gas. Gaseous fuel being of advantage for many metallurgical, ceramic, chemical and other industrial processes, it is of interest to note that in France the makers of this pulveriser have supplied a number for various classes of industrial furnace work; it is only comparatively recently that economy in fuel has been seriously studied in many forms of industrial heating.

The Turbo pulverisers were supplied by a French company, "La Combustion Rationelle," of Paris, the English makers of plant on the same system being Messrs. Clarke, Chapman & Co., Ltd., of Gateshead.

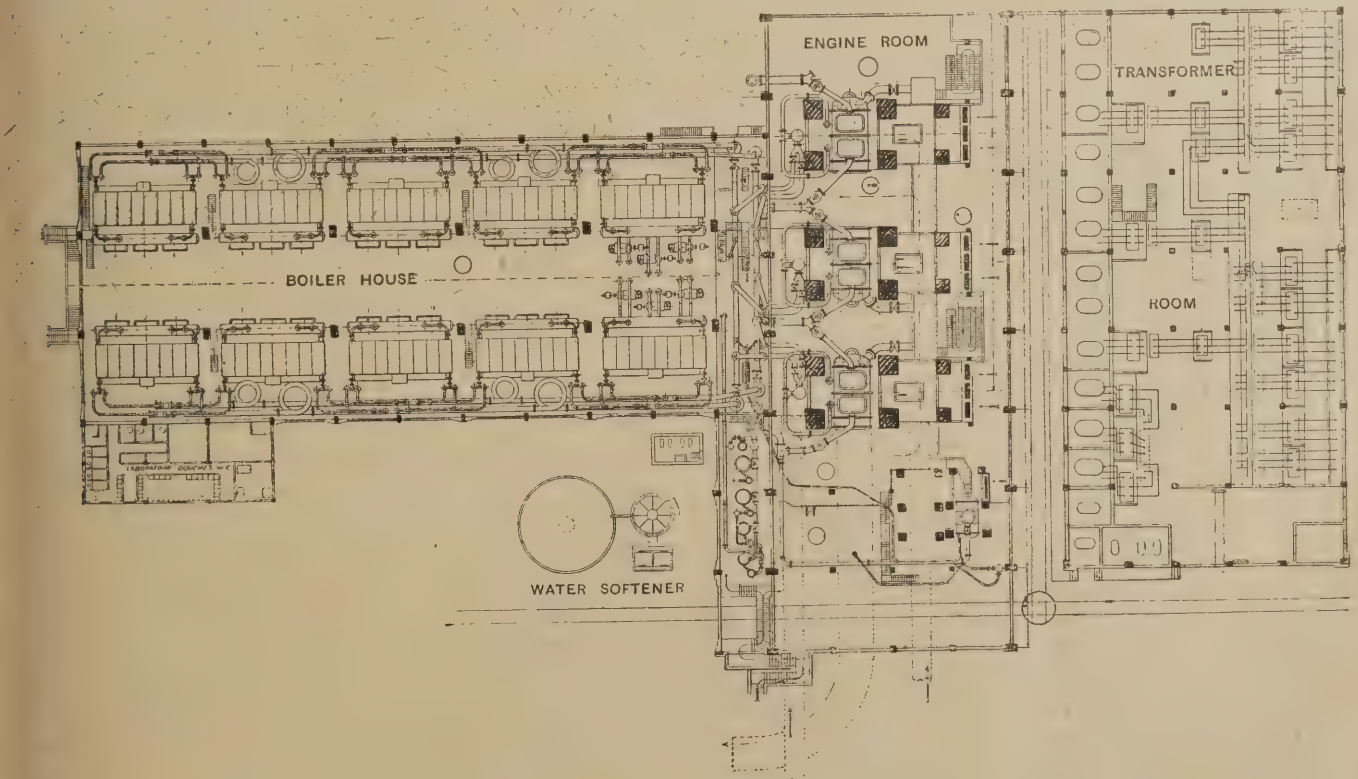


Fig. 16.—Comines Power Station; Plan of First Section.

Circulating Water System.

When the lay-out of the power station as a whole was under consideration, owing to the unsatisfactory subsoil and the urgent necessity for rapid completion, it was decided to avoid as far as possible the excavation

of deep trenches across the site, as not merely would it tend to diminish the stability of the foundation, but also owing to the timbering, pumping, &c., required it would seriously delay the completion of the whole installation, besides being costly.

It was decided, therefore, to put a pump house at the riverside and to install two circulating pressure mains with branches to individual turbines, the flow of water to each condenser being regulated by sluice valves, in lieu of the use of separate circulating pumps for each turbine. A pump house was constructed on the river bank 27.9 metres (91 ft. 6 in.) long and 10.10 metres wide, the floor being 3.2 metres (10.6 ft.) below flood level; the walls, which are of armoured concrete, were made watertight. A ten-ton electric overhead traveller is arranged to handle the plant.

The condenser water flows through double grids into two armoured concrete suction chambers, each having a floor level 2.65 metres (about 8 ft. 8 in.) below the normal level of the river; they are 5 metres (16 ft. 5 in.) wide and have a combined length of 22.8 metres (about 90 ft.). The inlet from the river is 11 metres (36 ft.) wide.

To protect the inlet there is a floating boom arranged with a duck-board so that a man can walk along it to clear away floating rubbish. There are also two sets of grids; the outer one is fixed, and in front of it is a trench for the deposit of mud, which can be washed away by special pumps. The inner grids are arranged so that they can be lifted and cleaned by water jets.

The pump house contains four Rateau type horizontal centrifugal pumps, working up to 12 metres (37 ft. 8 in.) head, two of which usually suffice for the load; each is driven by a three-phase induction motor of 450 h.p. at 730 r.p.m. at 220 volts. Two geared pumps driven by motors are used for priming. The main pumps deliver into a common cross header which can be separated into two parts by a sluice valve, the header being connected at the ends to two armoured concrete pressure conduits of 1.8 metres (5 ft. 11 in.) internal diameter running longways under the turbine house, from which branches controlled by valves are taken to the individual condensers, one branch from each conduit; the condenser discharges flow into a rectangular conduit running under the condenser bodies. Arrangements are made so that as soon as the capacity of the river is exceeded, cooling towers may be erected and the incoming water mixed with suitable proportions of cooling-tower discharge water.

Two 1,000-kW 10,500/220-volt three-phase transformers are placed in an annexe to provide power for the pump house. The transformer cubicles are arranged in a manner similar to those shown in fig. 13, p. 62.

(To be continued.)

Electricity Showrooms.

By W. A. GILLOTT, A.M.I.E.E.

THE question of showrooms for an electricity supply authority is one that, unfortunately, does not receive the attention it deserves, taking the country as a whole. There are comparatively few really good showrooms in existence; where they are in evidence, it is in places where the demand for a supply of electricity is rapidly increasing.

One of the first questions asked when a show-room is suggested is:—"Are showrooms necessary?" It is agreed that a supply authority has a valuable product to dispose of, and by supplying more energy it not only brings profit to itself, but provides means to relieve the monotony of work by the use of labour-saving appliances. The employment of electricity assists to prevent accidents, enables a building to be warmed in a hygienic manner, cooks food, cleans the air, and generally makes for a more healthy race. It is essential, however, that the people who are to receive these benefits, must be shown how they can be obtained by the aid of electricity. There still exists the mistaken belief, that everybody knows that one can cook, heat, clean, wash, &c., by electricity; it is true that a large percentage of the public has *heard* that electricity can be used for such purposes, but it does not *know* it. At a recent electrical exhibition in a town of nearly a quarter of a million inhabitants, many visitors were surprised to learn that electric cookers were actually in use, and the demonstration of an electric bed warmer was witnessed with astonishment. Such instances demonstrate the need of educating the public by direct application. Press advertising is necessary to create the interest; electrical exhibitions fill the part of stimulating that interest; and the showroom, with its congenial surroundings and well displayed appliances, is necessary to secure the order.

Can We Afford a Showroom?

It is not proposed to reply to this question by a plain "yes" or "no," but to give its answer in another way. Above it is shown how necessary it is to have a shop window for the power station to promote the extended use of electricity, and authorities who have not operated an up-to-date showroom cannot realise the business-pulling power which they possess, if properly managed. I have had experience with electricity showrooms where a turnover of some thousands of pounds per annum is done in counter sales—without taking from or upsetting the electrical contractor, and I will refer to him later—in cases where authorities have, or do not have, selling powers, and the result of this is also seen in the yearly returns of output. In one case of which I know, where it had not been the policy to appear in public, it was decided to establish well-appointed showrooms, and by the end of the first year the undertaking was able to trace the effect of this to the tune of nearly a million kWh increase in domestic consumption. In another instance, after showrooms had been opened but a few weeks, the station superintendent reported an appreciable increase in the demand on the station at midday on Sundays, and another undertaking found that it was able to induce shopkeepers to continue their window lighting until late at night. The effect of this showmanship was to earn more revenue, and by encouraging the class of load which the station needed, to materially help in filling up the "valleys" and secure a general improvement in the station costs. The trade slump of 1921 was felt by almost every supply authority, but I know of stations that were able to maintain their profits by an increase in domestic load. It is a fact that whatever the state of industry, people must eat, and it is "up to" the supply authority to see that they eat food cooked electrically. Another aspect is that a consumer has the right to expect (I was going to say require) the supply authority to keep him abreast of the times, show him the benefits of employing electricity, and how to use it to the best advantage, to enable him to extend its use in his home, office and factory, bringing in its wake increased output and profit to the undertaking. An undertaking cannot afford to be without a showroom. It is an excellent form of advertising, producing good results if it is properly managed.

What Form Should the Showroom Take?

Upon the assumption that it is agreed to proceed with a showroom, the next consideration is to be given to its type; this naturally depends upon the class of district covered by the supply authority, and, therefore, local conditions will determine to a large extent the way in

which the building will be equipped or laid out. It may be a palatial establishment complete with an Electric House, model works, kinema, ladies' retiring rooms, lounge with afternoon tea, smoking-room with morning coffee, shop windows arranged for each trade in the district, lecture hall, &c.; or, to go to the other extreme, a small shop with a model kitchen behind. Whatever the size of the building, one object must never be lost sight of, that is, the essential feature of exhibiting the goods in as nearly as possible their normal surroundings. Do not show a table standard with its delicate silk standing on top of a cooker, or a bowl fire on a shelf 8 ft. from the floor. If a small shop only is available it requires but a little more ingenuity to reach the necessary standard of dressing. The first care is to see that every section is properly illuminated; the window should have a minimum of 100 W per foot frontage, spot lights, colour lighting, signs, time switches, &c., all fixed in their proper position and shown working. The electric fire needs a suitable base in a fireplace, or if of the dog grate type, it will look better on an open hearth with the mantlepiece complete; the electric iron should be placed on an ironing board; and the cooker in the kitchen. Where space is limited arrangement can be made for dealing with single subjects at different times, leaving, of course, a section free as a general exhibit. Sufficient plugs and switches or other outlets should be fitted; they are all needed for quick demonstration. A client visits the showroom to obtain ideas of how his home or shop may appear when electrified; it should, therefore, be the endeavour to show the appliances performing the work which they are designed to do, so far as circumstances will permit. The showroom should educate the client in a pleasing manner how to use electricity correctly. Apart from this, goods well shown are half sold.

What of the Electrical Contractor?

The electrical contractor is a necessary link in the chain of progress. It will be admitted that there exists in some districts a feeling of unwillingness to get together, but if the subject is properly handled, both sides can secure lasting benefits to their mutual advantage. It is not intended to give schemes of co-operation here, but to any interested body which would like details of such an arrangement, I should be pleased to submit proposals that would secure the desired result. Almost in every district, where a supply of electricity is available, much greater progress could be made if contractor and supply authority worked together, each having the one object in view, *i.e.*, more consumers. The potential business is enormous but, to secure it, capital, vision and goodwill and new methods of marketing are needed, and co-operative working is but one of the procedures to adopt. Each section should do its utmost and stand by its own results after a proper understanding in working methods has been arrived at. There are districts known to us all where such happy circumstances exist; it is the extension of this that will help to bring us nearer really inexpensive installations that all may receive the full benefits that electricity can provide.

The Next Step.

The stage is now reached where these items are to be put into operation; the question of tariffs, hiring schemes, &c., are all agreed upon and premises secured. This is the critical period of the whole situation, and in order to obtain the best possible results, it is advisable to place the whole scheme in the hands of one who is experienced in these matters. If such an individual is not on the staff, he should be found. If this course is adopted, the foundation of increased output, more profit and better service is established.

Electric Fires.

A Few Notes on the Types of Heating Elements.

By A STATION ENGINEER.

In a recent issue of the ELECTRICAL REVIEW a writer dealing with this season's fires remarked on the multiplicity of designs and questioned the advisability of so many. Undoubtedly, for a comparatively new industry we have far too many types of fires, and when such an old-established industry as the gas apparatus suppliers have found the need to introduce and very extensively advertise a standard model gas cooker and certain standard types of gas fires, surely it behoves the electric fire manufacturers to get together and produce a few standardised models and advertise them in the lay Press. By all means let each manufacturer have complete freedom of action regarding the appearance of the fire, and if they wish, let each manufacturer continue to put any type of heating element he likes on the market, but let us have—and very quickly too—a standardised type of element which, of course, must be of the plug-in type.

As I write I have before me the catalogues of many fire manufacturers running back for some years, and it is amazing to note how many have changed their element designs nearly every season. I may be prejudiced in favour of a particular type of element, but let me say right away that as a supply company engineer with experience in eight different undertakings in various parts of the country, I have yet to come across a burnt-out element where such an element has consisted of a fire-clay former built up in multiple with steel supports of some sort, and the heating spirals wound on *without* any pinning to the fire-clay. Dr. Ferranti has often shown remarkable foresight in design, and whether he was personally responsible for the Ferranti fire or not, the Ferranti fire element was built up of small fire-clay units steel supported, and to my mind was an excellent job. It has not been manufactured for some years now. To-day I can only trace five types of fire elements built up in multiple and two types in which the multiple principle has been partly followed by supporting two or three fire-clay sections on steel. I regret to note that the manufacturers of the last two types are putting them into the background. Second in reliability I have found the old 500- and 600-watt fire-clay bar in which the spiral is run in vertical grooves and hooked on top and bottom. This bar is now being superseded by the 1,000-W bar, and I am afraid it is with the 1,000-W bar that so many makers change their designs frequently. There are several makers who have succeeded in producing a 1,000-W solid bar element and who have so designed the fireclay that no pinning or clipping of the heating spiral is necessary. Why several well known makers who previously made really good 500- or 600-W bars now persist in pining the spirals of their 1,000-W bars to the fireclay, passes my comprehension. Personally, I have had nothing but trouble with this type due to "hot-spots" developing. It is no easy matter to stretch out the spiral to the necessary length, fit it in the grooves and then insert several dozen small split pins and still keep the turns evenly spaced to prevent "hot spots." One maker uses no fewer than 44 small split pins in a 1,000-W bar, and it is an impossibility for the average contractors' electrician to satisfactorily fit a new spiral under 40 minutes.

In referring to my ideal element as a firebar built up in multiple, I do not include the reflector type of element in which some 6 to 12 small fire-clay bridges are fitted in a polished reflector. I believe the reflector type will soon die a natural death, and that any reflector

effect required in any particular design of fire will be obtained by a reflector that is part of the fire frame.

In conclusion, by all means let makers continue to produce their own elements, but at the same time let them get together and decide on a standard plug-in bar, standardised as to distance between centres of the plug-in pins and standardised also as to width. In a few years it should be possible for one to walk into a shop and take home a 500-W or 1,000-W plug-in bar and fit it oneself just as we do with lamps. How often does an electric fire manufacturer advertise his products in the daily Press?—one or two do very occasionally, most of them never. Standardisation should cheapen manufacturing costs, and the pooling of advertising resources should enable frequent announcements to be made in the daily Press. Advertising must be continuous to be successful, and I feed sure that contractors would as a whole be satisfied with smaller trade discounts on well-advertised fires as the turn-over would be so much greater.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

PROMOTED by the Physical Society of London and the Optical Society, this show is an event in the scientific calendar. It is held at the Imperial College of Science, South Kensington (January 5th to 7th, inclusive), and is looked forward to as an opportunity to view the latest products of the leading instrument makers. This year, however, the Councils of the above-mentioned Societies extended the scope of the exhibition, the sixteenth of the series, by including, in addition to the usual trade display (in which some 72 firms participated), three new classes of non-commercial exhibits, namely (*a*) exhibits illustrating the results of recent physical research and improvements in laboratory practice, (*b*) selected examples of effective lecture experiments, and (*c*) repetitions of famous historical experiments in physics.

The object in view, in the case of classes (*a*) and (*b*), was to afford teachers and research workers an opportunity for interchanging ideas and disseminating information on matters relating to their work in practical physics. The exhibits in class (*c*), it was anticipated, would not only interest the scientific worker, but would also be of value as a means of impressing upon members of the general public (who had an opportunity of attending the exhibition on the third day) the connection between the lesser-known fundamental physical phenomena and their more widely-known practical developments.

Amongst the short lectures that had been arranged was one by Prof. A. F. C. Pollard, A.R.C.S., A.M.I.E.E., on "The Mechanical Design of Instruments," and another by Major W. S. Tucker, D.Sc., on "Electrical Listening." The collection of exhibits included several ingeniously constructed novel instruments, and electromedical apparatus was also displayed this year, particularly artificial sunlight lamps.

Cambridge Instrument Co., Ltd.

In accordance with its usual custom, the company had one of the largest displays in the show. Among the electrical instruments we would draw attention to a new electrometer (fig. 1) originally designed by Professors A. H. and K. T. Compton, the principles upon which it is based having already been published. The instrument possesses high sensitivity which can be quickly adjusted to any required value over a wide range, while at the same time it is practically constant over a large range of deflection.

The Duddell oscillograph outfit (fig. 2), first exhibited a year ago in the experimental stage, is now being manufactured for commercial use rather than only for laboratory experiments. It has the advantages of adaptability, robustness, and portability, while the ease with which it is operated adds considerably to its value as a commercial instrument. The outfit is constructed almost entirely of metal; it may therefore be readily moved from one place to another without risk of damage, and can be brought into close proximity with the problem under consideration. The outfit is designed to enable simultaneous records to be obtained from three vibrators, which may be any combination of the electromagnetic and the electrostatic types; in addition, the standard outfit comprises a revolving-drum camera with mechanism for exposing the film or paper, focussing lenses, and a small metal-filament lamp. The uncertainty of operation associated with the electric arc is thus avoided, and in order to obtain the high intensity of illumination required for the photographic recording of the wave form, the lamp is considerably overrun during the period of exposure. By means of a system of rotating mirrors, the wave form under investigation can be observed right up to the moment of exposure.

The vacuum thermo-element designed by Dr. Moll (fig. 3) is based upon the fact that if a thermopile is placed within a vacuum, its sensitivity is considerably increased, while there is also the distinct advantage that disturbances due to air currents are eliminated. Thermopiles constructed in this way have not hitherto yielded the result which might have been

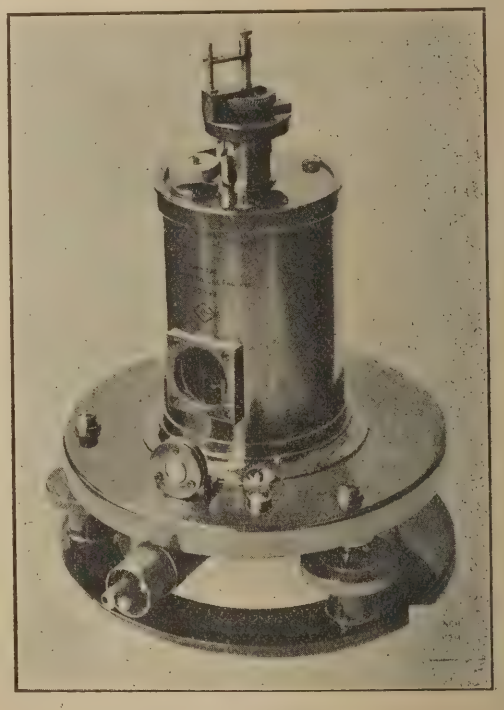


Fig. 1.—A New Electrometer.

expected, owing to the great heat capacity of the thermo-element, but by making use of extremely thin strips of metal, Dr. Moll and Dr. Burger have succeeded in designing a vacuum-element having a sensitivity about 100 per cent. higher than in air. It consists of constantan and maganin strips, brazed together, and blackened on one side; the strip is less than 0.001 mm. in thickness, even at the junction of the two elements, and the thermopile is mounted on platinum wire fused into a glass envelope, which is exhausted to a high degree of vacuity. In order to protect the thermopile against unequal heating, the glass is enclosed in a metal case, having double walls insulated from each other. Windows are provided on opposite sides of the case, that in front being fitted with a worked glass plate, which can be replaced, if desired, by a microscope slide cover glass, or a microscope objective. The window at the rear is fitted with a lens, so that the position of the thermopile may be adjusted relatively to the other parts of the apparatus. This thermo-element is particularly suitable for spectrum work, and is extremely rapid in action, the position of equilibrium being obtained within three seconds of the time of throwing the radiation on to the thermopile.

An electrocardiograph outfit was exhibited in an improved and simplified form, designed for operations from a 12-volt

electric battery. The illuminating source of light is a 50-c.p. half-watt type lamp, and a suitable rectifier, which enables the battery to be recharged from an alternating-current supply, is included.

A vertical force magnetograph with Helmholtz-Gaugain standardising coils, which the Company is supplying to the

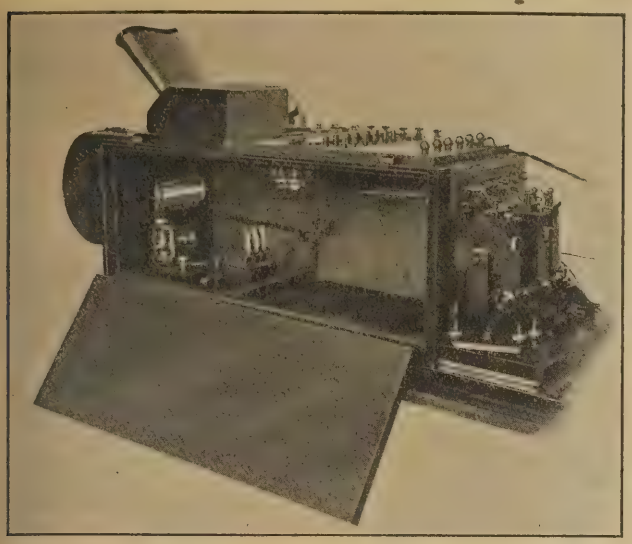


Fig. 2.—Improved Duddell Oscillograph.

Royal Observatory at Hong Kong, is of the Watson type; two tungsten steel magnets, mounted on either side of a platinised quartz mirror, are supported by two quartz fibres stretched in the same plane as the mirror, the system being kept taut by means of a quartz spiral spring. The design provides automatic compensation for changes in temperature, and

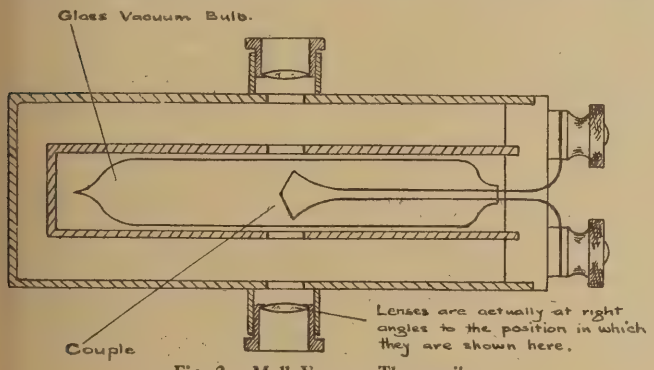


Fig. 3.—Moll Vacuum Thermopile.

the sensitivity is such that approximately 1 mm. is recorded on the chart for a change in magnetic force of 5 γ.

An instrument that should be better known is the "Cambridge" Unipivot galvanometer; this versatile instrument, by fitting a millivolt scale for d.c. and a thermal scale for a.c. work, can be used for the measurement of current or pressure

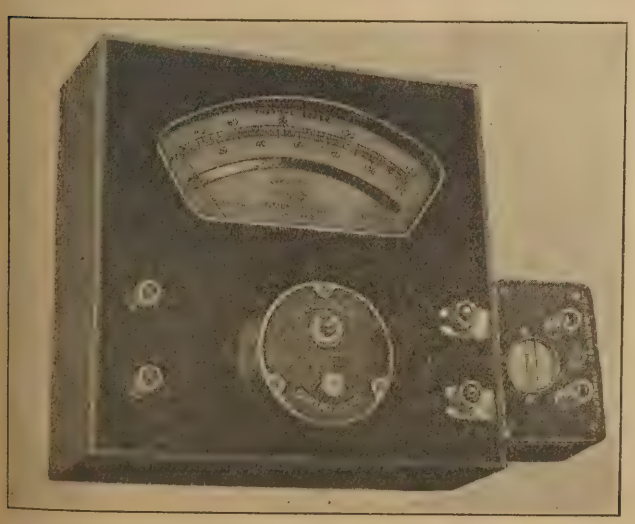


Fig. 4.—"Cambridge" Unipivot Galvanometer.

of either type over a range that can be varied with the aid of easily-attached accessories (fig. 4). Its application may be extended by the use of range multipliers so chosen that the current or pressure being measured is ascertained directly by applying a simple factor to the reading of the galvanometer. The multipliers are arranged for direct connection by means of tongues, as shown, but tapered holes enable connections to be made at a distance by plug-ended leads; they are interchangeable and made to cover ranges of pressure or current, one pattern being arranged for measuring both voltage and amperage without the necessity for changing connections. Alternating current, of high and low frequency, may be measured in conjunction with thermal converters, which are independent of frequency errors. The device consists of a thin wire heater of refractory material, to the centre of which is attached a fine thermo-junction; a.c. passed through the heater raises the temperature, which is measured by the thermo-junction on the millivoltmeter, the deflection being

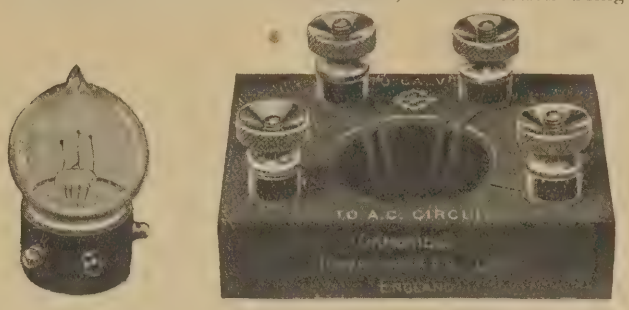


Fig. 5.—Vacuo-Junction.

proportional to the square of the current through the heater; the heater and thermo-junction are enclosed in a glass bulb (fig. 5). Converters are made in two ranges: one for use in conjunction with a.c. range-multipliers for pressure measurement, and the other for current measurement. For high-frequency work the heater is formed of two 0.05-mm. diameter iron and constantan wires looped together at their centres to form a cross. The accessory has a cover that acts as an electrostatic shield, which is completed by the case of the Unipivot instrument being connected to the moving coil.

The diagram (fig. 6) illustrates a millivoltmeter with a thermal converter (in the centre of the diagram), containing the thermo-junction JT in series with a small adjusting resistance r connected across its tongues. A heater H, together with

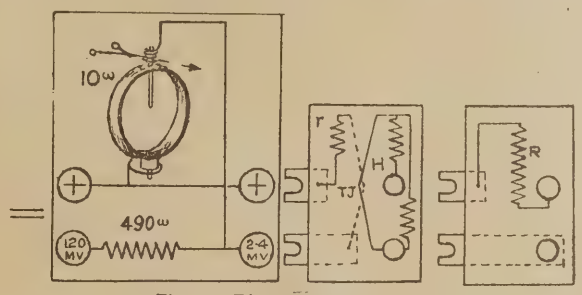


Fig. 6.—Diagram of Connections.

a small shunt and series resistance, is connected between the terminals of the converter. The a.c. range-multiplier (to the right of the diagram) contains a high resistance R in series for reducing the pressure at the converter terminals.

Marconi's Wireless Telegraph Co., Ltd.

In addition to an automatic call key and 4-seconds alarm device, various radio receiving sets were to be seen on this stand. In particular, the short-wave receiver shown in fig. 7, which has a wave range of from 15 to 100 metres, is a reproduction of the experimental apparatus used in Senatore Marconi's yacht for the interception of short-wave signals from

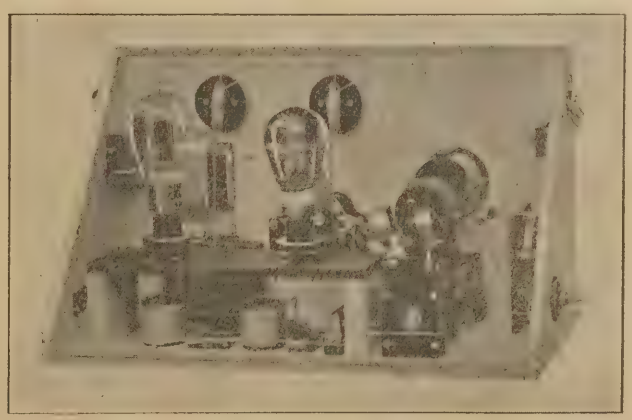


Fig. 7.—Marconi Short-Wave Radio Receiver.

the Poldhu station. Two valves are used, a detector and a low-frequency amplifier, the apparatus being designed to employ Marconi D.E.5 valves. An aerial, either of the "T" or "L" type, 50 to 150 ft. long, is suitable, but it is essential that it should be out of tune with the incoming wave, both as to fundamental and harmonics, and its tuning must always

be over the wave-length to be received. Two sets of tuning coils are supplied, together with a calibration chart for each receiver. The respective ranges of the coils are 15 to 40 metres and 35 to 100 metres. Three 40-volt dry batteries supply the high voltage for the receiver, the detector taking 80 volts and the low-frequency amplifier 120 volts. The broadcast receiver shown in fig. 8 employs no reaction whatsoever. It is composed of five h.f., one detector, and two l.f. stages. Each of the h.f. stages is tuned and separately controlled, adjustments for each being made by rotating the control dials to the wave-length marked on the scales. The circuit is "straight" and has its valve capacities balanced on what is claimed to be a unique method. A volume switch is incorporated in the set. Six D.E.3 and two D.E.5 valves are used, making the total current

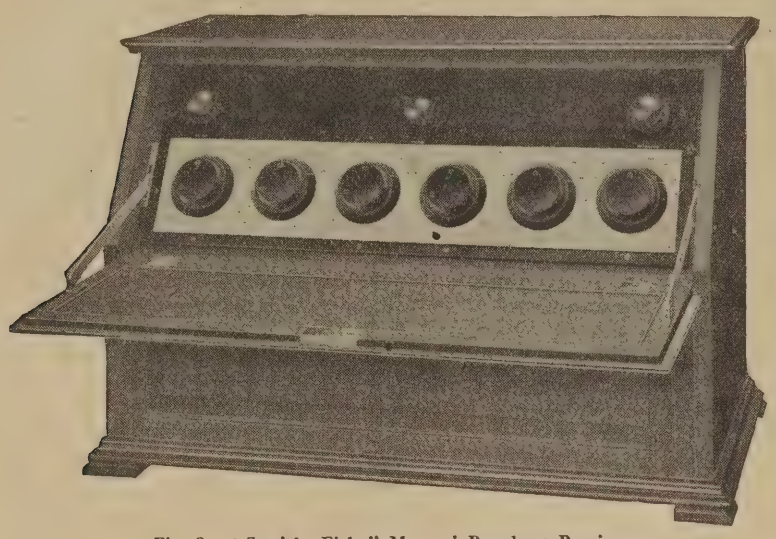


Fig. 8.—"Straight Eight" Marconi Broadcast Receiver.

consumption .68 ampere, using a 6-volt accumulator. Longer wave-lengths than the broadcast band are receivable on this model by additional coils. The h.p. batteries are housed in the base of the instrument; the selectivity is such that reception from stations immediately above or below the London wave-length can be obtained within four miles of 2LO.

(To be continued.)

Electricity Supply in Russia.

Various subjects were discussed at the Pan-Russian conference of representatives of municipal electricity supply works, which was held in Moscow during the third week in December. Dealing with the general situation of the industry, Mr. V. L. Levi pointed out that out of the 5,258 generating stations throughout the country 693, or over 13 per cent., were municipal or regional stations. The average capacity of the municipal stations was 34 per cent. of the average capacity of all the stations, *viz.*, 767 kW. Almost one-half of the plant was in Leningrad, Moscow and Baku. From 1917 the number of stations began to increase, the augmentation having been specially active in the past year. Down to 1923 the works constructed were principally of small size, but since then the average capacity had been raised to the pre-war level.

Internal combustion engines, the author proceeded to state, occupied a predominating position in the small stations, 50 per cent. of the stations being provided with that type of plant, while steam turbines were employed in the large stations. The total value of the stations amounted to about 220,000,000 pre-war roubles in 1923, and since then a total of 250,000,000 roubles has been expended, principally on regional stations, so that the capital invested in these undertakings has more than doubled in the past year or two. On the average about 27 per cent. of the plant in the works was out of service in 1923, while in 1924-25 the percentage of idle plant was further increased, except in the case of the works in Moscow and Leningrad. This circumstance is said to testify to the fact that the plant in the municipal stations has to a considerable degree become obsolete. As to the question whether the stations succeed in meeting the demand, it was mentioned that the load represented 71 per cent. of the capacity in 1924, whereas in 1925 more than half of the works had been operated without any reserve plant, and 16 per cent. were overloaded. The principal feature of the municipal stations was that their load was mainly lighting, 60 per cent. of them not having any industrial customers, although some improvement in the utilisation of the stations took place in 1924. The speaker expressed his preference for small stations, considering that large works were only of greater advantage where a reasonable demand already existed, which was seldom the case with Russian stations.

Mr. U. K. Mitlyan stated that the main problem of municipal stations consisted in the restoration, reconstruction and extension of the existing stations, and the effective administration of the industry. Funds for capital expenditure must be derived, in the first place, from amounts set aside for redemption, and profits. In individual cases funds could be obtained from consumers in the shape of credits granted or shares taken up in the stations. But the basic source of funds for the establishment of new municipal stations must be the granting of long-term loans by the Central Communist and Electrical Banks, which should organise a consortium for giving credit to municipal stations in conjunction with the Industrial and State Banks. The author held that all the stations should be placed on an economic basis by the charging of adequate tariffs, the organisation of redemption funds, the development of the load, and the preparation of correct forms of accounts.

The fuel question was dealt with by Dr. A. V. Volkenau, who stated that the stations used Donetz coal and liquid fuel to the extent of 47 per cent., local mineral fuel to the extent of 44 per cent., and wood to the extent of 9 per cent. As in the next few years there would be a shortage of coal and naphtha as a result of the development of the metallurgical and other industries, it would be impossible for the municipal stations to obtain all the fuel of high calorific value which they required, and they must therefore devote more attention to the use of local fuels of inferior quality, or pulverised coal.

Mr. I. M. Rusak spoke of the success which had attended the scheme of one of the Leningrad stations for the supply of hot water to certain undertakings such as hospitals and baths by means of special pipe-work. It was considered that a considerable scope lay in this direction for new stations.

Dealing with the cost of generation, Mr. M. K. Polivanoff stated that this was at present far too high. A considerable reduction in expenditure would be rendered possible by the erection of large units, a path upon which the Russians had recently embarked. Thus at the Schatur station it was proposed to install 35,000-kW turbo-generators and machines of from 25,000 to 30,000 kW at the Kaschir station, while machines of the same size were projected for Leningrad. Moreover, the success which had attended the use of peat and Southern Moscow coal had rendered possible the erection of boilers with a large superficial heating surface in conjunction with generators of large size; and reference was also made to the use of pulverised coal. At present the boiler efficiency was very low compared with that which was being obtained in the United States.

Many other questions were discussed at the conference, including the grant of credits to municipal stations during the current year (1925-26).

Electricity on Board Ship.—That modern passenger-carrying liners are usually fitted with large electrical installations is well known, but it is not often realised that cargo ships also use electricity to a considerable extent. The M.V. *Upwey Grange*, the latest addition to the Houlder Line, was built by the Fairfield Shipbuilding & Engineering Co., and is of more than usual interest in that she is said to be the largest and fastest refrigerated cargo vessel afloat. The propelling machinery consists of two 3,200-b.h.p. Fairfield-Sulzer Diesel engines and the ship will be used chiefly for carrying chilled meat between Argentina and London, the refrigerated space provided representing a capacity for 260,000 carcasses of mutton. The whole of the electrical material has been manufactured and supplied by the General Electric Co., Ltd. The generating plant consists of two "Witton" compound-wound d.c. generators, each of 25 kW, at 100 volts, coupled direct to reciprocating engines. The main switchboard consists of two generator and two feeder panels, whence cables run to iron-clad distribution boards in various parts of the ship, from which sub-circuits are run to teak-cased fuse boards for lighting. General lighting is provided by means of Osram ship-type lamps, in addition to a large number of Osram gasfilled lamps. Brass and white-metal pendants with obscured globes are used in the cabins, wellglass fittings for the alleyways and shelter deck lighting, the weather decks being lighted by guarded bulkhead fittings, and the engine room by gasfilled lamps in industrial reflectors. In each cabin a "Freezor" oscillating fan is installed and the dining saloon is ventilated by means of "Wing"-type deck-head fans. Special attention has been given to lighting so that cargo can be handled with the same dispatch at night as during the day. Cargo connection boards of a special pattern are provided, with "Neptune" lanterns and 500-watt gasfilled lamps, in addition to portable cargo lanterns accommodating 100-watt gasfilled lamps. A 7½-h.p. motor is installed in the workshop for driving the machine tools. In the pantry there is a 28-way bell indicator for the bell installation throughout the ship. The cable throughout is of Pirelli-General manufacture.

The Metallic Arc Welding of Cast Iron.

Particulars of the Technique to be followed.

By P. L. ROBERTS.

One of the most vexed and discussed subjects in the particular section of the engineering world concerned is the welding of cast iron. It is an exceedingly controversial subject, largely because the majority of engineers know little or nothing of the technicalities involved, and base their opinion entirely on their experience of the results. A great deal of indifferent and really bad welding has been done simply because the whole process has been entrusted to operators who have had no proper training and whose little knowledge is empirical. Then engineers, seeing only the poor results, condemn welding. This is just as sweeping as is the condemnation of electricity because one has had poor service from a particular type or make of electric motor! Research work combined with long and close observation of various methods of welding cast iron and the attendant results, have established the process on a firm basis of reliability. It is possible to state definitely beforehand, by visual examination, the possibility of successfully welding any particular iron casting. This, of course, requires the knowledge gained by intimate experience of such work.

Much has been written about the remarkable repairs effected by the metallic arc welding of cast iron, but little about the actual methods or technicalities involved. It is essential to have some knowledge of the physical properties of cast iron to appreciate the difficulties involved and the nature of the results obtained by welding. The chief difficulty in the welding of cast iron arises where expansion and contraction cannot take place freely, as cracking occurs due to the brittle nature of the metal. This brittleness, or entire lack of ductility, is well known as an inherent property of cast iron, and is caused by the large amount of free carbon, or graphite, in the metal. The graphite separates in flakes round the grain boundaries during and after the solidification of the cast metal, so causing separation in the iron. The tensile strength of cast iron, therefore, is only equal to the tensile strength of the "cement" formed by the graphite flakes between neighbouring crystals. The tensile strength, as a result, is low, as would be expected, and the ductility (stretching without fracture) practically nil. The natural consequence of this lack of ductility is that fracture will occur in or near a welded portion of cast iron in cooling, unless free to contract. For instance, assume a weld to have been made over a small area of a large piece of metal. The weld, in cooling from its molten to normal temperature, must contract. The weld has now become a part of the whole, but must contract independently of the whole, because heating has only been applied at the weld and not to the body of the metal. The result is that considerable stress is set up during cooling. If, however, the weld and welded part is steel or similarly *ductile* metal, it will stretch under the force of contraction, *without* fracture. In the case of cast iron, however, the force exerted due to contraction causes fracture of part or the whole of the portion which is cooling, because of the lack of ductility mentioned.

In practice the welded portion of a casting may be stronger than certain other parts, so that on cooling, the force of contraction will cause fracture at one or other of these parts. There are a number of ways of overcoming this, the greatest difficulty in the welding of cast iron, and they will be described later.

Another important effect on the cast iron due to the large amount of carbon present is that of chilling. The carbon content of cast iron varies from 3 to 4 per cent., which is all in solution, or combined with the iron, when the latter is molten. If the metal is cooled suddenly from that state, the carbon remains in the combined form, causing very considerable hardness of the metal. Such an iron is known as white iron, and cannot be machined in the usual way, grinding alone being effective. Slow cooling, or cooling in a temperate indoor atmosphere, from the molten stage to below a dull red temperature, will enable the carbon to separate from the iron, to form flakes of graphite as the cooling progresses. Slow and prolonged cooling will cause grain growth, and the larger the grain the weaker the iron. It is necessary, therefore, if the best results are to be obtained, to cool neither too quickly nor too slowly. The correct condition is realised when the metal is allowed to cool in air in a place free from draughts. Hence, after welding cast iron, the condition of cooling is arranged to meet as nearly as possible that indicated.

The methods of welding cast iron by the metallic arc may be divided into two classes: "The cast-iron electrode method" and "The mild steel electrode method."

The Cast-Iron Electrode Method.

In welding any metal it is always desirable that the weld should possess so far as is possible the same physical properties as the parent metal. In the particular case of cast iron, the physical properties of the weld can be made to correspond very closely with those of the casting. It is necessary, however, to preheat the whole or part of the casting before attempting to weld. The preheating is essential, when welding with a cast-iron electrode, to prevent cracking due to the contraction stresses set up, and to provide the means of slow cooling to ensure a grey iron weld, as previously indicated. The choice of whether a casting shall be partially or wholly preheated depends entirely on the position of the break and the type of casting. If the welded portion is perfectly free to contract on cooling, it is only necessary to preheat the casting across the broken section, simply to ensure that the deposited metal will not be chilled, resulting in a hard deposit. This is the simplest case, and the welding can always be made a successful piece of work. In cases where the welded portion is not free to contrast, preheating has also to serve the purpose of preventing contraction cracks. It will readily be seen that if the whole of the casting is heated, kept at a high temperature during welding, and then the weld allowed to cool slowly with the casting, no stresses will be set up, as contraction takes place uniformly throughout the whole mass. It is only necessary to heat the casting to a dull red (about 500 deg. C.) and maintain that temperature during welding, and to cool slowly in air practically to eliminate all contraction stresses.

The theoretical considerations having been dealt with, the practical aspect will now be discussed. First, the preparation and welding procedure must be decided. The casting must be prepared for welding by chipping, drilling, grinding, or otherwise opening the defective part so that it is completely accessible to the welding electrode. Where the defect is a crack, it must be opened by "veeing," that is, cutting a vee-shaped groove along the course of the crack to within $\frac{1}{8}$ in. of the bottom. In the case of a blowhole, drilling or chipping may be employed to open the defect so that all sand and carbonised metal may be removed, and every part made accessable to the electrode. Preheating is the next operation, and the method will have been decided when considering the possibility of welding. Total preheating, though the safest and the completely "fool-proof" method of preparing for welding, is avoided whenever possible, as it increases the cost of repair, and when large castings are concerned, radiates so much heat as to make the welding a very uncomfort-

able job for the operator, with the increased risk of scamped work. Local preheating about the weld, as pointed out before, may be used when the weld is free to contract. There is a third group of cases which may be successfully welded by partial preheating. If it is judged that the contraction stresses will be confined to one or two places, it will only be necessary to preheat at those points of stress to eliminate all danger of fracture during cooling. The application of partial preheating, to cases where the stresses set up are only local, saves considerable time and money and often makes welding possible on large castings which it would be impracticable to preheat. It is not possible to give any hard and fast rules governing partial preheating, and experience alone will give the ability to judge the position of contraction stresses.

The actual preheating is simple enough. If total preheating is to be used, the whole casting is raised from the ground and bricked in with *firebricks*, the top row being slightly higher than the top of the casting. The casting is so arranged that the portion to be welded is at the top and as accessible as possible. A loose cover of asbestos millboard should be used to cover the whole completely. The most convenient form of heating is a coal gas or paraffin blow pipe. A hole should be left in the brickwork for the insertion of the blow pipe nozzle. If the casting is small or hollow, a single blow pipe will suffice, the flame in the latter case being directed inside. Otherwise a sufficient number of blow pipes should be used to obtain *uniform* heating of the work. Alternatively, coke or charcoal may be used for heating purposes, but such solid fuel is dirty, gives off dangerous fumes, and is generally inconvenient.

If partial or local preheating is employed, each part to be preheated is built in by fire-bricks, leaving spaces for the insertion of the blow pipe or air-blast nozzles if solid fuel is used. The general rules already given regarding preheating hold good in the above cases.

When the casting is at a red temperature, the amount of heat supplied is reduced considerably, but the casting is not allowed to drop below a dull red temperature during the welding. The cover, or a portion of the cover, is removed and welding commenced. There are a number of electrodes on the market for *depositing* cast iron, but the most satisfactory results are obtained by using any ordinary high-silicon (3 to 5 per cent.) cast-iron rod as used for oxy-acetylene welding. A flux is not used in this case. A moderately high current is used, varying according to the thickness of the work. The electrode is deposited in the usual way, and the welding is made as continuous as possible to conserve heat. When the weld is completed, the cover is replaced, the heating flames removed (or the fire allowed to die out), and the casting allowed to cool normally. The weld is a soft, fine-grain grey iron, and is readily finished by filing or machining.

The Mild-Steel Electrode Method.

It is often undesirable, or even impracticable, to preheat castings—even partially—and so the work has to be welded cold. This calls for considerable skill, both in deciding the best procedure and in completing the actual weld. The reason for this will be apparent from what has already been said regarding the extremely brittle nature of cast iron. Each globule of metal is chilled by the cold casting as it is deposited from the electrode, and the contraction in the weld is sudden, leaving a residual stress in the metal, which readily results in fracture in or near the weld. The sudden chilling also causes hardness of the deposited metal. The simpler cases where the weld is free to contract will not be considered here; in fact, they are generally welded with a cast-iron electrode. All other cases are considered very carefully beforehand to decide the best method of welding procedure to avoid fracture due to contraction. Local contraction in the weld cannot be prevented, because it is an inherent effect, and preheating is not employed to make it uniform throughout the casting. Therefore, the endeavour is always to prevent the contraction stresses resulting in *fracture*. As pointed out previously, if local contraction takes place in a ductile metal, it will stretch without fracture. This fact is made use of in the welding of cast iron, and the mild steel electrode is employed to utilise this effect. When a mild steel electrode is fused with cast iron, a considerable amount of the carbon present passes into solution in the deposited metal. The result is a kind of carbon steel which is always more or less blown, due to carbon monoxide being given off and trapped during the solidification. A second layer of metal deposited on the first will contain very much less carbon, because a part of the carbon that the first layer contains will be uniformly re-distributed throughout the re-fused portion of the first and the whole of the second layer. In this way each succeeding layer will contain less carbon than its predecessor. The third or fourth layers are for all practical purposes mild steel. The surfaces of the parts to be welded are "coated" carefully with three or four layers of mild steel before any attempt is made to weld them together. Then the parts are welded together, and the deposited metal remaining a mild steel, stretches without fracture under the force of contraction. Such welding procedure necessitates special preparation of the defect beforehand. Cracks are veed out with a space of an inch between the edges to allow three or four layers to be built up along both sides of the vee without meeting in the centre. Cracks which only extend part-way into the casting are drilled at the end to prevent spreading. Blowholes are opened up in the usual way.

Welding is commenced at any point, using only sufficient current to obtain fusion of the electrode with the cast iron. Each run is short, not more than 2 in. in length, to prevent contraction in the weld metal causing local fracture at the fusion line with the cast iron. After making two or three runs, welding is commenced at another point further along the crack, and this method of progression continued, returning to the starting point eventually and repeating the cycle of welds until the sides of the vee are covered with one layer of weld metal. The second layer is then commenced. The casting is never allowed to reach a temperature above 50 deg. C. Even using the method of alternative positions, it is necessary to allow the casting to cool periodically before proceeding with the welding. The welding is carried on in the same way until the third or fourth layer has been deposited, when the edges of the vee are nearly touching; then the two sides of the crack may be fused together by welding down the centre, in alternative position as before. The deposited metal is stronger than the cast iron, but the absorption of carbon from the cast iron which has been fused with the electrode causes a line of weakness, along which fracture will take place if excessive stress is subsequently put on the casting. Although the general mechanical properties of this zone are inferior to those of the cast iron, such a weld will serve very satisfactorily for the majority of cases. Though the case of a crack was instanced above, the principle is the same for a blow-hole.

If the casting is part of a machine subject to considerable working stresses, such as a press frame, it is desirable to obviate the weak zone caused by absorption of the carbon. This end is accomplished by the use of studs. The break is prepared by veeing as before—though the gap between the edges of the vee is unnecessary—and the sides of the vee are drilled and tapped for steel studs. The size of the studs varies from $\frac{3}{8}$ in. to $\frac{5}{8}$ in., according to the thickness of the casting, and they are placed at intervals. After the studs have been screwed into the holes, welding is commenced by making a single run round each stud, fusing the stud and the cast iron. Welding round each stud in successively larger circles is carried on until the circles meet and the gaps between are filled. Further layers are built on top until the vee has been completely welded. Any stress that may arise due to contraction of the weld, or subsequent working conditions, is chiefly transferred through the studs to the cast iron right outside the welded area, which consequently has been unaffected in its physical properties by the welding. The weld, and

the area around the weld, is stronger than the cast iron itself, and so gives the full service which may be required of it.

The choice of the most suitable of the described methods of welding for a particular case is decided primarily according to whether the casting belongs to the class in which the weld is free to contract, or the rigid type. If the former, either the cast iron or the mild steel electrode may be used without having to do more than locally preheat in the former case or take any of the special precautions in the second. Great care is necessary, however, if the casting belongs to the "rigid" class. If small, the casting is preheated and difficulties due to contraction are eliminated, combined with the advantage of a grey cast-iron weld. When the casting is large, it may be impracticable to preheat, or uneconomical. It may be possible to overcome contraction stresses, however, by partial preheating at the areas where the stress will be set up. Then either the cast iron or the mild steel electrode may be used according to the kind of weld metal desired. Should the casting be complicated, and any of the foregoing methods impossible, one resorts to the mild-steel electrode method, employing the gap between the edges of the vee as described. If done carefully, welding by this method is invariably successful. As a special precaution, studs may be used as explained.

By the judicious use of one or other of these methods, and by close observation of the effects, much skill has been gained in the successful repair of all classes of the most complicated castings. Long service under conditions of high working stresses has proved that the application of the process of arc welding to such repairs is not only fully justified, but saves a very considerable amount of money in replacements. The time saved in obtaining and refitting replacement parts is often of greater consideration. Now that systematic research work has established the process on a scientific basis, and it is becoming thoroughly known, engineers generally will accept welding without doubts as to its reliability. Then the process will come into well-merited prominence.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Information for Shareholders.—WHITEHALL ELECTRIC INVESTMENTS, LTD., has issued a handsome brochure with the object of giving information to its share and debenture holders as to the various electrical undertakings in which the company's capital has been invested. The publication is profusely illustrated with views of the power stations, &c., in South America operated by the company's Latin-American subsidiaries. Particulars are given of the improvements which have recently been carried out, and the capacity and output of the supply undertakings. The latter have a total capacity of 122,000 kW, and the output in 1925 approached 300 million kWh.

Wiring Old Houses.—During the last decade or so the Northern States Power Co. has carried on a "campaign" for the wiring of old houses in Minneapolis. The result has been to bring the number to near "saturation point." In this city of between three and four hundred thousand inhabitants there were 52,000 unwired houses in 1914; by the end of 1924 only 6,000 remained unwired, and the campaign is being continued. The *Electrical World* says that the effect of the company's efforts is seen in the decreasing proportion of old houses wired in the number of new lighting customers. In 1922 the old houses wired accounted for 63 per cent. of the total, whereas in 1924 only 47 per cent. of new lighting customers were represented by old houses wired.

A Great Charitable Effort.—During the year which has just ended the employés of Messrs. A. Reyrolle & Co., Ltd., subscribed over £1,130 for hospitals and charities. The Employés' Hospital and Charities Committee has allocated this amount to 21 institutions and funds. The Newcastle Royal Victoria Infirmary and the Hebburn Infirmary receive £325 each and £100 is allotted to the Employés' Benevolent Fund.

Tyneside Developments.—On January 5th, Mr. H. W. Clothier presided at a meeting of the Electrical Section of Newcastle Chamber of Commerce when it was decided to strengthen the committee in view of the developments which may take place as a result of the effort being made to attract new industries. It is intended to obtain information as to the general costs of starting works on Tyneside, as compared with the costs experienced in other districts.

British Rails for British Railways.—The London and North-Eastern Railway has announced that in future it intends to specify that all rails supplied to it must not only be of British manufactured steel but must also be made from steel of British manufacture throughout. The other railway groups state that they already make this proviso in their contracts, the Southern Railway, indeed, insisting upon British goods for all its contracts.

British steel rails have made good showing in Japan. According to a recent statement by Sir William Larke, director of the National Federation of Iron and Steel Manufacturers, an investigation into the history of rails which had been in service for 54 years proved that after 40 years of service British rails showed no signs of breakage. Although American, Belgian, German, Russian and Japanese rails had lives of from 10 to 40 years, only a small quantity reached the latter figure.

"Underfeed" Contracts.—Among the more important orders recently received by the Underfeed Stoker Co., Ltd., for power station equipment are the following:—London Electric Supply Corporation, Ltd., air heaters and two Detrick arches; Nottingham Corporation (North Wilford station) six self-contained stokers; Central Electric Supply Co., two Detrick arches and four self-contained stokers; and Poplar Borough Council, ash and coal conveying plant.

Swiss Water Power Exhibition.—An International Exhibition of Inland Water Transport and the Utilisation of Hydraulic Power is to be held at Basle from July 1st to September 15th. During the period of the exhibition (from August 31st to September 12th) the first sectional meeting of the World Power Conference will be held in the city.

The Home Market.—Speaking at a recent luncheon at Nottingham, Sir Philip Cunliffe-Lister, President of the Board of Trade, said that the home market had of recent years assumed greater importance. It was our greatest market, and the more it could be developed the better our trade balance would be, providing more money for new markets abroad. Sir Philip said that the growing recognition of the value of Imperial trading relations was a hopeful sign for the future.

Electrical Trades Commercial Travellers' Association.—The social evening arranged for Friday, January 15th, has been postponed until Friday, the 22nd.

British Enterprise in South America.—In the course of a note on the British Industries Fair, the *Review of the River Plate* says:—"The publicity which has been given in Argentina to the forthcoming exhibition is a most excellent sign. It shows that manufacturers at home are acting in a fuller consciousness of their responsibilities to their emissaries in this part of the world and that merchants and representatives here will be able, in the future, to count upon the practical help and support they need, but which has not always been theirs in the past. This awakening of British manufacturers and traders to a sense of what is needed of them in the way of livelier enterprise and more wide-awake initiative is progressing satisfactorily. Numerous publications in the Spanish language giving valuable information regarding British industrial aims and developments show that Britain is waking up in many ways. Once the awakening process has been completed, we may be sure that the resultant and welcome trade push will be such as will take all minor obstacles in its stride."

A Holophane Staff Conference.—A half-yearly conference of the indoor and outdoor staff of Holophane, Ltd., was held on December 29th and 30th. In addition to the various matters discussed by the staff, the conference had the benefit of hearing interesting and instructive papers read by gentlemen prominent in the illuminating engineering movement who are not connected with the firm. Amongst these were Mr. Leon Gaster (secretary of the Illuminating Engineering Society) who gave a review of illuminating engineering progress during 1925; Mr. L. L. Robinson (Borough Electrical Engineer of Hackney), who dealt with "Street Lighting"; Mr. W. E. Bush (of E.L.M.A.) on "The Policy of E.L.M.A. Lighting Service Bureau"; Mr. W. J. Jones (of E.L.M.A.) on "Shop Window Lighting"; and Mr. Dudley Diggs (of the Street Lighting Department, International General Electric Co., of Schenectady, U.S.A.) on "Some International Aspects of Street Lighting."

Belgian Import Regulations.—The *Board of Trade Journal* for January 7th contains a list of goods for which certificates of origin are required upon importation into Belgium. The list includes tubes and pipes of iron, steel or cast iron; cable-making machinery, complete; dynamo-electric machines; electric accumulators and plates; submarine and land cables; electric and electrotechnical apparatus and parts; articles for electrical purposes of porcelain, faience, terra-cotta, stoneware or glass with metal parts; and insulating parts of asbestos, mica, micanite, rubber, ebonite, and other materials.

Local Exhibition.—MOTHERWELL.—At a recent exhibition of electrical cooking appliances the Credenda Conduit Co., Birmingham, displayed the "Creda" cooker, with which demonstrations were given by Mrs. Mole, M.C.A. (gold medallist). Other exhibits were made by the General Electric Co., Ltd., and Carron Co., while the tea-room lights were by the British Thomson-Houston Co., Ltd. An exhibit of model lighting was given by the Glasgow Lighting Service Bureau. In the radio section the General Electric Co., Ltd., and the British Thomson-Houston Co., Ltd., were represented. Lady Belhaven, president of the Scottish Electrical Association of Women, visited the exhibition, and spoke of the great saving effected by electric cookers and fires.

Meter Approved. — The Electricity Commissioners have approved of the construction, pattern, and method of fixing the meter known as the Chamberlain & Hookham single-phase watt-hour meter, Type "A1," rated from and including 5 amps to 20 amps., 200 V, at a frequency of 50 cycles.

An English Offer to Costa Rica.—*Commerce Reports* states that an English manufacturer of hydro-electric equipment has offered to install all the necessary plant for the recently-formed Cia. Nacional Hidro-electrica, Costa Rica, for about $375,000, the payments to be made over a period of five years following the installation and operation of the plant.

On the Ability to Sell Goods.—An address entitled "Notes on Salesmanship" was delivered to the Junior Institution of Engineers on Friday last by Mr. A. J. Simpson, the chairman. He summarised the qualities required in a salesman or representative as optimism, patience, tact, individuality, judgment of human nature, knowledge of things in general, and method, and he then described the nature of the work that a salesman had to do and the parts all those qualities played in it. Mr. Simpson invited discussion of his remarks, and a large number of members expressed their views. Mr. J. S. Highfield, who presided, said that he agreed with Mr. Simpson that it was generally desirable that salesmen should know how the articles they were selling were made; there were sometimes objections, and he gave examples of when it was desirable and when otherwise. Messrs. Rentell, A. E. Knight, and E. North spoke about means for securing the interest of buyers. Mr. F. E. Murrell said that he was now in England for the purpose of arranging a contract because representatives abroad had not sufficient technical knowledge to deal with the contemplated order. In distant lands a knowledge of things in general was very important indeed; an agent who could retail the latest information would never have his name forgotten. Mr. H. R. Williams and many other members contributed to the discussion. Some of their points may have seemed to be only small ones, but they were useful for intending or persevering salesmen.

Employés' Representative on J.E.A.—The Minister of Labour announces that he will shortly notify the Electricity Commissioners of the employés' organisations having members in the employment of the authorised undertakings composing the West Midlands Electricity District in order that these organisations may choose a representative. The unions concerned must make application to the Minister of Labour, on a special form, by January 23rd.

Trade Announcements. — MESSRS. BURWOOD (CONCESSIONAIRES) LTD., of 41, Great Queen Street, Kingsway, London, W.C.2, wish the trade to know that their letter-box was broken open on the morning of January 5th and all correspondence stolen. They would appreciate copies of letters due for delivery on that morning.

MR. J. H. GREENWOOD, of 21, Weston Lane, Otley, Yorkshire, asks for copies of trade circulars and catalogues for the use of students.

MESSRS. SIDNEY G. JONES, LTD., of Victoria Street, S.W., have removed to 1-3, Brixton Road, Kennington, London, S.W.9.

MESSRS. J. & E. HALL, LTD., of Dartford, have acquired a controlling interest in Medway's Safety Lift Co., Ltd., and are taking an active part in the management. The lifts will be manufactured at Dartford, where extended facilities are available, and special attention will be devoted to the maintenance department.

MESSRS. ALLEN-LIVERSIDGE, LTD., have just registered a company in Bombay under the name of Allen-Liversidge (India), Ltd., for the purpose of carrying on, in India, their business of dissolved acetylene manufacturers, carbide merchants, and lighting and heating engineers.

MESSRS. TAYLOR & PETTERS, LTD., mica merchants, have removed from Hatton Garden to 3-11, Westmoreland Place, City Road, London, N.1. New 'phone number:—"Clerkenwell 4105."

MR. GEORGE E. WHITEHEAD, who for some years has represented Messrs. Ferguson, Pailin & Co., Ltd., and the Lancashire Dynamo & Motor Co., in South Wales and the Western Counties, has severed his connection with these companies and has commenced on his own account at 102, St. Mary Street, Cardiff, as engineers' agent, having secured agencies for Messrs. Erskine Heap & Co., Ltd., and Edison Accumulators, Ltd.

THE MANCHESTER DISTRICT WIRELESS CO., of 21, Agur Street, Bury, Lancs., whose premises were damaged by fire on January 5th, has secured temporary accommodation at 14, Union Street.

Catalogues and Lists.—MESSRS. P. L. DWYER & Co., 30, Grosvenor Place, S.W.1.—January price list of electrical materials and accessories.

MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—An illustrated pamphlet for the trade announcing details of the "Universal" electric cleaner, electric ironer, washing machine, and other domestic appliances.

THE ATHOL ENGINEERING CO., Cornet Street, Higher Broughton, Manchester.—An illustrated pamphlet advertising a number of radio components—coil holders, earthing plugs, valve holders, &c.

BRITISH INSULATED CABLES, LTD., Prescot, Lancashire.—A well-produced catalogue of mining cables and accessories, containing particulars and illustrations of v.b., paper, and v.i.r. cables, joint boxes, cable racks, cable winches, switch-fuses, insulators, compounds, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A mailing card drawing attention to the company's radio sets, valves, wall plugs, and lampholders. Also Leaflet F.3,974, containing illustrations and prices of "Gecoray" shop-window lighting reflectors.

THE DE LAVAL CHADBURN CO., LTD., Wellington House, Buckingham Gate, S.W.1.—A booklet entitled "The Purification of Insulating Oils," containing details of the construction and operation of the company's centrifugal machines, and notes on the determination of the dielectric strength of insulating oils.

THE WHOLESALE FITTINGS CO., LTD., 23, 25 & 27, Commercial Street, E.1.—A pamphlet, illustrated in colour, giving prices of "Silchrome" glass shades with burned-in designs.

MR. HENRY JOSEPH, 96, Victoria Street, S.W.1.—A pamphlet illustrating radio cabinets made by Messrs. W. & T. Lock, Bath. Fully priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—Illustrated and priced booklets dealing, respectively, with display lighting equipment and domestic electrical appliances. Also a leaflet advertising "Memrex" ironclad switchgear.

MESSRS. J. & W. B. SMITH, LTD., 15-23, Farringdon Road, E.C.1.—An illustrated price list of "Redot" electric fires and domestic appliances; a booklet dealing with electric lighting for the home; and a pocket price list of electrical accessories.

MESSRS. E. BROOK, LTD., Empress Works, Huddersfield.—A folder containing prices of two- and three-phase protected squirrel-cage motors up to 16 h.p., and air-break starters.

Bankruptcy Proceedings.—W. A. A. C. ROBINSON, electrical engineer, 10, Carnaby Street, Golden Square, W.C.—Bankrupt's discharge suspended for two years until November 24th, 1927.

J. ADDY, lately wireless and cycle dealer, Bridge End, Long Preston.—Last day for proofs for dividend, January 19th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

A. H. MONCRIEFF, wireless manufacturer, late of 197, Anerley Road, S.E.20, and 60, Thornton Road, Bradford.—Last day for proofs for dividend January 19th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

T. A. WICKHAM, electrical engineer, Snaresbrook, Station Road, New Milton, Southampton.—Last day for proofs for dividend, January 20th. Trustee, Mr. H. Ashton, Official Receiver, Bank Chambers, High Street, Southampton.

A. F. WEBB, electrician, 102, Duke Street, St. Helens, Lancs.—Receiving order made January 6th on debtor's own petition.

A. C. STUART and C. PERRIER (Stuart Wireless Telephone Co.), 109, Kingsway, W.C.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released December 31st.

M. D. ROSENBLOOM (D. Rose & Co.), electrical engineer, 25, Osborn Street, E.—First and final dividend of 1s. 1d. in the £ payable January 20th at Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C.

JOHN BRODIE, electrical engineer, 59, High Street, Dunfermline.—This debtor was examined on January 7th. He admitted liabilities of £456, with assets amounting to £231, and said that he started business with a capital of £60. He attributed his bankruptcy to the loss of over £200 on a large contract.

Company Liquidations.—HOLOPHANE, LTD.—Winding up voluntarily for reconstruction purposes. (See ELEC. REV., January 1st, p. 15.) Liquidator, Mr. J. W. Ife, 122, Manor Waye, Uxbridge, who is authorised to consent to the registration of a new company to be named Holophane, Ltd. Meeting of creditors at Elverton Street, Vincent Square, S.W., January 15th. (This notice is purely formal, as all creditors have been or will be paid in full.)

CLEVELAND ELECTRICAL ENGINEERING CO.—Particulars of claims to Mr. M. McGilligan, 29, Grange Road, Middlesbrough, liquidator, by January 26th.

SOUTH-EASTERN AND CHATHAM CONSTRUCTION AND POWER CO., LTD.—A meeting of members is called for February 10th at the offices of the Southern Railway Co., Waterloo Station, to hear an account of the winding up from the liquidator, Mr. R. D. Heckels.

RE-ECHO ELECTRICAL MANUFACTURING CO., LTD.—Liquidator, Mr. G. D. Pepys, Official Receiver and Liquidator, Carey Street, released January 6th.

American Boiler Company's Purchases.—The *Financial Times* reports that the Babcock & Wilcox Co., of America, has purchased the Fuller-Lehigh Company and its subsidiaries, manufacturers of pulverised fuel and cement mill equipment; also the Bailey Meter Company, manufacturers of meters and recorders, combustion-control equipment, pulverised fuel plant, and water-cooled furnace walls.

Charge of Obtaining Goods by False Pretences.—At Old Street Police Court, on Tuesday, Charles Fredk. Kidby, 29, gramophone dealer, of 4, Roslyn House, Rushcroft Road, Brixton, and Alfred Sidney Taylor, 42, engineer's fitter, of 77, Carysfort Road, Stoke Newington, were charged on remand from January 4th with being concerned together in knowingly obtaining by false pretences a quantity of wireless goods, value £44 8s. 4d., from Ernest Edward Rooke, with intent to cheat and defraud, at City Road, E.C. Mr. Clayton prosecuted for the Director of Public Prosecutions, and, in opening the case, said that there would be further charges of obtaining goods by false pretences and also charges of conspiring to defraud. The two men had been trading as a company, C. F. Kidby, Ltd., from January, 1924. Premises were taken in City Road, and according to their bill heading they were wireless set manufacturers, cycle and gramophone manufacturers and importers, and apart from that they seemed to have dabbled in all sorts of things. There was no doubt about it that before the formation of the company the business seemed to have been paying its way, but it was suggested by the prosecution that from October, 1924, to June, 1925, the business was nothing but a fraudulent one. So far there were 110 complaints, and the total amount was about £3,000 in varying sums.

Mr. James Crewys, director of the Power Equipment Co., electrical engineers, Hendon, said that on December 9th, 1924, he received a letter from Kidby, Ltd., signed "A. Taylor, director." They replied and sent on a sample transformer. On December 18th a letter was received acknowledging receipt and enclosing an order for 50 transformers, the approximate value being £20. On January 7th they received another order for 50 transformers, value £22 18s. 6d. They had not been paid in respect of those orders.

Mr. Ernest Edward Rooke, proprietor of Rooke Brothers, wireless component manufacturers, W.C.1, said that on January 17th they received an order for wireless components, value £20 11s., and on February 3rd a similar order to the value of £23 8s. They had not been paid.

A further remand was ordered, defendants being admitted to bail in one surety in £250 each.

Copper Prices.—Messrs. F. Smith & Co. report January 12th:—No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report January 12th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £36 10s., 10s. decrease.

Messrs. Edward Till & Co. report January 12th:—India-rubber, Para fine, 3s. 6d., 4d. decrease.

Dissolution of Partnership.—MARLEY & WHITE, radio engineers, agents and merchants, 17, Sand Hill, Newcastle-on-Tyne.

Receivers Appointed.—COLE, MARCHENT & MORLEY, LTD., Bradford.—On behalf of the debenture-holders Mr. Alfred Greaves (F. H. Lee & Greaves, chartered accountants, 35, Bank Street, Bradford) and Mr. R. S. Brailsford have been appointed joint receivers. The announcement was made public on January 6th. The object of the appointment, it is stated to inquirers, is primarily for protection of the debenture-holders, but it is also hoped that it will enable the business to be continued as a going concern and without stoppage, whilst meanwhile it is hoped to find a solution of the difficulties arising out of the long period of bad trade during the past several years' slump. The business of Cole, Marchent and Morley, Ltd., has been established about 70 years, and employs normally between 300 and 400 workpeople. Our Bradford correspondent writes:—"At present the undertaking is fairly busy and the report on the past year's trading was one of the most bright in the rather doleful reports generally of engineering conditions in Bradford during 1925. During the past year orders completed by the company included a large twin condensing plant for the recently-inaugurated 20,000-kW turbo-generator at the Valley Road station of the Bradford Corporation Electricity Department and a somewhat similar order for the Leeds Corporation. The concern has nearing completion an order for two condensing plants for 15,000-kW turbo-generators for an electrical power station in the Midlands, and during the year it has been engaged on, or is still working on, condensing plants for Cardiff, Swansea, and Oxford."

Calendars, Diaries, &c.—A literary calendar has been received from BULL MOTORS, LTD., Ipswich. This has a block of slips with a quotation from Shakespeare for every day.

A neat calendar has been issued by the SOLENOID REGULATOR Co., 268, Moseley Road, Birmingham, consisting of a purple and gold case containing monthly date cards.

From MESSRS. W. W. SPRAGUE & Co., LTD., lithographers, of Bread Street Hill, Queen Victoria Street, London, we have received copies of their wall calendar, and blotting pads with memoranda slips, calendar, &c.

The D.P. BATTERY Co., LTD., of Bakewell, Derbyshire, once again dispels our London gloom with a beautiful piece of local scenery ("The Valley of the Dove, near Crowdicotes, Derbyshire") on its wall calendar for 1926.

MESSRS. HENRY WIGGIN & Co., LTD., Victoria Station House, Victoria Street, London, S.W., have sent us an excellent vest pocket diary which is unquestionably "one of the best."

MESSRS. W. G. BEAUMONT & SON, painters and contractors, of Priory Works, Bow, E.3, have sent us a copy of their annual year book and desk diary, and a calendar with a humorous picture by Lawson Wood.

Lead.—Reporting on January 9th, Messrs. James Forster and Co. stated:—"There is still little active buying by consumers, and it is really remarkable under these circumstances that the price has held up so well in view of the recent heavy arrivals. With these out of the way and a revival in demand from the trade, we might quite see a further recovery in values."

Social Events.—The second annual carnival of the A.T.M. Sports and Social Club (Automatic Telephone Mfg. Co., Ltd.) was held on December 29th, at the Grafton Rooms, Liverpool. It proved a very successful event, about 800



Prizewinners at an A.T.M. Carnival.

attending, and many original and attractive costumes were in evidence. We reproduce herewith a photograph of the prize-winners.

The annual staff dance and whist drive of the Clydesdale Supply Co., Ltd., Glasgow, was held on January 5th. Mr. A. Levine, managing director, and a representative gathering attended.

The annual staff dinner of Messrs. Francis Polden & Co., Ltd., took place on January 9th, at Anderton's Hotel, Fleet Street. The chairman (Mr. E. C. Polden) presided, and was supported by Mrs. Polden and a number of guests. Mr. F. J. Baker, in proposing the toast of "The Chairman and Company," expressed the appreciation of the staff of the efforts of the company. Mr. Polden replied, and later proposed the toast of "The Staff," and thanked them for their endeavours to maintain the work at a high standard. A musical programme was given by "The Merry Dominoes."

On January 2nd, the Sales Department of Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.), held its second annual companionship dinner and dance at the Connaught Rooms. About 120 people were present, including representatives of the engineering, manufacturing, and other departments. Mr. H. C. Trenain, general sales manager, presided, and a thoroughly enjoyable and successful evening was spent.

Brazilian Concessions to Rubber Factories.—In an effort to encourage the establishment of rubber factories in Brazil, the Government is offering special privileges to manufacturers. Among the concessions to factories for the manufacture of rubber articles which may be established in Brazil during the next three years, and those already established which increase their plants during the same period, is exemption from import duties and bureau charges during a period of 25 years for machinery, tools, and material necessary for the installation and extension of the factories or plants, chemical substances, various textile materials, combustibles and lubricants, indispensable to the working of the factories or plants. The exemption conceded on machinery, utensils and tools is retroactive, being applicable to such articles imported after January 5th, 1921.—*Reuter's Trade Service* (Washington).

The Shannon Scheme Dispute.—While the wages dispute in connection with the Shannon hydro-electric scheme cannot be said to have reached a definite settlement, the contractors, Messrs. Siemens-Schuckert, Ltd., have offered unskilled workers an advance in the rate from 32s. to 35s. 6d. per week, and more men are now being employed, with the result that a considerable amount of work is proceeding. The general feeling is that the strike will collapse. There is a marked increase in the opposition to the Labour Party's attempt to boycott the work by withholding labour.

German Radio Exhibition.—Under the auspices of the German Messe Amt and the German Association of Radio Dealers, a radio exhibition is to be held in Deutz-Cologne from January 30th to February 7th next. It is stated, however, that the Central Association of German Electrical Firms and the Union of German Radio Manufacturers have decided that the present financial position of the industry in particular, and Germany in general, is such as to render official recognition of the exhibition undesirable. The members of the two bodies have consequently been notified that they must not take part in the display.

For Sale.—The Director of Army Contracts invites offers for one 150-kW rotary converter, with starter and starting and distribution panels. Blackpool Corporation Electricity Department has for disposal one Browett, Lindley triple-expansion type engine, coupled to a British Westinghouse generator. Mr. H. J. Shaw will sell by auction on January 20th, at 13, High Holborn, W.C., the stock of an electrical and wireless goods factor and the stock of an electrical motor lamp and cable manufacturer. Bexhill Corporation Electricity Committee has for disposal two 500-kW Belliss-Dick, Kerr and Westinghouse d.c. generating sets, with field rheostats and circuit-breaker panels. Edinburgh Corporation Electricity Supply Department invites offers for two B. & W. boilers, with chain stokers and economisers, three Lancashire boilers, and two 330-kW Howden-Crompton 460-V, d.c. generating sets. Wembley Amusements, Ltd., invite offers for surplus electrical equipment. (See our advertisement pages to-day.)

The New Zealand Electric Federation.—Our New Zealand correspondent says that electrical utility services in New Zealand have grown to such a degree of popularity that the recently-formed Electric Federation is considered to be a move in the right direction, calculated to restore public confidence in the conduct of the trade generally, a confidence which showed a tendency to waver as the result of many anomalies which previously existed. As a first move the Federation sent its president overseas to study electrical matters in Canada and the United States, and as a result of the data thus obtained it is intended to develop the Federation's policy in New Zealand. New Zealand electrical houses have much to learn from America in the matter of merchandising electrical goods, as well as with regard to methods for popularising electrical utilities, but before definite selling and advertising campaigns are undertaken, it will be necessary to put New Zealand's house in order in other directions. The Federation is alive to this necessity, and is now concentrating upon the standardisation of materials and the securing of uniformity in the regulations governing electrical installations. At the present time some conflict of methods exists among the various Power Boards and others interested in distribution, and the Government is bringing in a measure to secure the licensing of all wiremen. The Government, as previously reported, is also considering the matter of establishing an Electric Standards Board with a view to testing and standardising all electrical material coming into the country. A conference of the Power Boards, the Government, the traders, and the Federation is being held shortly, when some matters of importance will be discussed.

Burnley and the Sale of Appliances.—At a recent meeting of the Burnley Town Council, Alderman Nuttall moved the reference back of minutes dealing with the sale of electrical appliances for cash or hire purchase. Councillor Parkinson inquired whether at the proposed electrical exhibition the Corporation would sell appliances at prices lower than those of private contractors, and whether it was wise to charge for admission to the exhibition. Alderman Nuttall replied that appliances sold by the Corporation would bear the same price as those of contractors in the town. It was necessary to have some charge for admission, but ten thousand free tickets would be issued to suitable people. Councillor Proctor said that if the Corporation could sell appliances cheaper than private firms it ought to be proud of doing so, and it would be to the advantage of the public. Councillor Whittaker asked if the price charged by the Corporation would include distribution, cost of fixing, &c. Alderman Nuttall said he was not sure that it was in the best interests to answer these questions. Their policy would be to sell at the same price as contractors, both at the exhibition and afterwards.

A Report upon North Africa.—A composite report upon the economic and commercial conditions in North Africa has been issued by the Department of Overseas Trade (Stationery Office, 3s. net). The principal feature of this is that it shows the predominance of French influence, and in the case of Cyrenaica, of Italian interests. Among the matters touched upon in the report is the electrification of the normal-gauge railway system in Morocco. The bulk of the material for this is being received from France. The line from Casablanca to Fez is the first line being electrified. The power station in the former place was completed at the end of 1924, and in May, 1925, it was linked up with a transformer station to supply Rabat and Salé. An automatic telephone exchange is approaching completion at Rabat. From a list of imports during 1924 it is seen that, of a total value of 1,149,000 fr. of dynamos imported, France was responsible for 1,145,000 fr. In the Tangier Zone there was a decrease in the quantity of machinery (unspecified) imported, but the French share was considerably greater. Interest in radio is being manifested in Algeria, but the use of British apparatus is generally precluded by the low exchange value of the franc. This factor also militates against the importation of other classes of British goods, although during 1923 British machinery to the value of 6,303,000 fr. was imported. In the section dealing with Tunisia, mention is made of the Cie. des Tramways de Tunis, which supplies electricity and runs an electric tramway and railway. In 1924 the company earned a gross profit of 1,208,077 fr. upon its capital of 12 million fr., paying a dividend of 6.5 per cent. net.

Explosion at Rubber Works.—An explosion occurred last Saturday in the power station of the Leyland and Birmingham Rubber Works. It is stated that damage to the extent of £6,000 was caused, the building being completely wrecked.

Book Notices.—"The *Mechanical World* Electrical Pocket Book, 1926." Pp. 401; figs. 130. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net.—As usual, this work treats the many phases of electrical engineering in a manner rendering it a useful book of reference to the practical engineer, wireman, &c. Several new features are to be found in this edition; an additional chapter deals with magnetic chucks and clutches, while a variety of new methods has been included in the chapter on jointing conductors. New material is furnished on electro-chemistry, and other new sections include industrial electric heating, cutting by the electric arc, and electric lifts, cranes, &c. The diary and memoranda for the year in question are included as usual.

"O'Connell's Coal and Iron Diary and Manual, 1926." (Pp. 508, diary and memoranda pages.) London: Harper and Co. Price 10s. 6d. (subscribers 5s.), post free.—In addition to being a useful general handbook and diary, this publication is a complete guide to the coal industry of Great Britain. The directory section contains exhaustive lists of collieries, coal owners, factors, and exporters, and the type of coal produced by British coal owners. The Coal Mines Act is reproduced, and so are the regulations governing the use of electricity in mines, the Explosives Act, 1875, and other legislative measures. The volume closes with a classified trades' directory in which electrical firms have a good showing.

"The Practical Electrician's Pocket Book, 1926." By H. T. Crewe, M.I.Mech.E. Pp. xci+585; illustrated. London: S. Rentell & Co., Ltd. Price 3s. net.—This is the 28th edition of this publication. It has been revised, and much of the matter dealing with elementary principles has been re-written. New chapters on power factor correction, fault localisation on underground cables, and automatic protective gear have been included in this edition, and the central station tables have been brought up to date.

"Electrical Photometry and Illumination," by H. Bohle. Second edition. Pp. xvi+427; figs. 320, and 59 tables. London: Chas. Griffin & Co., Ltd. Price 25s. net.

"Industrial Electricity." Part II. Pp. xv+480; illustrated. London: McGraw-Hill Publishing Co., Ltd. Price 13s. 9d.

"Engineering Abstracts from Current Periodical Literature." No. 25. October, 1925. London: Institution of Civil Engineers.

"The A B C of Relativity," by Bertrand Russell, F.R.S. Pp. 231. London: Kegan Paul, Trench, Trubner & Co., Ltd. Price 4s. 6d. net.

"The *Journal* of the Institute of Transport," No. 3, Vol. 7, January, 1926. Price to non-members, 2s. 6d.

"Miscellaneous Publications of the U.S.A. Bureau of Standards," No. 69.—Annual report of the director of the Bureau for the fiscal year ended June 30th, 1925.

"Scientific Papers of the Institute of Physical and Chemical Research, Tokyo, Japan." Vol. 1, Nos. 1-11, April, 1922, to March, 1924.

Foreign Machinery in Japan.—Japan's dependence upon foreign countries for her electrical equipment is illustrated by recent statistics showing the amount of plant installed in the country and the proportions of it made by foreign and Japanese firms respectively. For instance, the total capacity of installed water turbines is given as 1,143,800 h.p., and of this 960,800 h.p., or 84 per cent. has come from abroad. As regards other plant, Japanese manufacturers have only supplied 14 per cent. of the 450,250 kW of steam turbines installed; 17 per cent. of the hydro-electric generator capacity of 819,544 kW; 12 per cent. of the steam-driven generators (472,500 kW); and 20 per cent. of the transformers (3,033,680 kVA). Only 3 per cent. of the boiler capacity installed consists of Japanese plant, and this is all in private service.

A Rumanian Radio Exhibition.—It is reported from Bucharest that the Rumanian postal authorities are organising a permanent exhibition of radio apparatus in the head office in that city with the object of encouraging interest in radio matters in Rumania. Any British firm interested in the exhibition would doubtless be able to obtain particulars through the British Consul in Bucharest.

Lighting and Power Notes.

Barrow.—LOAN.—The Corporation has approved the recommendation of the electrical engineer that application be made for sanction to the borrowing of £48,000 for electricity purposes, made up as follows:—E.h.p. transmission lines, £31,000; sub-station buildings, £2,500; sub-station switchgear and transformers, £8,000; h.p. and l.p. distributing mains and services (Dalton and Ulverston R.D.C.), £6,000; meters, £500. The General Purposes Committee has considered terms with the Backbarrow Charcoal Iron Company and the Lancashire Ultramarine Company for the use of the River Leven at Backbarrow for the purpose of a proposed hydro-electric station. An official report of this meeting has not been issued, but it is understood that the members were in favour of the terms submitted subject to the proposed agreements being approved by counsel.

Bolton.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of £75,000 for mains extensions for the next three years.

(*Continued on page 103*)

Imperial Wireless "Beam" Communication.

Progress of the Canadian and South African Service Stations.

THE year 1926 bids fair to be one of the most important in the history of commercial wireless telegraphy as it affects Great Britain and the Empire. In a few months' time the first of the new Marconi-type "beam" stations will be brought into operation, and in the course of the year direct high-speed wireless services on the short-wave system will be established with all the principal Dominions The first of the "beam" stations are in an advanced state of construction. All the masts have been erected, the buildings completed, and the machinery and some of the wireless apparatus installed. The main part of the wireless apparatus (the transmitters and receivers) is now being tested at the Marconi Co.'s works at Chelmsford, and it will be installed as soon as the tests are completed. Meanwhile, work is progressing on the erection of the aerial and feeder systems, and in fencing and roadmaking.



Fig. 1.—Bodmin Transmitting Station: Rectifying Panels.

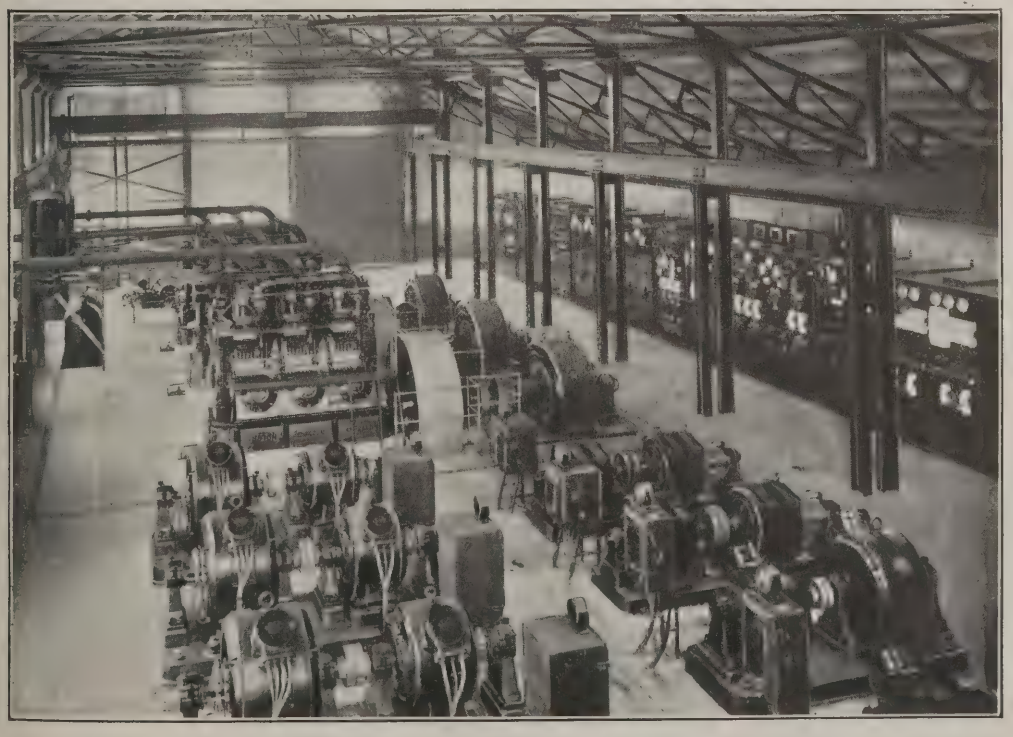


Fig. 2.—Bodmin Transmitting Station: Power Generating Plant and Switchboard.

The stations now nearing completion are at Bodmin in Cornwall, and at Bridgwater, in Somerset. The Bodmin transmitting station will be used for communication with Canada and South Africa, and the Bridgwater station will be the receiver for these services. At each station there are ten masts, five for communication with each Dominion, and their design is identical for the transmitting and receiving stations. The five masts for each Dominion are erected in a straight line at right angles to the direction in which communication is to be established; they are 277 ft. high, each having a cross arm at the top measuring 90 ft. from end to end. The aerial and reflector will consist of a number of vertical wires suspended from triatics attached to the cross arms of the masts. There will thus be two parallel steel cables, separated by a distance which depends on the wave-length used, running on each side of the masts from the first to the last. From these cables the vertical aerial and reflector wires will be suspended, the lower ends of the wires being kept in position by balance weights. The distance between the masts is 650 ft., from centre to centre, and the length of the whole system of five masts for each transmitter is about 3,200 ft. from tail anchor block to tail anchor block.



Fig. 3.—Bridgwater Receiving Station: Switchboards and Station Lighting and Battery Charging Plant.

At the Bodmin transmitting station the power plant consists of Ruston & Hornsby cold-starting oil engines driving d.c. generators built by Messrs. Newtons, of Taunton. The various voltages required for the operation of the valves will be supplied by motor generators and alternators. The valves themselves will be of the oil-cooled type, and the complete valve transmitters will be housed in a separate room adjacent to the power house. The generating plant has been mounted on a concrete raft, supported on cork to prevent vibration reaching the transmitting set, and the valve oscillators themselves are mounted on a similar raft. From the transmitting room feeders are led to the aerials by

means of copper tubes fixed above the ground. At the Bridgwater receiving station power is supplied by 18-h.p. two-cylinder Aster engines driving the d.c. generators which supply the station with light and drive the machines for charging the receiver batteries.

The first of the accompanying reproduced photographs shows the rectifying panels at the Bodmin transmitting station; behind them are mounted the "smoothing" units (which are illustrated in fig. 5), the well-known Marconi system of rectified alternating current being utilised at these stations. At the Bodmin station all the power required will be generated on site, and fig. 2 shows the machinery hall containing the plant referred to above. In striking contrast to this, fig. 3 is a view of the much smaller power plant needed at the Bridgwater receiving station; on the left are seen the switchboard and one of the small generating sets which supply the station lighting and drive the motor-generators (shown on the right) provided for battery-charging purposes. It will be noticed that the two lines of masts depicted in the last illustration are at right angles to each other, which arrangement provides for the left-hand row being used for the Canadian service, while the right-hand row of masts serves for the South African service.

Both transmitting and receiving stations will be connected by direct land lines with the Central Telegraph Office, G.P.O., London; the incoming signals will be automatically relayed to the land line at Bridgwater and passed on to the Central Telegraph Office, London, and the outgoing and incoming messages will be dealt with at the same table in the telegraph office, thus giving true duplex working and complete central control over the traffic. For the "beam" system, whereby the radiated energy is concentrated in one direction, very much smaller power is required for communicating over any given distance than in the case of high-power stations which radiate energy in all directions, while, in addition, the speed of working, and freedom from interference, are greatly increased.



Fig. 4.—Bridgwater Receiving Station, showing some of the Masts.

The corresponding stations in Canada, near Montreal, and South Africa, near Cape Town, are in practically the same state of advancement as the English stations, and other similar stations of the Imperial system are being erected at Grimsby and Skegness, in England, for communication with other stations at Poona, in India, and Melbourne, in Australia. In fact, at the present time the Marconi Company has in hand no fewer than 17 short-wave transmitting stations, including its own station at Dorchester, for communication with New York and South America.

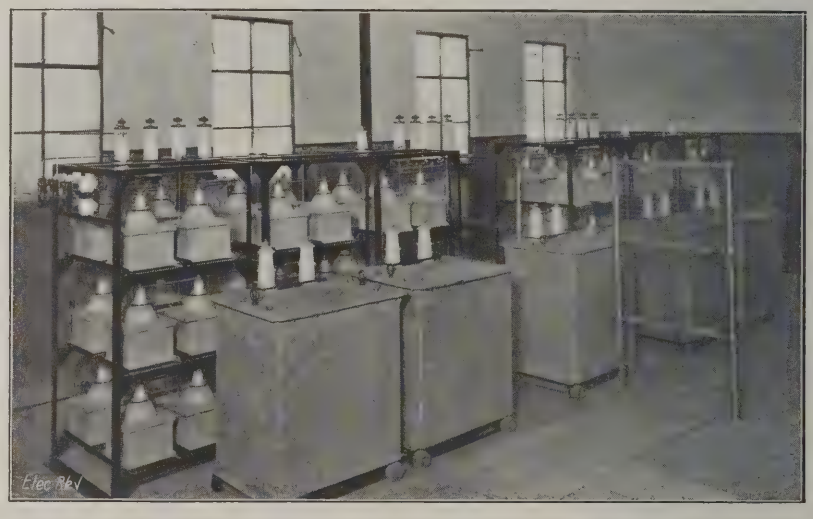


Fig. 5.—Bodmin Transmitting Station: "Smoothing" Units for Rectifiers.



Fig. 6.—"Canadian" Masts (Left) and "South African" Masts (Right) at Bridgwater.

The Imperial stations have been designed and are being built by Marconi's Wireless Telegraph Co., Ltd., for the General Post Office, the buildings and foundations being carried out to the Marconi Co.'s design by the Foundation Co., of London. At Bodmin the masts have been supplied and erected by the Armstrong Construction Co., and at Bridgwater they have been erected by Messrs. Francis Morton and Co., who are also responsible for the supply and erection of the masts at the Grimsby and Skegness stations.

It is understood that probably two wave-lengths will be utilised at each station so that in the event of interference, or fading, being experienced on one, a change over to the other could be made. It will be recalled that the original intention was to have the stations in operation this month as specified by the Canadian agreement which was signed in July, 1924.

Electricity Supply at Maidstone.

Some Particulars of the Recently Inaugurated Extensions.

THE public supply of electricity in Maidstone was commenced in 1901, with plant consisting of four hand-fired boilers and five d.c. engine-driven generators, having a total capacity of 675 kW. In 1908 the buildings were extended, a 500-kW set and an additional boiler were

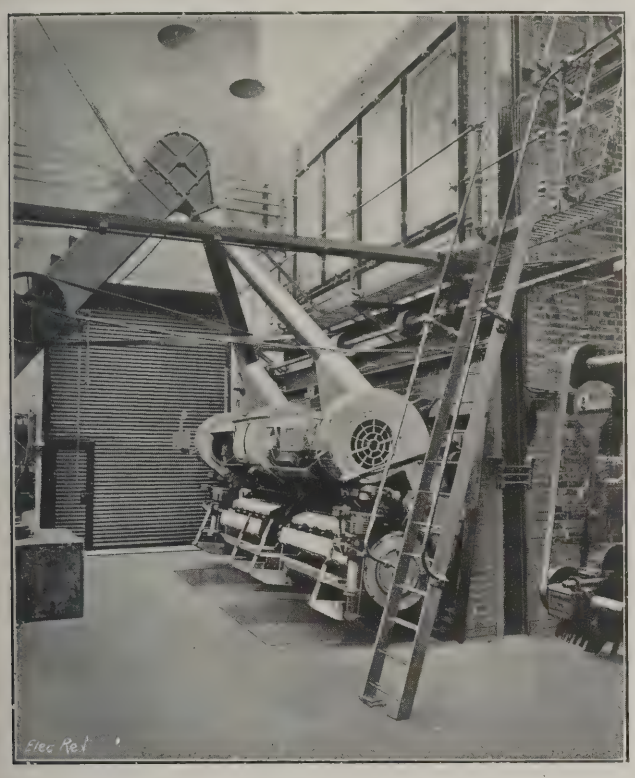


Fig. 1.—30,000-lb. Boiler with Underfeed Stoker.

installed, and mechanical stokers were fitted to the boilers. Additional plant became necessary in 1913, when a sixth boiler and another generator set, 825 kW, were added to the plant. Early in the war three of the old 150-kW sets were taken for "urgent Government requirements," and in their place were installed a 1,250-kW turbo-alternator and a 1,000-kW rotary converter. At a later date a second turbo-alternator, 1,500 kW, and a 30,000-lb. water-tube boiler were installed. In 1919 and 1920 the system of generation was changed to a.c., 3-phase, 50-period, 6,600-V, and a further 30,000-lb. water-tube boiler together with a third Brush-Ljungström turbine of 1,500 kW were put down. The recent extensions which were officially inaugurated on December 19th last (ELECTRICAL REVIEW, December 25th) include boiler and turbo-alternator plant, and the necessary switchgear, contained in a new ferro-concrete building, designed by Messrs. Mouchel & Partners, and erected by Messrs. Corben & Son, local builders.

The boiler plant was supplied and erected by Messrs. Vickers Boiler Co., Ltd., and comprises two water-tube boiler sets in brickwork, with a working pressure of 225 lb. per sq. in., and a heating surface of 6,000 sq. ft. each. They are fired by mechanical stokers, one having a stoker of the Bennis chain-grate type, and the other an Underfeed self-contained travelling-grate stoker, fig. 1, the grate area in each case being 170 sq. ft. Integral superheaters designed to give a final steam temperature of 650 deg. F., and a Green vertical economiser are provided with each boiler. A new draught equipment consists of one Louis Prat "Evasé" chimney, 80 ft. high, equipped with induced-draught fans. Two vertical direct-acting boiler feed pumps, each capable of dealing with 6,000 gallons of water per hour, one cast-iron hot-well tank having a capacity of 2,500 gallons, and two Bennis 8-in. bucket coal elevators are also installed.

A large panel placed opposite the front of the boilers accommodates the boiler instruments, including CO_2 recorders, pressure and draught gauges, and load indicators.

A 3,000-kW Brush-Ljungström turbo-alternator, fig. 2, with the necessary condensing plant and auxiliaries form the turbine generating plant. The turbine is direct coupled to two alternators having a combined output of 3,000 kW at 0.8 power factor, 6,600 V, 50 cycles, 3-phase, at 3,000 r.p.m. The condenser is of the two-flow surface type; it has a cooling surface of 4,000 sq. ft., and is capable of dealing with 35,500 lb. of exhaust steam per hour. Air is extracted from the condenser by means of a two-stage Brush-Delas ejector, capable of dealing with 20.75 lb. of dry air per hour. The condensate is removed by means of a Pulsometer centrifugal pump, and delivered to a Wright recorder, whence it is pumped to the hot well by a separate lift pump. The circulating water is delivered to the condenser by a motor-driven centrifugal pump of the Sunturbo type, made by Messrs. J. Stone & Co., Ltd., and a Carr's patent rotary screen, made by Messrs. Ledward and Beckett, deals with the circulating water. The coal handling plant was supplied by Messrs. Edward Bennis and Co., Ltd.; it consists of a conveyor trough incorporated with that previously existing so that fuel is fed in two directions at the same time, dealing with both coal borne by road and by rail. Installed at the river side is an electric crane which takes the coal from barges, and discharges it into a hopper serving an Avery weigher and totaliser.

A three-panel G.E.C. slate switchboard, with steel plate cubicles, accommodates the necessary switchgear and instruments. The alternator switchgear consists of an oil circuit breaker having a breaking capacity of 125,000 kVA, and provided with two overload and one shunt trip coils. Two sets of signal lamps indicate

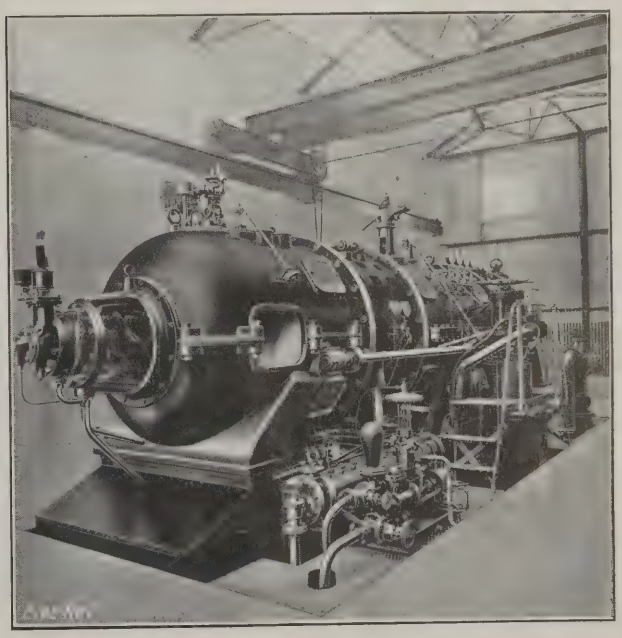


Fig. 2.—3,000-kW Turbo-Alternator.

whether the oil switch is in the "on" or "off" position, and whether the isolating switches are closed. A Brown, Boveri automatic pressure regulator is installed.

The total capacity of the station is now 8,575 kW, and the consumption of electricity per head of the population is about 400 kWh per annum.

The extensions to the plant were designed by the electrical engineer, Mr. E. E. Hoadley, M.I.E.E., who was assisted by Messrs. C. E. Winkle, E. E. Pope, and T. F. Maud.

A Large Hydro-Electric Development.

The New Generating Station at Isle Maligne, Quebec.

WHAT was to be completed by the middle of last summer, the first of two hydro-electric schemes projected by the Quebec Development Company for harnessing the waters of the Saguenay River at Isle Maligne, is claimed to be the largest single installation in water-power development ever undertaken. The Saguenay River is one of the great tributaries of the St. Lawrence River and flows out of Lake St. John by two channels, the Grand Discharge and Little Discharge. Lake St. John is located about 100 miles north of Quebec City. Its normal water level is 310 ft. above mean sea-level, and its drainage area is estimated to be 30,000 square miles. The Grand Discharge is divided into two channels by Isle Maligne, at the foot of which, in the left channel, fig. 1, is located the power house.



Fig. 1.—Plan of Development.

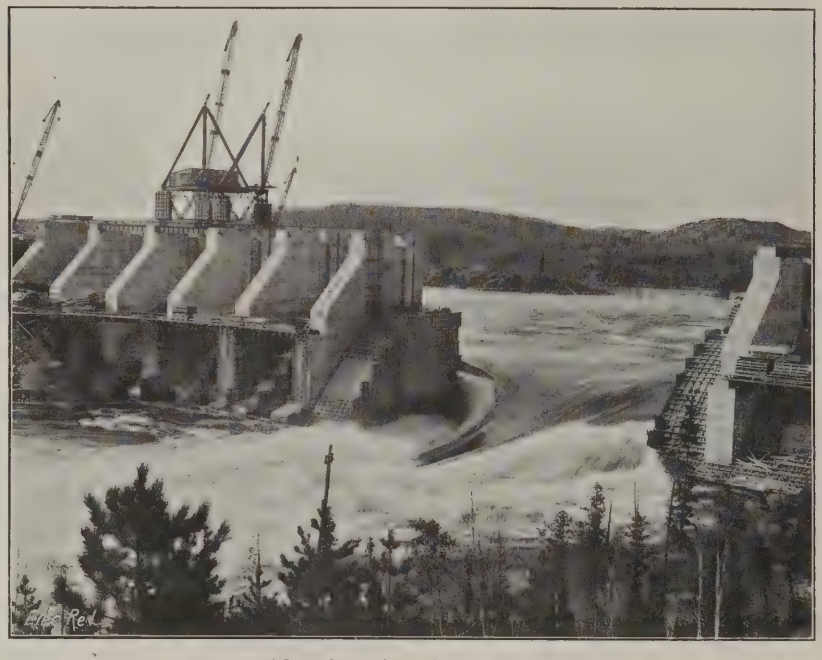


Fig. 2.—Main Dam, Isle Maligne, during Construction.

The main structure, fig. 2, consists of a combined gravity dam and power house, 720 ft. in length, with a bulkhead extension at the north end, 330 ft. long, inclined upstream at an angle of 30 deg., and tailrace walls carried downstream at either end at right angles to the building. The power house sub-structure and adjacent walls are built of concrete and the superstructure is built round a steel framing with brick and tile walls and a roof of reinforced gypsum slabs with tar and gravel finish.

The intake of each turbine is formed by twin rectangular openings, 16 ft. by 22 ft., in the concrete wall, each controlled by a butterfly valve. These converge into one, in which the rectangular section is gradually changed into a circular one, meeting the 22-ft. diameter steel penstock which carries the water to the steel-plate spiral casing. The latter surrounds and is riveted to the speed-ring, a massive cast-steel erection, 21 ft. 6 in. in diameter, consisting of top and bottom machine-faced flanges with interconnecting ribs between which the water is delivered to the runner. This is of cast iron, with a maximum diameter of 15 ft. It is cast in one section, and is connected to the generator by the main shaft, which is 28 ft. long and 29 inches in diameter.

In addition to the main structure, there are seven spillways and an earth dam to close up the channels and waterways and to direct all the water to the required channel only.

The construction of the station provides for the installation of 12 vertical, single-runner, Francis turbines, aggregating a total of 540,000 h.p. At the time of the preparation of our information eight turbine units were completely installed, and the foundations for the four additional machines were well advanced. The head on the turbines is between 100 and 120 ft., giving each a variation in horse power from 35,000 to 45,000. An individual governor system operating under an oil pressure up to 220 lb. per sq. in. is provided for each turbine, and the piping is so arranged that the governors may be operated separately or as an interconnected system of units in groups of four. The governor flyballs are directly connected to the turbine shaft below the rotor. The governor stands, gear-type oil pumps, pressure tanks

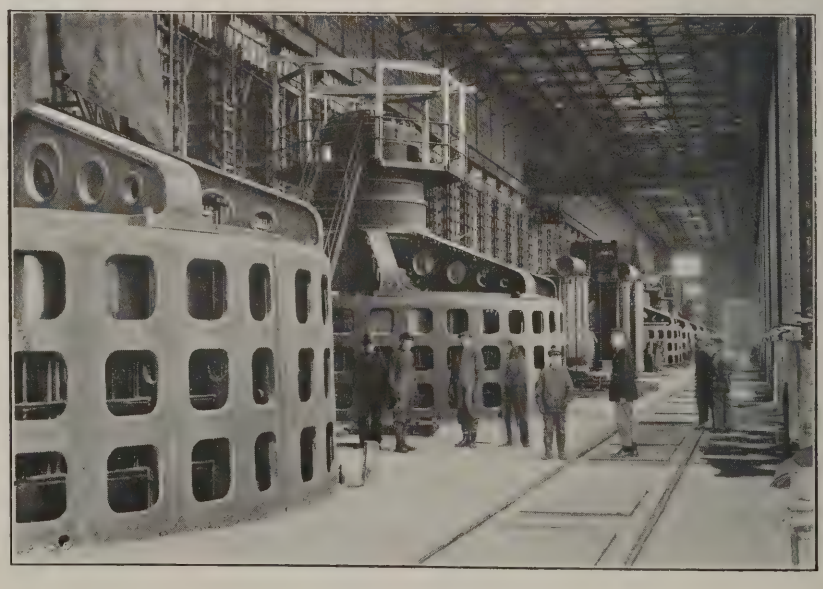


Fig. 3.—Interior of Power House.

and receiving tanks are located in the spacious power-house basement or turbine room. An emergency stop device is installed for each turbine, enabling the operator at the benchboard to shut the turbine gates and stop any machine without the assistance of an operator in the turbine room. The closing time for each of the governors is three seconds.

The eight generators directly connected to the turbines each have a continuous full-load rating of 30,000 kVA at 13,200 V, three phase, 60 cycles, 112.5 r.p.m. Each generator is equipped with an upper and a lower guide bearing. The thrust bearing on top of the generator is of the Kingsbury type, and its housing is provided with water-cooling coils. The individual exciters placed above the thrust bearings each have a full-load rating of 185 kW at 250 V.

The oiling system of each generator unit is self-contained and automatic in operation. The thrust bearing is immersed in an oil reservoir containing water-cooling coils located on top of the upper bearing bracket. A geared pump, mounted in a smaller oil reservoir located below the lower bearing bracket, is driven by a gear on the generator shaft and forces the oil to the upper thrust-bearing reservoir. Proper pipes also conduct the necessary oil to the two guide bearings, and the overflow oil from each bearing is carried back to the lower reservoir for re-circulation. Large brakes are provided for four of the eight arms of the lower generator-bearing bracket. If operated by air pressure, the brakes will stop the generator with the turbine gates closed, and if operated by oil pressure from the governor system, the brakes may be used as jacks to lift the rotor. Cast-iron stools are provided for mounting on the bracket arms to support the rotor when lifted.

Each generator armature is star-connected, and the six leads are brought out from the upstream side of the generator. By means of a 15,000-V disconnecting switch, the neutral point is connected to the neutral bus-bar consisting of a $\frac{3}{4}$-in. copper tube suspended by porcelain insulators on the mezzanine floor along the upstream side of the power house, and it is then earthed outside the station. Normally each generator feeds its own transmission line, and a low-pressure bus system provides for the transfer of energy from another generator in case of emergency and the means for delivering energy to the transformers for the station auxiliaries.

The rating of each circuit breaker is 3,000 A at 15,000 V, and the guaranteed interrupting capacity is 65,000 A at 13,200 V. An electrically-operated motor mechanism is provided for each breaker, and an arrangement is made for emergency manual operation. D.c. energy at 230 V, for the operation of the mechanism, is furnished from a 25-kW motor-generator set.

For the station use there are installed two banks of transformers, which are located in the centre of the high-pressure room, and each bank consists of three 200-kVA single-phase transformers stepping down from 13,200 to 550 V. Two 100-ton power-house cranes, a 100-ton crane for lifting and transferring apparatus from the generator room to the high-pressure room, a 60-ton gantry crane on top of the power house bulkhead, and 16 headgate hoist motors are installed.

For the actual construction of the power house, fig. 3, a steel trestle was built on the site of the structure and along its full length, carrying three lines of standard track and derrick gantry rails on either side. The whole of this trestle, with the exception of the floor members and the rail girders, is built into the dam.

During the construction an electricity supply was received from Chicoutimi, where Messrs. Price Bros., who are part owners of the development, have a hydro-electric plant, by means of a 44,000-V 40-mile transmission line.

We are indebted to Mr. W. S. Lee, chief engineer of the Duke Price Power Co., for the information given above, to the *Electrical News* (of Toronto) for the diagram, fig. 1, and to the Canadian National Railways for the photographs.

Lighting and Power Notes.

(*Continued from page 98.*)

Birmingham.—ELECTRICITY EXTENSIONS APPROVED.—At a meeting of the City Council on January 5th the chairman of the Electricity Supply Committee, moved a resolution authorising the latter to proceed with the installation of a 10,000-kW turbo-alternator set at a cost of £60,000. The resolution was adopted, and it was agreed to spend £158,000 on additional sub-stations and equipment and £260,000 on mains.

Bromley (Kent).—PRICE REDUCTION.—The Bromley Electric Light & Power Co., Ltd., has made a further reduction of 1d. per kWh in the charge for electricity for lighting. The revised rate is 7d. per kWh subject to a minimum charge of 8s. 9d. for the winter quarters and 5s. 10d. for the summer quarters.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—An official statement recently issued shows that new hydro-electric installations during the past year totalled 719,000 h.p., bringing the total to 4,290,000 h.p. The year's developments have involved a capital expenditure of $70,000,000, exclusive of the new capital required for the utilisation of the energy generated.—*Reuter's Trade Service* (Ottawa).

Clitheroe.—ELECTRICITY SUPPLY.—The Corporation is preparing for the early introduction of electricity in its area. The terms include a fixed charge for power purposes of £5 per kW of maximum demand, and $\frac{1}{2}$d. per kWh, the consumer to provide a transformer station and the Corporation the transformer.

Continental.—SWEDEN.—It is announced from Stockholm that the hydro-electric station which has been established at Lilla Edet by the Swedish Government for the supply of power to the Stockholm-Gothenburg railway has recently been completed.

FRANCE.—The City Council of Paris has recently approved a large programme of works to be executed by the Compagnie Parisienne de Distribution d'Electricité with the object of coping with the continuous development of the consumption. The works will extend over several years, and will involve a loan of about 356 millions of francs.

GERMANY.—The Berlin correspondent of the *Daily Mail* reports that £3,000,000 is being spent on the erection of electricity works at Rummelsburg, on the outskirts of Berlin. Dr. Rehmer, the director of the works, states that the undertaking will be completed in the course of the year and that the plant will have a capacity of 160,000 kW.

Elland.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,400 for street lighting in the north ward.

Hamilton.—TRANSFER OF UNDERTAKING.—The local electricity undertaking was recently formally transferred from Messrs. Edmundsons' Electricity Corporation, Ltd., to the Town Council.

Hebden Bridge (Yorks.),—LOAN.—The Urban District Council has made application for sanction to borrow £1,000 for the purchase of electric cookers and other domestic appliances, to be let out on hire.

Keighley.—EXTENSION OF SUPPLY.—The Town Council has authorised the Electricity Committee to proceed with the transmission line from Eastburn Foundry and the laying of mains for the purpose of a supply of electricity to the township of Sutton.

Liverpool.—LOANS.—The Corporation has received sanction to a loan of £200,000 for distributing mains.

The Tramways and Electric Power and Lighting Committee has made application for sanction to the borrowing of £69,799 for provision of h.p. and l.p. mains and services, and sub-station buildings and plant, for the supply of electricity to the Walton-Clubmoor, Highfield, Pinehurst Road, and Strawberry Lane housing estates.

MAINS EXTENSIONS.—The City Council has approved of the extension of mains in the Old Swan district at an estimated cost of £7,960, concurrent with the laying of a h.p. main from Lister Drive to Knotty Ash. Authority has also been granted for extension of mains in Higher Road, Hunt's Cross, at an estimated cost of £1,350.

Maidenhead.—OPPOSITION TO BILL.—The Town Council has decided to oppose the Bill of the Metropolitan Electric Supply Co. for powers to increase the area of supply which might encroach upon the powers of the Corporation undertaking.

LOAN.—Sanction has been received to a loan of £5,000 for mains and services.

Manchester.—PROGRESS DURING NOVEMBER.—During the month of November the Corporation electricity undertaking showed an increase in connections of 1,784 kW, bringing the total to 273,412 kW; and the number of applications received for supply, including existing consumers for additional supplies, was 1,052, representing a total of 2,942 kW. The number of consumers connected increased by 441, and the number of hired cookers connected by 81, bringing the total actually on circuit to 1,149. Applications for the hire of cookers totalled 108.

ELECTRICITY SUPPLY RECORDS.—On December 3rd, the output reached 1,575,920 kWh, and on December 15th, the maximum supply demanded reached 136,560 kW, both figures constituting records in the history of the undertaking.

Morecambe.—ELECTRICITY CHARGES.—At a recent meeting of the Town Council a letter was received from the Heysham Urban District Council, suggesting a joint arrangement for charging for electricity supplied from Morecambe to private houses in Heysham on the basis of the rateable value of the premises, plus a small charge per kWh. It was resolved that the Heysham authority be informed that the proposal was at present under consideration and would shortly be reported on by the borough electrical engineer. The Council also received correspondence from the Morecambe and Heysham Master Builders' Association, with regard to the revision of charges for laying electricity services in private premises. The electrical engineer submitted a revised table of charges for various classes of service, and the matter was deferred to the next meeting. The borough electrical engineer reported that the laying of an additional e.h.p. feeder cable had not been commenced owing to the L.M. & S. Railway Company's asking to be supplied with energy for working the Heysham branch electric line, and that would affect the direction in which the cable would be laid. There was a considerable portion of the feeder which would be common to both schemes, and the engineer was instructed to proceed forthwith with the laying of such portion.

Newport (Fife).—ELECTRICITY AGREEMENT.—The Newport Town Council has come to an agreement with the Fife Tramways Light & Power Co., Ltd., regarding the laying of cables in the burgh.

North-West Midlands Electricity District.—LOCAL INQUIRY.—In pursuance of the Electricity Commissioners' provisional determination of the above-named district, the Commissioners will hold a local inquiry at the Town Hall, Stoke-on-Trent, on February 17th, 1926, at 10.30 a.m. and following days, if necessary, with reference to the area to be included in the proposed district, and to consider a scheme which has been submitted by a Conference of Authorised Undertakers in the District for improving the existing organisation for the supply of electricity in the district and for the formation of a Joint Electricity Authority. Copies of the scheme may be obtained from Mr. H. H. Battle, hon. secretary to the Conference of Authorised Undertakers, Borough Hall, Stafford, at a cost of 10s. 6d. each. Representations with regard to the scheme should be addressed to the Secretary, Electricity Commission, Savoy Court, Strand, London, W.C.2, not later than February 6th, and a copy of such representations should at the same time be sent to the hon. secretary to the Conference at the address mentioned above.

Retford.—ELECTRICITY SCHEME.—At a recent special meeting of the Town Council it was agreed that the draft specification and tender form prepared by Mr. A. H. Seabrook for the new electricity scheme be accepted, and that a fee of £1,600 be paid on an estimated expenditure of £27,000. The plant, which is to be installed at the Corporation gasworks, will consist of one 50-kW steam-driven generating set and one 150-kW and one 250-kW gas engine-driven sets. The Committee was given power to increase the capacity as the demand arose.

Scarborough.—TRANSFER OF UNDERTAKING.—The formal transfer of control of the Scarborough electricity works from the Scarborough Electric Supply Co., Ltd., to the Corporation, under a recently agreed purchase arrangement, took place on January 1st, Mr. J. J. Addy, a director of the company, formally handing over the works to the Mayor.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electric Supply Committee has approved extensions of mains for general distribution purposes at an estimated cost of £21,843, and electricity extensions and works at an estimated outlay of £3,705.

South Africa.—JOHANNESBURG.—The Johannesburg correspondent of *The Times Trade and Engineering Supplement* reports that the Town Council has failed to obtain from the Transvaal Provincial Council the necessary sanction to a proposed expenditure of £500,000 on a new power station, the Provincial Administrator taking the view that the town could more economically supplement its existing supply by an arrangement with the Electricity Supply Commission, on whose behalf the Victoria Falls and Transvaal Power Co. is at present erecting a super station on the Witbank coalfield. The Council, being already committed to an expenditure of over £20,000 on the scheme, has decided to carry out the proposed extensions by means of a 10 per cent. addition to the existing plant annually, which it is empowered to do without reference to the Provincial Authority. Already a new 10,000-kW set is being installed, but it is doubtful if this will be sufficient to meet the needs of the town during the next winter. Although the Victoria Falls and Transvaal Power Co. generates electricity at a cost which enables it to supply the requirements of the gold mines of the Witwatersrand at less than 4½d. per kWh, the Johannesburg Town Council estimates that it can generate at a still lower cost and effect a saving of about £23,000 per annum, as compared with the cost of taking a supply from the company.

South-East Lancashire Electricity Advisory Board.—*Electricity Supply for Eccles.*—The Engineering Advisory Committee has considered the question of a bulk supply to Eccles Corporation, and has decided that in the interest of the district, it is of opinion that the supply to Eccles should be furnished from the Barton station of the Manchester Corporation, but that as the Agecroft station is a possible alternative source of supply, the Eccles Corporation be recommended to invite offers for its requirements from the Lancashire Electric Power Co. and the Salford Corporation upon conditions defined by the Committee.

Main Transmission Line.—The Committee has recommended the Board to approve the construction of the 33,000-V transmission line by the Lancashire Electric Power Co. and Rochdale Corporation.

Bulk Supply to Leigh.—The question of a bulk supply to Leigh Corporation has been considered, and the Committee has decided that the proper source of the bulk supply required by the Corporation is the Barton power station, *via* the Lancashire Electric Power Co.

Alderley Power Station Extension.—The consideration of the application of the Alderley and Wilmslow Electric Supply, Ltd., for permission to install an additional 120-kW Mirrlees Diesel engine, direct coupled to a 3-phase, 50-cycle alternator, was adjourned.

The minutes of the proceedings of the Committee have been adopted by the Board.

Southport.—NEW PLANT.—In view of the increasing maximum load on the station, the borough electrical engineer (Mr. E. Moxon) has suggested to the Electricity Committee that it should approach the Electricity Commissioners with reference to the installation of a 6,000-kW turbo-alternator. This would be required for service in the winter of next year.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Birmingham Corporation to supply electricity in the rural district of Solihull, and part of the rural district of Meriden, and the Isle of Wight Electric Light & Power Co., Ltd., to supply in the rural district of the Isle of Wight.

Applications have been made for Special Orders by the following authorities:—The Brighton Corporation to supply electricity in the parish of Telescombe, and to revoke the Order granted under Section 6 of the Electric Lighting Act, 1909; and Norwich Corporation to supply in the urban district of North Walsham and certain parishes in the rural districts of Aylsham, Blofield, Forehoe, Henstead, Loddon and Clavering, Mitford and Launditch, Smallburgh, St. Faiths and Wayland.

Sutton Coldfield.—ELECTRICITY EXTENSIONS.—The Borough Council is applying for sanction to the borrowing of £28,650 for improvements and alterations to plant. The electrical engineer (Mr. T. Bloore) states that whilst the present plant should meet satisfactorily the winter demand, it would be advisable to make further provision at Roland Road power station and the Lime Grove sub-station in readiness for the winter of 1926-27. On December 4th the maximum load on the undertaking was 1,102, against 783 kW last year. Further provision is necessary, in view of the probability of supplying in the near future the districts of Streetly and Little Aston.

Truro.—ELECTRICITY SUPPLY.—The City Council has approved the proposed agreement with Messrs. Edmundsons and the draft of the Special Order in connection with the electricity supply for the district.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The *Electrical World* reports that work is now actually under way on the Bucks Creek development of the Feather River Power Company in Northern California, to cost $8,500,000, and equipment for the two 32,000-h.p. impulse waterwheels and the two 25,000-kVA generators will soon be ordered. The development is being made by the Feather River Power Company of San Francisco, and upon completion of the project in August, 1927, the entire output of the plant will be sold to the Great Western Power Company. In consideration of the price to be paid for the power the plant is to become the property of the Great Western Power Company at the end of 35 years.

The House of Representatives, by 248 to 47 votes, has authorised the creation of a Joint Congressional Committee empowered to negotiate a private lease for the nitrate and water-power project constructed in war time at Muscle Shoals, at the confluence of the Tennessee and Alabama rivers.

Wath-on-Dearne.—ELECTRICITY IN SMALL HOUSES.—It was reported at a recent meeting of the Council that the Dearne Valley Electric Board had decided to allow householders to extend the payment of the cost of installation of electricity in their houses over a period of five years. This will amount to about 1s. 6d. per week per house.

Wimbledon.—ELECTRICITY SUPPLY.—The Electricity Committee has decided to lay new feeder mains at a cost of £12,250, and to enlarge and re-equip five sub-stations at a cost of £3,200.

Worcester.—ELECTRICITY EXTENSIONS.—The City Council has authorised the Electricity Committee to spend £3,000 on account of the £33,000 sanctioned, to procure plant for the supply of electricity to the extended area. It was stated at a recent Council meeting that the Electricity Commissioners' consent to the scheme was expected about the middle of January.

Worthing.—LOANS.—The Electricity and Waterworks Committee has recommended to the Town Council that application be made for sanction to the borrowing of £10,500 for plant and cables in connection with the supply of electricity to the East Preston rural district, and £12,635 for a Diesel engine and dynamo, &c.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—The Swiss Federal Railway Authorities in Berne have recently issued a report on the progress of the electrification of the Swiss railways, which shows that, excluding the lake valley lines, about 488 miles of the system have so far been converted to electric traction. All the lines, with the exception of about 47 miles, are operated on the single-phase a.c. system. Additional sections of the system are being electrified at the rate of about 125 miles per year. The Palezieux-Geneva section will soon be completed; the Zurich-Rapperswil line will be completed next summer; the Brugg-Biel line and the Brigniue-Sitten line by the end of 1926; the Winterthur-St. Gall-Rorschach, Rothkreuz-Rupperswill and Palezieux-Freiburg-Berne sections by the summer of 1927; the Richterswil-Chur, and the Winterthur-Romanshorn-Rorschach lines by the summer of 1928; the Biel-Delsberg and the Zurich-Schaffhausen lines by the end of 1928. The length of the track in hand is about 490 miles, which will bring the total of electrified lines in Switzerland, including the lake valley lines, to approximately 1,010 miles by the beginning of 1929. This represents about 56 per cent. of the Swiss railway system.

GERMANY.—Inquiries are being made into the possibilities of economies in working by electrifying the railway between Frankfort-on-Main, Mannheim and Basle. It is considered that the necessary electrical energy could be supplied by the hydro-electric stations on the Upper Rhine.

Japan.—NEW ELECTRIC RAILWAYS.—It is reported that a contract has been given to the Kawakita Denki Kigyosha, of Tokio, by the Nasu Electric Railway Co., Ltd., for the construction of an electric railway between Kurodahara station on the Government north-eastern line and the Nasu Yumoto hot springs, a distance af ten miles.

The Uyeda Onsen Denki K.K. is to proceed with the construction of the suburban electric railway at Uyeda, Shinshu.

The Odawara Rapid Transit Railway Co., will shortly commence work on the line from Shinyuku to Odawara, a distance of 60 miles. The line will be opened for traffic in May, 1927.

Liverpool.—TRAMWAY EXTENSIONS.—The Ministry of Transport has sanctioned the borrowing by the Corporation of £91,102 for the purpose of constructing tramways authorised by the Liverpool Corporation Tramways Order, 1925. The Tramways Committee intends to apply for sanction to borrow £6,132 for the construction of tramways connecting Great Crosshall Street with Tithebarn Street, and the construction of an additional junction at the corner of Great Crosshall Street and Byrom Street.

London.—TUBE "SPEED-UP."—In the course of the next eighteen months the rolling stock of the Central London Tube is to be remodelled and refitted throughout, to provide the same standards of comfort and efficiency as are now afforded on the Hampstead and City lines, at a cost of £200,000. The first of the 250 new coaches is already in commission, and a recent experiment demonstrated that passengers alighted from it in 12 seconds, as against 28 seconds taken by passengers in an adjoining coach. This is due to the substitution of pneumatically controlled doors, giving access immediately into the compartment, for the manually-operated and much smaller gates at the ends of the coaches. The improvements include more commodious seats, better lighting, and better ventilation. Instead of four motors on the six-seven car trains, there will be six, and this increase of power will, it is estimated, enable four minutes to be saved on the through journey. Six trains will be running by Easter.

INQUIRY.—It is anticipated, according to the Finance Committee of the Camberwell Borough Council, that the inquiry to be held by the London and Home Counties Traffic Advisory Committee into the question of the provision of tube railways for the South-East London district will be held about the end of the present month.

Newcastle-on-Tyne.—LOAN.—According to the *Financial Times*, subject to the assent of the ratepayers under the Borough Funds Act, the Corporation is applying to Parliament next session for power to borrow £2,147,125. Of this sum £118,125 is the amount proposed to be paid for the purchase of the undertaking of the Tyneside Tramways and Tramroads Co., and £71,500 is for improvements to the tramway system.

Telegraph and Telephone Notes.

France.—INCREASED TELEGRAPH AND TELEPHONE RATES.—The further fall of the franc has been followed by a fresh increase in foreign telegraph and telephone rates. The basic rate now has to be multiplied by 5.3 for international messages, as compared with a multiplication by 4 at the beginning of August, 1925, and by 5 on December 10th, 1925. Contrary to the practice obtaining hitherto, substantial increases have also been made in French colonial rates, the same multiplier index being applied as for international telegrams except in the case of messages sent to French colonies by wireless, or *via* Dakar, in which case the basic rate will be multiplied by 3.5 only.—*Reuter* (Paris).

Germany.—AUTOMATIC TELEPHONY.—Despite the financial difficulties attending the introduction of new methods by the post office authorities, the introduction of the automatic telephone system has made rapid progress in Germany. A beginning in this respect was first made in 1907 by the conversion of the Hildesheim network to the automatic system, but further work was interrupted by the war and in the three years immediately following, and it was only possible to make a fresh start in 1922 in a systematic manner. As a manual exchange only has a life of about 15 years and many exchanges have to be annually renewed, it was decided in the latter cases to change over to the automatic system as being more appropriate, notwithstanding the additional expenditure involved of from 50 to 100 per cent. above the cost of manual exchanges; on the other hand, the automatic system results in a saving of labour and of other working expenses. The aim of the postal authorities now is to completely transform the local networks within a period of 15 years. At present in the old Reich telegraph area there are 33 large exchanges with 105,000 automatic connections, 29 medium exchanges with 10,000 automatic connections, and 113 exchanges with 8,000 such connections, and preparations are being made for the conversion of a similar number of other exchanges. The course of the financial position will determine whether the 15 years' programme will be entirely carried out.

Peru.—MARCONI CONCESSION.—One of the most bitterly contested concessions in the recent legislative history of Peru terminated with the Senate's ratification of the Marconi contract for twenty-five years for the administration of the Peruvian post, telegraph and wireless services. The concession has been in effect under a referendum clause since 1921, though the opposition of politicians and private interests threatened its annulment, says the *Financial Times*. It is understood that its ratification coincides with the initiation of an energetic construction programme, including the erection of a "beam" station for communicating with the United States, Buenos Aires, Rio de Janeiro and Bogota. The programme provides for expenditure exceeding £500,000.

The Telephone Service.—POLICE SIGNALLING DEVICE.—A new system of police signalling is being tried in the provinces. At some twenty sites in the borough of Halifax telephone boxes have been placed, and in an elevated position near them are fixed coloured lights; by the latter the officer on duty at the police station can call the attention of a constable on beat in the neighbourhood, who will at once go to the telephone box for instructions.

LONG-DISTANCE SERVICE.—It is understood that London will shortly be able to communicate by telephone direct with Wick, a distance of about 730 miles, when junction apparatus has been installed. This installation will also link the extreme north of Scotland with Penzance and enable subscribers to talk from Penzance to Wick, a distance of about 850 miles. At present Inverness is the farthest north town in Great Britain that can be telephoned to direct from London.

SERVICE RESTORATION FEE.—The Postmaster-General has decided that a fee of five shillings will in future be charged to telephone subscribers in every case in which delay in payment of an account leads to the withdrawal and restoration of telephone facilities. The cost entailed by temporary suspension of the service owing to non-payment has now reached a sum of about £25,000 per annum.

MANCHESTER'S NEW EXCHANGE.—Some 4,000 tons of steel will be required for Manchester's new main telephone exchange, the contract for building which has just been placed with a local firm, Messrs. Gerrard, of Swinton. It will take three years to complete, will occupy a floor space of six acres, and will cost altogether some £250,000; its ten floors will house a staff of 1,500. Three units of automatic apparatus, each dealing with 10,000 lines (30,000 lines in all) will be accommodated in the building, which has been designed by Mr. C. P. Wilkinson, of H.M. Office of Works.

SWANSEA DOCKS INSTALLATION.—In order to improve the telephone facilities at Swansea Docks, the Great Western Railway Co. is installing an enlarged branch exchange in the docks offices, which will enable all important parts of the docks to be linked up and provide for both dock traffic control and marine control. The existing exchange in the High Street will be abolished and the lines now connected therewith transferred to the new exchange.

United States.—NEW YORK TELEPHONE RATES.—The New York Telephone Co. has filed a supplemental complaint in the District Court in its action against the Public Service Commission and the Attorney-General of New York, seeking to restrain them from enforcing the rates last set by the Commission. The Company asks that the 10 per cent. surcharge on local rates in New York City allowed by Federal Judge John C. Knox, on May 1st, 1924, be increased to 35 per cent.; also that it be allowed to increase its charge within the State sufficiently to show a fair return on the value of its properties. The Company alleges that, after including the present 10 per cent. surcharge now applied to New York City, the rate level collected there is only 12.9 per cent. over the 1914 level, while living costs have increased 68.5 per cent. in the same period. The Company, after including money derived from the application of the surcharge of 10 per cent. in the city permitted by the terms of the injunction, has been able to earn only 3.96 per cent. on its property devoted to the service in the city and only 4.28 per cent. on its entire property used in the service throughout the State. The property, the Company asserts, has a value largely in excess of $500,000,000.—*Financial Times.*

Radio Notes.

Broadcast Wave-lengths.—SOME PROBABLE CHANGES.—The International Broadcasting Conference, first held at Geneva and recently at Brussels, has accepted the principle that the broadcast wave-band should be extended, the proposed limits being 200 and 600 meters inclusive. On account of shipping interference, no British station will be permitted to use a longer wave than 550 m., whilst 250 m. is probably the lowest limit that can be reached by the existing types of receiving sets; if it is found necessary to operate a British station below 250 m., at least a year's notice will be given, so that present sets need not be modified before March, 1927 (the Commission's findings will probably be published in March next). Moreover, the use of waves shorter than 300 m. is subject to the permission of the Post Office authorities. The Conference has adopted the principle of the allocation of exclusive and non-exclusive wave-lengths, and will respect the seniority of the longest-established stations so far as is possible. The *Evening News* says that Capt. P. P. Eckersley, chief engineer of the B.B.C., left for Brussels on January 11th, where the Conference met again, and is resigning his presidency of its technical section in order to retain an unbiased position.

India.—BROADCASTING COMPANY.—The Indian Radio Telegraph Co., which is building "beam" stations in connection with the Empire wireless chain, has been granted a licence by the Government of India to form a separate broadcasting company for India, with stations in Calcutta and Bombay. The capital of Rs.15,00,000 is all underwritten, it being an entirely Indian company with Indian capital. The *Daily Telegraph* expects that both stations will be working at the beginning of 1927. The income of the company will be 80 per cent. of the licence fees, and the remainder will go to the Government.

United States.—BROADCASTING HELPS FARMERS.—A complaint received by the State Railroad Board shows that the installation of radio receivers by farmers enables them to listen to the market and receive earlier returns, so that if the market falls they can sell their stored grain before the elevator operator learns of the change in price. The Board admits that the situation may be a difficulty for the elevator man, but says that the Board can do nothing in the matter.—*Reuter's Trade Service* (Bismark, N.D.).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—March 16th. Postmaster-General's Department. Battery-charging power board equipment.*

March 23rd. Telephone switches.*

March 29th. State Electricity Commission. Transformers and auxiliary apparatus.*

Bath.—January 29th. Electricity Department. One 6,000-kW turbo-alternator, one water-tube boiler, mechanical stoker and economiser, and one 1,000-kVA transformer. (See this issue.)

Belgium.—ANTWERP.—February 1st. Municipal Council. Electric motor-driven centrifugal pump.*

Blackpool.—January 23rd. Electricity Department. One 2,500-kVA phase and frequency changer. (January 1st.)

Clitheroe.—January 20th and February 23rd. Corporation. Transformers, switchgear, and cable connection for sub-station; e.h.p. and l.p. cables, boxes, &c. (See this issue.)

Dewsbury.—January 23rd. Town Council. Reciprocating electrically-driven sludge pumps with motors and electrical equipment for Mitchell Laithes sewage disposal works. Specification from Mr. H. Dearden, borough engineer, Town Hall.

Edinburgh.—January 25th. Tramways Department. 25 air brakes suitable for electric tramway cars. Specifications from manager.

Grimsby. — January 30th. Electricity Department. 500-kW traction converting plant, sub-station e.h.p. switchgear, e.h.p. feeder and pilot cables. (See this issue.)

Ilkley.—January 20th. Electricity Department. Feeder cables, distribution cables, feeder pillars, and network boxes. (January 1st.)

India.—March 8th. India Store Department. 40 electric freight locomotives in connection with the G. I. P. Railway electrification. (See this issue.)

Liverpool.—January 28th. Electricity Department. Twelve months' supply of cables, meters, electrical sundries, electric lamps, &c. (See this issue.)

London.—METROPOLITAN ASYLUMS BOARD.—January 27th. Installation of electric lighting at the Darenth Colony, Dartford (approx. number of points, 2,300).

E.C. January 30th. Marryat & Place. 113,000 5-amp., 220-V tumbler switches. (January 8th.)

LONDON COUNTY COUNCIL.—January 25th. 4,425 tons of standard steel girder tramway track rails, fishplates and fish-bolts, and about 600 tons of conductor rails. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

ISLINGTON.—January 28th. St. Mary's Board of Guardians. Installation of electric lighting at Andover Row schools. (See this issue.)

Lye.—January 16th. Worcestershire E.C. Electric lighting installation, Valley Road and Orchard Lane schools. Mr. A. V. Rowe, county architect, 38, Foregate Street, Worcester.

Manchester.—January 29th. Electricity Committee. Wiring for electric lighting and power circuits, offices, stores, and workshops at the High Street depôt, Chorlton-on-Medlock. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—March 8th. New Zealand Government Railways. Two 25-h.p. variable-speed motors, one 125-kW motor-generator set and 17 400-V, 3-pole switches.*

Plymouth.—February 4th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c.; one 350-kW converter. (See this issue.)

Sheffield.—January 18th. Electric Supply Department. Erection of stores and ambulance room, on site of Neepsend generating station, Club Mill Lane. Particulars from Mr. S. E. Fedden, general manager and engineer.

South Africa.—JOHANNESBURG.—S.A. Railways and Harbours. February 25th. Electrically-operated hoists for raising, &c., heavy locomotives, electrically-driven geared winches, &c.*

CAPE TOWN.—January 27th. Electricity Department. Oil-cooled transformers.*

Tenterden (Kent).—January 27th. Board of Guardians. Electric lighting installation at the Institution. Master of the Institution.

Uruguay.—MONTEVIDEO.—February 26th. State Electricity Works. Diesel oil engine and a direct-coupled generator.*

Walthamstow.—January 27th. U.D.C. Electricity Department. Two water-tube boilers, mechanical stokers, economisers and pipework, &c. (January 8th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—The Société des Ateliers de Constructions Radiophoniques, of Brussels, has lately secured a contract for the supply of wireless apparatus for the aeroplane section of the Belgian Army.

Bradford.—Tramways Committee.

Three railless vehicles, with one spare set of equipment (£4,913).—Associated Equipment Co., Ltd.
Three ditto, and spare equipment (£5,040).—Richard Garrett & Sons, Ltd.
50 chrome steel axles (£286).—Vickers, Ltd.

Electricity Committee. Accepted:—

Supply and erection of radiant heat superheater at Valley Road works.—Power Speciality Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—

Three 50-kVA transformers and three 100-kVA transformers (£847).—Metropolitan-Vickers Electrical Co., Ltd.

Glasgow.—Corporation. Accepted:—

Conversion of two existing service lifts at Govan Town Hall into electrically-controlled lifts (£106).—A. & P. Steven, Ltd.

Irish Free State.—The following contracts were among those placed by the Controller of Stores, Posts and Telegraphs, Dublin, from November 23rd to December 21st, inclusive:—

Cable.—Siemens-Schuckert (Ireland), Ltd., and Routledge & Co.
Electric lamps.—E. C. Handcock; Sphinx Electric Supplies (Ireland), Ltd.
Bronze and copper wire.—W. F. Dennis & Co., Ltd.
—*Irish Builder and Engineer.*

Lamp Contract.—The Admiralty has placed a contract for carbon-filament lamps with the Edison Swan Electric Co., Ltd.; and the British Thomson-Houston Co., Ltd., has received a six months' contract for the supply of "Mazda" lamps from the Great Northern Railway Co. (Ireland), Ltd.

Leeds.—Electricity Committee. Accepted:—

Supply of transformers for two years.—British Electric Transformer Co., Ltd.
Cables.—Enfield Cable Works, Ltd. (£1,491); W. T. Henley's Telegraph Works Co., Ltd. (£1,358).

Leicester.—Tramways Committee. Accepted:—

Special trackwork in manganese steel (£1,999).—Hadfields, Ltd.

London.—METROPOLITAN ASYLUMS BOARD.—Works Committee.

Renewal of electric lighting cables at Brook Hospital:—

T. Clarke & Co., Ltd. (Accepted.)	**£430**
G. E. Taylor & Co.	460
Riddle & Goddard, Ltd.	480
Toy & Winslow	546
V. G. Middleton & Co., Ltd.	575
Read & Partners, Ltd.	695

HACKNEY.—Electricity Committee. Recommended:—

Two 10-ton overhead travelling cranes (£407).—Herbert Morris, Ltd.

SOUTHWARK.—Electricity Committee. Recommended:—

Reconstruction of generating set (£5,136).—Fraser & Chalmers, Ltd.

Manchester.—Housing Committee. Accepted:—
Electric lighting installation at houses on the Openshaw estate.—Armstrong and Co. On the Withington estate.—A. Spreadborough.

Marlborough.—Town Council. Accepted:—
Conversion of street lamps for electric lighting (£591).—James Bros.

Oldham.—Electricity Department. Accepted:—
Three 12,500-kW turbo-generator sets and condensers for the new power station.—Metropolitan-Vickers Electrical Co., Ltd.

Portsmouth.—Electricity Committee.
Four carbon-dioxide recorders (£340).—Jas. Gordon & Co. (Accepted.)
Cables (£946).—Johnson & Phillips, Ltd. (Recommended.)

Salford.—The Council on January 7th accepted the tender of the Nederlandsche Kabelfabrick, of Delft, Holland, for the supply of cable to the Electricity Committee for £1,792. The lowest offer by a British firm was £717 more than that of the Dutch company. Inquiries were made as to whether the conditions of employment under the Dutch firm were satisfactory, and no contrary report was received. Some opposition was raised to the order being given to a Dutch firm, to which it was replied that trade was reciprocal, and if there was no buying abroad on the part of this country we could not sell goods abroad.

Shrewsbury.—Electricity Committee. Recommended:—
600-b.h.p. 6-cylinder 4-cycle heavy oil engine, 400-kW Rees Roturbo generator, switchboard panel, 8-ton crane, &c. (£8,137).—Belliss and Morcom, Ltd.

Stockton-on-Tees.—Board of Guardians. Accepted:—
Installing electric lighting at Portrack Lodge (£392).—T. B. Watson and Sons, Ltd.

Torquay.—The Electricity Committee quotes £2 5s. per house for wiring 100 houses now being erected by the Newton Abbot U.D.C. at the Broadlands estate.

Woolwich.—Town Council. Accepted:—
Cables in connection with the bulk supply of electricity to Erith and Bexley (£13,261).—Standard Telephones & Cables, Ltd.

Worcester.—City Council. Accepted:—
One 6,000-kW turbo-alternator, with accessories (£23,758).—British Thomson-Houston Co., Ltd.
Continuous-flow condenser (£6,200).—G. & J. Weir, Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, January 15th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Characteristics of Electric Lamps in Relation to their Testing," by Messrs. B. P. Dudding and G. T. Winch.

Institution of Mechanical Engineers.—Friday, January 15th. At the Institution, Storey's Gate, S.W. At 7 p.m. Discussion on "Novelties at the 1925 Engineering Exhibition."

Manchester Electro-Harmonic Society.—Friday, January 15th. At the Albion Hotel, Piccadilly, Manchester. Concert.

Electrical Development Association Conferences.—Friday, January 15th. At Caxton Hall, Westminster, S.W. Lecture on "Suggestion and Auto-Suggestion in Salesmanship," by Mr. Ll. B. Atkinson.

Electrical Trades Commercial Travellers' Association.—Friday, January 15th. At E.L.M.A. Lighting Bureau, 15, Savoy Street, W.C.2. At 7 p.m. Lecture, "Demonstration of Lighting," by Mr. W. E. Bush.

Salford Technical and Engineering Association.—Saturday, January 16th. At the Royal Technical College. At 7 p.m. Presidential address by Mr. J. Morris.

Faraday Society.—Monday, January 18th. At Burlington House, W. At 5.30 p.m. Ordinary meeting.

Junior Institution of Engineers (North-Western Section).—Monday, January 18th. At the Manchester Geographical Society, 16, St. Mary's Parsonage. At 7.30 p.m. Lecture on "The Importance of the Selling Aspect of Production Planning," by Mr. W. D. Adamson.

Royal Institution.—Tuesday, January 19th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "X-rays and Living Matter," by Dr. J. A. Crowther.
Friday, January 22nd. At 9 p.m. Lecture on "The Work of the Davy-Faraday Research Laboratory," by Sir William Bragg.

Paisley Association of Engineers.—Tuesday, January 19th. At the Paisley Technical College. At 7.30 p.m. Lecture on "The Spectrum Visible and Invisible," by Principal A. McLean.

Association of Mining Electrical Engineers (London Branch).—Tuesday, January 19th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. Paper on "Rescue Apparatus for Mines," including demonstration of certain apparatus by Messrs. Siebe Gorman, Ltd.

(South Wales Branch).—Saturday, January 16th. At Cox's Café, Queen Street, Cardiff. At 6.30 p.m. Annual dinner. Visit of the president, Mr. Theodore Stretton.

Electrical Contractors' Association.—Tuesday, January 19th. At the Trocadero, Piccadilly Circus, W.1. At 6.30 for 7 p.m. Annual dinner.

Edinburgh Electrical Society.—Wednesday, January 20th. At the Royal Scottish Society of Art, 117, George Street. At 8 p.m. Paper on "Maintenance," by Mr. J. M. Couch.

Electrical Power Engineers' Association (West Yorks. Section).—Wednesday, January 20th. At the Cinema Exchange Theatre, Queen's Arcade, Briggate, Leeds. At 7 p.m. Paper on "Boiler Plant Efficiency: Some Practical Considerations," by Mr. B. Samuels.

Institution of Electrical Engineers.—Thursday, January 21st. At the Institution, Victoria Embankment, W.C.2. At 6 p.m. Paper, "Notes on the Testing of Static Transformers," by Messrs. J. L. Thompson and H. Walmsley.

(Irish Centre, Dublin).—Thursday, January 21st. At Trinity College, Dublin. At 7.45 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 18th. At The University, Liverpool. At 7.30 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(North-Western Centre).—Tuesday, January 19th. At the College of Technology, Manchester. At 7.30 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(North-Midland Students' Centre).—Tuesday, January 19th. At the Hotel Metropole. At 7 p.m. Address by the chairman of the Centre, Mr. S. Derwen Jones.

(London Students' Section).—Friday, January 22nd. At the Institution, Victoria Embankment. At 6.15 p.m. Paper on "Switchgear," by Mr. C. F. George.

Institution of Electrical Engineers—(*continued*).

(East Midland Sub-Centre).—Tuesday, January 19th. At the College, Loughborough. At 6.45 p.m. Paper on "Justifiable Small Power Plants," by Mr. A. B. Mallinson.

(Sheffield Sub-Centre).—Wednesday, January 20th. At the Royal Victoria Hotel, Sheffield. At 7.30 p.m. Short addresses on "Regulations," by Messrs. G. H. Nelson, H. W. Walker, D. M. Rait, and D. H. Davies.

(Tees-side Sub-Centre).—Monday, January 18th. At the Cleveland Technical Institute, Middlesbrough. At 7.15 p.m. Informal discussion on "The Isolation, Location and Repair of Faults," to be opened by Messrs. E. E. Dunn and W. S. Ramsdale.

Illuminating Engineering Society.—Thursday, January 21st. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7 p.m. Discussion on the "Lighting of Coal Mines," to be opened by Mr. E. Farmer.

Institution of Production Engineers.—Friday, January 22nd. At the Society of Motor Manufacturers, Ltd., 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Features of Machine Tools which make for Increased Production," by Mr. G. W. Rawlings.

Physical Society of London.—Friday, January 22nd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary Scientific Meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

TAIFUN electrical ventilators.
BEAR portable punches.

Notes.

Appointments Vacant.—Assistant telegraph superintendent (Rs. 500 per cal. month), for the Burma Railways Co., Ltd.; female cooking demonstrator and show-room attendant, for the Cardiff Corporation Electricity Department; plumber-jointer, for the Penmaenmawr U.D.C. Electricity Department; electrical engineer and electrical assistant, for the Bettws-y-Coed U.D.C. Electricity Department; lecturer in preliminary technical studies (£400), for the Cape Technical College; plumber-jointer for the Stepney Corporation Electricity Department. (See our advertisement pages to-day.)

The British Association.—This year's meeting of the British Association for the Advancement of Science is to be held at Oxford from August 4th to 11th under the presidency of the Prince of Wales. The name of the president of the Engineering Section is to be announced later. Dr. A. Fowler, Research Professor of the Royal Society, is to be president of the Mathematics and Physics Section; Dr. J. F. Thorpe, Professor of Organic Chemistry at the Imperial College, is to be president of the Chemistry Section; and Sir Josiah Stamp is to be president of the Economics Section.

Local Societies.—BIRMINGHAM ELECTRIC CLUB.—The following officers for the year 1926 were appointed at the annual meeting, held on December 18th:—President, Mr. A. E. Cunningworth; hon. treasurer, Mr. D. G. Brooks; hon. secretary, Mr. J. M. Dunkley; hon. social secretary, Mr. F. W. Martin.

LIVERPOOL ENGINEERING SOCIETY.—The annual dinner will be held at the Midland Adelphi Hotel, Liverpool, at 7 o'clock, on Thursday, February 4th. The Lord Mayor of Liverpool has accepted an invitation. Tickets (exclusive) will be twenty shillings each, and the dinner list will be closed on Saturday, January 30th.

Electrical Development.—In an interesting "talk" on this subject broadcast from the London station on Tuesday evening, Mr. D. N. Dunlop recalled that on a visit to an engineering works, Lord Kelvin once remarked to him: "I place no limit on the possibilities of the future; if man will only learn to be unselfish enough to be trusted with Nature's secrets." He proceeded to refer to the marvellous development of engineering since the time when James Watt occupied his little attic workshop, and declared that national progress depended more upon the use of electricity than on any other factor. In Watt's time men worked with their hands, and their horizon was restricted; now machinery did so much for them that few could realise what the world would be like without steam and electricity—such a city as London could not even exist. Power entered into every phase of their daily life—but they were not yet in a position to use electricity as freely as they should. The Government intended to introduce legislation to foster electrical development; all political parties were agreed as to its necessity, and such legislation, if effective, would confer countless benefits on the people, relieving them from drudgery and enabling them to develop those qualities which would make them a finer and nobler race.

Legal.—TELEPHONE MFG. Co., LTD., *v.* WM. SOUTTER & SONS, LTD.—Mr. Justice Greer, in the King's Bench Division on January 11th, heard an action by the Telephone Manufacturing Co., Ltd., against William Soutter & Sons, Ltd., of Birmingham, an action by the plaintiffs to recover from the defendants damages for alleged breach of warranty and misrepresentation.

Defendants counterclaimed for loss, which they alleged they had sustained through the cancellation of the agreement entered into between the parties in June, 1924, by which the plaintiffs were appointed the defendants' sole distributing agents for the sale of "Soutterware," a description of ironmongery manufactured by the defendants.

The plaintiffs' case was that the defendants represented that their sales amounted to some £30,000 per annum, upon the strength of which they spent large sums of money in advertising and getting the distributing organisation into working order, but that the defendants had dealt with the deliveries in such a way that orders were lost and plaintiffs were compelled to cancel the agreement. They accordingly asked for cancellation of the agreement and damages for the alleged neglect by the defendants to carry it out.

In the result, Mr. Justice Greer decided to send the case to an Official Referee, and made an order accordingly, the plaintiffs, through their counsel, agreeing that any charge of fraud they had originally made should be unreservedly withdrawn.

The Accident at Barking Power Station.—Referring to the accident which took place at the power station of the County of London Electric Supply Co., Ltd., at Creeksmouth, on December 14th, we have received the following particulars from the Company:—About 12 o'clock noon on Monday, December 14th, 1925, when the second line of a 40,000-kVA compound set was being run up, the cover of the governor valve was dislodged and fell through the floorplates on to the feed-pump gallery below, other pieces of metal of small section being at the same time scattered throughout the engine room in the vicinity of the turbine. Fortunately, the damage to the other equipment in the station was confined to the jamming of the governor gear on the other line of the same turbine, which was on load at the time. Three men (the driver, a pump attendant, and an employé of one of the contractors) received injuries, one of them having both legs fractured. The men were removed to the Poplar Hospital, and are reported to be making good progress towards recovery; in fact, two of them will, it is expected, be able to leave the hospital very soon.

The Company's supply was not interrupted, and the effect on the system was only slight, thanks to the Barking power house being interconnected with other generating stations.

The cause of the trouble has not so far been fully diagnosed, as, until the men concerned are fit to give evidence, those who are carrying out the investigations will be unable to arrive at any final conclusion.

From the foregoing it will be seen that the parts involved were of minor importance, and that the reports circulated in the first instance were exaggerated.

Electrical Association for Women.—The Association is arranging a musical afternoon at the Æolian Hall on January 23rd, when the application of electricity to the production of good music for the home will be fully demonstrated. Members and guests will be received at 3 p.m. by Mrs. Wilfred Ashley (vice-president of the Association), and later in the afternoon Mr. H. V. Spanner, Mus.Bac., F.R.C.O., a blind musician, will lecture on "The Place of Music in the Home."

The Economy of Railway Electrification.—The Interstate Commerce Committee is conducting an inquiry into the financial condition of the Chicago, Milwaukee and St. Paul Railway, and the *Electrical World* states that Mr. R. Beeuwkes, the company's electrical engineer, recently gave evidence showing that since electrical operation began, in 1916, up to the end of 1923 a saving of $12,400,000 had been effected. The total cost of electrification was less than $16,000,000. Mr. Beeuwkes estimated that it would take about two years to electrify the remaining 212 miles of the mountain section of the railway, if there were no interruptions. His opinion was that the company had been fully justified in the result of the electrification already carried out, and he believed that it would be profitable to convert the remaining stretch.

International Electrotechnical Commission.—The following important matters will come before the I.E.C. Advisory Committee at the meetings to be held in New York from April 13th to 22nd, 1926:—

1. Preparation of Part 2 of International Specification for Electrical Machines. (Large machines.)
2. General discussion on rating of electrical machinery, including presentation of papers by experts from various countries.
3. Preparation of a specification for traction motors.
4. Revision of the I.E.C. Publication 29—Hydraulics, including proposals for an International Specification for Hydraulic Turbines.
5. Preparation of an International Specification for Steam Turbines for driving Electrical Plant.
6. Completion of the list of International Graphical Symbols.
7. Preparation of an international basis for the testing of insulating oils.
8. Approval of the international standards for lamp caps and holders.
9. Confirmation of the list of international standard high pressures.
10. Preparation of international standards for high-pressure tests.
11. Preparation of an international code of rules and regulations for overhead lines.
12. Preparation of an international code of terminal markings.
13. Preparation of an international electrical vocabulary.
14. Some additional minor matters.

It will be seen that the questions under discussion at this meeting are of vital industrial interest to this country. Delegates will be present from all the principal countries, and information with regard to the meeting can be obtained from the Secretary of the British Electrotechnical Committee.

Women's Engineering Society.—A visit has been arranged for Monday, January 25th, to the Research Laboratories of the General Electric Co., Ltd., at Wembley. Those wishing to join the party should notify the secretary of the Society not later than January 20th. On February 12th Miss E. M. Kennedy will lecture on "Some Problems of the Machinery Market," and on March 12th Mrs. G. Shaw Scott, B.Sc., will lecture on "Women's Contribution to Metallurgy."

Tramway Equipment for New Zealand.—We learn from our New Zealand correspondent that new machinery is now on its way from England to that country for the Thorndon and Karori tramway sub-stations. It consists of automatic supervisory gear which will enable the whole of the plant to be controlled by an operator at the main station by means of an instrument of the automatic telephone type. This plant was described in the ELECTRICAL REVIEW for October 16th, 1925, page 621.

Institution Notes.

Institute of Metals.—The Institute increased its membership last year from 1,571 to 1,692. Such progress at a time of acute depression in the engineering and metal trades indicates that manufacturers are anxious to avail themselves of the latest scientific knowledge of metals with a view to meeting foreign competition. A ballot for the election of members and student members will take place on February 24th. Persons elected will be entitled to membership advantages for the extended period ending June 30th, 1927. Particulars of these advantages, and membership application forms, can be obtained from the secretary.

Institution of Heating and Ventilating Engineers (Inc.).—At a meeting held on January 6th, a paper was read on heating with hot water by Mr. J. R. Preston, who said that systems dispensing with mechanical power had in this country given way to electrically- or steam-driven pumps, largely because of the almost universal supply of electricity.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. FRANK GILL, M.Inst.C.E., M.I.E.E., has found it necessary, owing to an important engagement abroad, to resign his position as President of the National Association of Supervising Electricians. This decision is widely regretted, but the Association has been fortunate in securing as President Mr. A. M. Sillar, M.Inst.C.E., M.I.E.E., M.I.Mech.E. Mr. Sillar was formally introduced to the members at a meeting on January 5th, held at the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, by Mr. A. H. Dykes, M.Inst.C.E., M.I.E.E., a past President of the N.A.S.E. He will give his presidential address on the opening of the new session in October next. An account of the career of Mr. Sillar was published, together with his photograph, in the ELECTRICAL REVIEW for December 15th, 1922, in connection with his presidency of the Association of Consulting Engineers.

The *Daily Chronicle* states that Mr. N. ASHBRIDGE, B.Sc., A.M.Inst.C.E., has been appointed assistant-chief-engineer of the B.B.C. During the war he served with the Royal Engineers in France, and afterwards joined the Marconi Company as head of the Writtle experimental section, which he took over from Captain Eckersley when the latter joined the B.B.C. in 1923.

Dumfries Town Council has appointed Mr. W. ERSKINE as electrician for the ensuing year.

Kendal Town Council has increased the salary of the electrical engineer and manager by £44 to £450 per annum.

Subject to the proviso that no increase be granted to any official whose salary was advanced last year unless he has been promoted or has undertaken additional official responsibilities or duties, Manchester Corporation has accepted the following recommendation:—Traffic superintendent, tramway department, £981 to £1,000; permanent way engineer, superintendent, stores superintendent, parcels superintendent, chief claims clerk, carworks department, all of the tramway department, each from £703 to £750.

On January 6th the Liverpool City Council approved the appointment of Mr. H. A. W. WILLIAMS as turbine house superintendent in the electricity supply department at a salary of £425 per annum.

Beckenham Urban Council has decided to increase the salary of the electrical engineer and manager from £600 plus bonus, to £850 per annum, rising by annual increments of £25 to £1,000, as from April 1st, 1925.

In connection with the taking over of the local electricity undertaking by the Dalkeith Town Council, Mr. H. SMITH, at present employed at the station, has been appointed resident engineer at £286 per annum.

SIR GEOFFREY CLARKE, C.S.I., has been appointed to the board of the Telegraph Construction & Maintenance Co., Ltd., in the place of Mr. F. J. Lucas, who recently retired. He will act as joint managing director.

SIR A. HENRY MCMAHON, G.C.M.G., &c., has accepted a seat on the board of the Oriental Telephone & Electric Co., Ltd., and will take the chairmanship, in place of the late Sir George S. Gibb.

The *Board of Trade Journal* announces that, owing to ill-health, Mr. W. G. WICKHAM, Senior Trade Commissioner in South Africa, is relinquishing his position. Mr. N. ELMSLIE, Trade Commissioner in New Zealand, has taken up duty at Johannesburg pending the appointment of a successor to Mr. Wickham.

Science reports that DR. HARRIS J. RYAN, professor of electrical engineering at Stanford University, has been awarded the Edison Medal for the year 1925 by the Edison Medal Committee of the American Institute of Electrical Engineers "for his contributions to the science and the art of high-tension transmission of power."

On Friday last the Lancashire and Cheshire Tramways Authorities Council presented a grandfather clock and a trio of silver bon-bon dishes to Mr. JOHN BARNARD, M.B.E., the Bolton manager, to commemorate his silver wedding, and in recognition of his services as hon. secretary to the Council since its establishment.

Obituary.—MR. CONRAD W. COOKE.—We regret to record that Mr. Conrad William Cooke, M.I.E.E., passed away at Hampstead on Sunday last in his 83rd year. The deceased gentleman was for many years prominent in the consulting and electrical engineering world, but in recent times his activities did not bring him into such close touch with electrical affairs and those connected with them. It is by the older generation that he will be especially remembered, for it was just over fifty years ago (1872), after coming to London and entering into the partnership Whieldon & Cooke, engineers, of Lambeth, that, according to the published records, he introduced and made the first dynamo-electric machine (Gramme), and designed and installed the first electric light on the Clock Tower of the Houses of Parliament, which is stated to have been the first searchlight. He was joint author with the late Mr. James Dredge, of the celebrated work "Illuminating Engineering," and he was a regular contributor to the pages of our contemporary *Engineering* on electrical and physical subjects. He was very closely interested in the introduction of the incandescent mantle system of gas lighting. Mr. Conrad Cooke reported for *Engineering* the proceedings of the British Association at Glasgow in 1876, when Lord Kelvin described the invention of the telephone. He lectured at the Society of Arts in 1879 and gave them the first account of the Edison loud-speaking receiver. He was a witness for the defendants in the telephone case at Edinburgh, when it was first explained that the tilted diaphragm to the iron box receiver illustrated by him in *Engineering* and since incorporated in most text books, though accurate as regards the instrument shown by Lord Kelvin, was not in accordance with the design of the inventor. He also appeared as an expert witness in later cases, but took no active part in the development of telephony. As an expert witness in electrical and other technical cases in the Courts, his services were in frequent demand, while he was also a member of the Juries of many International Exhibitions. His numerous interesting additions to literature included a memoir of Gilbert of Colchester, and together with the late Prof. S. P. Thompson, he founded the Gilbert Club in the year 1889. The funeral service took place at Hampstead Parish Church on Wednesday, followed by cremation at Golders Green.

MR. C. G. DAY.—The death took place on January 2nd, of Mr. Colin George Day, who had for 17 years been secretary of Messrs. Mirrlees, Bickerton & Day, Ltd., of Stockport, of which his brother, Mr. Charles Day, is the managing director. He was 61 years of age.

MR. J. A. BRINELL.—The death recently occurred in Stockholm, at the age of 76 years, of Mr. J. A. Brinell, whose name was known throughout the world in connection with his ball hardness-testing machine. He also took a prominent part in metallurgical development in Sweden.

Will.—The late Mr. A. W. GATTIE left £1,208.

New Companies Registered.

Ormond Engineering Co., Ltd. (210,790).—Private company. Registered December 31st. Capital, £25,000 in £1 shares. Objects:—To adopt an agreement with E. J. L. Defosse, and to carry on the business of screw manufacturers and manufacturers of wireless components and accessories formerly carried on by the vendor as the Ormond Engineering Co. at 203, Pentonville Road, and 36, Whiskin Street, London. The directors are:—E. J. L. Defosse, 266, Green Lanes, Stoke Newington, N., engineer (permanent governing director and chairman); O. H. Delfosse, 21, Queen's Court, Wembley Park, engineer; Evelyn H. L. Townsend, 16, Claremont Square, Clerkenwell, secretary. Qualification, £100. Remuneration (except governing director) as fixed by the company. Registered office: 3, Throgmorton Avenue, E.C.

Bowden & Higlett, Ltd. (210,922).—Private company. Registered January 6th. Capital, £3,000 in £1 shares. To acquire the business of electricians and electrical engineers and mechanics carried on in Guildford as Bowden and Higlett, recently purchased by R. H. Tribe. The permanent directors are:—R. H. Tribe, Highfields, Nightingale Road, Guildford, builder; C. G. Howard, Kingsby, Bray Road, Guildford, electrician (managing director). Qualification, £50. Remuneration as fixed by the company. Solicitors: Smallpiece & Merriman, Guildford.

Official Returns of Electrical Companies.

Victoria Electrical (Manchester), Ltd.—R. N. Brookes, C.A., of 6, Princess Street, Manchester, was appointed receiver on December 28th, 1925, under powers contained in debenture dated January 28th, 1922.

Medway's Safety Lift Co., Ltd.—Second debenture dated December 22nd, 1925, to secure all moneys due and to become due not exceeding £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder:—J. and E. Hall, Ltd., 10, St. Swithins Lane, E.C.4.

Charles Fitz-Hugh, Ltd.—Particulars filed of £500 debentures authorised December 23rd, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

C. & J. Arrigoni & Co., Ltd.—Particulars filed of £100 debentures authorised December 4th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the extent of £6,876 on December 22nd, 1925, of debenture stock covered by trust deed dated June 28th, 1905, and a supplemental deed of acknowledgment dated June 12th, 1907, securing £200,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

International Automatic Telephone Co., Ltd.

An extraordinary general meeting was held on January 5th, when the proposals outlined in our issue of December 11th (p. 946) were considered. Sir Alexander Roger (chairman), who presided, said that the proposals marked an important stage in the company's progress. The telephone field was engaging the attention of new interests, and fresh efforts were being made all over the world to accelerate the development of the telephone. In order for the company to keep abreast of its responsibilities and opportunities it was necessary to raise fresh capital. The association of the company and the Automatic Telephone Mfg. Co. had resulted in a period of marked prosperity for them both; this association was made possible by the co-operation and assistance of Messrs. Theodore Gary and Co., who, as a consideration, were given an option to purchase 360,000 ordinary £1 shares of the company at 30s. each. The directors considered that the removal of this option would be in the interests of the shareholders. It was accordingly proposed that, in lieu of the option, Messrs. Gary & Co. should be offered, in the first instance, 360,000 of the 640,000 new ordinary shares which were to be created, at the price of 30s. per share. It was the intention of the board to issue in the near future shares, numbering probably 60,000 and not exceeding 140,000, in connection with certain trade investments already arranged or being negotiated. It was also necessary to alter the articles of association. The chairman then formally moved the resolutions; they were seconded by Mr. D. Sinclair, vice-chairman, and unanimously adopted. At a subsequent meeting of ordinary shareholders the resolutions were sanctioned and assent was given to the variation of their rights.

Vickers, Ltd.

The resolutions passed at the meeting held on December 17th (*vide* ELECTRICAL REVIEW, December 18th, p. 989, and December 25th, p. 1026) came before an extraordinary meeting on January 5th for confirmation. Mr. Douglas Vickers (chairman) presided, and said that the following shareholders had been invited to confer with the company's advisers:—Mr. Albert, senior managing director of George Senior & Sons, Sheffield; Mr. C. E. Siddall, chairman and managing director of the Sheffield Forge & Rolling Mills Co.; and Sir John F. Beale, a director of Guest, Keen and Nettlefolds, Ltd., and other companies. The resolutions were then formally moved. These, it will be remembered, provided for the reduction of the ordinary capital, the reorganisation of the board, the formation of three separate management boards, the winding-up of unremunerative subsidiaries, &c.

A shareholder endeavoured to move a resolution declining to sanction the proposed reduction of capital and appointing a committee of investigation to examine the financial transactions of the company. He was, however, ruled out of order and the original resolutions were confirmed by a large majority.

Electrolytic Zinc Co. of Australasia, Ltd.—A dividend at the rate of 12 per cent. has been declared on the preference and ordinary shares in respect of the half-year ended December 31st last.

The annual meeting was held at Melbourne on October 27th, when Mr. W. L. Baillieu, the chairman, said that apart from the zinc industry the company had been able to satisfy all the demands made upon it for superphosphate. This product was of a high uniform standard and the business was rapidly expanding. The directors had been able to increase the dividend and the financial position was such that there was every prospect of maintaining the rate.

Stock Exchange Notices.—Dealings in the following securities have been specially allowed by the Stock Exchange Committee under Rule 159:—

Crittall Manufacturing Co.—22,535 ordinary shares of £1 each, fully paid, Nos. 427,466 to 450,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Montreal Tramways Co.—$17,826,500 series "A" 30-year 5 per cent. general and refunding mortgage sinking fund gold bonds, Nos. M1 to M8,599 and M8,601 to M15,902 ($1,000), D1 to D2,750 ($500), and C1 to C5,505 ($100).

Chili Telephone Co., Ltd.—An interim dividend of 3s. per share, free of tax, has been declared.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are once more unsettled by the apprehension of a possible rise in the Bank Rate. So many millions of money have been required during the past few weeks for the purposes of new issue flotations that it has been fairly apparent to many people that the drain of money could not go on indefinitely without the money market being affected sooner or later. A great deal of the capital required during the past couple of months has been for interests outside the United Kingdom; British money has flowed into foreign loans raised without any proviso that the cash, or part of it, should be employed in this country for the encouragement of trade.

In these columns we have suggested that there is plenty of scope for employment of considerable sums of money in the various branches connected with electrical work, railway power, equipment, &c., and that the investment of British money in bonds and shares of American utility companies is a policy which has disadvantages from the patriotic point of view. Since the embargo was removed by the Government from the issue of foreign loans in this country, there has been a not unnatural scramble on the part of promoters to raise as much money as possible through the foreign issues which are so readily absorbed by British investors. The experience of the past few days is alone sufficient to emphasise the readiness with which the British investor subscribes to any stocks, foreign or otherwise, that appear to him to be cheap.

The electricity supply market is firm, with rises in several of the London shares. Kensingtons are ¼ better at 13½, St. James's have hardened to 15⅝, and Westminsters are 2s. up at 2½. Charing Cross strengthened to 49s. 6d.; Chelseas to 2 3/16. Countys are once more over £3. Deduction of the dividends from prices of several of the preference shares is being recovered, and the market is firm throughout. The warning is raised in several quarters against shareholders expecting too much from their boards of directors in regard to forthcoming dividends. Some of the financial guides maintain that prices in this section are already too high, as compared with those that rule for other sound industrials. Certainly the existing level of shares in home electricity supply companies offers temptation to those who recognise the discretion of taking a good profit upon the original purchase prices, but, in spite of this, the outlook is sufficiently promising to justify proprietors in keeping at any rate the greater part of their shares, though they may elect to sell a proportion in order to lessen the cost of the remainder.

The Home Railway market has been better, and the Undergrounds hold their improvements, although the stocks of the steam companies show a tendency to dwindle. The strength of the market is ascribed to dividend anticipations that, at the moment, are rather more optimistic than they have been of late. Underground "A" shares rose to 7s. 6d. Metropolitans and Districts are both better.

International Telephones are a strong market at 45s. Since the re-arrangement of the company's agreement with the American firm of Messrs. T. Gary & Co., the price of Internationals has gone sharply ahead. Automatics are 2s. 6d. up at 53s. 9d. Marconis have developed a firmer tendency, and the price of the parent shares is 1/16 better, at 26s. 3d. Marines are unchanged at 17s. 6d. Cable stocks exhibit little change.

Manufacturing shares are unusually quiet. The reaction in the price of raw rubber is deemed to be a bull point for the companies that use large quantities of the produce, but, in view of the likelihood of recovery in Mincing Lane, the investor in "equipment" shares prefers to go slowly as regards fresh purchases. Edison 5 per cent. debenture is quoted at 83 ex dividend, a price at which the yield on the money comes, once again, to a shade over 6 per cent. General Electrics remain at 29s. 3d. Babcock & Wilcox have strengthened to 51s. 3d. bid. The iron and steel market, with that for engineering shares, shows a disposition to improve: the argument is that prices can hardly be expected to go much lower than the existing range, and this suggests, of course, an expectation of recovery.

While Mexico Tramways fives have risen a point, Mexican Light & Power Firsts are again 1½ down. Brazilian Tractions put on a modest fraction; British Columbia deferred has regained the dividend taken off the price last week. Business in rubber shares has dwindled very appreciably, and the Stock Exchange as a whole is inclined to blame the Bank Rate uncertainty as being the cause for the quietude of trade that prevails in most of the markets round the House.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Jan. 11 1926.	Rise or fall.	Yield p.c.
Bournemouth and Poole	1	13	14	59/6	—	4 14 1
Brompton Ordinary	1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	1	14½	15	49/6	+9d.	6 1 3
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2 3/16	+1/3	5 9 9
City of London	1	15	15	50/9	—	5 18 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	29/6	—	5 8 6
County of London	1	15	15	60/9	+1/3	4 18 9
do. do. 6% Pref.	1	6	6	22/-xd	+6d.	5 9 1
Edmundson's Ordinary	1	7	7	24/6	—	5 14 8
do. 7% Pref.	1	6	7	21/6xd	+6d.	6 10 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	13½	+¼	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	10	33/6	—	5 19 5
do. do. 6% Pref.	5	6	6	5 5/16	—	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6xd	+6d.	5 2 10
Midland Counties	1	5½	6	28/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	22/6	—	6 4 5
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½xd	+¼	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅝	+⅛	5 12 0
South London	1	15	15	2⅜	—	5 18 1
South Metropolitan Pref.	1	7	7	1½	—	5 12 8
Urban Ordinary	1	4	4	18/3	—	4 7 8
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	2½	+2/-	6 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—	7 13 10
Yorkshire Elec.	1	8	8	30/6	—	5 5 0

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	"	4	5	69½	+½	7 3 11
do. District	"	3½	3½	48½	+1	7 4 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	7/6	+6d.	Nil
do. do. Income	Bonds	6	6	98	—	*6 2 5

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	25	+⅛	6 0 0
Automatic Telephone	1	3	6	53/9	+2/6	2 4 10
Chili Telephone	5	6	5	6 7/8	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 9
Eastern Extension	10	10	10	17⅜xd	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	176¼xd	+½	*5 14 0
Globe Tel. and T. Ord.	10	10	10	18½	−⅛	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	89	—	6 18 4
Indo-European	25	7	8½	45½	—	*4 18 5
Marconi	10	10	10	1 7/8	+1/3	7 12 4
Marconi Marine	1	10	7½	7	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	5	8	8	7 1/8	—	5 2 5
Western Telegraph	10	10	10	18	—	*5 11 1

HOME AND FOREIGN TRAMS, &C.

Anglo-Arg. Trams First Pref.	5	5½	5½	8¼	—	8 9 2
do. do. 2nd Pref.	5	6	6	8 1/8	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	"	6	6	119½	—	5 0 0
do. do. 6% Pref.	"	6	6	105	—	5 14 3
Brazil Traction	100	4	4	85½	+½	4 13 7
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	83½xd	—	5 19 9
do. do. Preferred	"	96/-	96/-	102½xd	—	*4 12 8
do. do. Deferred	"	129/5	129/5	127xd	+8½	*5 2 4
do. do. Deb.	"	4½	4½	77	—	5 10 5
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	8/6	—	Nil
London United Tram. Deb.	Stock	4	4	40½xd	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	62½	+1	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	69	−1½	7 4 11
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	51/3	—	*4 13 4
British Aluminium Ord.	1	5	10	38/-	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	
British Insulated Ord.	1	15	15	2 1/16	—	5 6 3
Brush Ord.	1	10	10	28/-	—	7 2 10
Callenders	1	15	15	3½	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9xd	+6xd.	5 9 5
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	9/3	—	4 6 6
do. 5% Deb.	Stock	5	5	83xd	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½xd	+6d.	6 0 0
English Electric	1	5	5	19/3	—	5 3 11
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	5	7½	29/3	—	5 2 7
Henley	1	15	16	3½	—	4 11 5
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1 1/16	—	*4 14 1
Johnson & Phillips	1	10	10	56/3	—	3 11 1
Met-Vickers, Ord.	1	8	8	27/-	—	5 18 6
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	35/-	—	4 5 9
Telegraph Construction	12	20	20	27	—	*4 9 0

*Dividends paid free of Income Tax.

A Hospital Radio Installation.

A Large Igranic Receiving Outfit at the London Hospital.

IN connection with the equipment of hospitals in this country with broadcast radio receiving apparatus, under the *Daily News* scheme, for the entertainment of both patients and staff, the installation recently completed at the London Hospital is worthy of notice. As the hospital is the largest in the United Kingdom, a set of unusually large size had to be provided, it being capable of serving 1,000 listeners at different points.

The receiving apparatus, which has been designed and presented by the Igranic Electric Co., Ltd., is housed in an asbestos-lined hut on the roof of the institution. It employs 16 valves and is operated through the agency of relay mechanism

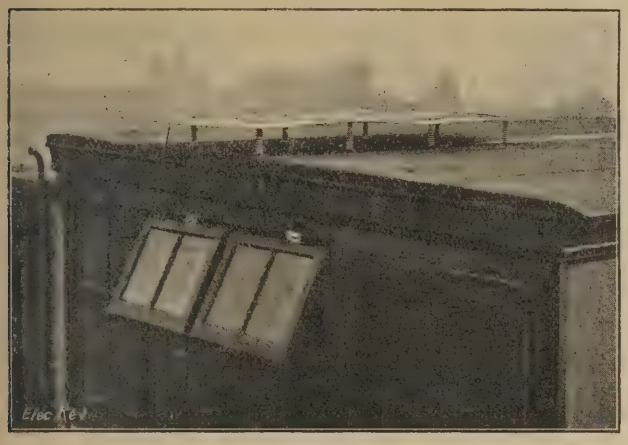


Fig. 1.—Plate Aerial on Roof.

controlled by a tumbler switch in the porter's lodge. The various wards have been wired into nine distinct circuits, eight of which supply 842 pairs of headpnc es, whilst the ninth actuates a series of loud-speakers in the children's wards.

The Receiver.—As indicated in fig. 1, a sheet of metal fixed to the roof of the hut serves as the aerial for an Igranic 6-valve super-heterodyne receiver (illustrated in fig. 2, with the glass covers removed), the wiring arrangement of which is similar in essentials to that of the standard model. By employing various combinations of terminals it is possible to use a variety of signal input circuits. Thus, either the recently developed twin-winding frame aerial, or a simple frame, may be used directly coupled or else *viâ* the intermediary of a two-circuit tuner. Alternatively, any form of open aerial may be used, either directly or variably coupled, as before. The comprehensive nature of these arrangements facilitates the treatment of any regional interference on the lines best suited to its elimination.

The initial valve (an Osram DH5, working at 60 volts) functions in the dual capacity of oscillator and rectifier, a capacitative balancing system permitting the signal-frequency and oscillator-frequency circuits to be worked without mutual interference. The use of this system not only dispenses with one valve, but also restricts the amount of locally-generated energy passed into the aerial circuit, so reducing the possibility of radiation to negligible terms.

This valve communicates with three stages of intermediate-frequency amplification, each of which employs a form of reactance-capacity coupling adjusted to a wave-length of some 6,000 metres. This wave-length would seem to be the most satisfactory choice when it is intended, as in this case, to effect reception from stations using waves up to 2,000 metres in length, for it implies a desirably substantial frequency difference between the two channels of signal acceptance, whilst the copper losses remain low and the unwanted electrostatic couplings are of high reactance.

Great importance attaches to the resonance curve of the intermediate-frequency amplifier, for it is said that in no other practical receiving system is there the same opportunity of maintaining the most satisfactory selective condition throughout the entire range of received signal wave-lengths.

In the instrument under review it has proved possible by proportioning the l.c. ratios and damping factors to effect a form of band filter which cuts off sharply at the outer limits of the useful sidebands emanating from the transmitter. This is the condition of maximum selectivity consistent with faithful telephony. The characteristics of the band filter are, of course, entirely independent of the signal frequency and remain unaffected by any change of signal wave-length, since the frequency at which amplification is conducted remains constant.

As the result of an extinction of limiting couplings between the intermediate-frequency stages, the designers have been able to cascade three Osram DE5B valves, working at 120 volts, and to employ their high M value to the maximum in each stage without instability or resorting to the deliberate introduction of losses as a means of suppressing undesirable oscillation. Indeed, so stable is the amplifier claimed to be that it has been possible to impart to the grids of the intermediate-frequency valves a negative bias of 1½ volts in order that no grid current shall flow and so encourage premature rectification and consequent distortion.

A novel arrangement is used to apply reaction to the amplifier when desired; the potential gradient between the grids of the first and second amplifying valves is controlled by means of a variable non-inductive resistance having a maximum value of one megohm. The third intermediate-frequency stage delivers to the final rectifier (an Osram DE5B working at 120 volts) the grid of which is maintained at a positive potential so as to stimulate the flow of grid current that is essential for cumulative rectification.

The single stage of note amplification of the super-het receiver is not included in the hospital set, since the latter is attached to a special power bank amplifier as shown in fig. 2.

Although, by virtue of the very high amplification available, the plate aerial proves effective for full-load reception from a number of stations, higher selectivity and responsiveness are obtainable when the patent frame aerial is employed. The latter is collapsible for portability and performs an interesting secondary function, for it eliminates interference set up by stations using wave-lengths in, or near, the band to which the intermediate-frequency amplifier is responsive. It embodies two geometrically parallel windings consisting of an equal number of turns, one winding being tuned to the signal frequency by means of a condenser in the receiver, while the other is wound in the opposite sense and not tuned. The two windings are so arranged in the receiver circuit that the arrival upon the frame of a widely non-resonant frequency results in the simultaneous formation of two potentials of equal voltage and opposite sign, a condition producing mutual cancellation and elimination of the long-wave interference to which super-heterodyne sets working on directly-coupled frame aerials have always been subject. On the other hand, when dealing with resonant frequencies the responsiveness of the tuned winding rises to a maximum, while that of the untuned winding remains low; hence there are no opposing effects and reception from desired stations is therefore in no way effected.

The Power Bank Amplifier and Distribution Scheme.—In the power bank amplifier the secondary winding of the input trans-

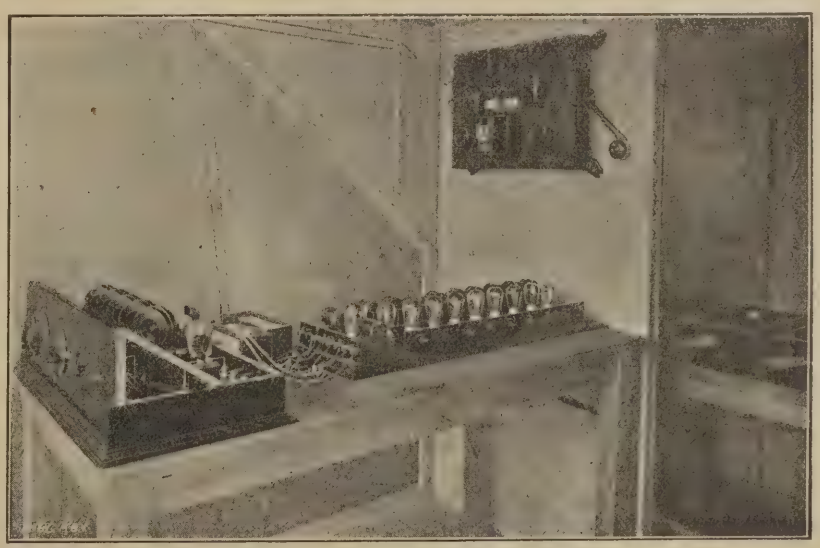


Fig. 2.—Super-heterodyne Receiver and Power Amplifier.

former is common to nine valves; the anode circuit of eight of them contains an output transformer, the secondary winding of which is earthed at its centre point in order to maintain the output leads at balanced potentials. The impedance of the various output circuits has been approximately equalised and it is such that, considered in relation to the anode impedance of the Osram LS5 valves, 7 to 1 step-down transformers were designed. Since the capacity of the line is reflected across the primary winding of its associated transformer inversely as the square of the ratio of transformation, it may be as high as 0.1 mfd, without seriously impairing the amplitude of the higher frequencies. This figure is not attained

at the London Hospital and even on the longest line there is no interference with the tonal balance.

The ninth valve delivers *via* an appropriate transformer to an Osram LS5A valve, the anode circuit of which is coupled through an output transformer to a number of Amplion loud speakers. An indication of the input voltage swings which are qualitatively permissible (and desirable to ensure a reasonable safety factor) is provided by the fact that a negative bias of 45 volts is imparted to the grid of each of the LS5 valves, while the grid of the LS5A valve is negatively biased to the extent of 120 volts. The anode current to all the valves in the power bank is supplied at a pressure of 300 volts.

The output lines are paired off and run in lead-covered cables, all the coverings being bonded and earthed to obviate induction effects. Each headphone circuit is sub-divided into four or five ward sub-circuits at appropriately placed junction boxes, and in the event of a local fault it is therefore possible to isolate any ward expeditiously without detriment to the main service. Some idea of the magnitude of the installation may be gauged by the fact that about 15 miles of lead-covered line had to be laid to carry the current from the radio hut to the bedside headphones and loud speakers in every part of the hospital.

Although primarily intended for reliable reception from the London and Daventry stations only, the plant is able to give a full-load service from a number of European broadcasting stations.

Batteries and Charging Mechanism.—The filaments of the receiver and power-bank valves require a total current of 10 amperes at 6 volts, while the combined anode requirements account for 150 milliamperes at 300 volts, a 3-ampere-hour accumulator providing the latter supply.

The batteries are housed in an isolated and separately ventilated section of the instrument hut. Practical considerations dictated the provision of two motor-generator sets for charging purposes and they are also installed in the battery compartment of the hut. No. 1 set has an output of 15 amperes at 10 volts, and No. 2 set delivers 0.3 ampere at 350 volts.

Since the apparatus has been designed to provide a possible 14-hour reception programme daily, it was necessary to adopt means of expeditiously conducting the charging operation; to this end the action of the motor generators is governed by Igranic automatic controllers. Directly the receiver is switched off, the controllers start the generators and the charging current, *inter alia*, drives a small mercury motor that communicates with an indicator which registers the extent to which the ampere-hour capacity of the batteries is satisfied. When the indicator is driven to the position denoting a complete charge, a relay is tripped and the charging circuits are broken. If the receiver should be switched on during the charging process, the generators will automatically stop and resume their task when the receiver is switched off.

The employment of this mechanical battery attendant, coupled with the fact that the two essential tuning adjustments of the receiver are normally fixed for reception from Daventry, eliminates the necessity for skilled attention.

Australian Trade and Industry.

The Growth of Home Production.

A REPORT upon the economic and commercial situation of Australia has been forwarded to the Department of Overseas Trade by Mr. R. W. Dalton, Senior Trade Commissioner in the Commonwealth.*

In his opening remarks Mr. Dalton says that in general conditions in Australia during the past 12 months (*i.e.*, to June, 1925), were very favourable and production was at a high level. Mention is made of the gradual drift of the small population of Australia to the large cities, and it is said that the development of manufacturing industries by a system of high protection has intensified this drift, and will probably continue to do so. This aspect of Australia's life is not without considerable interest and importance from an economic point of view, and it is also one which must be taken into account in the consideration of commercial organisations for the development of trade. In the early part of the year 1924-25 the financing of industry and shipment was attended by considerable difficulty; the position later improved and is now much easier. Regarding the general financial condition of the Commonwealth, Mr. Dalton states that at the last annual conference of the Associated Chambers of Commerce, a resolution was passed emphasising the paramount importance of the restriction of expenditure and public borrowing to reproductive public works. The resolution also deplored the action of the Government in treating as revenue that proportion of State loans which represented the amount of Customs duty paid by the State to the Commonwealth, on plant and machinery imported for State use.

Manufacturing Industries.

Statistics are given in the report indicating the rapid development of manufacturing industries in Australia during the last few years, and the undoubted desire to intensify this development. It is shown that the number of factories increased from 18,023 in 1921-22 to 20,189 in 1923-24, and the number of hands employed from 395,425 to 429,990. The value of plant and machinery increased from £78,085,680 in 1921-22 to £99,552,539 in 1923-24. Mr. Dalton says that Australian industries on the whole are advancing in the satisfaction of home demand. The output of Australian factories per head of the population is very much in excess of the imports per head. This is a feature of Australian trade which is often overlooked, the belief being widespread that the import trade is very much more serious than it actually is in competition with Australian industries. A more or less detailed list of the various classes of industry appears in the report, from which it is gathered that the number of factories producing metalwork, machinery, &c., in 1922-23 was 2,349, with a total output value of £51,038,984. In another section, "Heat, light and power," the number of works is given as 590 and the total value of output £13,467,604. Apart from industries in connection with the production of food and drink, by far the most important industries in Australia are those connected with the manufacture of goods from metals and textiles. There has been a rapid development in these in the last few years; as regards the former, particularly in iron and steel. It has been maintained by these industries that they have to face very severe competition from imported goods, and they have made persistent requests for increased protection, which is likely to be accorded them. Considerable added protection has already been given them, particularly by the tightening up of the regulations with regard to the percentage of British labour required to qualify for preference and by the application of the Industries Preservation Act. A number of branch factories of British firms have been established in Australia, and during the past year many representatives of other British firms have visited the country in order to ascertain what possibilities of success might attend the establishment of additional factories. In some outstanding cases, the establishment of such factories has not been successful—sometimes due to over-capitalisation, high production costs, uncertainty of labour conditions, and lack of demand. It will soon be necessary, even if it is not now necessary, for Australian industries in certain sections to find an export outlet for their goods.

Tariff Questions.

Most of the secondary industries of Australia have made persistent demands during the past year for increased tariff protection, and the Tariff Board which was made permanent by Act of Parliament during the last session, has been busy throughout the year hearing applications in connection with a large number of classes of imports. During the year there was a great deal of complaint by Australian manufacturers regarding the importation of British goods containing a large proportion of foreign material, and it was contended that the requirement of only 25 per cent. British labour or material, or both, to qualify for British preference, was much too small. The Minister of Customs therefore decided to alter the basis on which preference was given, and it was at first thought that the new regulation would make the requirement for preference 75 per cent. British labour, or material, or both, but after discussion this view was modified. There has been, and still is, a good deal of misconception as to the requirements of the new regulation, many importers in Australia and exporters in Great Britain appearing to believe that there is an all-round 75 per cent. requirement. This is not the case. If no process of manufacture has been carried out abroad which could be carried out in the United Kingdom there is no specification of the percentage of British labour or material required to qualify for preference. That is, supposing that in £100 value of goods shipped no labour was applied to the goods abroad which could have been applied in the United Kingdom, as much as £99 might represent foreign raw material if the remaining £1 represented British labour, and still the goods would be admitted for preference. On the other hand, if any process of manufacture were carried out abroad which was commercially practicable in the United Kingdom, then if the goods were of a class made in Australia, 75 per cent. United Kingdom labour or raw material, or both, would be required to qualify for preference; thus, if in £100 value of goods 6d. represented labour carried out abroad which could have been carried out in the United Kingdom, £75 at least would have to represent United Kingdom labour or material before the goods would be admitted to preference. In cases of goods of a class or kind not made in Australia, in which foreign processes have been applied which are commercially practicable in the United Kingdom, the old "25 per cent. United Kingdom labour or material, or both" requirement still obtains.

Electrical Machinery Imports.

The report states that the total imports of machines and machinery into Australia in the year 1923-24 were valued at £12,716,184, as compared with £10,963,874 in the preceding

* Stationery Office. 2s. net.

year. No separate total for electrical machinery is given, but the chief sections of the electrical trade are set out. It is shown that the two most important items were cables and wires of all kinds, amounting in value to £1,274,274, of which the United Kingdom supplied £1,240,088; and dynamo-electric machinery valued at £990,351, the United Kingdom's share being £613,153 and that of the United States £271,041. Complete lists of Australian electrical imports in the years 1922-23 and 1923-24 appeared in our issue of July 10th, 1925 (page 76).

Trading Methods.

Although the population of Australia is only about 6 millions, the Commonwealth is Great Britain's second largest export market—a fact that should be sufficient to attract the attention of firms in the United Kingdom and to lead them to look more closely into the possibility of development of this very valuable market. Close study of the market is necessary, for the difficulties of organisation facing any firm which sets out to extract the maximum amount of business from the Commonwealth can only be realised after first-hand investigation. The placing of agencies requires most careful consideration and appreciation of the differences between the various States. There are some well-known firms of agents which have their own branches throughout Australia, and with which agencies may safely be placed. These firms, however, are relatively few and are accordingly well supplied with agencies and are often unable to consider further offers. It is desirable, therefore, if not essential, to consider carefully the appointment of separate agents in each State. It is not sufficient merely to give an agency to a firm in Melbourne or Sydney for the whole of Australia merely because it asks for it, as the firm's organisation may be totally inadequate to cover the whole of the Commonwealth. Mr. Dalton says that many British firms of high repute have been seriously prejudiced in Australia by the appointment of agents who would never have been appointed had the exporting firms taken proper steps to understand the trading organisation of Australia, and to ascertain the standing and experience of the agent in question.

Magnetic Separation Plant.

By Col. B. I. ROLLING, D.S.O.

(*Abstract of Paper read before the* INSTITUTION OF CHEMICAL ENGINEERS.)

A GREAT variety of trades are interested in the possibilities of magnetic separation, but there is a paucity of literature on the subject. There are three uses for such separation :—

1. The concentration of weakly-magnetic ores—high intensity separation.
2. Slag reduction and the reclaiming of unburnt coal.
3. Removal of iron content from scrap material or from flowing material, *e.g.*, grain, sugar, for refining clay, chemicals, &c.

Of modern mining processes for grading out a mass of material into classes according to the relative susceptibilities to intense magnetisation, one of the most effective under certain conditions is magnetic separation. Many valuable minerals contain iron, sometimes in minute quantities, but generally in a sufficient amount and in a form which permits them (in a raw or roasted condition) to be influenced by a magnet.

Wetherill's separator was originally designed for the handling of raw ore containing valuable, or very weakly magnetic, minerals; later it was adapted for the removal of roasted pyrites from zinc blende, &c., as its capacity on such highly magnetic material is very large and costs for power and labour extremely low. The dry material to be treated flows on to the feed roller, which spreads it in a thin uniform layer over the whole width of the conveyor belt, as it travels towards the poles of two horse-shoe electromagnets, arranged one above the other. The poles of the upper magnet are forged in the form of a sharp wedge, while the lower ones are flattened. The principle is characterised as "sharp against flat," and it is the high magnetic concentration on the upper pole caused by the converging field which enables the separator to treat very weakly magnetic material. The magnetic force of the upper wedge-shaped pole supersedes that of the lower, so that the magnetic particles are strongly attracted towards the upper pole, but are intercepted and prevented from reaching the upper pole by a cross-belt which removes them quickly from the field and allows them to drop into a receptacle at one side.

The removal of the magnetic particles is assisted by mounting a sharp piece of iron on the front part of each upper pole; by means of this horn the influence of the magnetic field on the particles being removed is gradually decreased. These separators may be constructed with one, two, or three double magnets giving two, four, or six poles, each double magnet having a rheostat for regulating the current strength. A take-off belt is provided for each pole, and a single feed conveyor belt for the entire machine.

This form of separator is durable and accessible, and when once adjusted to the requirements of a particular ore, it will operate continuously at a nominal cost for the renewal of wearing parts. The use of a series of magnets of different strengths permits the separation from one another of materials having different magnetic permeability, as well as the separation of the magnetic from the non-magnetic. The separate removal of the strongest as well as the very weakest magnetic minerals is thus obtainable. All ferrous ores, whether oxides, sulphides, or arsenical, are susceptible to magnetic concentration.

In the concentration of ores, consistent sizing plays a very important part. Ding magnetic separators extract by means of a revolving disk directly above the conveyor belt which carries the ore through the magnetic zones of the separator. The capacity of a magnetic separator is in direct inverse ratio to the mesh to which the ore is crushed. Another factor which determines the capacity of the separator is the reluctance of the mineral to magnetic flux. Pure iron furnishes the least resistance to magnetic flux and each impurity adds to the resistance offered to the flux passing through it. To extract iron filings from brass chips, for instance, requires only a weak magnetic field, but wolframite requires a separator in which the magnetic lines of force are concentrated upon knife edges that produce zones of magnetic flux which virtually saturate the gap between the poles through which the ore must pass.

It was customary, before high-intensity machines had been exploited sufficiently, to subject zinc ores to a substantial "sweet" roast in order to oxidise them thoroughly, thereby making the iron sulphides perceptibly magnetic, and in so doing making it possible to extract them by means of a medium-intensity machine. Great waste resulted because with high-intensity machines only a very light "skin roast" is required, and therefore not only is the final zinc content of the finished product raised, but the roasting costs are cut and the high percentage of sulphur in the iron sulphide permits of its being utilised for the manufacture of sulphuric acid.

In the zinc fields of South-Western Wisconsin, concentrating plant, which previous to the application of high-intensity magnetic separators had tailing piles averaging from 2 to 5 per cent. zinc, the loss has been reduced to less than ½ to 1 per cent. and the content of the finished ore has been raised from 57 to 63 per cent. Iron sulphides have found a ready market at acid plants and bring from 21s. to 35s. per ton. Formerly the latter was not only a direct loss but also required fuel to burn off the sulphur, and incidentally also encouraged lawsuits arising from the destruction of crops and vegetation in surrounding districts.

For separating slags containing iron from coke and other fuel residues, the wet process is cumbersome and of small efficiency; the plant is expensive, the working cost high, and valuable quantities of fuel are lost.

The greater part of the fuel residues which are no longer combustible possess magnetic properties; the fuels contain iron compounds to a small extent (*e.g.*, pyrites) which are converted in the fire to various oxides of iron and appear in the ashes and slag as silicates by fusion with SiO_2, and it is possible, by passing the ashes through a highly-concentrated magnetic field, to recover the coal as a non-magnetic product.

This process can be carried out dry, whereby subsidiary plant, such as dehydrating apparatus, pumps and large settling tanks, are dispensed with, and only 1 kWh of d.c. energy is necessary to separate one ton of ashes. Even the finest material can be treated and the fuel contained therein easily recovered. Also it permits of the recovery of the coke and unburnt coal in an easy and cheap way from ash and slag wastes from industrial works, railways, shipping, and from refuse. Recovered fine particles of fuel can be made up into "briquettes" or directly fired as powdered fuel.

In view of the simplicity of the equipment, it is possible to build a profitable plant for a very small output, such as would not be possible in the case of a wet mechanical plant. The economic advantage of the magnetic process becomes much more apparent, however, when the greater yield of coke and unburnt coal is taken into consideration. When we realise the huge quantities of fuel residues produced annually in industry, traffic organisations and households, we perceive that the magnetic process is capable of bringing about great national economies. The most common application of magnetic separators is the separation of material of high magnetic susceptibility. Machines are liable to be damaged by the presence of iron or steel, in the form of nails, bolts and nuts, &c., which are also in many cases detrimental to the finished product. One of Messrs. Christy Brothers' machines, capable of extracting iron from materials such as cotton seed, destructor clinker, bones, &c., has a shaking tray which serves the double purpose of distributing the feed uniformly, and also causes the iron to sink to the bottom of the stream by gravity. It then rides over the slowly revolving magnetised cylinder, when the non-magnetic material falls down in front, and the iron is carried round past the bottom and falls at the back. The release is effected by two commutators, one at each

end, breaking the electric current which energises the magnet coils, just as each row passes the bottom; the commutators also connect each row as it passes the top, thus magnetising them again.

The stud feature is used by the Rapid Magnetting Machine Company. The belt is studded with conical "feelers" which become magnetic when passing over the drum, thereby increasing the magnetic field. "Igranic" magnetic separators are employed in a large number of sugar plants to remove iron rust or oxide from animal charcoal, a contamination produced while passing through the "char" burners, so that trouble with iron colouring in the sugar is prevented.

The use of powdered or pulverised fuel has led to the need of magnetic separators in cement works, steel works, power houses, and many other kinds of plant. A pulley made by the Igranic Electric Co. consists of a number of steel disks keyed to a shaft, an electromagnet winding being placed between alternate disks. The magnetising coils are wound on steel bobbins, which are dowelled to the disks to prevent shifting. The coils are all connected in series and terminal wires brought through a hole in the centre of the shaft to a pair of collector rings. The coils are impregnated with a moisture-repelling and insulating compound by the vacuum process, and the space surrounding them is filled with the same compound poured in the molten state during assembly. A tubular brass spacer, which also performs the function of a coil shield, is placed between the adjoining steel disks.

In designing such pulleys, it must be borne in mind that dimensions and weight are not the only features. Less copper and more steel secures a cheaper construction, while an abundance of copper may be spoiled by a lack of steel in the magnetic circuit. A small reduction, as from 100,000 to 90,000 lines per square inch, reduces the pull to 81 per cent. The windings, if placed near the shaft instead of near the outside of the pulley, will require much less copper, but the efficiency will be reduced on account of excessive leakages. Large diameter pulleys will, in every case, give better results than those of small diameter, and the wear and tear on the belt is less. Good practice allows 3 in. of diameter per ply; for example, 18 in. diameter for a 6-ply belt. Small diameter pulleys, however, have a lower first cost, and where a short belt is installed their use is permissible. Where conveyor flights are long, and especially where the magnetic pulley is a driving pulley for the conveying-belt system, it is frequently economical to use a large diameter narrow-face pulley because of the saving effected in the cost of a narrow belt.

For removing iron from metal turnings, dust, and similar materials containing a large percentage of iron, the feed tray is oscillated sidewise, and the delivery end is serrated to distribute a regular stream of material on to the whole width of the revolving brass drum, which has ridges at intervals across its width. Inside the drum are fixed electromagnets with alternate poles. The magnets radiate from the centre and occupy one half of the drum only, the other half being hollow, and the magnetic field extends round the front half of the drum. The iron is attracted to the surface of the drum and momentarily held there till one of the brass ridges pushes it out of the field of the magnet of, say, north polarity. The material then jumps to the next magnet, which will be a south pole, and this process is carried on till the last magnet has been passed, when the magnetic material falls. Whilst the iron is being pushed from one magnet to another it changes polarity and throws out any particles of brass which may be adhering, preventing waste and giving a clean product at the back. The process will successfully separate a mixture of 99 per cent. iron and 1 per cent. brass or copper, &c., turnings or filings.

A less expensive class of separator consists of a trough in the bottom of which are concealed electromagnets to attract the iron content. This type is limited in application and cannot be recommended for material containing more than 3 per cent. of iron.

Finally the liquid separator is used chiefly in art-tile and porcelain manufacture for the treatment of slip which passes up the annular space between the core and the non-magnetic tube. The magnetic substances are held against the grooved section of the pole pieces which serve to concentrate the flux across the air gap at these sections. The apparatus must be de-energised and flushed down for the removal of the magnetic material.

Considerable improvements have been made and patented in this country by Krupps, of Magdeburg, most being so designed that the material to be separated is acted on at several points simultaneously. Another device of Krupps relates to the wet magnetic separation of ores and other materials by the aid of drum separators of the kind in which the material is charged on to the upper part of a drum in contradistinction to those wet processes in which the magnetic separating surface is located above the feed conduit. At the same time there is formed on the separating surface a continuously renewed layer of water, the raw material being itself charged either dry or wet. The magnetic particles are attracted to the separating surface through the liquid layer, while the non-magnetic particles are held back by the surface tension, so that good separation is effected.

Krupps have also recently patented a system of multiple drums, by means of which the material withdrawn at one or more points of separation is fed on to the next point for repeated treatment. Another interesting separator by the same firm has pole plates so constructed that the individual fields formed by each two adjacent plates increase or decrease in the direction of the supply of the material. The plates can be adjusted axially for increasing or decreasing the field. The pole pieces can also be adjusted radially. An interesting type is made in this country by the Rapid Magnetting Co., and in America by Ding's Separator Co. It is used mostly for the treatment of refuse and the removal of tins, &c., and consists of a rotating screen and a curved magnet or magnets. The material is fed into the rotating screen, and the magnetic contents are held to the sides of the screen until they are just above a chute, at which point the magnetic circuit finishes, and the tins or other iron articles are dropped into the chute.

Discussion in London.

Mr. H. N. Ridge referred to a magnetic separator which was used in New Jersey 26 years ago for treating zinc ores, which were dealt with at the rate of 1,000 tons per day. He also illustrated machines which he used in Australia in the nineties, and with which he had been able to produce zinc concentrates commercially from Broken Hill sulphide ore. Later, however, the plant had been scrapped, because the magnetic separation of the weakly magnetic ores had been superseded by flotation, except in isolated cases. Referring to a statement in the paper, that sulphide and carbonate zinc ores were roasted in order to oxidise the foreign sulphides associated with zinc, he did not think any plant was carrying out that operation to-day. Plant in operation to-day might appear to be very similar; the operation in that case, however, was not roasting, but calcination.

Professor J. W. Hinchley referred to the separation of leucite mineral, of which 55 per cent. consisted of a black gangue which was slightly magnetic. The gangue was not readily removable by the standard Wetherill magnetic separator, but when the lower magnet of that machine was removed, the material was handled perfectly. With the magnetic system usually adopted in the Wetherill machine, separation was a failure. He had seen the machine actually dealing with 1½ tons of total material per kilowatt-hour without the lower magnet, the upper magnet doing all the work.

Mr. W. M. Mordey was not surprised to hear that the Wetherill machine had been able to deal with leucite quite well when the lower magnet was removed. The thing that impressed an electrical engineer when he began to study magnetic separation was that the inventors of machines knew very little about electricity, and less about magnetism; however, the inventors knew a very great deal, and obtained results which they would never have obtained if they had asked the advice of electrical people. In the Wetherill machine, both magnets attracted the material, and the action of the separator was a differential one. If the lower magnet were taken away it was possible that a better result would be obtained, because there would then be no differential action, but a flux would be set up which would enable the material to be lifted. Most of the ingenuity of inventors had been spent, not in attracting the material to be separated, but in getting it away from the magnets; the actual attraction was a comparatively small part of the problem. Hitherto only direct current had been used, but recently he had been experimenting with alternating current; by repelling material instead of attracting it, one got rid of the difficulty of having to remove the material from the poles, and a cleaner concentrate could be obtained. Mr. Mordey showed a number of slides to illustrate his work, and one of them showed how a magnet repelled specular hematite in the form of a halo a considerable distance from it, there being no signs of attraction or lines of force. The material was interesting; in books it was said to be non-magnetic, but it always occurred in nature, he believed, associated with a little magnetite, and if that magnetite were removed by an ordinary magnet a residue of specular hematite was left, which was not attracted by an ordinary magnet, or even by a strong electromagnet. The only means by which he had been able to demonstrate that the material was slightly magnetic was to scatter a little of the fine powder on water, when the material floated very slowly and formed two clouds over the poles of a magnet. Yet, in an a.c. field it was repelled in the form of a halo, the distance between the pole and the inner diameter of the halo being about eight inches. Another slide showed the effect of a two-pole alternating-current magnet, forming two halos of the repelled material coalescing, whilst in another case a mixture of magnetite powder and specular hematite scattered over the single pole of an ordinary laminated alternating-current magnet showed both attraction and repulsion. Attraction and repulsion of the same material by an a.c. magnet was also illustrated. A two-phase magnet was used, with successive poles overlapping one another, giving the effect of a moving magnetic field, the forces overcoming one another, according as the field was weak or strong.

Hungarian Company Regulations.—*Reuter* reports that, by a decree recently published, all joint-stock companies in Hungary have been directed to arrange their future balance sheets on a gold basis—in terms of the new currency unit, the pengo (27.8 to the pound sterling). It is also decreed that a revaluation of the assets is to take place and companies with net assets of less than 50,000 pengo (say, £1,800) are to be wound up, unless they are companies with purely local interests, in which case the minimum will be 10,000 pengo. The nominal value of the shares in these companies is not to be less than 10 pengo; shares of lower value are to be amalgamated. Branches of foreign firms, insurance companies, and co-operative societies are subject to special provisions.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Lawn Mower.

Fig. 1 is an illustration of an electric lawn mower which is marketed by the COLDWELL LAWN MOWER COMPANY, Newburgh, N.Y., U.S.A. The cutting and propelling operations are controlled by the motor and the steering is effected

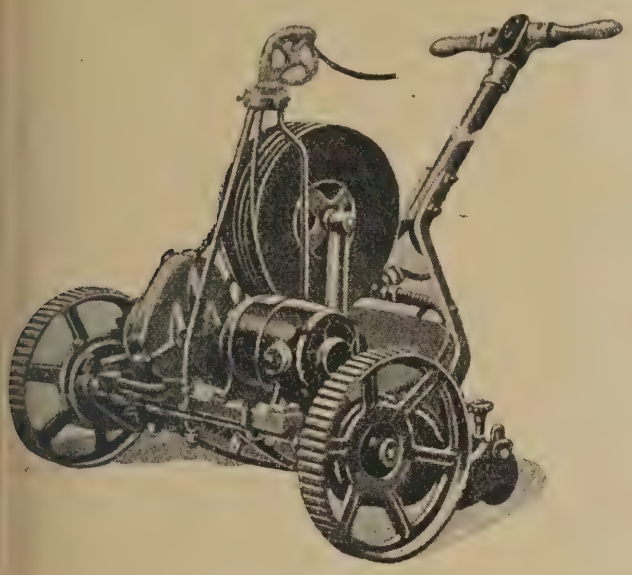


Fig. 1.—Electric Lawn-Mower.

by the operator. It is claimed to be practical, efficient and silent, and capable of dealing with a quarter of an acre in an hour. The machine is fitted with "Timken" tapered roller bearings, and the motor is designed specially for the purpose. An automatic reel takes up and pays out the supply cable.

A Street-lighting Unit.

The accompanying illustration, fig. 2, is one of the 400 G.E.C. "Paisley"-type street lamp posts equipped with lanterns and "Superlux" globes, which have been installed by the Paisley Corporation for the lighting of its secondary streets and roads. The post is provided with a hinged door at the base, inside which is accommodation for fuses, time switch, &c. The globe is 16 in. in diameter, and is suitably ventilated for a 300-W gasfilled lamp. At Paisley two 100-W lamps have been fitted in each lantern, and it is said that the resultant illumination is highly pleasing, free from glare, yet of sufficient intensity for side-street lighting. Two of these street-lighting units were shown at the recently-held electrical exhibition in Paisley. They are particularly suitable, it is claimed, for residential districts, as they combine efficiency with ornamental design. For this reason also they should prove particularly useful for such places as seaside gardens, &c., as they are practically all cast-iron. Credit for the layout of the Paisley lighting scheme is due to Mr. W. Blair Smith, the Corporation engineer.



Fig. 2.—Paisley Lighting Unit.

An Automatic Stuffing Box.

We illustrate in fig. 3 a new type of stuffing box which has recently been marketed by the PULSOMETER ENGINEERING CO., LTD., Nine Elms Iron Works, Reading, and which is designed to overcome the difficulties that arise in centrifugal and other forms of rotary pumps when dealing with water containing grit or dirt. The box space is fitted with a bronze bush which is a sliding fit on the spindle and a driving fit in the bore of the stuffing box. A cast iron housing is held in position by lengthened gland studs. In the housing are fitted two hardened-steel sleeves which are caused to rotate with the spindle by means of a key. These sleeves are kept apart and in contact with the neighbouring faces by means of a helical spring which, incidentally, has the effect, it is claimed, of churning up the grease and allowing it to find its way through the space between the ends of the brushes or sleeves; the grease enters through this space and works along the spindle, efficiently lubricating it and preventing the ingress of dirty water. When fitted on a pump with a suction lift, the higher this lift the more effective, it is claimed, is the action of the packing because the grease is drawn more forcibly through the fine clearance between the shaft and the bush, affording continuous automatic lubrication. This keeps the working parts perfectly cool at the highest speed and the frictional losses are practically

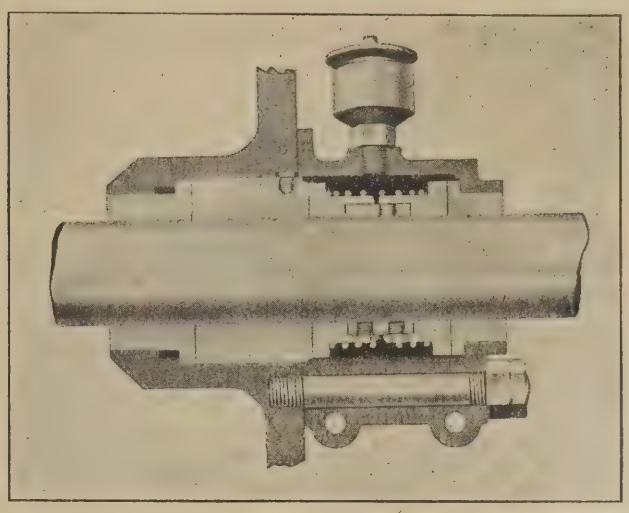


Fig. 3.—Automatic Stuffing Box.

eliminated. When the pump, instead of drawing its water, is fed from a positive head, it is essential that the grease in the housing should be fed into the gland at a pressure higher than that at which the dirty water enters the eye of the impeller so as to ensure the grease flowing in the right direction. Special lubricators are supplied for this purpose.

An Electric Hand Plane.

MESSRS. RENE VOLET, LTD., 242, Goswell Road, London, E.C.1, have put on the market the "R V" hand-planing machine, fig. 4. It is a wood plane in which the ordinary fixed steel plane is replaced by a rotary steel cutter. The latter is driven, through the medium of suitable pinions, by a 1.1 h.p. "R V" motor designed for use on both a.c. or d.c. The cutter is 4.75 in. wide and is capable, it is claimed, of rapidly rough-planing the hardest of woods with the minimum of effort, and

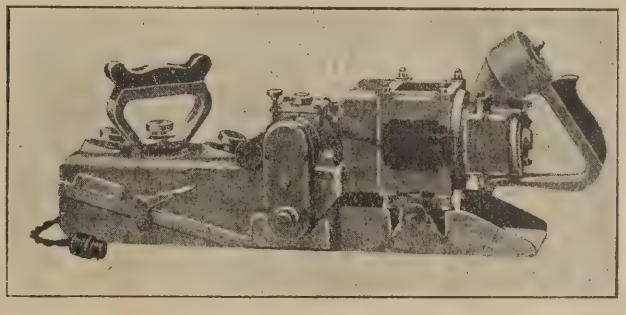


Fig. 4.—Electric Hand Plane.

when working on beech or oak, a cut of $\frac{1}{8}$ in. deep is readily obtained with a rapid forward movement. The rear part of the machine is always kept on an exact level with the rotary cutter, whereas the elevation of the forward part can be adjusted by means of a very simple mechanism controlled by an accurate vernier. The forward sale is used to limit the depth of the cut while the rear one ensures a thoroughly straight guidance and prevents the cutters from plunging or slipping. This construction is claimed to result in work of the highest accuracy.

A New Batten Holder.

We have received from MR. J. C. WHITE, 49, Bridge Street, Deansgate, Manchester, a sample of a new batten holder which he has recently placed on the market. It has been designed to meet the H.O. requirements and for use in basements, cellars, &c., where the head room has to be considered. The metal parts are embedded in a compound moulding which is claimed to be fireproof and shockproof. The connections are enclosed entirely in the base, which is covered by a back plate of the same material. A bonding ring renders it a convenient device for use on lead-covered cables.

Wireless Telephony.

Its Past, Present, and Future Possibilities.

(Résumé of popular lecture delivered before the INSTITUTION OF ELECTRICAL ENGINEERS *on January 7th.)*

CAPTAIN P. P. ECKERSLEY, chief engineer of the British Broadcasting Co., in a lecture on the above subject, said that his convinced opinion was that wireless telephony would play only a secondary part as a means of communication; its disadvantages would preclude its use to a very large extent for any but the great fundamental work of broadcasting. People in this country did not appreciate what a tremendous industry had already been built up. In the United States the sales of wireless apparatus last year totalled 500,000,000 dollars in value and doubtless we should have a similar annual turnover in this country.

As this was in the nature of a popular lecture, he began by explaining in general principles how broadcast telephony was achieved, and then explained how experience had shown that it was impossible to work two broadcast stations unless they were separated by 10 kilocycles in wave-length, and suggested that all the complaints about interference were really an indictment of methods of receiving and not of transmission. Following a brief explanation of detector efficiency he referred to such arrangements as the Armstrong super-regenerative receiver which, for ordinary receiving, thank God, he said, had not been generally adopted. As a third point in his popular explanation of general principles an indication was given of the Heaviside layer and the theories concerning it; of the proposals that had been made to get over the distortion which now existed, due to the Heaviside layer, one was that the transmission should be sent over a wide wave band and by means of three or four receivers it would be possible to combine the components at the receiving end and so cheat the Heaviside layer of its distortion properties. That suggestion had not been put into effect, but it would be extremely interesting as an ordinary straightforward experiment. Whilst a solution of the difficulty was being sought in terms of higher power and longer wave lengths (the scheme adopted at the Rugby station) others were endeavouring to secure the object in view by means of short waves, but it was certain that long-distance wireless telephony would never enter its wider field of development until a solution of this distortion difficulty had been found. Explaining a diagram of the usual method of controlling the output of high-frequency waves, in support of his statement, Capt. Eckersley said that in commercial sets it was necessary for the generator to be capable of sending out twice the power it was delivering to the oscillating system, and when they spoke of 1½-kW sets what was really meant was 3 kW, because whereas at one moment the power sent into the aerial would be double the normal, at other times it would be nothing. Modifications of the method of control were illustrated, notably that of the Western Electric Co., which added a high-frequency magnifier in order to achieve some economy, which possibly was achieved and possibly was not. Another method of control was introduced by Captain Round, of the Marconi Co., in 1919; it was not used a great deal at present and it had the disadvantage that it absorbed only one half cycle, and in doing so might produce a strong second harmonic. Still another was the grid-control system that functioned in some way which he had never yet heard thoroughly explained.

Captain Eckersley had intended to speak about duplex telephony, but time did not allow him to do so. Wireless telephony would be useful to link up land lines and small duplex installations would be useful adjuncts to landlines in places where it would not pay, or be possible to, lay a cable. Captain Round and Mr. Franklin had shown that it was perfectly feasible to work such a system. He had often wondered why such stations had not been used to a greater extent all over the world to link up scattered points.

Those responsible for broadcasting started full of hope and ideas, but with no money, and they had built up a system which had served as a model to the world; nearly every European nation had adopted a system "something like our own." Every listener, no matter where he might be, must be given a signal robust enough to operate his set because it must be realised that 10s. was worth as much in Aberdeen as in the metropolis. The B.B.C. started with eight stations, but it was found that about 50 per cent. of listeners were not served in the manner it was desired they should be. He had got into more trouble through talking about crystal areas, but the fundamental consideration was that if a signal could be received on a crystal set, it meant that local interruptions were negligible; thus the crystal had been taken as the popular criterion of signal strength and after the first experiences with the eight main stations, the B.B.C. set to work to make 100 per cent. of the country a crystal area. There were even now, however, two possible troubles: One was that broadcasting could never go on in a perfectly natural way until it was possible to satisfy the "grousers" by giving them two things to grouse about instead of one. Alternative programmes would not be a complete solution, because of the international situation which had now to be considered in relation to any national system. At the present time, a station in Rome might seriously interfere with transmission in London and, as a result, the multi-station idea would have to be abandoned in favour of fewer stations; because of the uses made of wireless outside broadcasting it was essential to get an international solution. If the 250 stations working, or in contemplation, in Western Europe were to work unhindered it would be necessary to make one station do the work of five or six, and that could only be done by using far higher power than was now the case. There were difficulties, however, because however much some countries might be willing to scrap their present stations and build new high-power ones, they were not rich countries and they might not feel it fair that they should be asked to do so. Therefore, the solution that had been put forward was that certain of the important stations should be granted exclusive wave-lengths to themselves and to arrange that certain of the others should work on non-exclusive wave-lengths. In this way, the limited number of wave-lengths would be made to go round. If two stations worked on exactly the same wave-length there would be no interference between them up to a distance of five miles; at a distance of 10 miles one would detect a faint background of mush, and at 15 miles there would be definite interference. Therefore, it was established that two stations in different parts of the country working on the same wave-length would only have local significance and only in their crystal areas would such local programmes be received. The difficulty of getting the fineness of adjustment between two such stations, which had to be of the order of one-hundredth of one per cent., must not be overlooked, but perhaps the new crystal, which could be ground to give that accuracy, would assist. The task confronting the B.B.C. as a transmitter was extraordinarily simple in essence, but amazingly difficult to achieve, because the aim was to transmit from a frequency of about 30 up to about 10,000 cycles with equal clearness at the receiving end; so far there was no method which could render sound a measurable quantity and, although there were the advocates of the pressure method of testing and the audibility method, he believed eventually they would arrive at something between the two; he wished someone would provide a means for measuring what was being done.

Finally, Capt. Eckersley discussed transformer design and indicated the attempts that have been made to secure a more or less straight curve. It had been said that the transformer was the worst possible piece of apparatus and that it behaved badly, but that was not so; if the transformer were designed properly, it could be almost as perfect as resistance-capacity magnification. One way of overcoming leakage was to make the load as small as possible, and a transformer for wireless work must be designed like a power transformer to get proper regulation the whole way; that should be borne in mind and be appreciated as a fundamental conception underlying the design of transformers. Showing a curve obtained with the type of transformer now being used for simultaneous broadcast work, Captain Eckersley said it showed that there was no difference between a properly designed transformer and the vaunted resistance-capacity coupling. This result, he said, had been obtained by a little trick which consisted of using a choke in the anode circuit and a condenser in series with the transformer primary. Regarding input transformers, by making the transformer equal to the mean impedance of the line, a compromise was obtained which had proved successful.

Discussion in London.

PROF. C. L. FORTESCUE, after complimenting Capt. Eckersley upon delivering the lecture in his own inimitable way, said that the engineers of the B.B.C. always had before them the goal of perfection, but they had never allowed the best to be the enemy of the good. Thus it was that a system had been built up which had been copied the world over. Although acoustics was not usually included in the ordinary term of engineering it was quite obvious now that it must be, and there were very few who would care to tackle Capt. Eckersley on the problems of acoustics. The general impression from the lecture was that the receiving end was the one upon which the greatest concentration was required at the moment, and from this point of view it was to be hoped that in the fairly near future it would be possible to obtain receiving sets which would be cheap, selective, and efficient. There were very few people in this country who could afford £100 for a beautiful imitation of a piece of old furniture, most of the interior being occupied by a raucous loud speaker, and therefore the great need was a set which had the advantages of good selectivity together with cheapness in first cost and in maintenance.

Mr. P. J. VOIGT said it must be admitted that the loud speaker was the weakest link in the chain, and the point to be determined was what a loud speaker was expected to do. Was it to give the effect of a man speaking in the room, or the effect of the sound coming, as it were, through a hole in the wall? He had experimented on the latter lines, but in working out his calculations of pressure, velocity, &c., he had made the mistake of assuming that the hole was infinitely big and that a comparatively small hole would give the same effect as a large one. Working on these lines he had built a loud speaker which unfortunately was not loud, but which reproduced tones that no other loud speaker had ever

done; the "s's," however, came through badly. He had then worked out another arrangement with the idea of faithfully reproducing the energy sent out from the microphone at the B.B.C. and, although he got a quality slightly better, he believed, than that actually sent out from the B.B.C., the idea at present was only an ideal. He argued along the lines of pressure rather than audibility and recently had developed a microphone which was practically an electric pressure gauge; with it he had obtained loud-speaker results which were the most natural he had ever heard.

Mr. C. M. R. BARLBI said it was well-known that stations did not trouble to transmit sounds of low frequency because the lower notes were not picked up by the receiving stations. That might be satisfactory for commercial work, but for ordinary broadcasting when so much music was transmitted, the lower notes could not be overlooked. Whilst this attitude might have been justified a year or two ago, the degree of perfection now obtained with receiving sets had changed the situation considerably and it seemed reasonable to demand that the B.B.C. should investigate this matter and obtain the views of listeners with regard to it.

Mr. E. H. SHAUGHNESSY (G.P.O.), referring to the statement that the turnover in sales of wireless apparatus in America now amounted to 500,000,000 dollars, asked whether the reason why they had not reached a similar figure in this country was Capt. Eckersley's "crystal" attitude, which had made it possible for everybody to make his own crystal set for half-a-crown. In connection with the congestion of wave-lengths and the suggestion that some system should be adopted of sending only on one half of the wave band, that was the method which was to be adopted at Rugby for the trans-Atlantic telephony experiments, and it was a method which had been explained to the Institution by Dr. Nichol, of the American Telegraph and Telephone Co. two years ago. He disagreed with Capt. Eckersley's statement that wireless telephony would only be useful for broadcast work; personally, he regarded wireless telephony as having a very wide field of application. It might well be that in the future wireless telephony would have to be relied upon to bridge long distances over water where cables could not be laid and there might even be an international agreement to prohibit wireless telegraphy and only allow wireless telephony, and so occupy the ether to a higher degree of efficiency. It must not be overlooked that wireless telegraphy was not cheap for long distances, because it cost a lot of money to run a big station. Whilst there were difficulties in having two or three stations working on the same wave-length, he should have imagined that it was an easily soluble problem, because there could be a land line connecting several stations with a master oscillator at one station to transmit the carrier wave for all the stations working on the same wave-length. He disagreed strongly with the implied suggestion of Capt. Eckersley that all reception and all loud speakers were bad, because if one paid a proper price it was possible to get a receiving set which would give almost perfect reception under present conditions.

Mr. D. KINGSBURY, speaking on quality of reproduction, said he thought the arrangement shown by one of Capt. Eckersley's slides by which a choke was used in the anode circuit and a condenser in series with the transformer primary was the answer to the "feathering" which was noticeable in the reproduction of certain notes in the bass region. This effect was particularly noticeable in connection with the drums and it was also noticeable in a certain announcer's vowel sounds. The horn as a means of amplifying the efforts of a small diaphragm would not be with them always; loud speakers would take the form of some large surface acting as an air motor.

Mr. S. BRAENDLE said he was using a form of cone loud speaker with which he was able to obtain the lowest notes in music, such as the double bass, or the drum, with equal clarity to the higher notes of the violin. There had been, however, one or two cases of unsteadiness which might be due to outside interference, or might be the same effect which Mr. Kingsbury had referred to as "feathering." He, however, was not inclined to blame the B.B.C., because he was using rectified a.c. and therefore was perhaps liable to some criticism.

CAPT. ECKERSLEY, replying to the discussion, said he had not wished to give the impression that transmission was so much superior to reception, because he was quite ready to admit that the problems of transmission were fewer than those of reception. It was, indeed, a little discouraging sometimes to feel that all one's best efforts to produce the best transmission were sometimes hideously ruined in the homes of the listeners, through no fault of their own, however. The point he always had in mind was that it would be a wrong policy to develop broadcasting on the lines of making it difficult to receive and it was for that reason that he had taken his "crystal" attitude, because if the owners of crystal sets could receive the signals then it was quite certain that the users of other sets would be well served, because the average crystal set was not selective. As to the suggestion that the B.B.C. was going to alter its wave-length, that statement was characterised by its inaccuracy. There was no intention of changing to 100, 110, or even 200 metres. Perhaps the difficulties of the B.B.C. might be better appreciated if Mr. Shaughnessy realised what his own position would be if the Post Office had no control over the receiving instruments in the homes of telephone users. The B.B.C. was compelled to proceed on the lines of compromise. He was surprised to hear Mr. Barlbi say that it was well-known that the B.B.C. did not transmit the lower notes, because that was not the case. Although, theoretically, there should be no interference if transmission took place on a half wave, there were practical difficulties in the way, and the receiver would not be selective enough. The land line idea for transmitting the carrier wave, as suggested by Mr. Shaughnessy, had been considered, but the trouble was international. In reply to Mr. Kingsbury, he did not think the circuit he had mentioned was responsible for the feathering effect referred to, and with regard to microphones he admitted that experiments were being carried out which might introduce some such effect. At the same time, unless the B.B.C. did experiment in this way upon the public, very little progress would be made.

Selling Electric Refrigerators.

A RECENT article in the *Electrical World* by a refrigerator manufacturer draws attention to a matter which, while at present little thought of in this country, appears to offer opportunities. The writer deals particularly with domestic refrigeration, and his remarks are reproduced below:—

It does not seem at all necessary that any drastic changes should be made in the present high-class refrigerator construction in order to render it adaptable to electric refrigeration, and the advisability of establishing a standard refrigerator—that is, with respect to size and form—is seriously questioned. Manufacturers would be more than pleased if only one style were in demand, but, despite the fact that every effort is made to keep the line as simple as possible, they are obliged, because of the various tastes of the public and the definite but non-uniform space allowed for refrigerators in homes, to produce about fifty different sizes and styles of refrigerators. Any one of these is adaptable to electrical refrigeration without material change. The prime necessity is that scientifically constructed refrigerators should be used at all times, either with ice or electrical refrigeration, and that this should be particularly insisted upon by mechanical-refrigeration manufacturers and the dealers through whom their products are distributed. A study of this problem would reveal that the idea of good refrigeration must be imparted to the public first and that of electric operation next. The first task should be backed not only by refrigerator manufacturers, electric refrigeration-unit manufacturers and electric utilites, but by ice companies as well. The latter have been worrying about the inroads upon their business by electric refrigeration, but if they can be shown that this plan will help their business by stimulating the use of more refrigerators in more homes, they will give increasing help to the electric refrigeration idea, in which utilities, the electric refrigeration-unit manufacturers and refrigerator manufacturers are particularly interested. The policy endorsed at the recent convention of the National Association of Ice Industries at Los Angeles to launch an intensive campaign to educate the public to use more household refrigeration is in the right direction. Co-operation of the ice manufacturers with the N.E.L.A. on a plan which, it is believed, is now being worked out, will be beneficial to everybody concerned. The electric refrigerator is acknowledged to be the greatest revenue producer for central-station companies that has been placed on the market for some time. Granting this, an almost unlimited amount of assistance can be rendered by these companies in placing the refrigerator before the public. This can be done by wide-spread publicity. Some electrical companies have started a scheme of advertising, applying the amount of money it costs to connect a new residence with the street lines to a fund for newspaper announcements covering every electric refrigerator that goes into a home already wired. This is a good start, but I believe they can afford to go much further and spend considerable money, not only in local advertising, but collectively in national publications in order to further this new application.

Electrically-operated Crossing Gates.—A description is given in the *Railway Gazette* of an example of electrical operation for railway-crossing gates which may be seen at Sleaford, Lincolnshire, where the L.N.E.R. crosses the Southgate Road. The crossing is protected by four 25-ft. gates connected to a common driving rod cranked up to the signal box and operated by a crab working a crosshead travelling along a double-threaded screw shaft. The operating mechanism and levers controlling the running signals are so interlocked that before the gates can be moved all the signal levers must be in the normal position. This protection is ensured by electrical detectors fixed to the respective gateheads. A 1½-h.p. series motor is geared to the controlling shaft, its speed and direction being controlled by the necessary equipment operated by the signalman. A friction clutch on the motor shaft prevents any damage to the gates by a continued pull when they reach their open or closed positions. The electrical equipment was supplied by Messrs. Thos. Broadbent & Sons to the L.N.E. Railway's specification, and was installed by the railway company's telegraph and signalling staff.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Super-Station Switchgear.

I was rather surprised to read the opinions expressed by Mr. G. L. E. Metz with reference to the above subject in your issue of January 1st.

I cannot agree with his statement that a comparison of the oil-circuit-breaker designs of the five main manufacturers in this country will reveal such a close similarity for a given rating.

This is borne out by a recent comparison of oil circuit breakers having approximately the same rated rupturing capacity, manufactured by five of our leading firms, presumably those referred to by Mr. Metz. In these designs the quantity of oil per phase varied from 9 gallons to 590 gallons, velocity of rupture from 4 to 9 ft. per second, head of oil from 8.5 inches to 26 inches, and length of break from 9 inches to 25 inches.

In addition, the tanks showed great variation in design, including rectangular, elliptical, and round tanks, the thickness of the walls varying from 0.375 inch to 1.25 inches.

Again, one manufacturer will pin his faith to Bakelite condenser-type bushings for the leading-in insulators, another to oil-filled porcelain insulators, whilst yet another considers compound-filled porcelain insulators to be the best. Each manufacturer gives apparently sound reasons for the choice of any particular design, but unfortunately it often happens that their opinions as to the principles underlying the operation of circuit breakers are very conflicting.

With regard to the external appearance of the containing structure of switchgear of similar type, I agree that there is a certain amount of uniformity in the various makes, but that is usually as far as the similarity obtains.

I am entirely in agreement with the writer of the article criticised by Mr. Metz, as regards the lack of unanimity of opinion on oil-circuit-breaker design. It is indeed probable that all the various makes would stand up to their *rated* duty more or less satisfactorily, but it is improbable that they would all have the same *actual* rupturing capacity.

C. A. Wilson.

Leeds, *January 4th*, 1926.

The Metering of Three-phase Power.

I regret that I have been unable to reply to "A Meter Superintendent's letter before, as, having been away from home during the holidays, I was unable to obtain my copy of your valuable journal.

I am in complete agreement with your correspondent regarding the fact that a two-element, 3-phase, 4-wire meter will give accurate results *provided* that certain conditions (which he mentions) are complied with. May I add that the condition $e1 + e2 + e3 = 0$ depends on the following:—

(1) That the voltages must be exactly equal.
(2) That they must be 120 deg. apart.
(3) That they are pure sine curves.

It is my contention that these conditions can be, and are, upset on a modern 3-phase supply system, and I therefore once more aver that the correct three-element system of metering should be employed. To say that one may know the circuit conditions is hardly sufficient since, as Mr. Malcolm has shown us in his recent article, these circuit conditions are likely to alter.

Since your correspondent has in his previous letter mentioned B.E.S.A. specifications, may I in conclusion add that the two-element, 3-phase, 4-wire meter does *not* comply with the B.E.S.A. meter specification No. 37—1919. (See paragraph 57.)

In reply to the last paragraph of your correspondent's letter, I regret that I am unable to publish the facts and figures which he asks for. To do so would mean my quoting *individual* practice and I feel sure your correspondent will appreciate my position and my inability to mention such matters here.

"A Meter Engineer" is to be congratulated on his excellent contribution. He, without doubt, deals admirably with many of the important points on this subject.

H. Hugh Jaques.

London, *January 4th*, 1926.

Electric Wiring.

I read with interest "Polyphase's" letter in your issue of October 16th. I note his remarks with regard to plumbers doing electrical work; I am aware of that practice, as I served my apprenticeship as an electrician in Scotland, but conditions are totally different "out here." Take, for instance, a wireman or electrician arriving at Wellington and seeking employment with a contractor; this employer dare not employ him until he applies to the City Council for a licence, as the examinations are held every six months. If he can satisfy the local electrical engineer as to his experience and apprenticeship, he will be granted a "Provisional Licence" until the examination; then he will have to go through a theoretical and practical examination. At every new town he goes to throughout New Zealand he will have to obtain a "ticket"; in fact, there is a township approximately eight miles from Wellington called Lower Hutt, and neither of the supply authorities recognises the other's ticket. There is some word of a "National ticket" coming into force next year—the sooner the better. Now take the employer's side; should he be a master plumber and desire to commence wiring, he will be barred throughout New Zealand from doing anything. He has only one resource and that is to employ an electrician holding a master's certificate (note, not a wireman's ticket as explained above; the "master's" is much harder to obtain). So you will see what the plumbers in this country have to contend with; well, why shouldn't they?—"one man one job."

When the contractor obtains any wiring job, from one point upwards, he dare not commence it until he gets a "permit from his Power Board to commence work; the same thing applies to alterations and extensions of old installations. I should like to see some of the "knights of the gas pipe" in the old country under our regulations out here. I admit that at first I did not care too much for the N.Z. regulations, but after residing in New Zealand for two years one gets used to these things, and now I congratulate the Government and fire-underwriters of N.Z., as your readers will see that no one but an experienced licensed wireman or electrician dare do any installation or electrical repair work. I may add that the sooner the supply authorities in Britain adopt some method like that of the Dominion of New Zealand the better it will be for them and electrical contractors, as well as for all competent persons employed in the electrical industry. I think the electrical contractors in Scotland and England would not miss the plumbers if they were barred from doing electrical work. I have often attended E.T.U. meetings in Scotland over the plumber question. I would be glad to hear from "Polyphase" or any other of the REVIEW readers. I have read the REVIEW for years now—I look forward to getting it out here. I may add I hold the master's certificate for electrical work. Wishing the REVIEW the best of success.

S. J. M. Ewart.

Hastings, N.Z., *December 7th*, 1925.

An Electric Vehicle Association.

Having informally discussed the present stage in the progress of electric propulsion by electric storage methods, I feel that now is the opportune moment for seriously considering the immediate formation of an Association, Institution, or Society consisting of those who are interested in any way whatsoever in electrical vehicles (*e.g.*, road vehicles, tractors, trucks, locomotives, launches, barges, &c.), whether they be manufacturers, electricity supply engineers, owners, or users thereof.

By such representation at periodical meetings where the progress in other countries would be reviewed, and papers read evoking free discussion, not only would the members benefit by exchanging opinions and so forth, but the interest of the general public would be aroused by the lay Press reports of the proceedings of an institution devoted solely to the subject of electrical transport for both passenger and goods traffic.

I am already assured of some support from those who fully appreciate the advantages which will accrue from the inauguration of such a society, but I would like to hear the views of your readers if they will kindly communicate with me direct, as I am arranging for an informal meeting at an early date to discuss formation details.

J. C. Elvy.

3-7, Southampton Street, London, W.C.2.
January 7th, 1926.

Meetings of the Institution of Electrical Engineers.

Those who heard Captain P. P. Eckersley's brilliant lecture on Thursday last were entertained in a manner seldom known at a meeting of the I.E.E. I wish, however, to enter a protest against an ordinary meeting of the Institution being devoted to a popular lecture, especially in view of the fact that the amount of time allotted to the discussion of the excellent papers by Captain P. Dunsheath and Professor S. Parker Smith was most inadequate in each case.

With the greatest respect, I suggest that the Council of the I.E.E. appears to be in danger of being carried away by the "Radio Flood" which is sweeping through this country at the present time; and I trust in future the ordinary meetings of the Institution will be restricted to the reading and discussion of engineering papers and to scientific lectures.

H. C. Silver.

Ewell, Surrey, *January 8th*, 1926.

Agricultural Electricity in Germany.—A special "Electricity in Agriculture" section is being organised in connection with the "Green Week" Exhibition to be held in Berlin from February 20th to 28th next. The section is being organised by the Union of Electricity Supply Companies in conjunction with the German Agricultural Society, and it is intended that the exhibits shall be of a comprehensive character to demonstrate the various directions in which electricity and electrical appliances can be advantageously used in connection with agricultural operations.

Reviews.

British Wire-Drawing and Wire-Working Machinery. By H. DUNELL, A.C.G.I., A.M.I.Mech.E. Pp. xv + 188; figs. 181. London: Constable & Co., Ltd. Price 21s. net.

This book forms one of the well-known "Engineer" series of volumes dealing with what may be termed the more or less specialised branches of the engineering industry. The wire-drawing industry and that of the design and manufacture of wire-working machinery are perhaps more specialised than most, and the author in his preface confesses that he often found a difficulty in obtaining information from manufacturers regarding certain phases of his work. Despite this, however, he has succeeded in getting together a fairly comprehensive account of the various ramifications of the trade, which after appearing as a series of articles in our contemporary *The Engineer*, is now issued in book form in the hope that it may help towards a greater interchange of knowledge among the individuals directly and indirectly concerned in the wire industry to the ultimate betterment of the trade.

The importance of the wire industry can be gauged from the fact that in this country alone, it consumes roughly three-quarters of a million tons of steel annually—very little iron wire is now made—and about half as much of the non-ferrous metals, including, of course, copper which is used in the manufacture of electric cables and transmission lines, although whether copper conductor of large size, such as is used for overhead tramway trolley wire or in armature construction, is included in this total does not appear from a study of this book. It is of interest to note further that apart from its intrinsic value, the wire industry is regarded in the United States and on the Continent as a vehicle for the consumption of large quantities of steel and is associated with and fostered by the steel industry in consequence. The manufacture of wire and of machinery for making wire goods, although they are highly specialised industries, are of particular interest to electrical engineers, first because of the fact that copper wire enters so largely into every branch of the electrical industry, and, secondly, because the complex and often very heavy machinery used in the wire industry is largely driven by electric motors and the driving of this machinery is often a problem demanding intimate knowledge of the conditions involved. Thus, in the course of a description of a works in which the wire rods are made, this forming the first stage in the manufacture of wire, it is stated that an electric motor of 2,750 h.p. is employed. This gives some idea of the extent to which power is utilised in the wire-making industry.

The ground covered by the author can be roughly divided into two parts, the first dealing with the manufacture of the wire itself and the second with the manufacture of various articles from wire. The production of the wire involves the manufacture of wire rods, of the various kinds of dies and wire-drawing blocks, and of the machines for the drawing of the wire, as well as straightening and cutting off in required lengths. The various processes involved are described in detail and a large number of illustrations and drawings of both the machinery and its essential parts are given. In fact, it may be mentioned that the illustration of the text is a notable feature of the book and one on which both the author and the publishers are to be congratulated. With reference to the second part of the book in which the conversion of wire into manufactured articles such as springs, chains, &c., is described, readers of the ELECTRICAL REVIEW will be particularly interested in the chapter dealing with electric cable making. It is indicative of the highly specialised nature of the wire industry that in this branch, as in many others, the manufacturers of the articles are also the designers and makers of the machinery which is used in the manufacture of the articles. An interesting process of which a description is given in this part of the book, is the flattening of wires from round to square or rectangular section, this being found cheaper than drawing the wire to the required section. The machines which have been developed for this kind of work are described and illustrated and it is apparent that their use leads to cheaper manufacture for certain classe of products. This is a process which is capable of being increasingly employed in the electrical industry.

Although, as his title suggests, the author deals particularly with British-made machinery, he occasionally refers to what is being done in other manufacturing countries, from which it is apparent that the wire industry is one which is considered all over the world to be of such great importance as to be worthy of careful study. We recommend this book to all who are interested in the industry in this country, particularly to those who realise that by the use of improved machinery it is capable of being still further developed.

The Elements of Internal-combustion Engineering. By TELFORD PETRIE, M.Sc., Assoc.M.Inst.C.E. Pp. xi + 236, with 62 diagrams. London: Longmans, Green & Co. Price, 10s. 6d. net.

The internal combustion engine has already become a prime mover of considerable importance to the electrical engineer. For the development of small amounts of electrical energy in isolated districts where current from a central supply is not available, no unit is more efficient than an oil engine directly coupled to a dynamo, and where larger powers are required, as in the electric generating stations of country towns, the Diesel engine-driven generator having an output of anything up to 1,000 kW is becoming recognised as the most economical form of unit available. The use of the Diesel engine as a stand-by and for dealing with the peak load of a hydro-electric installation is also of considerable commercial importance. For larger outputs, this type of engine cannot compete with the steam turbine when considered from the broad standpoint of commercial operation, but under special circumstances it is not unlikely that the internal combustion engine with its superior thermal efficiency might prove of considerable value. Thus, in dealing with the problems of coal conservation in this country, it is often urged that instead of burning raw coal it should be first of all subjected to distillation at low temperature in order to obtain the valuable by-products in the form of oil and ammonia. In this process of distillation certain quantities of gas are obtained and it is almost essential to the financial success of the scheme that some use should be found for this gas. It has been suggested that it could be employed to operate large gas engines which, in turn, would drive large electricity generators, the latter delivering their energy to a ring main connecting the various collieries where the distillation process is utilised. Other possible developments of the use of the internal combustion engine for the generation of electrical energy could be given, but sufficient has been said to indicate not only the present importance but the possibly even greater importance of this type of engine in the future to the electrical engineer.

In the book which lies before us, Mr. Telford Petrie has dealt with the theoretical aspect of the various types of internal combustion engine which are available at the present time and he has even ventured to suggest certain developments which may occur in the near future. The whole work is admittedly dealt with from the point of view of the student, but it does not necessarily suffer on that account, since one need not be young or go to a technical college to realise the importance of studying the development of any new phase of engineering science. After an introductory chapter in which the history of the internal combustion engine is briefly reviewed, the author gives a description of the various forms of gas engines and their cycles of operation, this being followed by a similar treatment of the various kinds of oil engines, *viz.*, petrol and paraffin engines and the heavy-oil engines, or the Diesel and semi-Diesel engines as they are often termed. In both of these chapters the most recent types are mentioned, including double acting engines, the Still engine and the Humphrey gas pump, simple outline diagrams being given of each type with, in many cases, indicator diagrams corresponding to the different strokes of the piston. The more theoretical aspect of the various cycles of operation is then studied in detail, such problems as the ideal efficiency, efficiency ratio, mean effective pressure and consumption of the ideal cycles being considered. This part of the work is prefaced with a brief outline of the theories of thermodynamics and the physical properties of a perfect gas. Considering next these theories in their relationship to the actual performance of an internal combustion engine, the question of the variation of the specific heats of a gas is dealt with and this is followed by the familiar treatment of the subject of entropy in so far as it deals with the problem of the energy developed during the cycle of operations in the cylinder of a gas or oil engine. The problems of ignition and combustion are next discussed, and finally the author gives a valuable chapter on temperature effects in which the important problems of jacketing, temperature stress and loss of strength of metals due to high temperatures are investigated. The volume concludes with a brief discussion on the possibilities of development in which the question of other cycles of operation and the internal combustion turbine are investigated. There are also a number of examination questions with answers grouped at the end of the book under the headings of their respective chapters and a comprehensive index is appended.

The whole work has been carefully produced, the diagrams are most informative—although some of them might perhaps have been reproduced to a rather larger scale—and no attempt has been made to unduly compress the various mathematical investigations, so that the working is always easy to follow. This is a book which should be in the hands of not only the student at the technical college, but of every electrical engineer who is desirous of understanding the theories underlying the design and operation of the very many different types of gas and oil engine which are being used for driving electrical generators.

Alternating Current Problems. By R. E. BROWN, Assistant Professor of Electrical Engineering, Moore School of Electrical Engineering, University of Pennsylvania. Pp. viii +84; figs. 16. London: Chapman & Hall, Ltd. Price 6s. net.

This little volume comprises a collection of examples, for the most part of a numerical character, arranged to illustrate the fundamental principles encountered in studies of the flow of alternating currents and of alternating-current machines. In the early part of the book special attention is devoted to the trigonometrical and symbolical methods of representing alternating quantities and many excellent and varied examples are included which will ensure a good and flexible knowledge of this important branch of electrical work to those who systematically work through them. The later part of the book,

which is mainly concerned with examples on generators, motors and transformers, is perhaps hardly so interesting as the earlier part, since the majority of the examples are of a more orthodox nature, nevertheless a wide range of work is covered.

The chief criticism we have to make is that, with isolated exceptions, no answers are given to the numerical examples. Students taking advanced work of this nature are not likely to delude themselves or others by making improper use of the answers, and, on the other hand, the answers would oftentimes be of very real help to those who have no opportunity of turning to an instructor for aid. It should perhaps also be mentioned that a small proportion of the examples will not be of great interest to English readers since they depend on an acquaintance with the Standardisation Rules of the American Institute of Electrical Engineers and are concerned largely with facts rather than with principles.

Teachers of electrical engineering are well advised to allow their students to work as great a variety of numerical exercises as circumstances permit and few teachers will fail to find new ideas relating to problems if they peruse a copy of the book under notice.

On the Road. By W. H. BEABLE. Pp. 115. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 5s. net.

Most of us have met commercial travellers of one kind or another. They have appeared in fiction and, occasionally, in caricature. They are to be seen in the train, and, less often perhaps, at the club. Many of us meet them in the course of business, and draw our impressions from that. But few people could give a very clear idea of them as a whole and of their work as a profession. The different types of men grouped together under the heading of commercial travellers seem to have so little in common, that only a rough conclusion would appear possible.

But the author of this book draws some very definite conclusions. He is not afraid to insist on the plain virtues of hard work and sobriety, truth and honesty. He asks the reader to do no more than he himself has done, and the following passage will give an insight into the style of the book and the character of the man.

"I had an appointment with a gentleman to discuss the question of selling Hungarian wines in this country, a subject on which I knew nothing whatever. I looked up Hungary in my encyclopædia, read all about the hills and dales where the grapes were grown, and the methods employed in the cultivation and production of wine. Then I turned up "wine" and became familiar with their peculiar properties, how they compared with French and other wines. Thus armed for the interview, I was able to discuss the subject so intelligently that my interviewer was quite astonished to learn that I had never been to Hungary, and had never been associated with the wine trade."

That is the way he talks from page to page through the book, for his style is simply good talk transferred to paper. His instances are best when drawn from his own experience. One or two of his quotations are less apt. For example, an employer asking a brisk young manager what the noise was outside would scarcely expect to get such a wordy reply as one story says he got

The book is, however, so readable that there is no need to magnify a solitary fault or two. One prefers to draw notice to its fluent and lucid English—a rare quality in books on commercial subjects. Some of the subjects dealt with are "The Salesman's Contract," "Selling Advertising Space" and "The Sales Manager." A bold commercial, genuinely dissatisfied, might lend it to his employer, in the hope that he might read about "Choosing an Employer." This chapter is something new in commercial literature.

The book is good value for 5s., but one hopes it may soon be possible to issue a popular edition so that juniors may share its good things along with those who are already on the road.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 6th :—

Day-Fan (lettering and design). No. 459,153. Class 6. Electric fans, electric motors, and parts thereof.—Dayton Fan & Motor Co., Dayton, O., U.S.A. (British representatives: White, Langner, Stevens and Parry, Jessel Chambers, 88-90, Chancery Lane, W.C.2.)

Combine (lettering and design). No. 462,791. Class 8. Variable electrical condensers and parts thereof.—Somco, Ltd., 1-11, Larch Road, Balham, S.W.12.

Salient (lettering and design). No. 462,958. Class 8. Scientific instruments and instruments and apparatus for use in radio-telephony.—S. A. Cutters, Ltd., 18, Berners Street, W.1.

K. (lettering and design). No. 463,682. Class 8. Electrical measuring instruments.—Beckett & Parker, 157 159, Summer Lane, Birmingham.

Lissenola. No. 464,071. All goods in Class 8.—Lissen, Ltd., Richmond, Surrey.

Brinford. No. 464,825. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—A. G. Brini, 63, Chelmsford Road, Woodford, E.18.

Elmah. No. 462,460. Class 11. Electric massage apparatus.—Hoare and Co. (Engineers), Ltd., 70, Old Broad Street, E.C.2.

Staba-Lare (lettering and design). No. 464,440. Class 13. Electrodes of ordinary metal.—Allen-Liversedge, Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printe specification.
The numbers in parentheses are those under which the specifications will b printed and abridged, and all subsequent proceedings will be taken.

1924.

14,766. "Electric stoves for use in the enamelling of electric conductia wires." V. Planer. June 18th, 1924. (244,501.)

21,681. "Electric condensers for neutralising capacity coupling betwee parts of electric circuits." Hazeltine Corporation. February 20th, 192 (229,625.)

21,799. "Induction motors." P. K. Sen. September 15th, 1924. (244,511

21,802. "Metering in automatic telephone systems." Siemens Bros. an Co., Ltd., and J. Berry. September 15th, 1924. (244,512.)

21,879. "Sound recorders, sound-amplifying devices, and microphones. W. S. Purser. September 16th, 1924. (244,516.)

22,053. "Variable inductance devices." Igranic Electric Co., Ltd., an A. H. Curtis. September 18th, 1924. (244,525.)

22,312. "Spacing of plates of variable condensers." British Thomson Houston Co., Ltd. (J. M. Enders). September 22nd, 1924. (Convention dat not granted. Addition to 212,205.) (222,149.)

22,753. "Electric batteries." W. Peto, H. M. Genese, and Pritchett an Gold & E.P.S. Co., Ltd. September 26th, 1924. (244,540.)

23,944. "Automatic electric circuit-breakers." E. M. Johnson and Metro politan-Vickers Electrical Co., Ltd. October 9th, 1924. (244,548.)

24,129. "Transmission of wave energy for high-frequency signalling. Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd. (Western Electric Co. Inc.). October 11th, 1924. (Addition to 243,088 (244,552.)

27,249. "Receivers for wireless telegraphy and telephony." C. Seymou G. A. Irving, and J. C. W. Drabble. November 14th, 1924. (244,568.)

27,847. "Means for balancing telephone cable circuits." A. H. De Voog November 23rd, 1923. (225,229.)

28,583. "Electrically-heated appliances." P. M. Edinborough and Metro politan-Vickers Electrical Co., Ltd. November 28th, 1924. (244,574.)

29,012. "Control of electric motors." British Thomson-Houston Co., Ltd and E. B. Tuppen. December 3rd, 1924. (244,576.)

29,084. "Device for holding coils for wireless apparatus and like pur poses." G. Gosden. December 4th, 1924. (244,577.)

30,773. "Electric relay systems." British Thomson-Houston Co., Ltd December 29th, 1923. (226,813.)

30,953. "Electrical measuring instruments for alternating-current circuits. Metropolitan-Vickers Electrical Co., Ltd. January 2nd, 1924. (227,104.)

31,000. "Insulation removing devices." Standard Telephones & Cables Ltd. (formerly Western Electric Co., Ltd.). (F. Doring). December 29th 1924. (244,586.)

31,140. "Automatic or semi-automatic telephone systems." Standard Tele phones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Elec tric Co., Inc.). December 29th, 1924. (244,587.)

31,224. "Electromagnetic relays." Standard Telephones & Cables, Ltd (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). Decem ber 30th, 1924. (244,591.)

31,231. "Telephone head-sets." A. Milledge. December 30th, 1924 (244,592.)

1925.

225. "Inductances and auxiliary apparatus for electrical measurements. A. Campbell. January 3rd, 1925. (244,596.)

2,032. "Crystal detectors for wireless reception." E. E. Rooke. January 22nd, 1925. (244,604.)

3,181. "Method of indicating frequency changes in alternating electric cur rents." Standard Telephones & Cables, Ltd. (formerly Western Electric Co. Ltd.). (Western Electric Co., Inc.). February 4th, 1925. (244,607.)

3,503. "Self-excited induction motors." British Thomson-Houston Co Ltd. February 9th, 1924. (228,937.)

4,263. "Electric drive for transmission gear-operated high-tension electri switch apparatus." Maschinenfabrik Oerlikon. February 14th, 1924. (229,348.)

6,916. "Electric discharge tubes." Naamlooze Vennootschap Philip Glocilampenfabrieken. June 4th, 1924. (235,141.)

7,479. "Electrically-controlled lifts." J. Fothergill. March 19th, 1925 (244,621.)

9,142. "Vacuum tube." F. R. Geyser. April 6th, 1925. (244,628.)

10,168. "Compensated alternating-current machines of the kind having a commutator winding." Sachsenwerk Licht-und Kraft Akt. Ges. October 31st 1924. (Addition to 231,895.) (242,221.)

10,803. "Multiplex telegraphy." Standard Telephones & Cables, Ltd (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). April 25th, 1925. (244,635.)

11,910. "Thermionic valve systems." Edison Swan Electric Co., Ltd. May 7th, 1924. (233,718.)

13,920. "Control of alternating-current motors, particularly induction motors." P. C. Rushen (Hazeltine Research Corporation). July 4th, 1924 (Convention date not granted. Divided application on 218,675.) (234,822.)

14,192. "Dynamo-electric machines." British Thomson-Houston Co., Ltd May 26th, 1924. (234,841.)

15,751. "Electrodes for electric furnaces." B. E. D. Kilburn (Norske Aktieselskab for Electrokemisk Industri). January 5th, 1925. (Convention date not granted. Divided application on 227,821.) (235,894.)

16,124. "Connector hooks for use in electric distribution systems." British Thomson-Houston Co., Ltd September 16th, 1924. (240,129.)

16,129. "Electric shunts for instruments or other devices." British Thomson-Houston Co., Ltd. (General Electric Co.). June 22nd, 1925. (244,657.)

16,258. "Wattmetrical element for electric meters of the induction type." M. R. Fichter. June 24th, 1924. (236,215.)

17,883. "Thermostats." Metropolitan-Vickers Electrical Co., Ltd. July 11th, 1924. (236,960.)

17,908. "Electron discharge devices." British Thomson-Houston Co., Ltd. July 17th, 1924. (237,208.)

21,383. "Rotors for electrical machines." Siemens-Schuckertwerke Ges. August 27th, 1924. (239,214.)

21,626. "Method of manufacturing uniformly-loaded conductors used for signalling purposes." Felten & Guilleaume Carlswerke Akt. Ges. September 1st, 1924. (239,232.)

21,957. "Process for the manufacture of tubular electric incandescent lamps known as 'strip light' lamps." General Electric Co., Ltd. March 11th, 1925. (244,682.)

22,524. "Electrical liquid-heating apparatus." J. A. Law (W. E. Hudson). August 14th, 1924. (Divided application on 19,296/24.) (244,683.)

26,210. "Electric pulley tackle." O. R. Jurgensen. October 25th, 1924. (241,904.)

26,353. "Electric arc welding and apparatus therefor." British Thomson-Houston Co., Ltd. October 25th, 1924. (241,914.)

27,301. "Electrolytic cells." British Thomson-Houston Co., Ltd. November 10th, 1924. (242 632.)

28,061. "Electrodes for electron discharge devices." British Thomson-Houston Co., Ltd. November 8th, 1924. (242,662.)

29,918. "Electrical connectors." J. D'A. Clark. June 11th. (Divided application on 244,136.) (244,388.)

The

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Electricity Supply: The Government Scheme.

ON Friday last week the Prime Minister delivered the long-promised statement with regard to the policy adopted by the Cabinet for the development of electricity supply in this country; and on Monday the Electricity Commissioners imparted further information on the subject to representatives of the technical Press. We now, therefore, are in possession of the main outlines of the scheme, which will be further elaborated in the Bill which is to be introduced into Parliament early in the new Session.

We are very glad to find that on many points we are in full agreement with Mr. Baldwin. To the facts which he quoted we take no exception, and the personal opinions which he expressed, as distinct from the proposals which, we take it, were formulated by his advisers, are in accordance with those which we have repeatedly put forward in these columns. For instance, he recognises that electrical power in itself does not afford the solution of industrial efficiency; he rightly stated that exaggerated statements had been made, and that cheap power alone could not revive industry. We also welcome his realisation that a good selling organisation is essential to the success of the electricity supply industry; that, in our opinion, is a fundamental requirement—but unfortunately the scheme makes no proposals for providing it. Again, Mr. Baldwin admits that the necessity for the standardisation of frequency is not universally accepted; an isolated area has little to gain from it. And lastly, he stated that improvement of the load factor was of vital importance—a view which cannot be too strongly emphasised.

Turning to the scheme, essentially, it involves the creation of a central executive authority which shall establish a huge network of interconnecting mains between all the large power stations, existing or contemplated, and shall become a "middle-man," purchasing electricity from the producers and selling it to the distributors. In one respect the constitution of this authority will be as warmly approved by the industry as it was by Mr. Baldwin's audience—namely, in that it will not be a Government department. It will, however, be vested with compulsory powers of unprecedented scope; it will be able to "bring everybody into line." If this result is achieved, we may hope at last to see the end of

the parochial system which Parliament imposed upon this country by the legislation of the 'eighties, and which for 40 years has clung round the neck of the industry like Sindbad's Old-Man-of-the-Sea; but the Board is set a gigantic task, and will have an army of vested interests arrayed against it. Important national interests must necessarily over-ride local claims, but we trust that full justice will be done to all those undertakers, whether municipal or company, who have honestly endeavoured to provide the public with that service for which they were granted a monopoly by Parliament.

As we have surmised in these columns, it is clear that the provision of capital for the use of this new authority has been the perplexity of the Cabinet; it would now seem that the Cabinet has found the problem insoluble. Mr. Baldwin states that the Board must find the capital for itself; to enable it to do this, a Government guarantee will be provided. We here find one of the contradictions that appear in his speech. He says that the outlay on interconnecting mains will be remunerative, and that the cost of standardising frequency will be fully off-set by economy in the cost of generation; he indicates that the Board must earn interest and sinking fund on its expenditure, and that the surplus (if any) will go to reduce the charges to the distributors. If the outlay is so sure to be remunerative, why seek the assistance of the Exchequer? and on the failure of that quest, why grant a Government guarantee? Unfortunately, we see no hope of a return from long interconnecting mains—save at the cost of the consumers—and as for the standardisation of frequency, we remember that Mr. Philip Snowden, as Chancellor of the Exchequer, declared this to be in the national interest rather than that of the undertakings concerned, which could not be expected to incur a heavy and unremunerative outlay. The Board will be a middle-man with a profit to make to cover interest and sinking fund, which will constitute a new charge on the supply of electricity, thus making three profits between the coal pile and the consumer's terminals instead of one or two as at present. These charges, we are told, will be fully off-set by economies in generation; we fear that the hoped-for economy, on the contrary, will be more than off-set by the additional charges.

According to the invaluable statistical Return of the Electricity Commissioners, in 1922-23 the average revenue of all undertakings was 2.08d. per unit sold, whilst the cost of generation was 0.54d. per kWh generated—say, 0.67d. per kWh sold, the cost of fuel being about 0.40d. There are many electricity works of quite small output, whose total revenue per kilowatt-hour to-day is less than 1.5d.; on the other hand, many large undertakings, some of which are interlinked with other undertakings, are charging over 3d. a unit on the average for all purposes. As we have shown on previous occasions, saving in fuel cannot possibly affect the price materially except in bad cases. Only by reducing capital charges and improving the load factor can the price be effectively lessened. It is claimed that interconnecting mains will dispense with a large amount of stand-by plant, and will improve the load factor; but a large proportion of the existing stand-by plant is of obsolete and inefficient pattern, and the mains must be paid for, whilst little improvement of load factor can be effected by coupling large stations with similar load curves, and the loss in transmission over long mains must not be ignored. The suggested resultant economies in generation are therefore somewhat problematical, and it is not even certain that undertakings owning very large power stations can supply electricity more cheaply than those of quite modest dimensions. For example, Manchester, with plant of 209,000 kW, receives 1.32d. per kWh, whilst Luton, with 12,000 kW, receives 1.10d. It is true that the large stations use fuel more economically, and with a high load factor can supply energy at a low price, but as Mr. Baldwin most truly said in his address, the great need is to reduce the cost of distribution, and to cover fresh areas—yet the "single purpose" of this scheme is to reduce the cost of generation. The former is greater than the latter, and it is of little use to attack the minor factor whilst leaving the major severely alone. No wonder that the Prime Minister did not think that this scheme would be the salvation of industry!

The fact is that the politicians are obsessed by the one idea of cheapness—always cheapness—failing to realise that electricity supply, for power purposes at any rate, is already cheap in our great industrial areas. What is required is development, and it would be far better to spend a large sum (but modest in comparison with the millions required for this scheme) on the education of the public to the advantages that they can derive from the free and even lavish use of electricity, than to sink enormous capital in mains and in replacing plant of non-standard frequency. Over a year ago we expressed the hope that "the technical advisers of the Government will recommend a sane and sound policy, avoiding an unprofitable outlay, but spending freely where it is wise to do so." We do not feel that the scheme before us fulfils that hope. We fear that the Government has tackled the wrong end of the problem; it is embarking on an unprofitable outlay.

Let it be understood that of the interlinking of adjoining power stations we cordially approve; our objection is taken to the erection of long mains connecting widely separated areas. In countries where water power or coal is available only in remote localities, such long mains are indispensable, but in this country that condition does not obtain—coal is available almost everywhere, and there is no necessity to transmit large blocks of power over great distances. Lancashire, already supplied with cheap power, will gain nothing from connection with the North-East coast or the Midlands, and *vice versa*.

The large expenditure contemplated would be more profitably devoted to assisting the electrification of our railways, which would at the same time carry electricity supply into the rural areas.

Research in the United States.

A BULLETIN has been issued dealing with the expenditure of the United States on research; her industries spend about 35 million dollars per annum on co-operative laboratory research, and it is estimated that this results in a saving of approximately 500 million dollars. By those who make use of the facilities offered, the outlay is regarded in the light of a sound and profitable investment; they find that it pays them extremely well. It is deplored that the value of the service proffered is not universally recognised; there, as here, there are powerful interests which stand aloof, showing that after all Britons hold no monopoly of stupidity. What is really of moment to British industries is not the fact that certain Americans are less alive to their opportunities than is supposed, but that the majority are alert and progressive, in no direction more so than as regards their attitude to research.

In many instances there is hearty and effective collaboration between industrial plant and university, between workers in applied and pure research. It is sufficient to read the records of such manifold and valuable researches as are described from time to time, for example, in the pages of the (American) *General Electric Review*, to realise how important a part scientific inquiry for practical ends plays in the development of the staple American engineering industries. Research is with them no luxury stunt; it is deemed to be a sheer necessity.

British engineering must not be allowed to lag behind in this respect; it will do so to its own increasing detriment. Much good work has been done, and is being done, alike at the N.P.L. and in commercial laboratories. Various research associations are holding their own, if doing little more. One or two, such as that of the electrical industries, are forging ahead. Taken as a whole, however, there is occasion for serious stock-taking. Much better things are possible; much closer attention to the real needs of the situation is called for.

As a nation we are faced with keen and well organised competition. Abroad the scientific spirit, as an aid to industry, is freely cultivated. British steel manufacturers, for example, have a hard fight before them. Not less, but more reliance upon the researches of expert metallurgists is a vital necessity. We have to hold our own—nay, to excel.

Thus the prime requisite is that Britain shall emulate her over-the-seas cousin, and in capitalising research, that she shall do so with no niggard hand.

The Protection of Investors.

THE frequent references in our own columns and in those of certain financial dailies, warning the public to be on their guard against invitations received through the post to invest in certain extremely weak and undesirable electricity supply companies, have not succeeded in entirely stopping the issue of such invitations. As we have repeatedly said electrical men (and women) who are familiar with electricity supply matters and the main essentials to success of electricity undertakings, are unlikely to be led astray by primitive and obviously misleading prospectuses, and their peculiarly-worded accompanying communications; the victims are seemingly innocently-minded and unsuspecting individuals who have no occasion to read either the electrical or financial Press, and who in their effort to make a slight increase in their meagre incomes in these hard times have reposed their trust in unknown and unworthy advisers, and have awakened after a short time to find that they have lost their money. It is in the interest of electricity supply and, indeed, all forms of legitimate enterprise that everything possible should be done to lessen the activities of postal "share-pushers." The President of the Board of Trade was questioned on the subject in the House of Commons recently and he undertook to bring the subject before the Committee which is considering possible amendments to the Companies Acts. Mr. Waldron Smithers who put the question has been interviewed by the *Financial Times*, and he has mentioned the possibility of introducing a licensing system which would enable a "black list" of undesirable circularisers and of doubtful shares to be kept. Only expert investigation can decide how far such a system could prevent the wholesale victimisation which appears to be prevalent at present. In one part of the interview with Mr. Smithers it is revealed that one method which has been employed for inducing people to part with their life savings has been to offer shares "in a particularly good electrical concern" at slightly under market price. "On payment of 1s. fee at Somerset House the names of people interested in electrical companies are ascertained and they are circularised to buy the shares in the company of standing. On application prospective buyers are informed that the shares which were on offer have been sold, and the firm then tries to interest them in something else it is anxious to dispose of." Mr. Smithers advocates that the widest publicity should be given to such methods. We fully agree, and if only our highly organised newspaper Press from one end of the Kingdom to the other would shoulder this responsibility it would be serving the real interests of its millions of readers in a way which is open to nobody else, and bring to itself far greater credit than is due to it for sensational and kindred stunts.

Registered Contractors.

WE wish to direct the attention of our readers to the very interesting article relating to the position and progress of the movement for the registration of electrical contractors which appears on pages 130 and 131 of this issue. We are indebted for this statement to Mr. P. V. Hunter, C.B.E., the Chairman of the Executive of the National Register. It will be observed that down to December last 804 applicants had been admitted, and 50 others were then under consideration. But it will also be seen that there are still a large number of eligible contractors who are, for some reason or other, holding back. Mr. Hunter tries to clear away some of the sources of misunderstanding that exist regarding the objects of the movement, and we trust that the publication of his article will stimulate interest and increase the rate of applications for membership. In another part of this issue we also give publicity to the list of contractors whose names have been added to the register since the summer of 1924.

Coal, Power, and Transport.

ON Thursday last week a grandiose scheme for the co-ordination of coal mining, the generation of electric power, the production of coke and smokeless fuel with recovery of the attendant by-products, and transport, was submitted to the Royal Commission on the Coal Industry by the Miners' Federation. The scheme essentially involved the nationalisation of all these important industries under the control of a Government Commission endowed with autocratic powers, attached to the Board of Trade. In place of the Electricity Commission there would be a "Power and Transport Commission" consisting of six full-time Commissioners, which would deal with the development of power (including coal) and transport; there would also be a "National Coal and Power Production Council," to control the organisation of the industry as a board of directors, and provincial councils, pit and works committees, and a consumers' council were provided for, as well as a separate export commission which would purchase coal and export it. It appears that the miners themselves would be heavily represented on these various bodies.

The collieries would be purchased at market values, by the issue of Government stock, or by a guaranteed national loan.

The scheme included the generation of electrical power at or near the mines, largely from refuse fuel, and the use of gas for producing electric power, as well as the adoption of low-temperature carbonisation, was contemplated.

One cannot but admire the calm effrontery with which this preposterous proposition was laid before an astonished public. The scheme was said to represent the views of a joint committee of Labour organisations; it is impossible to believe that it was ever meant to be treated seriously, and the only apparent purpose with which it was launched must have been to divert attention from the fact that the miners had put forward no concrete proposals for restoring the coal mining industry to a healthy condition. It has expired in a burst of laughter.

The Market in the Dutch East Indies.

ON another page is printed a statement showing the imports of electrical and allied material into Java and Madeira. It will be seen that in spite of the importance of the market in these two prosperous islands of the Dutch East Indies, the share of Great Britain in the electrical trade is practically negligible. Yet the purchasing power of Holland's East Indian possessions is growing rapidly owing to their exportable surplus of many agricultural and mineral products, *e.g.*, rubber, sugar, tobacco, cinchona, coffee, tea, oil, and tin, for which the world's demand is either increasing steadily or at least very stable. The population of the islands is roughly fifty millions. Of these about 35 millions are to be found in Java, among them over 135,000 Europeans. Whilst the figures to which we draw the attention of British exporters desirous of finding promising outlets for their goods, refer to the most populous and highly-developed portions of Holland's colonial empire, there are other regions which show great promise of agricultural and commercial expansion. In Sumatra vast schemes are being undertaken for the cultivation of rubber, coffee, tea, and cinchona, whilst in South East Borneo iron ore deposits have attracted the notice of capitalists. In the Celebes there is a project for utilising water power in the manufacture of fertilisers.

It would therefore appear that the market is worth the serious attention of British electrical manufacturers and traders.

Another Automatic Converter Sub-Station.

Demonstration of Reyrolle-Mather & Platt Equipment at Park Works, Manchester.

THAT the advantages of the automatic operation of converter sub-stations are being appreciated is evident from the fact that, whereas four years ago no such plant existed in this country, there are now a number in service, and at least six firms have manufactured, or are prepared to supply, equipment of this class. The increasing importance that this type of plant is assuming offered an opportunity last week of examining with much interest a rotary-converter equipment in-

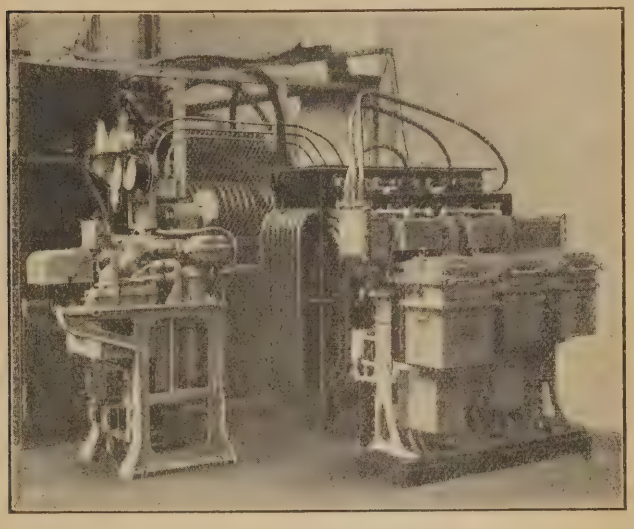


Fig. 1.—H.P. Switch, Transformer, and Starter Panels.

stalled at the Park Works, Manchester. The sub-station comprises a 500-kW self-synchronising rotary converter by Messrs. Mather & Platt, Ltd., with completely automatic control gear by Messrs. A. Reyrolle and Co., Ltd., and a transformer by Messrs. Ferranti, Ltd.

Like other automatic control equipment produced by Messrs. Reyrolle, this is an entirely metal-clad job with a minimum number of relays, all of fundamentally simple type. The main h.p. switch panel is shown in fig. 1; it consists of a standard 6,500-V, compound-filled, metal-clad panel of the horizontal draw-out type "C," with a normal rupturing capacity of 75,000 kVA, provided with a 3-phase potential transformer on the incoming side, low voltage, overload, and earth-leakage protection with t.l. fuses. A simple drive by a small 3-phase motor standing on top of the bus-bar chamber makes adequate provision for electrical operation without interfering either with the draw-out principles or with hand operation when required.

The Ferranti transformer is placed immediately behind this switch, and the starting switchgear is arranged directly alongside the l.p. terminals of the transformer in a direct line between it and the converter, thus minimising the length of cable required for the l.p. connections and avoiding awkward cable runs. The starting gear (seen on the right in fig. 1) consists of three neat metal-clad, oil-immersed switch pillars of the Reyrolle 400-V mining class, arranged in line and provided with mechanical interlocks and solenoid operation.

Messrs. Mather & Platt's standard method of starting has been incorporated in this equipment; the system is particularly suitable for automatic control owing to its simplicity, the certainty and smoothness with which synchronising is effected, the ease with which the polarity can be controlled, and to its independence of external and internal variables, *e.g.*, temperature. It is not necessary to lift the d.c. brushes during the starting period, so that not only is one source of complication removed, but it becomes possible to fit the standard M. & P. simple and rigid brush gear with all springs and flexibles thoroughly shielded.

On the d.c. side a standard 3-wire machine panel with automatic reclosing circuit breakers has been provided, and the equipment feeds in to the d.c. shop network in parallel with the manually-operated equipment installed in the firm's main sub-station some hundred yards away. The automatic control panels are shown in fig. 2 mounted alongside the d.c. machine panel; one carries the indicating instruments and manual controls without which no Reyrolle automatic equipment is turned out; on the other panel is mounted the whole of the relays required for starting the plant by low voltage on the network, or through the agency of an astronomical time switch and the Reyrolle standard master timing device shown in fig. 3.

This is set to prevent the switch being started by momentary kicks; it energises the closing motor on the h.p. oil switch through the operation of the master relay. This operation cannot be effected, however, unless the a.c. low-voltage coil is first energised, its circuit being completed through all the main protective devices and through the auxiliary "police" switches indicating the position of the various starting switches and the d.c. circuit breaker. As the closing motor is a 3-phase machine, the fact will also be appreciated that it will not operate to close the switch if one phase happened to be lost, thus providing against single-phase operation, a further safeguard in this respect being provided by connecting certain of the a.c. relays to opposite phases.

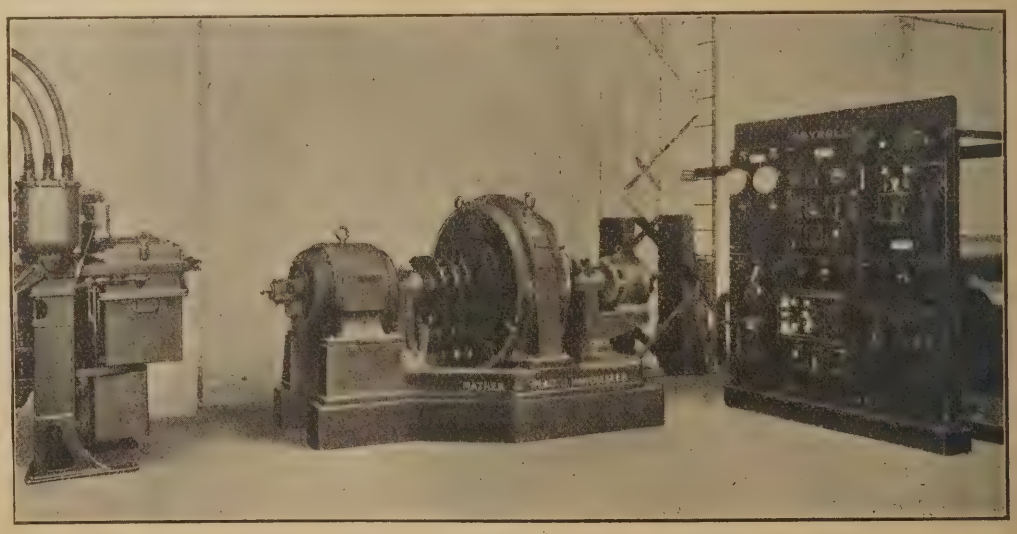


Fig. 2.—The Park Works Automatic Rotary Sub-station.

When the h.p. switch is closed, the transformer is energised, and the starting motor of the rotary converter is connected to the l.p. side of the transformer. The machine accordingly begins to accelerate and, the correct polarity having been determined by a suitable relay, the l.p. transformer connections are transferred

to the second (or synchronising) step; the machine now runs up to full speed, the main field winding is adjusted to the correct strength, and the machine brought into synchronism. The operation of the relay provided to prove synchronism closes the main (or running) contactor on the l.p. side, cutting out the starting motor, opening the contactors controlling it, and connecting the l.p. transformer leads direct to the slip rings; at the same time an adjustment is made to the field strength to give normal no-load voltage on the d.c. side, and

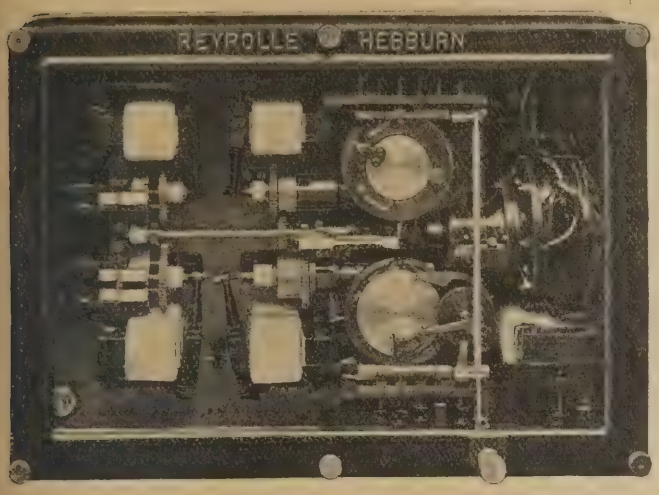


Fig. 3.—Master Control Device.

the discriminating relays controlling the operation of the main machine circuit breaker are put into operation.

If the load proves to be within the limits of the machine, these circuit breakers close, and the load is at once picked up. Underload and overload d.c. relays govern the operation of the set through the medium of the master timing device, which also incorporates in one common case all the time elements required for the whole equipment. In the event of a failure to synchronise for any reason, the set will shut down and will automatically start a second, and then a third, time before finally locking itself out.

The time taken to get the rotary on load is remarkably small, being considerably under one minute. The converter is equipped with an exciter and with bearing-temperature and overspeed devices of Messrs. Mather and Platt's own design and manufacture. The polarity is at present determined by the exciter, but an alternative scheme was demonstrated to us which allows of the correct determination of the polarity without the use of an exciter.

A feature of Messrs. Reyrolle's equipment is that each individual piece of main apparatus controlling the plant is not only provided with a handle, but is definitely made for normal hand operation, as well as fully automatic. This is a point which will be appreciated, for it provides easy facilities for overhaul and efficient examination by the inspection staff. The relays are all of the plain electromagnetic type, with lift and fall armatures carrying visible contacts, and are enclosed in dust-tight cases of uniform design with glass fronts to show the interiors. The master timing device illustrated in fig. 3 is an ingenious adaption of simple principles, and comprises a single main shaft driven at a speed of approximately three revolutions per minute, to which are connected, by electromagnetic clutches controlled by the various relays, simple trains of gearing which drive graduated cams that operate robust visible contacts. The range of timing offered by this piece of apparatus is such as to provide an ample margin to satisfy the varying conditions met with in practice.

In conclusion, it may be remarked that we were also shown a smaller converter set in the works which is completely controlled from a distant point with the aid of pilot wires and switching apparatus of the type made by Messrs. Bertram Thomas, similar to that illustrated in our issue of October 17th, 1924.

The Comines Power Station.

A French Central Station using Pulverised Fuel.

By THEODORE RICH.

(*Concluded from page* 88.)

Water Services.

In many parts of Flanders the question of feed and other water supplies gives rise to difficult problems, especially as nowadays a steam station has so many auxiliary services requiring water besides the boiler feeds; for instance, the cooling of air which passes through the generators, the cooling of the turbine circulating oil and that of the transformer coils, also supplies of drinking water. There are two sources of water supply at Comines—one from the River Lys, drawn from the circulation pressure pipes, and the other a tube well sunk 190 metres (623 feet) deep, into carboniferous limestone. The former water, in addition to its use for condenser circulating purposes, is used for the cooling of the evaporator auxiliary condenser and for fire service. The well water is used to supply the workmen's cottages and the station with drinking water, and can be used as an alternative for other services. A pump house is fitted on the ground floor, containing centrifugal pumps, which are used for the different services; it also contains the distilling plant. Three tanks are arranged—two of 65 cubic metres (2,280 cu. ft.) capacity and one of 20 cubic metres (702 cu. ft.); the two former are used for raw river or well water, the latter for distilled water. A water softener of the Demouly-Lamy type, of a capacity of 40 cubic metres (8,800 gallons) per hour is arranged to work intermittently; the water is then passed into a settling chamber of 300 cubic metres (9,350 cu. ft.) capacity. A tank of the same capacity is fed by the distillers, this water being used for cooling the transformers and reactances, the cooling of this water being by means of sprays.

There are four Sulzer centrifugal feed pumps; three of these are driven by high-pressure steam turbines and the fourth is operated by a three-phase motor running at 220 volts. Each has a capacity of 200 cubic metres (4,400 gallons) an hour under a pressure of 23 kg. per sq. cm. (327 lb. per sq. inch). These pumps have their suctions under head in the feed tanks, which are supplied from the condenser. The pumps have excess pressure valves which release back into the feed tanks.

In order to eliminate trouble through scale in the boilers or in transformer and other cooler coils, a Kestner multi-effect distiller is arranged, which will be described at a later date. The steam supply for the heating comes from the exhaust of the Sulzer turbines which drive the feed pumps. The output of the distiller is passed through a Lea Recorder.

Piping System.

The steam pipes are of solid drawn steel, with circular loop expansion rings. There are two independent lines of mains running at the back of each line of boilers, terminating in steel separators, and a double header running along a covered alley way between the boiler

houses and the turbine house; there is a duplicate supply up to the turbine separators. The pipework is covered with a composition made up of 85 per cent. Newalls sulphate of magnesia and 15 per cent. fibrous asbestos; the insulation of the pipe joints is made removable. Steam meters of the type made by the American General Electric Co. are fitted. The feed pipes to the economisers form a double ring; they are fitted with Worthington-type water meters.

The Driving of Auxiliaries.

In accordance with a practice very usual in France, separate generating sets are provided for the driving of the auxiliaries; two Rateau-Schneider-Thomson-Houston turbines have been installed running at 3,000 r.p.m., one of 3,500 kW and the other 5,200 kW (these were illustrated in fig. 14, p. 62, in the issue of January 8th). The generators are wound for 10,500 volts, and are connected to a special auxiliary switchboard placed quite apart from those of the main station.

The auxiliary bus-bars are in duplicate, and in case of accident, by means of oil switches, they can be connected to a set of duplicate local supply bus-bars, which are supplied by step-down transformers 45,000/10,500 volts from the main station bars, these local supply bars being connected to certain outgoing feeders at 10,500 volts.

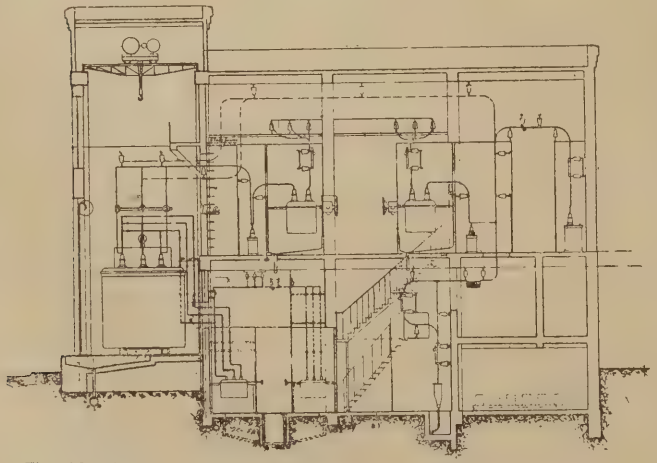


Fig. 18.—Vertical Section of Transformer Station at Tourcoing.

To these auxiliary bars are connected 10,500/220-V, 2,000-kVA transformers for the operation of those auxiliaries which are run on three-phase current; for instance, the fans for the chain-grate stokers, the Prat induced-draught fans, and the pulverisers; a set of two 1,000-kVA transformers for the river pumping station; and a set of transformers for operating the rotaries. The station and other overhead travellers, the coal transporters, elevators, and belt conveyors are operated with direct current at 230 volts from two 500-kW, 1,000-rev., six-phase rotary converters, shunt wound and fitted with centrifugal trip gear. For the emergency lighting and the operation of the auto-switchgear, a 350-ampere-hour, 110-volt iron-nickel battery is provided, charged by means of a 12-kW asynchronous motor-generator.

Transformers and Switchgear.

A house for transformers and switchgear runs the whole length of the main buildings; it is 28.4 metres (33 ft. 3 in.) wide, and is separated from the main bay of the turbine house by a passage arranged so that the transformers can be run on to a trolley from the cells in which they are placed and run out of the building. Each cell is fitted with roller shutters. This can be seen from the section of a similar building, fig. 18. The operating board is placed above this passage.

Each turbo-generator is connected to three single-phase transformers, each of 10,500 kVA, 10,500/45,000 volts; the low-pressure side being in delta and the high-pressure in star.

There are three sets of bars—one for coupling, one set of main bars, and an auxiliary set. Each group of step-up transformers is connected to an automatic oil switch fitted with differential relays for the protection of each alternator, and a wattmeter-type relay which comes into action in the event of bad paralleling. Connection is made by three remote-controlled switches to the three sets of bars, the connection to the coupling bars being through reactances. The main bars are

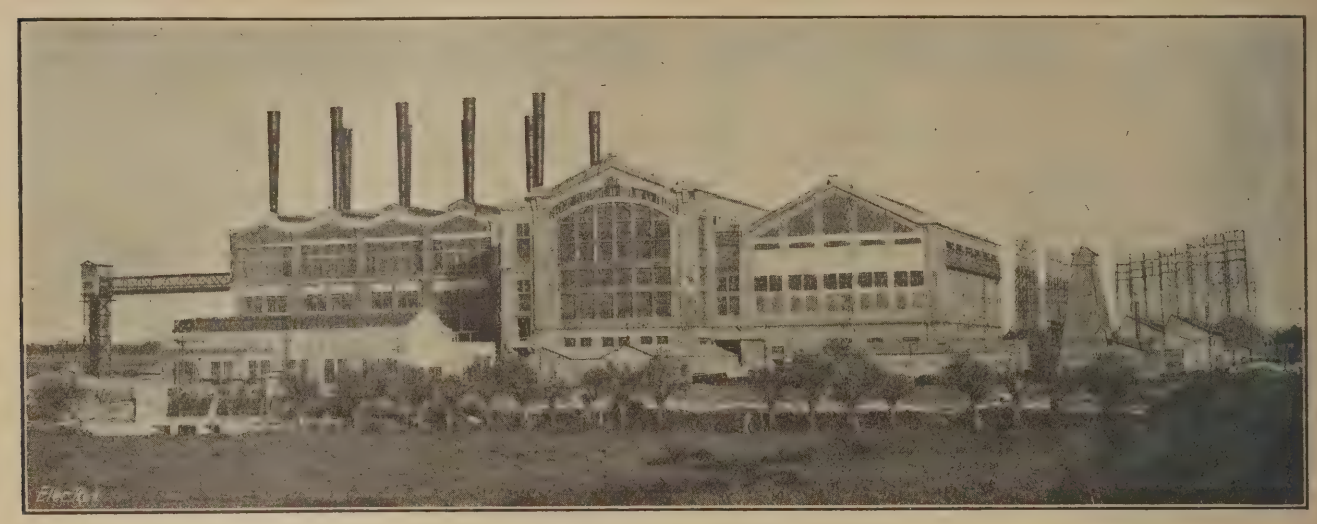


Fig. 17.—General View of Comines Power Station.

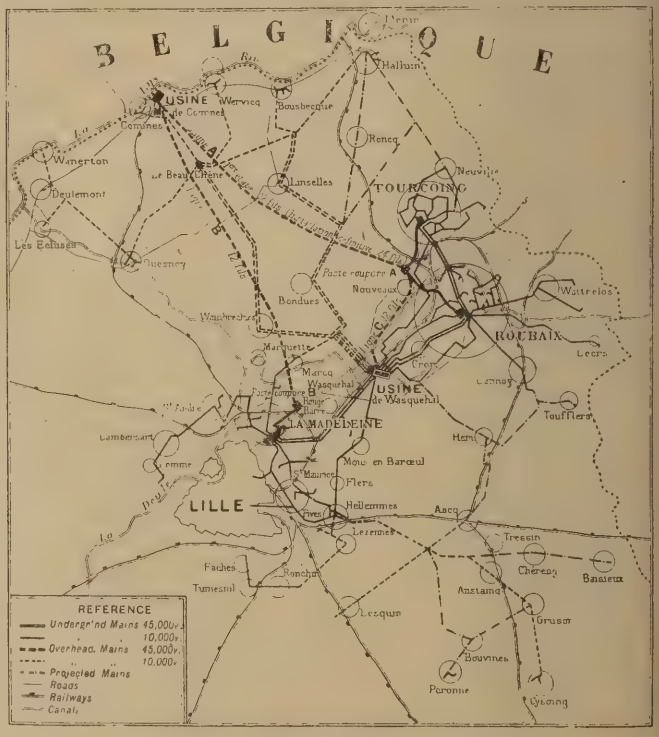


Fig. 19.—Plan of the Network of the Company.

sectionalised so that, if desired, the Roubaix-Tourcoing section can be run separately from the Lille section. Each feeder is connected to the main and auxiliary bars by means of two automatic switches; protection is given to each feeder by means of water-jet limiters and horn dischargers fitted with liquid resistances. With the aid of the auxiliary bars, should the automatic switches on a feeder come out, it is possible, by means of a regulating transformer, gradually to raise the pressure on it to see if there is a permanent fault.

The electrical end of the main turbo-generators, the transformers, and the switchgear and appliances were supplied by the French Thomson-Houston Co.

Auxiliary Buildings.

A workshop about 100 ft. long by 33 ft. wide is provided for general repairs; it contains tools and equipment for general electrical and mechanical work, with a forge, coppersmiths', and woodworking shops. In an annexe to the main building lavatories and shower baths are fitted. In view of the difficulty of getting accommodation in the neighbourhood, a number of houses have been put up for employés, each block consisting of four dwellings, each with a strip of garden.

Transmission Lines.

Fig. 19 shows the trunk lines. In the direction of Roubaix-Tourcoing there are 12 stranded conductors of copper, 105 sq. mm. (0.163 sq. in.) section. Fig. 20 shows the type of standard used, the normal span being 65 metres; the standard is set in a block of concrete. The top conductor is fixed about 38 ft. and the lowest about 30 ft. from the ground. The main uprights are made up with four braced angles 60 × 60 × 6 mm. (2.36 × 2.36 × .23 in.), on a base at the ground line of 1.200 metres (3 ft. 11 in.). The earth wire is of double-galvanised stranded steel of 35 sq. mm. (0.05 sq. in.) section. The insulators for the 45,000-volt lines are tested to 140,000 volts in the dry. The distance between the conductors is 1.25 metres (4 ft. 1½ in.) horizontal and 1.35 metres (4 ft. 5 in.) vertical. A wire guard is put up between each section of six conductors at the supports, so that one section can be got at safely while the other is alive.

There is a 6-conductor line towards Lille, which has running alongside it most of the way a similar line

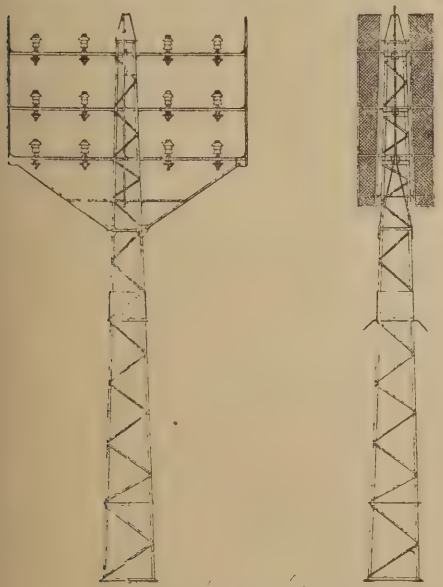


Fig. 20.—Steel Standards for 45,000-Volt Line.

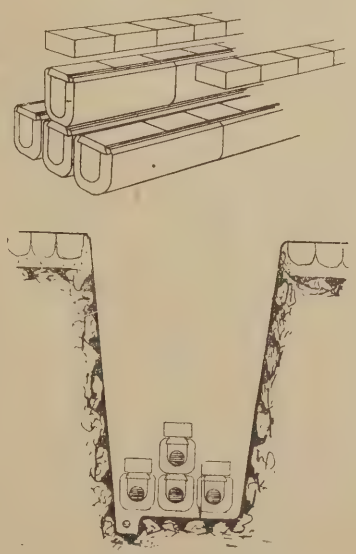


Fig. 21.—Section of 45,000-Volt Underground Mains.

built by the State to link up with a main trunk line running between Valenciennes and Lomme, which is to the west of Lille.

Outside Roubaix-Tourcoing and Lille indoor switching stations are arranged, with incoming and outgoing feeder auto-switching gear and protective apparatus. From the former station aerial lines make connection with the Wasquehal power station. From these two stations to the three main sub-stations 45,000-volt cables are laid. To Roubaix four single-conductor cables of 340 sq. mm (0.53 sq. in.), 3.5 km. (3,828 yd.) long, to Tourcoing 2.35 km. (2,570 yd.) and 150 sq. mm. (0.23 sq. in.), and to La Madeleine-Lille 1.69 km. (1,748 yd.), also 150 sq. mm.

The single-core cables are insulated with paper and covered with lead, then surrounded by an insulating compound and two layers of tarred paper, the whole being served with impregnated jute. These cables,

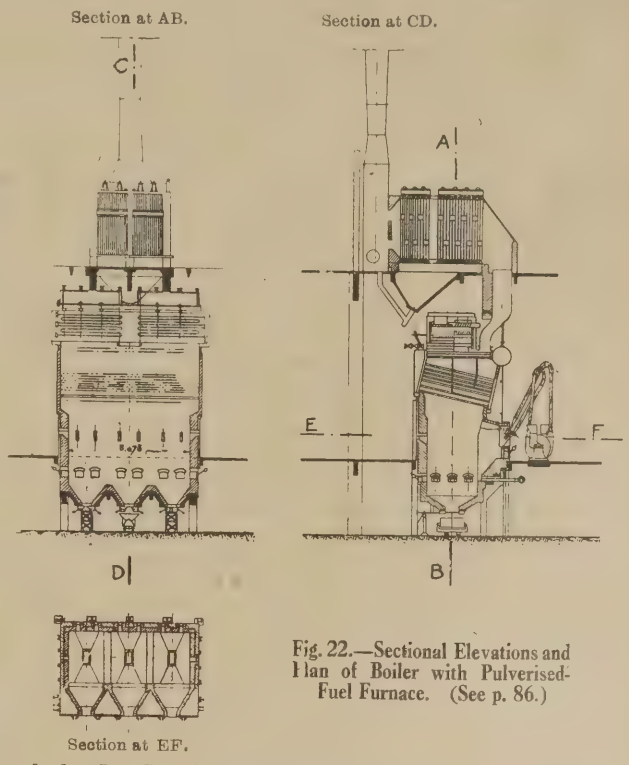


Fig. 22.—Sectional Elevations and Plan of Boiler with Pulverised-Fuel Furnace. (See p. 86.)

made by La Canalisation Electrique, of Saint-Maurice, were tested before delivery to 80,000 volts for five minutes.

The four cables are laid in a trench in concrete troughing, as shown in fig. 21. The three cables at the bottom have equal spacing, and the height of the fourth reserve cable above the axis of the bottom centre one is the same as the spacing of the three below. The bottom cables are transposed into sections of one-third the length, each conductor occupying in turn the positions of right, centre, and left; the top reserve conductor runs right through. With this disposition, all the coefficients of induction of the different conductors balance out, and there is no action on the copper or lead sheath of the spare conductor. At Roubaix, Tourcoing, and La Madeleine-Lille indoor transformer sub-stations are arranged (naturally inside cities the land for outdoor sub-stations would be very expensive). The transformers are arranged in 5,000-kVA units, 45,000/10,500 volts. A cooler and a detartariser for the transformer circulating water are placed on the flat roof of each sub-station.

A small battery of accumulators is provided for the operation of the trips. In order to improve the power factor of the system, some 6,000-kVA synchronous condensers have been installed recently at suitable points.

The design, construction, and equipment of the Comines station and of the transmission lines and sub-stations were undertaken by the Société Générale d'Entreprises, of Paris, one of the largest electrical contracting concerns in France. The thanks of the writer must be given to that company, and particularly to M. Duval, their electrical engineer, and to M. Orengo, the central-stations director of the "Energie Electrique du Nord," for help in the preparation of these notes.

Hydro-Electric Power in Argentina.

Development of the Iguazu Falls.

By PERCY F. MARTIN, F.R.G.S.

UNLIKE its neighbour, Brazil, Argentina is but poorly endowed with natural waterfalls; the one source of real potential importance, the falls of the Iguazú, belongs territorially as much to its neighbour as to Argentina, forming, indeed, part of the common frontier. For at least two decades the question of joint utilisation of the falls has been mooted, and it may be stated now with some authority that use is about to be made of them by both Governments, and in connection with this an official announcement will be made at no distant date. It is proposed to build four lines, each sufficiently powerful to carry the full load, so that if any one should break down or be interrupted, there would be no complete cessation of the supply. Preliminary estimates of the expenditure place the figure at between $50,000,000 and $60,000,000 gold (£10,000,000 and £12,000,000) for supplying Buenos Aires with a *per capita* supply of 500 kWh a year, at a cost of 60 per cent. of the present rates, while the actual work of construction would occupy, perhaps, two-and-a-half years.

An Iguazú hydro-electric power scheme is by no means new. It has been visioned by successive administrations of both States, while, as far back as August, 1919, something like a definite project was put forward at the instigation of Dr. Honorio Pueyrredón, at that time Minister of Foreign Affairs, and now the Argentine Ambassador to the United States. A satisfactory feature of the proposal put forward was that when—if ever—the projected exploitation of the Falls of Iguazú came about, both Argentina and Brazil would work hand in hand to the mutual advantage of their nationals. Since then both Governments have devoted funds for the purpose of preliminary scientific investigations, and they have come to the mutual conclusion that the time is now ripe when commercial exploitation of this vast untouched water supply could be successfully carried into effect. So far as early, but necessarily incomplete, examinations of the commercial possibilities of the Iguazú Falls have proceeded, it seems that some 150,000 h.p. (subsequently to be increased to 300,000 h.p.) could be obtained, sufficient to supply the city of Buenos Aires with about 125,000 kW during ten months of the year, that is to say, about 80 per cent. of the energy produced. The remainder could be distributed *en route* to the second most important commercial town of Argentina, Rosario de Santa Fé, which would be connected up by means of a branch transmission line. The one adverse factor is the unavoidable partial service available during the dry season, when the quantity of electrical energy would have to be reduced to a maximum of 75,000 kW, thus rendering it necessary to provide an auxiliary power installation by means of coal or oil fuel which would be capable of supplementing the hydro-electric works. At the same time, it is considered possible to further increase the quantity of energy supplied by the falls of the Iguazú by the construction of a number of dams, not provided for in the engineers' original estimates.

Most of the course of the Iguazú river forms the boundary between the Rio Grande and Santa Catharina States, of Brazil, and the State of Misiónes, on the borders of Argentina, and at its mouth are located the falls of the same name as the river The only navigable part of the stream (from Puerto da Uniao to Puerto Amazonas) is in Brazil. The actual falls are 1,200 km. (approximately 750 miles) distant from the city of Buenos Aires, and the question has been raised whether it is possible to successfully transmit the energy over such a distance. Water power must, generally speaking, be developed where it is found, while fuel power can be developed where it is wanted. There must of necessity be a loss of power in transmission, while in regard to cost, not only must the plant be larger in order to deliver the required power over and above the loss, but the transmission lines must be paid for and maintained. By a prodigal expenditure, such as would have to be taken into consideration in relation to the Iguazú scheme, the losses in transmission can be made low; but this does not necessarily mean a saving in the total cost of transmission if the additional annual charges are thus unduly raised. The progress that has been made within the past few years, however, in the construction of transformers, &c., required for transmission at 220,000 V, has placed the proposal of transmitting energy over the distance referred to well within the bounds of realisation. It appears, however, from what the engineers have finally reported, that the distance to be covered between the falls and Buenos Aires cannot be shortened by any feasible means. It has been definitely decided that in drawing up the necessary calculations and conclusions, the higher voltages must be allowed for. Distance, however, beyond the heavy outlay involved by the transport of plant and material through jungly country without roads, offers no obstacle; this has been proved in numerous other similar cases, notably the transmission of energy over a length of 450 miles in Southern California, and, in another instance, where transmission has been carried over a distance of nearly 1,000 miles. It is calculated that the Iguazú Falls could be harnessed so as to provide 500,000 h.p., one half of which would go to Argentina (where, besides the city of Buenos Aires, the territory of Misiónes and the two provinces of Corrientes and Entre Rios could be brought within the scheme of supply), and the other half to Brazil.

The Falls of Iguazú consist of 275 cascades, one of which has a sheer drop of 260 ft., compared with Niagara's highest fall of 160 ft. One of the most costly items to be met in carrying out the enterprise would be the clearing of land on the Brazilian side of the falls, which are at present nothing but jungle. The vegetation is so prolific, and the rains are so heavy and abundant, that special thoroughfares would have to be made, and, when constructed, kept in order at a very heavy outlay. The question of labour would be less difficult to solve, since there is an almost unlimited number of native hands available both on the Argentine and the Brazilian sides.

The Iguazú is not the only potential source of electric energy in Argentina. Investigations have shown that the waters of the Salto Grande, north of Concordia (Argentina), and the Salto (Uruguay) could be utilised, so that the neighbouring states could obtain from the falls a supply of not less than 50,000 h.p. In the Department of San Rafael the Atuel falls could be utilised to provide sufficient energy to electrify the system belonging to the Western Railway. In Argentina, where, as indicated, no waterfalls are available, and wood, coal (imported and native), and petroleum are extremely costly, the only solution of cheap fuel provision is for factories to group themselves about central stations of large capacity, and take their supplies from them. These installations, furnishing many thousands of kW, could supply at rates far below the cost of electricity produced upon a small scale by means of isolated plants. Indeed, in Argentina the rates are not high if considered from a comparative point of view, and for a country which has earned the reputation of being one of the most expensive in the world in which to live. The fact becomes the more notable when it is remembered that practically everything having relation to electricity has to be imported.

Initiating Mr. Smithers.

By "STAN DARD."

I WAS considering packing-up for the day when the bell summoned me to the Chief's office. As I wended my way there I cast about in my mind for any technical omissions I might have made recently, for, as a rule, a summons to the Chief's office meant but one thing: that there was "something up." I had satisfactorily gone through two recent jobs by the time I had reached his sanctum, and as I opened the door I began to marshal the facts relating to one not quite so favourable. My trend of thought was upset by the unusual aspect of my Chief.

He was seated, as might have been expected—true; but his customary highly-critical demeanour seemed to be lacking. His gaze, usually of an e.h.p. quality and directed point-blank at the arriving victim, was unexpectedly mild (even irresolute), and it was lingering upon someone else. The latter was a young fellow, who (remarkably enough) appeared perfectly at ease. Indeed, a chance onlooker would at once have identified him as the most impressive character in the room.

"Oh—er, Dard," said the Chief, turning towards me. "This is Mr. Smithers, who is joining us for an insight into our—er—work. I'd like you to take him along with you to-morrow and initiate him. You might as well be getting on with these four jobs."

On the following morning I had some difficulty in locating the latest arrival, and eventually found him, in a state of abstraction, behind "The Wireless Herald." He appeared somewhat taken aback and (to my relief) not quite so impressive as on our first meeting.

"We'd better be getting along," I hinted. "By the way," I went on, "I wouldn't advise you to wear such good togs on our work. The jobs to-day, for instance, are a bit rough-and-ready, so to speak."

"Oh, that's all right," he hastened to assure me. "I know what electrical work is like."

During our run to the first place I gathered that Smithers, after leaving college with a technical degree, had found some difficulty in adapting himself to the practical world. Yes, electrical work appealed to him. He seemed, though, to be under the illusion that electrical conditions were just a kind of magnified lab. work. Our first halting-place was in the nature of a rude awakening. It was a flock factory. Here a number of carts were unloading sackfuls of rags, which were first placed in ovens. Inside the factory proper were a number of machines looking very much like a.c. generators, the rotors, however, bearing nasty-looking spikes; into these machines the rags were fed, to emerge from the tearing process as flock. They were driven by electric motors, and, as I explained to Smithers, our job was to investigate the electrical conditions following on the installation of some static condensers.

Smithers, however, was in no mood for technical matters, and as time went on his interest decreased to zero. This was understandable, and due to a detail which I have neglected to mention. The atmosphere of the factory was stiflingly hot, and full of tiny, irritating fragments of flock. These had filled all the crevices in the walls, and every article in the place bore deep layers of flock—the Supply Co.'s meters and cables being especially favoured. Smithers' discomfort impelled him to retire from the scene, coughing and itching. Having arrived at my power-factor and other details I, too, hastened to leave. Smithers was conversing with the foreman. "Been long here?" said the latter, with a hearty and fluffy laugh. "Lor' bless yer, fourteen years!"

For some miles Smithers was silent but still *restless*. At last he enquired as to our destination. I told him: a soap and candle works. I added that there was no reason to expect an atmosphere like the flock factory's. This was not altogether fair, because the atmosphere we presently entered more than made up in aroma for what it lacked in solid matter. Our technical work here dealt with the metering; the works was on a day-and-night tariff, and as the day meter had gone on strike and the night meter was working a 24-hour shift, the works was receiving all energy at the cheaper rate. When the fault was cleared and we reached the fresh air, Smithers expressed the view that it was a wonder *anything* worked in such a place. "Besides," he added, with some indignation, "what do people want with candles nowadays? Soap I suppose we need, but candles . . .!"

When he heard that the next job was down a pit he cheered up surprisingly. I hinted that we'd have some work to do—as a matter of fact we got more than I bargained for. At the pithead we met the electrician and had a long and cold wait while a "set" of tubs was hauled to bank. I donned overalls and cap, while Smithers elected to retain his top coat in lieu of dungarees. At last the banksman nodded us into the cage.

The cage dropped and Smithers gasped. The shaft was a wet one, and water splashed into the streaming cage. Smithers's top coat was not so out of place after all! At the bottom we paused awhile to attune ourselves, the onsetter regarding Smithers's trilby and top coat with frank amazement; then, burdened with current transformers, instruments and lamps we set off inbye—the electrician leading the way. For a while we clambered and splashed over tramlines in a main road. The roof lowered, and abruptly we turned right, down a steep incline. Bent nearly double, and half-slithering, half-walking, I managed to keep in sight of the electrician. Behind me I could hear Smithers stumbling along. I was perspiring freely and did not envy him.

The electrician halted. We had reached our objective—a wet and dimly-lighted pumphouse. Here was a pump driven by a 60-h.p. electric motor, the working conditions of which were to be investigated. Smithers was exhausted and sad, and, I am afraid, was not of much help. I do not think he was able to reconcile his expectations to the crude actuality. The investigation was duly completed, in spite of water and bad light and Smithers's wilting state. After a hard climb back to the shaft-bottom, and another wet journey to bank, we were once more on the surface, and on our way to the last job.

Smithers seemed to be thinking hard, and at last affirmed that he would never again criticise miners. After another spell of thought he went on to say (frankly if ingenuously) that electrical engineering (or to-day's sample of it) was not what he had expected. When I gently made the inevitable rejoinder he hesitated, and his answer, beginning with a floundering attack upon his technical education, ended by a confession of his espousal of wireless. (No wonder he had, earlier in the day, been so contemptuous of our local frequency of a mere 50 cycles!) He was commencing a description of his latest "super-het" when the increasing flavour of the air informed me that our last destination (a glue factory) was nigh.

Smithers was visibly reluctant at entering, but during a breather in the office he must have pulled himself together, for when I appeared with the engineer he followed us with no apparent hesitation. The technical trouble here lay in the fact that the normal maximum demand had suddenly risen. The engineer's ideas anent his hourly max. demand were hazy—as often is the case. Having examined the demand indicator and found it in order, by some judicious inquiries we elicited the real cause: their gelatine section, long disused, was starting up again.

Our wanderings took us through an atmosphere hot

and stinking. At one place we passed a mysterious tank around which a dense crowd of big flies were busy. Hides, skins, and bones were being melted in open boilers, and the glue-stock boiled in water. In wooden congealing boxes the gelatinous fluid formed into stiff jelly, after which it was cut up and dried. All these interesting operations were marred by the stench. As Smithers (looking sick) and I hastened to depart, the engineer, with an air of pride, showed us a sample sheet of glue, and explained how the beautiful polish was obtained by re-dipping in water and again drying. "A fine bit of stuff," he said, passing his hand lovingly across it. "If ever you want a good piece of glue, just you come along here."

On our homeward journey Smithers contented himself with a large number of abnormally deep breaths, and his "good night" was uttered in rather dejected tones. I forebore to press for an opinion of his day's experiences. I saw him next morning engaged in a confab. with the Chief, and from that day "our place" knew him no more. The Chief announced briefly that Young Smithers was not continuing with us.

Whom should I meet a week later but Smithers himself! He appeared supremely satisfied with existence. His greeting, whilst a trifle lordly, was tinged (I verily believe) with a certain respect—perhaps he admired my courage in professionally penetrating into noxious regions. He was now, it appeared, with a radio engineer and "doing well." I congratulated him on dropping into a more congenial sphere and, as we parted, I told him that there was one thing he need never want. He looked puzzled. Then I reminded him of the kind offer of the glue factory engineer: "If ever you want a good piece of glue, just you come along here." At that Smithers's face paled, a shudder passed over him, and he hurried away.

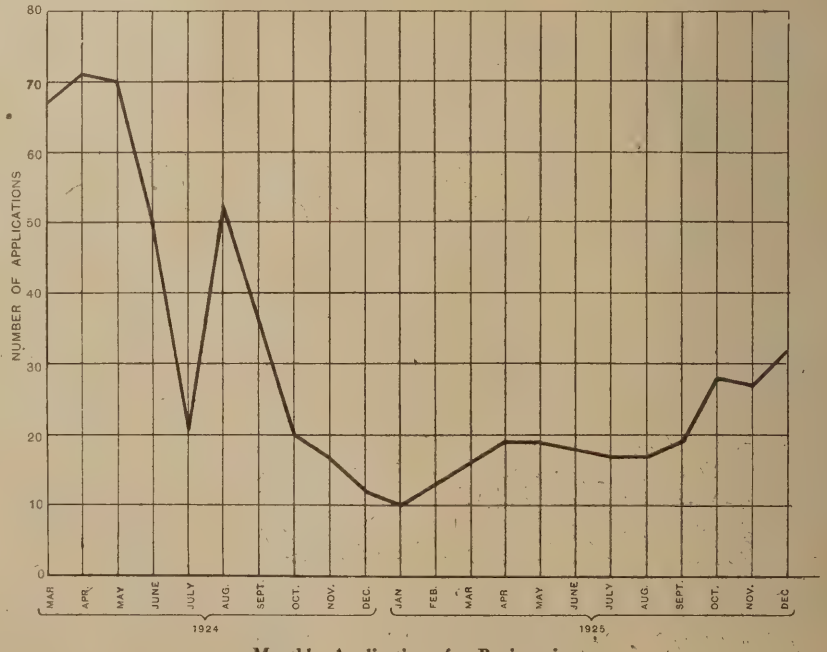
The Registration of Electrical Contractors.

The Present Position and Progress of the National Register.

By P. V. HUNTER, C.B.E., M.I.E.E., Chairman of the Executive of the N.R.E.I.C.

It may be opportune at the commencement of a new year to review the progress which has been made since the National Register of Electrical Installation Contractors commenced to receive applications in March, 1924, and to consider to what extent the ideals of those who originally laboured to establish it are being met.

Considering first of all the purely statistical side of the subject, it is interesting to find that a total of 930 installation contractors had applied for admittance to the Register up to December 31st, 1925. Of this total, 804 had been registered on that date, and 50 were still under consideration. The remainder (76) for various reasons were declined. The rate at which applications have been received, while showing occasional variations, has on the whole been gratifyingly regular. For the benefit of those who prefer to absorb such information in graphical rather than purely arithmetical, form the graph appearing herewith, showing the monthly rate at which applications have been received during the time the Register has been in operation, will be of interest. It is evident from this that there is no sign at present of a decided falling off in the rate of application.



Monthly Applications for Registration.

It is difficult to form even an approximate estimate of the proportion which the number of contractors admitted to the Register bears to the number of those who are eligible. The total number of installation contractors within the area embraced by the Register is not known, and estimates as widely different as 2,000 and 7,000 have been made. The smaller figure probably more nearly represents the number eligible for registration, as the larger one admittedly includes all those working electricians who occasionally purchase wiring material but have no established business or equipment. It is evident, however, that there are still many suitable contractors who have not been registered. The causes operating to prevent these eligible contractors from applying for registration are somewhat difficult to determine. It is no doubt a fact that some of the smaller contractors quite misunderstand the policy of the Register with regard to admittance. They are under the impression that the standard is set largely by the magnitude of the contractor's operations, whereas in point of fact quality of work and reputation are the real essentials, and provided that the minimum accommodation and equipment necessary to carry on as a contractor are in the possession of the applicant, the magnitude of his business is not such an important consideration. To some extent no doubt this erroneous impression has been fostered by the support given to the Register by the larger and better established firms. Practically the whole of the contractors of this class were admitted to the Register in its early days; they had little or nothing to gain in reputation by being registered, their principal object in applying being to help forward the cause of registration *per se*. It is to be hoped, therefore, that their action will not have the opposite effect to that intended, namely, of deterring eligible contractors from applying for admittance to the Register.

Another source of misunderstanding arises from the fact that many people have an erroneous impression of the object for which the Register exists. Those who have not given the matter more than casual consideration are apt to assume that the Register is a purely trade organisation existing for the benefit of those who are registered. This idea cannot be too forcibly contradicted. The primary objects of the Register are to

serve the public who employ wiring contractors by providing a list of names of contractors who can be relied on, and to raise and uphold the standard of good workmanship. For this reason wiring contractors are in a small minority on the Registration Board, the major portion of the *personnel* being nominated by various institutions representative of different sections of, and who are interested in the advancement of the electrical industry, so that both the public and the applicant for registration may be assured that the Register will deal impartially with applications, and that so far as can be foreseen none but competent contractors will be registered.

Registered contractors are of course entitled to the advantages which accrue to them from being registered, but that is not one of the immediate objects for which the Register was formed, though it is necessarily incidental, and the National Register is not therefore conducted as if it were. On the other hand, every endeavour is made by the Registration Board to ensure that the eligibility of a contractor for registration is, subject to compliance with certain requirements under the rules, judged purely on his merits as an installation contractor. In particular, too, academical consideration of the candidate's qualifications is avoided.

For this purpose the Executive Committee has the advantage of the co-operation of some 100 local advisory committees who can be relied on to report on the candidate's qualifications from personal local knowledge in a manner which could never be approached by a committee at headquarters. More are in course of formation, and additional ones will be formed where required. These local advisory committees each consist of three members, one representing the Institution of Electrical Engineers, another the electricity supply section of the industry, and the third member is a Registered Contractor. The assistance of these advisory committees has been of the greatest value to the Executive Committee of the Board, and has undoubtedly operated to the advantage of *bonâ fide* installation contractors.

At the present time the need for a National Register of Installation Contractors is more pressing than has been the case at any time during the history of the electrical industry. The last two years has seen an enormous expansion in the numbers of domestic installations wired for electricity supply. It is quite common experience for the number of installations connected annually to be four times that of a year or two ago, and the rate is still increasing.

In such circumstances it is obviously difficult for trained *personnel* to keep pace with the growth of demand. In particular, this rapid expansion has brought into prominence the jerry wireman who, without any business establishment or resources, undertakes domestic installations purely speculatively. Generally in order to get the business, the prices quoted have to be so low as not to permit of proper workmanship or material being employed. The National Register takes the greatest trouble to distinguish between such undesirable speculators and the genuine installation contractor who, although in a small way of business, is doing good honest work, and the latter class may submit their names to the Register with every confidence that they will receive proper consideration.

Householders who employ wiring contractors necessarily do so at such very infrequent intervals that they are seldom in a position to judge of the merits of any contractor they employ from personal experience, in the same way that they are able to judge other tradesmen with whom they are constantly dealing. The existence of the Register should therefore be of the greatest assistance to them. Many public bodies are so satisfied of its advantages that they have signified their intention of confining installation contracts to registered contractors, in order to ensure that a reliable job will result.

It is naturally the case with an organisation that has only been set up for such a short time, that the full effect of the existence of the Register has not yet been felt. The action and reaction between the purchasing public who find it advantageous to employ only registered contractors, and the increasing number of contractors who find it advantageous to register because of this employment, have obviously not had any marked effect in the short time during which the Register has been in existence, but they may be relied on eventually to ensure that the majority of contractors who are eligible will find it advantageous to register.

Legal.

Consolidated Electrical Co., Ltd., v. London Woollen Co., Ltd.

IN the Court of Appeal on January 18th, Lords Justices Bankes, Scrutton and Atkin heard an application by the plaintiffs in this matter for an order requiring the defendants to give security, to the extent of £200, for the costs of an appeal which they had entered from a judgment of Mr. Justice Avory and a special jury in the King's Bench Division on November 12th last (*vide* ELEC. REV., November 20th, p. 840).

For the plaintiffs it was contended that the hearing of the appeal would take some time. The defendants replied that there was only one point in question, and they had offered security of £50.

The Court ordered the defendants to give security in the sum of £75.

Heath Pritchard, Ltd., v. Schnider.

IN the Bow County Court, on January 15th, before Judge Snagge, Messrs. Heath Pritchard, Ltd., electrical and general engineers, Canning Town, E., sued Mr. Schnider, a tailor and outfitter, of Victoria Dock Road, E., to recover £5 2s. 6d. for electrical work done at the defendant's shop.

The plaintiffs' representative said that it was agreed to carry out the work for £3 5s., but when the Council's official inspected the work, he found fault with the connections, which had nothing whatever to do with them, and alterations had to be carried out, which ran up the cost. The defendant suggested that these alterations had nothing to do with him, but the plaintiffs' representative said that they were bound by the Council, and the consumer had to pay.

Judge Snagge gave judgment for the plaintiff for £5 2s. 6d. and costs.

Attorney-General (St. Pancras Corporation) v. County of London E.S. Co., Ltd.

THE Corporation of St. Pancras, through the Attorney-General, brought an action in the Chancery Division on January 13th, claiming an injunction restraining the County of London Electric Supply Co., Ltd., from supplying electrical energy outside its area, and within the area of the Corporation, *viz.*, to the property belonging to E. Hulton & Co., Ltd., Gray's Inn Road, W.C.

SIR T. H. HUGHES, K.C., for the plaintiffs, said the object of the action was to restrain the defendant company from acting *ultra vires* by supplying electrical energy outside its area of supply. The plaintiffs were the electricity authority for the borough of St. Pancras, and the defendant company had an area in the borough of Holborn. Hulton's had acquired a large piece of property bordered by Gray's Inn Road, Wilson Street, Gough Street, and Elm Street, and had erected large works for which they required a very large supply of electricity. About 1,000 square yards of Hulton's premises were in the defendant company's area and the remaining 5,000 in the Corporation's area. Hulton's approached the Corporation when their buildings were being put up with regard to a supply of electricity, and after long negotiations they signed an application form in January, 1923. But in the following month they got into communication with the defendant company and negotiated for a competitive supply, and on June 13th, 1923, a contract was entered into with the defendant company. But anticipating that there might be trouble they took an indemnity from the defendant company against any action that might be taken by the St. Pancras Corporation. The whole of Hulton's site was in the borough of St. Pancras, but, as stated, the whole of it was not in the Corporation's area of supply. Hulton's contract with the defendant company provided for a minimum payment of £4,500 a year for electricity for a minimum period of seven years.

Having referred to the various Acts and Orders bearing on the case, Counsel said that the defendant company was supplying energy for the whole of Hulton's premises as constructed and intended to supply it to those premises yet to be built in contravention of the provisions of the Acts and Orders quoted.

His LORDSHIP (Mr. Justice Tomlin) said he understood the question to be whether under these Acts and Orders the supply of energy meant supply to the terminals of the consumers in the manner suggested in the decided cases. If that was so it would seem to be a question of fact as to where the energy was supplied. If it was supplied to terminals within the defendant company's area the next question was whether the consumer was with the knowledge of the defendant company using it for purposes outside the area.

SIR THOMAS HUGHES agreed that these were questions to be dealt with, but he submitted that the supply was being made to the lamp that was burning or to the engine, and not, as in

this case, to the defendant company's sub-station on Hulton's premises in Elm Street.

Evidence was called on both sides, and SIR ARTHUR CLAUSON, K.C., submitted the case for the defence. It was denied that the defendant company was supplying energy beyond its statutory area in contravention of the material Acts and Orders. If Hulton's intended to use energy supplied by the company for one part of their property on another part, the defendants denied that this would constitute a breach of the Acts or Orders. They further denied that the St. Pancras Corporation had been ready and willing to supply energy to Hulton's on reasonable terms. Alternatively it was submitted that if the defendants had committed any breach (which was denied), the Corporation was not entitled to the relief it claimed. Under Section 6 of the County of London (Northern Extension) Electric Lighting Order, 1897, as confirmed by the Electric Light Orders Confirmation Act, 1897, it was indicated that should the defendants supply energy in contravention of Section 5 of the Order, which delimited the defendants' area, the Electricity Commissioners had power to revoke the Order. They contended, therefore, that the Corporation's remedy was by application to the Commissioners, and that that Court had no jurisdiction to grant the relief claimed.

The hearing was adjourned.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

A Swedish Company's Activities.—The Allmänna Svenska Elektriska Aktiebolaget has obtained large orders for electric power stations in New South Wales. The works are at present well occupied with orders from Sweden, Finland and Russia. The negotiations with the Soviet authorities for a concession for the resumption of the company's engineering activity at Jarcslav are expected to terminate within a few days.—*Reuter's Trade Service* (Stockholm).

A Large Stoker Order.—The Riley Stoker Co., Ltd., has received an order for eight Riley "Super" stokers, each to burn up to 10 tons of coal hourly, for eight Babcock boilers, each for 134,000 lb. actual steam hourly, and for 156,000 lb. overload. Four boilers will have water-cooled walls; the other four will have the ordinary straight-wall settings. Each stoker has an undivided furnace, the incandescent surface of the entire fuel bed radiating direct to the boiler tubes which form the roof boundary of the archless furnace. This is a repeat order from a central station already using 13 Riley stokers.

The F.B.I. and Inter-Imperial Trade.—The Federation of British Industries has addressed to the Prime Minister a letter dealing with the importance of the Empire markets as consumers of British manufactured goods, and urging the necessity for encouraging this trade in every possible way. It is pointed out that in 1924 the value of United Kingdom exports to various parts of the Empire were valued at £337,000,000, and represented 41 per cent. of the total export trade of this country. The need for an increase in our total export trade is evident, and is the true solution of our unemployment problem. The expansion of our exports to the Empire depends upon the purchasing power of the Dominions, and the greater the volume of Dominion products bought by us the greater is the possibility of the purchase by the Dominions of British manufactured goods. The letter concludes by expressing the opinion that the reports issued last year by the Imperial Economic Committee deal with some of the most pressing problems confronting the Empire to-day, and the Prime Minister is asked whether the Government intends to issue a statement with regard to the action which it is proposed to take on these reports.

Paraguayan Electrical Imports.—A report upon Paraguay by Mr. F. W. Paris, British Chargé d'Affaires at Asuncion (Stationery Office, 1s. net), includes some details of the country's electrical imports. The total value of these in 1924 was £18,185, as compared with £9,968 in 1923. During the first half of 1925 the value rose to £16,292. The United Kingdom's share in 1924 was valued at £1,665 (£325 in 1923), but there was a fall to £400 during the first half of last year. On the contrary, Argentina's share rose from £1,720 in 1923 and £4,528 in 1924 to £10,075 in the first six months of 1925. The figures for Germany were:—1923, £1,947; 1924, £1,123; and 1925 (six months), £2,603. The equivalent figures for the United States were £460, £1,543, and £4,242.

The British Industries Fair.—Preparations for the forthcoming British Industries Fair, to be held in London and Birmingham from February 15th to 26th, are now well advanced. Nearly 250,000 square feet of space has been booked, a large number of overseas buyers have already intimated their intention of visiting the Fair, and there is little doubt that it will be one of the most successful of the series. To celebrate the opening of the Fair, a banquet will be given by the Government on the opening day. The Prince of Wales will be the principal guest, the Lord Mayor of London is lending the Mansion House for the occasion, and Sir P. Cunliffe-Lister, M.P., President of the Board of Trade, has promised to preside. The annual banquet of the Birmingham Chamber of Commerce has been fixed to take place during the first week of the Fair. Advantage is being taken of the presence in the City of a large number of prominent overseas and home buyers, and many of these will be invited to the function.

Irish Free State Electrical Imports.—The official returns show that the imports of electrical goods into the Irish Free State during October last attained a value of £58,983, as compared with £38,495 in the corresponding month of 1924. The aggregate imports for the first ten months of the past year are returned at £308,015, as against £329,269 in the similar period of 1924. It should be noted that the foregoing figures do not include electrical machinery.

The Eight-hour Day in Sweden.—The Government proposes that the present law relating to the eight-hour day, which is to remain in force until the end of 1926, shall be rendered definitely valid after that date with certain changes in order to bring the law into conformity with the Washington convention and prevent the abuse of concessions granted by the present law.—*Reuter's Trade Service* (Stockholm).

Glass-makers and Protection.—Representatives of employers and workmen concerned in the glass industry met in national conference at Birmingham on January 13th to consider the question of initiating a new movement for securing recognition of the claims of the industry to protection against foreign competition. The bodies represented were the British Flint Glass Manufacturers' Association, the Northern Association of Pressed Glass Manufacturers, the National Flint Glass Makers' Society, and the Pressed Glass Makers' Society. Mr. William Stuart, of Stourbridge, presided. The view was expressed that the application previously made could only have been rejected through inappreciation of the situation of the industry, and its importance from a national standpoint was shown during the war. It was recalled that the Controller of Glassware made a record that the production of chemical, medical, surgical, and other scientific glass-ware, bulbs and tubing for electric lamps, and glasses for miners' lamps, assisted very materially in the successful prosecution of the war. A resolution was passed in favour of steps being taken to promote a further application to the Government.

Lead.—In their report for January 16th, Messrs. James Forster & Co. say:—"The Board of Trade returns, as below, give the December imports as 30,132 tons, which constitutes a record for arrivals during any one month, and up to the 13th of this month about 15,000 tons have been imported. In addition to all this lead, it is estimated that there are probably 5,000 tons in warehouse. In face of the foregoing, and with the present consumptive demand, the price of £35 per ton for lead seems to us to be quite high enough. The Board of Trade returns for December were:—Imports, 30,132 tons; exports, 3,174 tons; leaving for home consumption, 26,958 tons."

The A.E.U. and the Industrial Alliance.—Ballot papers have been issued to its members by the Amalgamated Engineering Union asking them to vote for or against the proposal to affiliate with the Industrial Alliance. The Alliance at present embodies the miners', railwaymen's, transport workers', iron and steel workers' and other trade unions, which have undertaken to afford one another financial or active support in industrial disputes.

Exports of British Machinery.—Commenting on the Board of Trade Returns issued last week, the British Engineers' Association points out that some of the most satisfactory figures are those relating to the exports of machinery, motor cars, locomotives and electrical apparatus. The total of exports of machinery for December, 47,744 tons, is not only the highest monthly total recorded this year, it is higher than that of any month during the past three years. The total exports of machinery for the year 1925 amount to 515,896 tons, the highest figure for any year since 1913. The steady tendency to improvement recently reported by the Association is generally confirmed by these statistics. It should not be forgotten, however, that the total export tonnage of machinery still represents only 75 per cent. of the pre-war average, and that there is still considerable leeway to be made up, but given favourable conditions, and no acute labour disturbances, it may reasonably be anticipated that the results for the ensuing year will show further and progressive improvement.

Venezuelan Contract for a British Company.—It is announced that MESSRS. MELDRUMS, LTD., have been awarded a contract for a complete refuse destructor installation for the city of Caracas. The plant will have a capacity for dealing with 100 tons of refuse per day and will provide steam for the generation of electrical energy.

Belgian Cable Orders for Germany.—The *Financial Times* reports that the orders for large quantities of telephone cable recently given by the Belgian Government have been placed partly with the Felten and Guilleaume Company and to a large extent with the Allgemeine Elektricitäts Gesellschaft, of Berlin.

Another Western Electric Development.—It is reported that the wholesale electrical supplies business carried on by the Western Electric Co., Inc., has been separated from that company's telephone manufacturing business, and put in charge of a new company known as the "Graybar Electric Company." Our contemporary *Electrical Merchandising* says that this gives a separate identity to the "largest wholesale distributor of electrical apparatus and related equipment in the world." The business was first conducted by a partnership under the names of "Gray & Barton," from which the new name has been derived. The president of the new company is Mr. A. L. Salt, and the chairman of the board of directors is Mr. C. G. Dubois. The capitalisation is $15,000,000, all owned by the Western Electric Co. The company will market a wide variety of appliances which have hitherto been sold under the name of "Western Electric," under the trade name of "Graybar." The range will include generators and motors, cables, telephones, lamps, domestic appliances, and radio apparatus.

Electrical Display at Birmingham.—In connection with the recent Birmingham and Midland Institute conversazione, the Birmingham Electric Supply Committee arranged an "All-electric home" at the Institute. The exhibit comprised a combined lounge and dining room, a part of which is depicted in the left-hand section of the accompanying illustration; a bathroom (centre); a bedroom (right); and a kitchen. The display proved most attractive and interesting, and elicited much favourable comment. In the combined lounge and dining room, the prevailing style of furniture and decorations was that of the Tudor period. It contained a 3-kW "Magicoal" fire, supplemented by a 2-kW portable fire. There were two lighting brackets with 40-W white gasfilled lamps, and a four lamp lantern fitting for the general lighting. A counterweight fitting with three 40-W white gasfilled lamps was fixed over the dining table, and a floor standard and desk lamp were also shown. There was an up-to-date array of small appliances consisting of coffee percolator, table grill, toaster, kettle, hotplate, iron, vacuum cleaner and fan, also the ubiquitous loud speaker. The bedroom was furnished in mahogany. A two-light rise-and-fall pendant was fixed over the dressing table, a single counterweight light in the centre of the room, and over the cot a single "Osglim" lamp. A tray as set for early morning breakfast, with kettle, toaster and reading lamp, was placed on a table at the side of the bed. The heating was by means of a 2-kW "Arora" fire, with a 600-W bowl fire for occasional use. In the bathroom a geyser was fitted over the lavatory basin, and a 3¼-gal. electric geyser for the bath. It also contained a 2-kW cabin fire fixed to the wall, electric towel and gown rails, and a shaving mirror with a spot light. A totally-enclosed bowl fitting was installed for lighting. In the kitchen the apparatus consisted of an "All-British" washing machine, an automatically regulated refrigerator with compartments for freezing and cooling, one of the latest pattern 6-kW type cookers as supplied on hire by the Birmingham Electric Supply Department, and a 2-kW fire for general warming purposes. A totally enclosed ceiling lighting unit, with special adaptor for use with occasional appliances, irons, kettles, &c., was fixed in the centre of the room.



An "All-Electric Home" at Birmingham.

The "Americanisation" of Canada.—The penetration of American goods and ideas into Canada has been increasing at a rapid rate during the past few years. According to the Toronto *Electrical News*, this is not viewed without alarm in certain circles. Recently at an annual meeting of chambers of trade and commerce in Ontario, a resolution was passed urging the Dominion Government to place an import duty on American magazines entering Canada (of which there are said to be 150), as these consist largely of advertising matter. The latter, when it enters undisguised, is subject to a duty of 15 cents per pound.

Swedish Telephone and Telegraph Exports.—According to the *Swedish Economic Review* (the journal of the Swedish Board of Trade) the exports of telephone and telegraph apparatus during the period January—November, 1925, were valued at 6,476,000 kr., as compared with 6,778,000 kr. in the equivalent period of 1924.

Chinese Notes.—The Honan authorities have recently ordered five small radio plants from the Siemens (China) Co.

The whole of the property of the Kiangwan Electric Co. (Shanghai) has been acquired by the Chapei Electricity and Waterworks Co.

Lead Prices.—We have received from Messrs. M. H. Cawson & Co. a chart showing the prices of soft foreign pig lead for each month from 1913 to 1925 inclusive. Statistics of imports and consumption for each year are also given.

The Timber Trade.—Our Timber Trade correspondent reports that the demand for soft woods for general requirements is increasing in volume, which is assisting the rather large stocks on the London and provincial markets. Prices of late months have been on a very cheap level, considering costs of production, and the year 1925 has been an unremunerative one to the trade, and especially to the foreign exporters. The latter, however, are now attempting to raise values for shipments to come forward this season, and although these values will be on a slightly higher level, compared with 1925 closing rates, they will be lower than prices ruling a year ago. In the hardwood section of the trade, prices for all descriptions are firm, and this is especially so of teak, which is used in the electrical trades for various purposes. Mahogany is also a firm market, and those choice timbers described as "fancy woods" continue to be strong in value.

A Visit to Germany.—The *Birmingham Post* reports an address by Mr. Wilfrid Hill to the members of the Council of the Birmingham Chamber of Commerce upon the economic position of Germany. Mr. Hill, who has paid a series of visits to that country, said that Germany's national wealth had shrunk, and that had caused a scarcity of money which was holding up trade. The payment of reparations was being made by means of money borrowed at high interest, and Germany could only repay this by exporting goods. Export trading was rendered difficult by the tariff walls which had been raised against German goods. This was a problem which affected not only Germany, but, more or less, every other European country, and might possibly result in a European Zollverein, a project which was under consideration at the present time. It was not true that German competition was more aggressive than before the war in all branches. The plant, machinery, skill and determination were there, but the motive power of adequate money was lacking. At the recent Berlin motor, motor-cycle and cycle show it was admitted that German productions were badly beaten, both in price and quality, by British products, and that was the case in many trades. German banks were charging from 10 to 14 per cent. for accommodation. Wages, however, had not increased to the same extent as British wages, but the demand for increases was persistent. Taxation was at nearly three times the pre-war level, representing 46 per cent. of the German people's income, as compared with 18.6 per cent. in our own case. Other handicaps were the eight-hour day, and higher freight charges. Mr. Hill said that for the next two years he failed to see Germany as an effective competitor in the world's markets, and "it was now the psychological moment for those who had complained so bitterly of German competition in the past to thoroughly realise the situation, and so take steps not only to regain that which was lost, but even to sell goods in the German home market, which in many trades was actually possible to-day."

Foreign Glassware.—At a meeting of the Weymouth Town Council, last week, a protest was offered against the acceptance of the tender of a foreign firm for globes for the public electric lamps. The borough electrical engineer said that no British firm could make the globes. Another speaker said that the globes were made in Czecho-Slovakia. The tender was accepted.

Industrial Court President Resigning.—It is reported that Sir William Mackenzie, K.B.E., K.C., is shortly resigning the post of President of the Industrial Court, which he has held since the establishment of the Court in 1919. The Minister of Labour has appointed Mr. Harold Spencer Morris, K.C., to succeed him as President. Mr. Morris was appointed last year to be Chairman of the Railway Wages Board in succession to Sir William Mackenzie.

Unemployment.—No unemployment figures were issued for the week ended December 28th, but during the subsequent week the number of unemployed registered was 1,251,900, an increase of 149,500 during the fortnight. There was, however, a decrease of 30,306 in the subsequent week.

A Unique "Dividend."—*Electrical Merchandising* reports that the Hartford Electric Light Co. stated in a recent note to its consumers that as its working expenses had been abnormally low, and the earnings were about 5 per cent. more than required for interest, dividends, and a moderate surplus for the year, each customer would receive a "dividend" in the form of a 50 per cent. discount on his October bill.

Trade Announcements.—MR. FREDK. J. GORDON, formerly a sales director with Fuller's United Electric Works, Ltd., is now established as a manufacturers' representative at 91, Moorgate Street, London, E.C.2. He has just taken over the London agency for the Clayton Rubber Co., Ltd., of Manchester, and is open to take up another in addition.

MESSRS. SPRECHER & SCHUH CO., Aarau, Switzerland, announce that, in order to meet the increasing demand for their switchgear, "and to comply with the justifiable desire of customers that it should be of British manufacture," they have made arrangements with Messrs. Isenthal & Co., Ltd., to manufacture it on their behalf and to their designs at their Denzil Works, Willesden, N.W.10. Communications should be addressed to Mr. J. B. Rudkin, the company's representative, at the London office, Albion House, 59, New Oxford Street, W.C.1.

MESSRS. G. F. CLARK & PARTNERS, consulting engineers, of Parliament Mansions, S.W., have removed to 7, Victoria Street, S.W.1.

Catalogues and Lists.—THE IGRANIC ELECTRIC CO., LTD., Elstow Road, Bedford.—A number of publications dealing with "Igranic" and "Igranic-Pacent" radio apparatus, as condensers, filament resistances, transformers, &c., and complete supersonic heterodyne receiving outfits.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Leaflet 4045, describing methods and apparatus for testing portable accumulator batteries.

MESSRS. CHARLESWORTH, PEEBLES & CO., 5, Eden Street, Hampstead Road, N.W.1.—A leaflet and price list advertising the "Quickfix" electric light gallery.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—A folder illustrating the illumination of a number of cathedrals and churches; and a pamphlet giving illustrations and prices of "Luxor" lighting fittings.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A mailing card advertising "G.E.C." Home Office fuse boards.

SWITCHGEAR & COWANS, LTD., Elsinore Road, Old Trafford, Manchester.—A set of scales from ⅛ in. to 3 in. = 1 ft. Much useful information is given on the scale backs including conversion tables, and British standard tables for bare copper conductors and wire gauges.

SMITH & ANSELL, LTD., Stockfield Road, Acocks Green, Birmingham.—Illustrated pamphlet describing a new series of lighting fittings known as "Cylinder Units."

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—January price sheet of electrical materials, appliances and accessories.

MESSRS. DONOVAN & CO., 47, Cornwall Street, Birmingham.—An illustrated booklet dealing with industrial panels made by combining "Safuse" and "Donlok" switch and fuse gear with busbar chambers.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—January stock list of motors and dynamos.

MESSRS. J. MCMILLAN & CO., 17, Surrey Street, Strand, W.C.2.—A price list of telephone condensers of from .005 to 4 mfd. capacity.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, U.S.A.—Illustrated pamphlets dealing with induction frequency changers, self-propelled 'buses, and the "Inertaire" transformer.

MESSRS. FERRANTI, LTD., Hollinwood, Lancashire.—Pamphlet Ta.746, illustrating and describing the "Ferranti" surge absorber.

ORION LAMPS, LTD., 15, Eldon Street, London, E.C.2.—Price list of "Orion" gas-filled and vacuum lamps.

MESSRS. COLEY & SWINNERTON, LTD., St. John's Square, Wolverhampton.—Three illustrated and priced pamphlets, dealing respectively with the "Electric Perfection" oven, the "Savex" cooker, and the "Savex" wash boiler.

MESSRS. E. P. ALLAM & CO., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list of d.c. motors, &c., for sale or hire.

Bankruptcy Proceedings.—H. L. WOOD, 7, Taswell Road, Southsea, Hants., electrical engineer and wireless dealer.—The first meeting of creditors was held on January 18th at the Official Receiver's offices, Portsmouth. The statement of affairs showed liabilities of £4,069, while the net assets were estimated at £85, leaving a deficiency of £3,984. Debtor attributed his failure to liability under judgment given against him in an action brought by his late partner. It appeared that in December, 1918, with about £500 capital, he commenced business at High Street, Clapham, as an electrical engineer. The business was apparently a success, and debtor alleged that in August, 1920, he sold it for £1,500, at which date he owed nothing. He then took premises at 2, Palmerston Arcade, Portsmouth, and commenced a new business as an electrical engineer with £1,500 capital. In March, 1921, he was joined in partnership by another who paid £2,000 for a half share in the business. In the following month the partnership purchased an additional small business and traded at those premises and at Palmerston Arcade as electrical engineers and, subsequently, as dealers in wireless sets. The business was not successful, and in May, 1923, a deed of dissolution was executed and a receiver appointed. A claim was made against debtor for £1,717, and judgment was given against him for the full amount claimed with costs. After the dissolution of the partnership, debtor stated, he entered into a partnership with his wife. The business was successful, and in March, 1924, he instructed a firm of solicitors in London to register a limited company for the purpose of acquiring the business. Fees and costs were paid to the solicitors to the extent of about £400, but the matter was never completed. Subsequently further steps were taken and on November 17th last a company was registered with a nominal capital of £500. An agreement was entered into under which the company purchased the assets of the business for £1,998 and undertook to discharge outstanding liabilities to the extent of £300. The purchase price was to be paid by the allotment of 498 £1 fully paid up shares to the debtor and his wife, and £1,500 debentures issued to debtor's wife. No actual cash was found. Debtor did not admit that he was aware of his position until the judgment was obtained against him by his late partner, and finding it impossible to meet this liability he decided to file his petition. The case being a summary one was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
David, G. J.	105	Michaelsen, R.	254
Jay Bros.	30	Stanton, H. G.	1,916
Lister, Miss E. J.	900	Torr & Co.	200

T. W. CRAWFORD, dealer in electric lamps, 25, Highbury Hill, N.—This debtor failed in August last with liabilities of £792 against assets of £19, and on January 13th he attended for public examination before Mr. Registrar Coldridge, at the London Bankruptcy Court. Replying to Mr. Waterer, Official Receiver, the debtor stated that in December, 1923, he commenced business at 41, Cheapside, E.C., as a general merchant, dealing mostly in foreign electric lamps, and trading, from March, 1924, under the style of "The Despina Co." The business was fairly successful, but upon an injunction being obtained against him in June, 1924, restraining him from infringing the patents of an English company, he closed the business. During the previous April he had opened under management, a similar business at 25, Lord Street, Liverpool, under the same trading name; that business was badly managed, and was closed in October, 1924. Another business was opened by him in September, 1924, at 32, Victoria Street, S.W., under the style of "T. Wheatley & Co."; owing to lack of capital, and also mismanagement during his absence through illness, that business was not successful, and was abandoned in April, 1925, on the landlord distraining for rent. The examination was concluded.

H. HALL, wireless dealer, 26, Egerton Street, late of 6, Market Place, and Albert Chambers, Blackburn Street, Radcliffe, Lancashire.—Receiving order made January 7th, on debtor's own petition.

G. BONNET, electrical contractor and general engineer, 2a, Camden Road, N.—Receiving order made January 12th, on creditor's petition. First meeting, January 26th. Public examination, March 17th, both at Carey Street, W.C.

J. F. CARR, electrical goods agent, 89, Aston Avenue, Fallowfield, Manchester.—Receiving order made January 13th, on creditor's petition.

J. R. BARKER, wireless dealer, Tanshelf House, Front Street, Pontefract, and 183, Kirkgate, Wakefield.—Receiving order made January 11th on debtor's own petition. First meeting, January 25th, at the Official Receiver's office, 21, King Street, Wakefield. Public examination, February 11th, at the Court House, Wakefield.

H. WILSON, electrical contractor and decorator, 56, Woodhall Avenue, and 1,057, Grangefield Avenue, Thornbury, Bradford.—First and final dividend of 3s. 1d. in the £, payable January 22nd, at the Official Receiver's Office, 12, Duke Street, Bradford.

R. L. FOGGIN (Tithebarn Radio Co., Crosby Radio Co., and High Bridge Radio Co.), electrical engineer, "Glen Avon," Fir Road, Waterloo, 63, Tithebarn Street, and 75, Crosby Road North, Liverpool, and High Bridge, Newcastle-on-Tyne.—First and final dividend of 10d. in the £, payable at the offices of the Official Receiver, 11, Dale Street, Liverpool.

T. F. FINUCANE, lecturer in wireless telegraphy, 10, Sunny Gardens, Hendon.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released January 8th.

A. E. MARTIN, electrical engineer, 104, Oldham Road, Manchester.—Trustee, Mr. J. G. Gibson, Official Receiver, released January 7th.

A. MEADOWS, electrician, The Arcade, Penzance.—Trustee, Mr. G. C. Hancock, Official Receiver, 12, Princes Street, Truro, released January 8th.

W. M. HORSFALL, electrical engineer, 7, Redcross Street, Liverpool.—Last day for proofs for dividend, January 30th. Trustee, Mr. E. W. Davies, 11, Dale Street, Liverpool.

S. H. BARDWELL (Bennett, Bardwell & Co.), electrical engineer, 22, Church Street, Basingstoke.—Last day for proofs for dividend, January 30th. Trustee, Mr. H. Ashton, Official Receiver, Midland Bank Chambers, High Street, Southampton.

F. A. FRASER, electrical engineer, Sanctuary House, 33, Tothill Street, S.W.—Bankrupt's discharge suspended for two years, until December 16th, 1927.

A. A. WATMOUGH, electrical engineer, lately carrying on business with W. Hurworth at 41, Town Street, Horsforth, and 1, Back Street, Harrogate.—Immediate discharge granted subject to consenting to judgment for £50 to be paid within one calendar month.

E. W. ADAMS, lately carrying on business as the Wireless Accessories Stores, 664, Old Kent Road, S.E.—Trustee, Mr. W. J. H. Boyle, Senior Official Receiver, Carey Street, W.C., released January 5th.

R. EMMETT (Emmett & Co.), builder, gas and electrical engineer, 249, Goldhawk Road, Shepherd's Bush, W.—Trustee, Mr. W. J. H. Boyle, Senior Official Receiver, released January 5th.

Company Liquidations.—ARTHUR LANGHAM & SONS, LTD., Holborn Viaduct House, E.C.—The report of Mr. J. Barwick Thompson, Official Receiver and Liquidator, upon the failure of this company, has been issued to the creditors and shareholders. The accounts filed under the liquidation show liabilities of £10,730 against assets of £91, and a deficiency of £10,642 with regard to shareholders, the issued capital being four ordinary shares of £1 each. The company was registered as a private company on December 28th, 1923, with a nominal capital of £10,000, to carry on business as general merchants, importers of articles of Continental manufacture, and exporters of British goods. No established business was acquired by the company, but the original object was to deal in electrical goods, household utensils, and wireless components. Continental purchases were negotiated by Mr. C. A. P. Langham, the late managing director, amounting to approximately £30,000. In May, 1924, the company made arrangements for the purchase of 10,000 wireless headphones to be delivered in fortnightly consignments. The total purchase price was £4,375, and 14 bills of exchange were accepted by the company in respect thereof. No goods were ever received, and it was ascertained that the manufacturers had gone into bankruptcy and could not execute the order. The company thereupon demanded the return of the bills, but without success. It appears that the bills have been sent to the Continent and negotiated there. Some of them have been presented to the bank by third parties who are apparently holders for value. The circumstances in which these bills have been negotiated require further investigation. The failure of the company is attributed by the directors to the inability to obtain delivery of goods from the Continent. A contributory cause was insufficient working capital, and also the bill transaction referred to. In the opinion of the Official Receiver the failure is due to lack of proper business methods, extravagant expenditure and mismanagement.

HALL & BRENARD, LTD., manufacturing radio engineers, Terminal Aerodrome, Croydon.—A meeting of creditors was held on January 11th. The chair was occupied by Mr. A. A. Baster, I.A., Croydon, who had been appointed to act as liquidator in the voluntary liquidation of the company. The statement of affairs presented showed liabilities of £3,613 and net assets of £491, leaving a deficiency of £3,122. Mr. Baster reported that the company was registered in 1923 when it acquired a concern which had previously conducted a mail order business. It had only been a small business, and the issued capital was £702. During the year to May 1st, 1924, the company made a net profit of £362. No accounts had been prepared since May, 1924. In May of last year the company was in difficulties, and in the following July a meeting of the creditors was called. It was then suggested that the creditors should agree to a scheme under which they would be issued debentures in respect of their claims. The scheme was not finally completed until December, and by that time the directors came to the conclusion that they could not carry on the business any longer, and voluntary liquidation took place. Since May, 1924, the company had suffered severely through bad debts, the total being between £900 and £1,000. He did not anticipate that the creditors would receive more than 2s. in the £. The result of the liquidation depended very largely upon the amount obtained for the machinery. The Air Council was in possession, and the assets were being disposed of. Mr. W. Baker, of the Wholesale Traders' Association, pointed out that the distraint took place after the company had gone into liquidation, and he thought the landlords should withdraw. A director of the company said that the normal turnover had been something like £2,000 a month, and it was anticipated that that would be continued. Towards the end of last year, however, the sales fell to £300 or £400 a month. The company had an enormous amount of partly manufactured stock, but it could not be realised to advantage unless the goods were completed. A resolution was passed to the effect that the voluntary liquidation of the company should not be confirmed. The following are creditors:—

	£		£
Aluminium Corporation, Ltd.	246	Hughes, F. A., & Co., Ltd.	91
American Hard Rubber Co.	21	Hampton Works Co.	42
Air Council	169	Iliffe & Sons, Ltd.	30
Allen Bennett Motor Co.	23	Judge & Priestly	22
Brooke, E., Ltd.	27	Kynochs, Ltd.	86
Barkers Advertising, Ltd.	53	Lowenadler, Ltd.	287
Baster, A., & Co.	105	McKechnie Bros., Ltd.	48
Buckley's, Ltd.	104	Odhams Press, Ltd.	95
Churchill, C., & Co.	21	Premier Manufacturing Co., Ltd.	34
Cassell & Co., Ltd.	40	Paper Goods Manufacturing Co.	56
Coles, W. H.	37	Siemens-Schuckert, Ltd.	26
Delta Metal Co., Ltd.	203	Studeli Adam & Co.	123
Dalziel Foundry, Ltd.	117	Wallace, H. W.	27
Ebonestos Insulators, Ltd.	26	Young, T. W., Ltd.	235
Export World	37		

L. WEEKES, LTD., electrical engineers, Langley Street, Luton.—A meeting of creditors was held on January 14th, at the offices of Messrs. Crew, Turnbull & Co., C.A., Luton. The chair was taken by Mr. B. T. Crew, the liquidator appointed by the shareholders. A statement of affairs prepared as at December 1st, 1925, disclosed liabilities of £4,262, there being, in addition, debentures and accrued interest of £2,857, and preferential claims and receiver's liabilities were set down at £981. The net available assets amounted to £840, leaving a deficiency of £3,421. There were also questionable assets totalling £2,848, but they were not included in the statement of affairs. The company was incorporated in June, 1916, for the purpose of acquiring the business of Mr. L. Weekes, who was identified with the British Electric Calibrated Fuse Co., and was also interested in a concern called the Safetee Controlling Appliance Co. In August, 1924, the bankers, who held the debentures, instructed Mr. Crew to make an independent report as to the position, and this was done. Mr. Crew said he was then of the opinion that an opportunity should be given to Mr. Weekes to introduce new capital into the concern, and that it would be unwise to close the business forthwith. The trading, therefore, was continued for over twelve months, but in August, 1925, creditors began to press and writs were issued. Mr. Crew was appointed receiver, and received an offer for the whole of the undertaking from Mr. Dryden. This was accepted, the larger creditors being called together and informed of what was proposed. There was a probability of a dividend of between 3s. and 4s. in the £. A creditor remarked that in a period of six years something like £15,400 had been drawn as directors' remuneration. It was decided that Mr. Crew should be confirmed as liquidator of the company. The following are creditors:—

	£		£
Baltic Scandinavian Co. (Copenhagen)	60	Grey & Marten, Ltd.	68
Bengal Foundry Co.	180	Hoare & Bellamy	34
Berger, Lewis & Sons	23	Hudson, E. A., & Co.	27
Berry's Electric, Ltd.	117	Kent, Geo., Ltd.	815
Banker, W. F.	22	Lambert, C.	38
Burrell Bros.	21	Langley Garage	31
Burgess Bros.	23	Laporte, B.	29
Burns, J., Ltd.	61	Marston Billington, Ltd.	114
Cantie Switch Co.	24	Matthew, E., Ltd.	55
Clark, Hunt & Co.	62	McKechnie Bros.	111
Coventry Malleable, Ltd.	49	Mica Manufacturing Co.	159
Croager Bros.	20	Nettlefold & Sons	27
Delta Metal Co.	80	Ormiston, P., & Son	85
ELECTRICAL REVIEW	107	Phosphor Bronze Co.	104
Ellison, George	48	Redfern, Stevens, Ltd.	22
Farmer, Stedall & Co.	23	Rigby, R.	582
Gallenkamp, A., & Co.	26	Terry, Herbert, & Son	55
Gibbs & Dandy	65	Tompkin, H., & Sons	40
Geipel, W., & Co.	62	Teale & Co.	30
Godden & Rudd	32	Wilson, C., & Sons	21

ELECTROZONE CO., LTD.—Winding up voluntarily. Liquidator, Mr. F. J. H. Boultbee. A meeting of creditors was called for January 18th at the offices of Messrs. Desmond, Page and Adams, 13, Victoria Street, S.W.

ERITH ELECTRICAL CO., LTD.—A petition for the winding up of this company has been presented on behalf of the E.S. Co., Ltd. (in voluntary liquidation), creditors, by the liquidator, Mr. B. A. Smith, and will be heard at the Court House, Eastgate, Rochester, on February 10th.

GAS & ELECTRIC SECURITIES, LTD.—First meetings of creditors and contributories, January 26th, at Carey Street, W.C.

New French Companies.—Among the new hydro-electric undertakings recently organised in France are the Société des Forces Motrices du Bearn (63, Avenue des Champs Elysées), with a capital of 10 million francs, and the Syndicat pour l'Etude des Chutes d'Eau du Bassin du Lot (54, Rue de la Boetie, Paris), capital 150,000 fr. La Société des Etablissements G. Oyer & Cie. La Radiotéléphonie Française is the name of a new company which has lately been formed in Paris (11, Rue du Rhin), with a capital of 700,000 fr., to acquire and develop a radio apparatus manufacturing business.

An American View.—In an article on "British Electric Power Developments," *Commerce Reports* says:—"Among the influences restricting the sale of American household labour-saving devices has been the high cost of electricity and the utter lack of uniformity in current supply. The present policy of large interconnected generating stations, resulting in lowered production costs, should gradually bring about the removal of this handicap."

Japanese Electrical Companies Prospering.—Reporting upon conditions towards the close of last year, the United States Commercial Attaché in Tokio stated that electrical power companies were prosperous and had declared good dividends from earnings. The sales of electrical equipment during November were quiet, but some large equipment business was in prospect. The indications were that there was eliminative competition going on among domestic manufacturers of smaller electrical equipment.

New Zealand Preference Regulations.—The revised regulations made by the Government of New Zealand with regard to the admission of British or partly-British goods at preferential rates are reproduced at length in the *Board of Trade Journal*, dated January 14th. Full particulars are given of the certificates required and the method of preparing invoices, &c.

The Contractors' Dinner.—The annual dinner of the Electrical Contractors' Association was held at the Trocadero, Piccadilly, W., on Tuesday last. A report of the proceedings will appear in our next issue.

Book Notices.—"Official South African Municipal Year Book, 1925-1926." Edited by W. P. M. Henderson and Francis G. Pau. Capetown: Francis G. Pau; London agents, Edw. G. Allen & Son, Ltd.—Contains particulars of the South African Municipalities, sectionalised both with regard to the Provinces and the various municipal concerns. A section on the electrical undertakings gives full details of the generating plants, distribution systems, tariffs, &c., for each electrical supply department. These particulars, besides being given under separate headings for each municipal undertaking, are dealt with in prepared tables under the above headings.

"Engines of High Output." By Harry R. Ricardo, B.A. P. viii + 110; figs. 38. London: Macdonald & Evans. Price, 7s. 6d. net.—This book is a treatise on the possibilities and limitations of high-speed internal-combustion engines, dealing in particular with the thermo-dynamic side of the subject. The author has avoided to a large extent the use of mathematical calculations and formulæ, although he has supported many of his views by curves and simple arithmetic.

"Marconiphone Log Book."—As its name indicates, this little pocket booklet is ruled for entering the essential particulars of radio stations heard. The valve notes and tables enable data to be ascertained quickly, not only for individual valves, but also for complete sets; a large number of arrangements of valves suitable for different types of sets have also been tabulated. The booklet is obtainable from the Marconiphone Co., Ltd.

"Vibrations in Engines and Machinery." By A. T. J. Kersey, A.R.C.Sc. "The Elements of Reinforced Concrete Design." By H. V. Crabtree. Publications of the Association of Engineering and Shipbuilding Draughtsmen. Price 2s. each.

"Quarterly Bulletin of the British Cast Iron Research Association." No. 11. January, 1926.

"Report on the Economic Conditions in Venezuela, September, 1925." By H. A. Hobson, H.M. Consul, Caracas. London: H.M. Stationery Office. Price 1s. net.

"The Story of Mathematics," by D. Larrett. Pp. 88. London: Ernest Benn, Ltd. Price, 2s. 6d. limp cloth, 3s. 6d. stiff cloth.

"The Post Office Electrical Engineers' Journal." Vol. XVIII, Part 4, January, 1926. London: Electrical Review, Ltd. Price 2s.

"National Economics for Britain's Day of Need," by E. Batten. Pp. xi + 217. London: Sir Isaac Pitman & Sons. Price, 5s. net.

"The *Transactions* of the South African Institute of Electrical Engineers," Vol. XVI, Part 10; November, 1925. Price, 2s.

"Turbo-Blowers and Compressors," by W. J. Kearton. Pp. xi + 333; figs. 153. London: Sir Isaac Pitman & Sons, Ltd. Price, 21s. net.

"Engines of High Output," by H. R. Ricardo. Pp. viii + 110; figs. 38. London: Macdonald & Evans. Price, 7s. 6d. net.

"Pitman's Radio Year Book for 1926. Pp. xii + 182. Illustrated. London: Sir Isaac Pitman & Sons. Price, 1s. 6d. net.

"The *Journal* of the Institution of Electrical Engineers." Vol. 64. No. 349. January, 1926. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

The Egyptian Electrical Market. — In the course of a recent article upon this subject *Commerce Reports* states that the abundance of cheap labour in Egypt has restricted the development of the market for domestic electrical appliances. Electric fans have attained a large measure of popularity, and, in spite of their higher cost, British and American fans are becoming in greater demand owing to their superior quality. Ceiling fans are extensively used in large buildings, but the possible market for small exhaust fans for offices, shops and public halls has never received the serious attention of local dealers. There is but little demand for vacuum cleaners, although a few hand-operated German machines are on the market. The low charges of hand laundries have excluded electric washing machines, but a good demand exists for electric irons, and the Germans supply the bulk of these at present. Electric kettles are sold in small numbers, and hotplates have a small but growing market. One article for which there are opportunities is the electric refrigerator, although it is handicapped by the high charges for electricity; it is thought that the demand for refrigerators is likely to grow considerably. As most Egyptian houses have no heating arrangements, electric heaters find a considerable market in the cool season. The bulk of these are of the "headlight" type (bowl fires), and of German, Italian, and French makes. At Alexandria, Cairo, and Port Said dealers in electrical appliances generally buy direct from foreign manufacturers, or, in a few cases are given consigned stocks by German manufacturers. As a general rule, electrical appliance dealers stipulate that exclusive representation shall be given for Egypt, the Sudan, Palestine, and, in a few cases, Syria. Although this is not always satisfactory it is believed that, with increasing purchasing power and lower rates, the most important dealers can adequately handle this wide territory, as the countries are closely related through customs, language, and transportation.

Doncaster and Electrical Contractors.—The Doncaster Corporation, replying to protests by local electrical contractors and the Chamber of Trade against the proposed municipal sale of electrical appliances and fittings, states that no such sale is intended unless the contractors charge unreasonable prices.

The W.R.A. and Trade Organisation.—We are requested to give publicity to the following:—"In the present crisis in the organisation of the industry, the Wireless Retailers' Association feels that a statement of its views on certain important matters, which not only relate to the organisation of the trade as a whole, but which directly concern dealers, may be helpful in clarifying the general position and in defining issues.

"The first is that the consensus of opinion amongst retailers is that their interests should be represented by an independent Association of their own. This fact has been ascertained beyond question by voluntary statements, exhaustive inquiries and the issue of a questionnaire on the subject, in the course of which practically no dissentients from this view were encountered.

"It will be generally admitted that in the present stage of evolution of the industry the problems confronting each section are more than sufficient to tax the whole attention, energies and resources of any body representing it, without attempting to encroach on other interests. In these circumstances, it is submitted that the only logical course is for each section to devote its entire efforts to the organisation of its own constituents.

"The second is that a far closer co-operation between the manufacturing and retailing sections of the industry than has hitherto obtained is imperative; but this can only be really effective when each section is thoroughly organised.

"The W.R.A. has never ceased to proclaim its desire for active co-operation, and any scheme for the organisation of the manufacturers' section of the industry which embodies the principles outlined, can be assured of receiving the unqualified moral and active sympathy of this Association.

"The third point is that there should be no control of discounts, and that preferential treatment should be excluded.

"The Executive of the Wireless Retailers' Association is assured that the recognition of these principles is vital to the success of any scheme for reorganisation which the manufacturers may have under contemplation, and urges those with the welfare of the industry at heart to use all their influence to secure their adoption, believing that it is only in this way that the trade can be organised on a sound, equitable and permanent basis."

For Sale.—By direction of Messrs. C. J. Thursfield and Co., Ltd., manufacturers of electrical fittings, Birmingham, who are rearranging their works, Messrs. E. L. Stevens and Champion will sell by auction on January 28th, at Cecil Works, 42, Clement Street Parade, Birmingham, a stock of high-class new electrical fittings, &c. Mr. H. J. Shaw will sell by auction at 13, High Holborn, W.C., on February 3rd, a manufacturer's stock of wireless goods and materials. (See our advertisement pages to-day.)

Social Events.—A New Year's party and dance was recently given by Mr. Arthur Cozens, of Ascot, Camberley and Clacton, to his staff and friends, about 200 being present.

The annual dinner of the staff and friends of Messrs. Ernest F. Moy, Ltd., took place at the Britannia Hotel, Camden Town, on January 16th. After dinner and the loyal toast, Mr. W. B. Dykes proposed the health of the company and Mr. E. F. Moy responded. The visitors' toast was proposed by Major C. G. Fox and replied to by the Mayor of St. Pancras (Ald. Dr. E. A. Gregg, J.P.).

The annual fancy dress carnival and dance of Messrs. Johnson & Phillips, Ltd., was held on January 8th in the Woolwich Town Hall, and there was a good attendance of members of the staff and their friends. The prizes were the gift of the company's Australian branch manager, Mr. E. A. Kinsley, who was unavoidably absent. The costume which won one of the prizes was that worn by Mr. H. D. Parsons, of the publicity department, representing "One of the J. & P. Pages"—a familiar feature of the advertisement section of the Electrical Review. The prizes were presented to the winners, on behalf of the donor, by Mrs. J. Macgregor and Mrs. C. Stewart.

Calendar.—A calendar sent us by Mr. W. H. Squire, 31, Sweyne Avenue, Southend-on-Sea, depicts a young lady with a bunch of violets. Monthly date slips are provided.

Lighting and Power Notes.

Ashby-de-la-Zouch.—Street Lighting.—The Urban District Council is to convert the street lamps in its area from gas to electric lighting at a cost of £340 per annum for the first five years, and £313 during the next five years.

Ashton-in-Makerfield.—Loan.—The Urban District Council has applied for sanction to a loan of £8,480 for electricity purposes.

Ayr.—Electricity Supply.—The engineer and general manager of the Ayrshire Electricity Board has recommended various improvements, including new sub-stations and transformers, at a cost of £25,000, and the Board has agreed to carry out the scheme. New distributor cables to replace the existing ones are to be laid where the cables are found to be in a bad condition.

Bangor.—NEW ELECTRICITY CHARGE.—The Electricity Committee has decided that electricity consumers of not less than 3,000 kW per annum shall be offered the following tariff as an alternative to the present rate of 8d. per kWh for the first 1,000 kWh per quarter and 7d. per kWh for the next 500 kWh, &c. :—For electricity used for lighting between four p.m. and eight p.m., 9d. per kWh. For electricity used between eight p.m. and 4 p.m. next day, 4d. per kWh, provided that not less than 2,000 kWh per annum shall be used during the hours from four p.m. to eight p.m.

Barnes.—PRICE REDUCTIONS.—The Urban District Council has approved the following revised charges for electricity as from the meter readings in March next :—Private lighting : 4d. per kWh. Lighting, heating and cooking (domestic purposes) : 10 per cent. per annum of the rateable value of premises, plus 1d. per kWh during the winter quarters, and ½d. per kWh during the summer quarters. Power (other than contract), heating and cooking : 2d. per kWh, with discounts up to 37½ per cent. Public lighting : A reduction of £1 per annum for each post in side streets.

Birkenhead. — NEW ELECTRICITY CHARGES. — The Town Council has approved the new scale of electricity charges for domestic purposes, outlined in our issue of January 8th. The new scale will apply only to premises of a minimum rateable value of £18.

Blackburn.—LOANS.—The Town Council has given approval to an application for sanction to the following loans :—Mains, £93,000; services, £45,000; sub-stations, £16,500; change-over of system from d.c. to a.c., £7,500; purchase of showrooms, &c., £14,560.

Bognor.—STREET LIGHTING.—A scheme for lighting the main thoroughfare of the town by electricity is being carried out by Mr. H. A. Harding, electrical engineer to the Bognor Gas-Light & Coke Co. Central suspension lamps of 500 W are being used.

Bradford.—MAINS EXTENSIONS.—The Electricity Committee has authorised the following works :—Cables from Four Lane Ends to Allerton and Sandy Lane, and erection of transformer chamber at Sandy Lane, £15,241; cables in Low Moor district, £3,517.

Chesterfield.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to a loan of £4,548 for wiring consumers' premises.

Continental.—SPAIN.—The programme of the Echevarrieta group for the utilisation of the Douro waterfalls seems to present a better aspect owing to the attitude of the present Government. The proposed works include two waterfalls of a maximum yield of 266,000 h.p. and a force of 126,000 h.p. at low water and three waterfalls with a constant power of 46,366 h.p., all in Spanish territory. The two waterfalls studied in connection with Portugal will supply about 400,000 h.p. all the year round.—*Reuter's Trade Service* (Madrid).

Dalkeith.—TRANSFER OF UNDERTAKING.—The Town Council is to take over the electricity undertaking on April 1st next.

Derby.—WIRING OF SMALL HOUSES.—The Corporation Electricity Committee has allocated £5,000 from the appropriation account towards the cost of wiring Corporation houses for electric light.

East Ham.—NEW ELECTRICITY CHARGE.—The Electricity Committee has recommended to the Council that the following domestic tariff be approved as an alternative charge for electricity supplied to premises used solely for residential purposes :—A fixed quarterly charge varying from 16s. for a five-roomed house to 37s. for a 12-roomed house, plus 1½d. per kWh for energy consumed for all purposes, with a discount of 5 per cent.

Fraserburgh.—ELECTRICITY SCHEME.—A special committee of the Town Council has considered a proposal for an electricity supply and has recommended that if electric lighting be introduced it should be by the Council in preference to an outside company. The Council is to prepare a scheme.

Gelligaer.—ELECTRICITY EXTENSIONS.—The Urban District Council is applying for sanction to the borrowing of £10,059 for its electricity undertaking, and £5,000 for mains and services.

Glasgow.—PROGRESS AT DALMARNOCK STATION.—Satisfactory progress continues to be made with the equipment of the new section of the Corporation's Dalmarnock power station. The boilers are in course of installation in No. 3 boiler house, while the first of the four 20,000-kW Parsons turbo-alternators is approaching completion and is expected to take up its share of the load by about the end of the present month. When the present extension is complete, approximately 80,000 kW will be added to the present capacity of 100,000 kW.

Gravesend.—LOANS.—The Electricity Committee is applying for sanction to loans of £4,027 for foundations for turbine and condensing plant, £4,216 for switchgear, and £6,816 for a Yarrow boiler.

Horsham.—WIRING OF SMALL HOUSES.—The Urban District Council has applied for sanction to a loan of £1,000 to cover the estimated cost of a scheme for the wiring of premises for consumers. It is proposed to charge a rental of ¾d. per point per week, and a scale of charges on this basis has been drawn up.

Holbeach.—ELECTRICITY SCHEME.—The Urban District Council has decided to adopt a proposal to obtain an electricity supply from the Boston Electricity Supply Co. The company is to act as the distributor, and the maximum price is to be 10d. per kWh. The Council is to have the option of taking over the undertaking on a special or "goodwill" basis at the end of 21 years, and on the ordinary basis at the end of 42 years.

India.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Indian Textile Journal*, hydro-electric plant totalling 91,325 h.p. has been installed in the country, the largest installations being the plant of the Tata Hydro-Electric Power Supply Co. (50,000 h.p.), and Cauvery power scheme (22,650 h.p.). The following plants are under construction :—Andhra Valley Power Supply Co., 64,000 h.p.; Tata Power Co. (first stage only), 75,000 h.p.; Burma Mines, Ltd., 9,750 h.p.

Irish Free State.—WATERFORD.—At a recent meeting of the directors of the Waterford Chamber of Commerce it was agreed to instruct the Chamber's solicitor to oppose the Waterford municipal electric lighting scheme at the forthcoming Government inquiry. It was felt that the proposed scheme was inopportune on account of the present high city rates, and the prospect of electricity being supplied from the Shannon scheme within the next few years.

Japan.—ELECTRICAL DEVELOPMENT.—The Nügata Denki K.K. proposes to erect a hydro-electric power station with a capacity of 20,000 h.p. on the Shinano river.

The Yamagata Denki K.K. has decided to erect a steam power station at Shiogama-Machi, Miyagi-ken, at a cost of 540,000 yen, the work to be completed by next winter.

Kendal.—LOANS.—The Town Council has applied for sanction to loans of £3,000 for mains, £500 for services, and £1,200 for a battery room.

Lexden and Winstree.—ELECTRICITY SUPPLY.—The Rural District Council has decided to support the application of Colchester Town Council for a fringe Order to supply electricity in the rural area.

London.—CITY ELECTRICITY CHARGES.—The Charing Cross Electricity Supply Co., Ltd., announces that the following scale of charges for electricity will have effect as from January 1st last :—Lighting : In the winter quarters, 6d. per kWh for the first 7 kWh per 30 watts connected, and in the summer quarters 6d. per kWh for the first 3 kWh per 30 watts connected, and 2½d. per kWh for all energy consumed in excess of such quantities. Power : 2d. per kWh. Heating : 1½d. per kWh.

HACKNEY.—According to *The Times*, at a town's meeting on January 16th approval was given to a Bill, to be promoted by the Borough Council in the next session of Parliament, to confer additional powers on the Council in relation to its electricity undertaking. The measure contains a clause which will enable the Council to obtain land for a new sub-station at a cost of £86,000, which is the only capital expenditure contemplated under the Bill.

Luton.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £18,175 for feeders, £6,955 for services, &c., and £7,583 for sub-station equipment.

Malvern.—PRICE REDUCTION.—The Urban District Council has reduced the charge for electricity for power and heating by 1d. per kWh.

Middlesbrough.—PROPOSED NEW POWER STATION.—The Cleveland and South Durham County Electric Power Company has written to the Electricity Committee giving revised terms for a new bulk supply agreement to come into force on November 1st, 1927, the terms being based on the Corporation's taking the whole of its electricity requirements from the company's mains, the Snowdon Road power station being shut down, with the exception of the two gas sets, which would be utilised only for stand-by purposes. The engineer has submitted a report on the question of electricity supply and has recommended that the Corporation should erect a new power station with a capacity of 9,000 kW. At a meeting of the Corporation on January 12th it was decided that the borough electrical engineer's report should be adopted, and that the Cleveland and Durham County Electric Power Co. should be informed that the Corporation was satisfied that it could produce electrical energy at a lower price than that quoted by the company, and that the Corporation had accordingly decided to proceed with the erection of its own generating station for supplying to its consumers when the agreement with the company terminates in September, 1927. The Town Clerk has been authorised to make application for approval to the scheme, and for sanction to a loan of £141,346, being the estimated cost thereof.

Milton Regis.—ELECTRICITY SUPPLY.—The Urban District Council has decided to apply to the Kent Electric Power Co. and others to supply electricity to the district and has asked the Milton Rural District Council and the Sittingbourne Urban District Council to co-operate in the matter.

Musselburgh.—PURCHASE OF UNDERTAKINGS.—The Town Council has appointed a special committee to report on its powers under Provisional Orders to acquire the local electric light and tramway undertakings in view of the fact that the Council's option to purchase expires in June.

Northern Ireland.—CASTLEBLANEY (Co. MONAGHAN).—The Urban District Council has approved an agreement with a Belfast firm for a public installation of electric lighting, the scheme to be completed by September next.

NEWRY (Co. DOWN).—The Urban District Council has adopted the revised estimated of £17,500 for the installation of a public electric lighting scheme, as submitted by Mr. P. A. Spalding, municipal electrical engineer, Dundalk.

Queensbury.—ELECTRICITY SUPPLY.—The Urban District Council has approved a plan submitted by the Yorkshire Electric Power Co. of proposed overhead lines in the district.

Rhyl.—LOAN.—The Urban District Council has applied for sanction to a loan of £10,000 for electricity purposes.

Shrewsbury.—ELECTRICITY EXTENSIONS.—The Town Council has approved a scheme for extensions at the electricity works which includes the erection of a new engine room, and the installation of a 400-kW generator, to be followed, probably immediately on the completion of the first set, by a second similar set. The building and installation of the first set is estimated to cost £15,000. The scheme has been approved by the Technical Sub-Committee of the West Midlands Electricity District.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Lancashire Electric Power Co. to supply electricity in the urban district of Walton-le-Dale.

Application has been made by Mr. J. A. Purves for a Special Order for the supply of electricity in the urban district of Brampton.

Tadcaster.—ELECTRICITY SUPPLY.—The Rural District Council has consented to an application by the Electrical Distribution of Yorkshire, Ltd., for a Special Order to supply electricity within the Council's area on condition that a fixed time is to be stated for the supply of electricity to be available.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, the rapidly increasing load supplied by the Niagara system and the necessity of maintaining a proper balance in the supply of steam and hydro-electric power have made it necessary to add a 60,000-kW turbine to the equipment of the River Station of the Buffalo General Electric Co. The station at present includes three 20,000-kW and one 35,000-kW turbo-generators.

Announcement has been made by the Byllesby Engineering and Management Corporation, that an order for eight 13,500-h.p. waterwheels has been placed with the Allis-Chalmers Manufacturing Co. This equipment is for the new Falls of the Ohio River station being built on the Ohio River at Louisville.

The growing demand for electric power in Florida has caused the completion of negotiations by the Florida Power & Light Co. for the purchase of land on the New River near Fort Lauderdale, on which work will be begun immediately for the construction of a new steam generating station to have an ultimate capacity of 100,000 kW. Orders have already been placed for two 25,000-kW high-pressure steam turbines, boilers and auxiliary equipment for this station, and it is expected that the first unit of the plant will be installed and in operation by the end of 1926 or early in 1927. The station will be equipped to burn either coal or fuel oil or both.

Watford.—LOAN.—The Electricity Committee is to apply for sanction to a loan of £20,378 for sub-stations, switchgear,

Tramway and Railway Notes.

Bradford.—TRACK RENEWALS.—The Tramways Committee, after considering a report submitted by the city engineer on track reconstruction work during the coming year has recommended the following renewals:—Manningham Lane, from North Parade to Oak Lane, £27,715; Barkerend Road, from Otley Road to Byron Street, £14,740; and Barkerend Road, from Rushton Road to Leeds Road, £8,262; total, £50,717.

Continental.—NORWAY.—An underground railway is to be constructed by the City of Oslo, the capital of Norway, from Majorstuen, a station on the Holmenkollen Railway in the suburbs of Oslo, to the centre of the city. The tunnel will carry the trains of the four lines handling the heaviest traffic from the surrounding districts to Oslo, namely, Holmenkollenbanen, Smestadbanen, Sognvandsbanen, and Baerumsbanen.—*Commerce Reports.*

AUSTRIA.—The electrification of the Austrian Federal Railways is progressing in proportion to the release of funds from the balance of the League of Nations credits set aside for investment purposes. In addition to the 56 electric locomotives ordered last year, the greater number of which are already in operation, 50 additional locomotives have been ordered, delivery to be made progressively until the end of 1927. It is planned to reinforce the principal portions of the main lines at a future date, more especially the line Vienna-Salzburg, in order to permit the use of a stronger type of locomotive.

FRANCE.—The Paris correspondent of the *Daily Mail* reports that the Paris Municipal Council is to remove a number of the main tramway tracks running to the centre of the city and to confine the working of other tramways to early morning and shopping hours. It is proposed by the Council that, as a first step, the tramway terminus at the Opera end of the Rue du Quatre Septembre should be abolished and a new terminus for these tramway lines found outside the congested area. The same measure is to be adopted for some of the many lines which converge towards other parts of Paris, including those near the Gare du Nord. During the hours when tramway services will be prohibited motor-omnibuses will be substituted.

Dundee.—PROPOSED PURCHASE OF UNDERTAKING.—The Town Council has under consideration a proposal to acquire the undertaking of the Dundee, Broughty Ferry and District Tramway Co., Ltd., at a cost of £85,000.

Irish Free State.—DUBLIN.—The scheme for the extension of the Dublin tramway service to Lucan has successfully passed the negotiation stage, and as soon as the necessary legal formalities are completed the work of relaying the track to the wider tramway gauge will be commenced. Negotiations are also proceeding satisfactorily with the object of extending the tramway service from Dublin to Blessington, and it is anticipated that in the near future the two districts of Lucan and Blessington will be linked up with the Dublin tramway system.

Liverpool.—FAILURE OF NEGOTIATIONS.—It is reported that negotiations for the acquisition by the Corporation of the Waterloo tramway system have failed, and that a contract has been signed for a motor-omnibus service between Seaforth and Great Crosby for a period of five years.

Manchester.—TRANSPORT IMPROVEMENTS.—According to the *Electric Railway and Tramway Journal*, the Corporation Tramways Committee is contemplating the expenditure of £320,000 for the following purposes:—£14,000 for motor omnibuses; £105,000 for permanent way, new buildings, &c., £170,000 on car works extensions; £12,000 on equipment; and £15,000 for machinery for car works. The proposed extensions will practically double the capacity and the area of the car sheds. The Corporation intends to resume the construction of its own tramcars, the pre-war output of which was one car weekly.

Stretford.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £10,373 for tramway construction and electrical equipment.

United States.—RAILWAY ELECTRIFICATION.—According to the *Electric Railway Journal*, Vice-President Le Boutillier, of the Long Island Railroad, on December 24th laid plans before Mr. R. Nixon, chief engineer of the Public Service Commission, for further electrification of the Long Island Railroad from 1926 to 1929, at a cost of $12,600,000. The improvements proposed are as follow:—1926. Electrification of the Bay Ridge Division and the Bay Ridge yards ($4,040,000). 1927. Electrification of the Montauk Division, from Long Island City to Holban yards and the yards at Long Island City, Blissville, French Pond, and Holban ($6,010,000). 1928. Electrification of freight sidings on the North Side Division, the main line between Long Island City and Jamaica and on the Atlantic Division ($1,205,000). 1929. Electrification of the remainder of freight sidings in territory now electrified for passenger service ($595,000).

Uruguay.—RAILWAY ELECTRIFICATION.—According to *Commerce Reports*, the management of the Ferrocarriles y Tranvias del Estado in Uruguay has under consideration the partial electrification of the Ferrocarril del Norte (Northern Railway) from Montevideo to Santiago Vazquez on the Santa Lucia River, a distance of 19.5 km. La Transatlantica, a German street-car system of Montevideo, and the railway management are negotiating an arrangement whereby the company will operate a street-car service over the track of the Northern Railway in lieu of building a new and competitive line.

Telegraph and Telephone Notes.

Australia.—NEW CABLE.—There sailed from Greenwich, on January 15th the cable ship *Colonia*, the largest cable ship in the world. She is to lay a duplicate cable over the 1,800 nautical miles between Cocos (Keeling Islands), in the Indian Ocean, and Fremantle, Australia. More than ordinary interest attaches to the operation because the cable is of the new loaded type, and is the first British owned and manufactured loaded cable to be put down. It is the property of the Eastern Extension, Australasia and China Telegraph Co., Ltd., one of the Eastern Associated Telegraph group, and will be operated by British interests. Whereas the existing line from Cocos to Freemantle has a working capacity of 145 letters a minute, the new line is designed for a speed of 2,100 letters. This result has been obtained by winding round the core strips of a new metal capable of carrying additional current. The new cable is not in substitution, but in duplication, of the existing facilities, and will give the Eastern group yet another route connecting Europe and Australia. That means developing further the lines between Freemantle and Adelaide, a matter now under consideration. The *Colonia* is expected to arrive at Cocos about the middle of February and to complete the laying of the cable at Freemantle early in March. With the *Colonia* has sailed, as a junior cable engineer, Mr. John Jocelyn Denison-Pender, son of Mr. John C. Denison-Pender, vice-chairman of the Eastern Telegraph Co., and grandson of Sir John Denison-Pender, the chairman. Young Mr. Denison-Pender is thus the fourth generation of the Pender family to be actively interested in cables.

(*Continued on page 143*)

A Modern Cable and Rubber Factory.

A Visit to the Works of the St. Helens Cable and Rubber Co., Ltd.

THE St. Helens Cable & Rubber Co., Ltd., derived its origin from the firm of Messrs. W. & J. Glover and Co., whose works were at St. Helens, from which town the first-mentioned firm takes its present name. Messrs. W. & J. Glover & Co. were well-known manufacturers of wire and wire ropes, and had an extensive connection amongst the collieries. This business, together with that of Messrs. Hanchett & Co., Ltd., rubber manufacturers, was acquired by the St. Helens Cable Co., Ltd., which was registered in 1899 to take over the business of cable, wire-rope and rubber manufacturing, with works at St. Helens and Warrington. At the former place the manufacture of wire ropes was continued, and also the drawing of iron and copper wire, while the Warrington Works was devoted to the manufacture of electric wire and cables and also rubber tires and other mechanical rubber goods. The development of the pneumatic and solid-tire industry eventually led to the introduction of the cab-tire sheathed cable, with which probably all electrical engineers associate the name of the firm in question. With the commencement of the making of rubber tires the name of the undertaking was once again changed, and it became as it is styled at present, the St. Helens Cable & Rubber Co., Ltd. In 1923 the increase in the firm's productions rendered it necessary to establish a larger factory on more modern lines, and after a considerable search the present factory at Slough was chosen. It is part of the huge works built by the Government during the war which were to have been used for the repair of automobiles, and which is now owned by the Slough Trading Company.

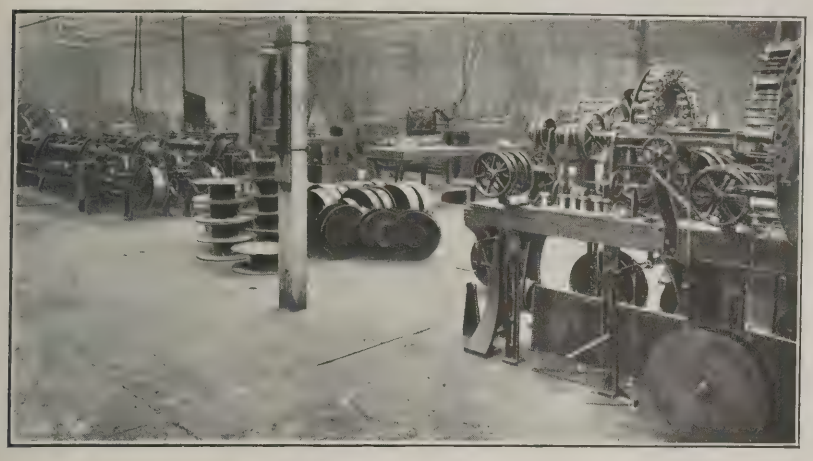


Fig. 1.—Fine-Wire Stranding Machines.

Although the manufacture of "C.T.S." cables forms the principal feature of interest in the works, at any rate from the point of view of the electrical engineer, many other products are of interest, including rubber insulating mats, gloves, and overshoes; the making of ebonite is also a special feature. The premises, which cover an area of 258,000 square feet, are of modern construction with only one floor level and good natural lighting, bordered at opposite ends by sidings of the G.W.R. These are each run in a covered way flanking the premises with the necessary loading and unloading platforms on the same level as the factory floor. The north end is arranged as the import section and the opposite end forms the export branch, the whole of the factory being set out so that the raw materials received at the import end travel as nearly as possible in a straight line in the works through the different processes of manufacture till they reach the export room in the completed stage.

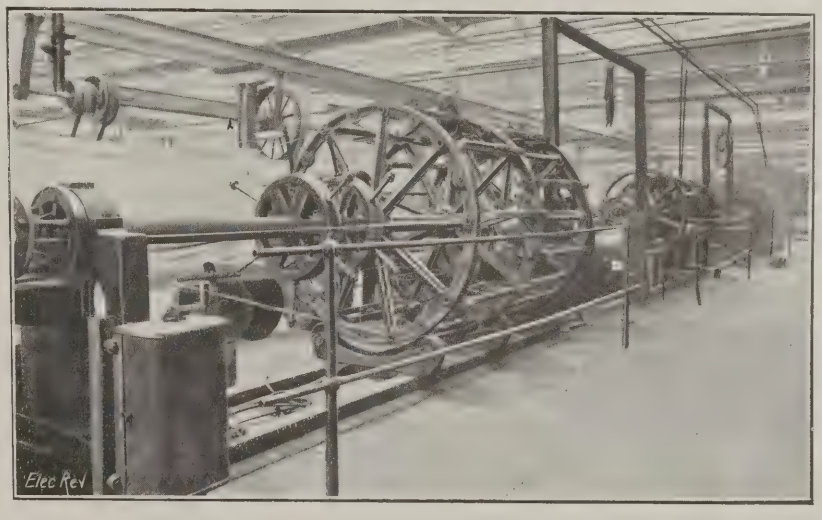


Fig. 2.—Large Stranding Plant.



Fig. 3.—Cotton-Covering Section.

The factory proper is arranged in two main sections, one devoted chiefly to the preparation of rubber for its many uses, and the other to cable stranding, covering, &c. All the wire used is received already drawn to the required sizes from one of the associated companies of the firm. The first operation in the making of cables, stranding, is effected immediately inside the main factory at the import end. Fig. 1 shows some of the fine-wire stranding machines, and fig. 2 is a view of some of the larger machines employed in this process. In the first-mentioned illustration the machines were dealing, when we recently visited the works, with flexible cord containing up to 70 wires. Adjacent cotton-covering machines, fig. 3, deal with wires required for instruments,

&c. Bunching machines, in which the strands are merely assembled without twisting, for the sake of flexibility, form a feature in this portion of the works. A twinning machine, which can be adapted for either stranding or twinning operations, is another item of interest; it follows closely the design of a special machine which is used for the combined operations of twinning multi-core cables and taping between the cores as they are assembled. The latter operation is employed in the making of C.T.S. cable so as to ensure that, besides surrounding the cable as a whole, the cores are each separately encircled with a coating of the sheathing material. Heavy-stranding revolving-bobbin machines are also installed for dealing with the larger cables.

The insulating of the cores is an interesting branch of the work. Rubber-taping machines are employed in this process, the bare cores being taped with pure-rubber strip. It is interesting to note that the ends of the rubber strip are welded together when necessary by simply beating them together in a similar manner to that employed in iron forge-welding. The insulating rubber is supplied from the rubber department in different colours, indicating the various classes up to the 2,500-megohm grade. The colours are all of light shades, enabling the tester to easily discern any foreign matter or other defects in the rubber during the two examinations to which it is subjected when it is in sheet form. Other covering machines are of the grooved-roller type, fig. 5, in which the core is sandwiched between two rubber strips, and on which both the pure-rubber and the compounded-rubber insulation, the separator and the jacket, are applied by one machine. Other machines, which deal with h.p. cables, serve the cores with two layers of each insulation.

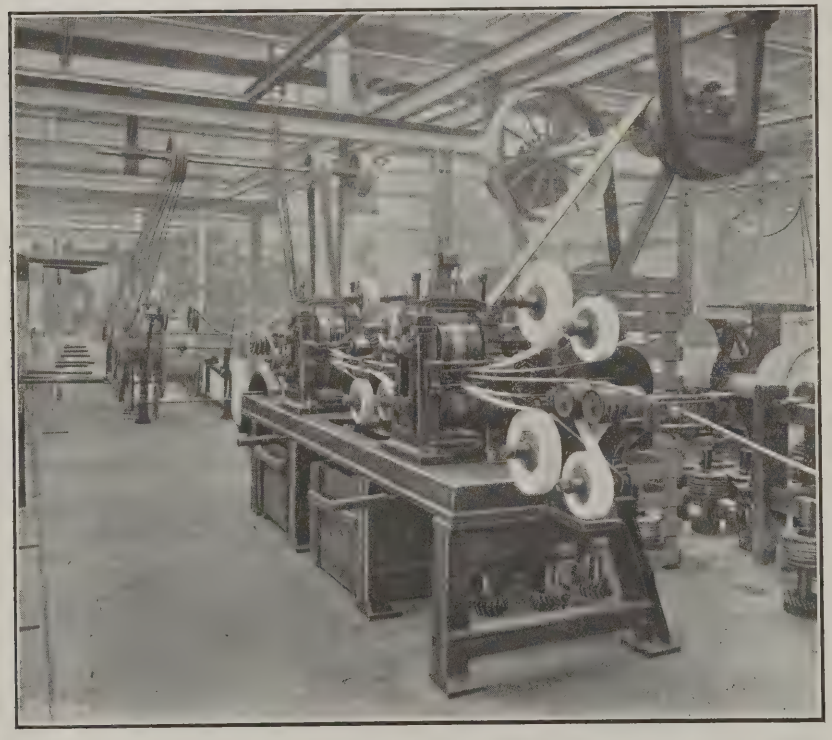


Fig. 5.—Grooved-Roller Rubbering Process.

A considerable number of braiding machines of the vertical type are also installed to deal with ordinary v.i.r. cables. The latter are finally dealt with in colouring troughs. Two large laying-up and armouring machines, on which colliery cables are dealt with, form another important part of the equipment. These are of the revolving-bobbin type.

The application of the cab-tire sheathing is effected in the rubber preparation department. Here forcing machines, fig. 4 of various sizes are employed on this work. The "cab-tire" is fed into these machines at the top; it is "minced" and applied hot to the cable by means of a die-mould through the centre of which the cable is drawn at right angles to the direction of application. A fine thread is drawn in the sheathing of all cables of this class, as a maker's distinction mark. As the sheathed cable is received from the machine it is paid out on to a revolving circular tray, where it is covered with french chalk; later on it is vulcanised.

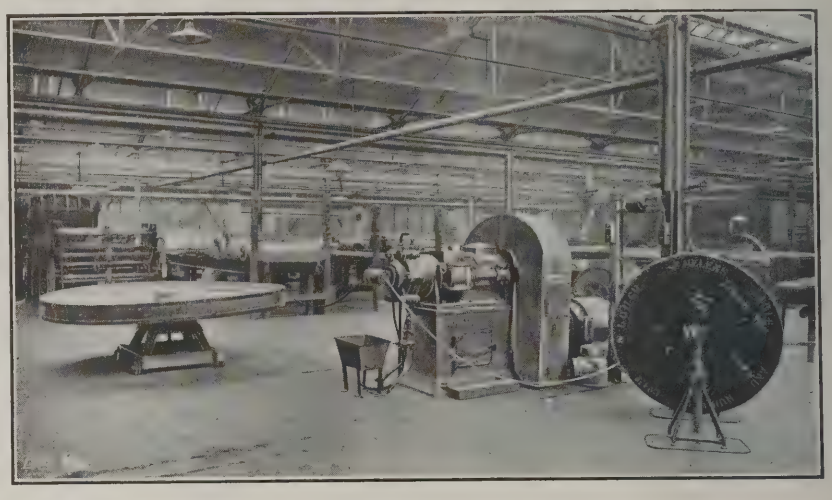


Fig. 4.—Rubber-Forcing Machines.

Of particular interest is the rubber department. Here rubber is received from the Malay States in two grades, refined rubber, which has been collected direct from the tree cups, and a coarse grade, or "browns," which consists largely of the leakage gums which run down the tree bark. The first-mentioned grade is used for insulating, and is received in sheets packed in wooden cases, as is the crude rubber, which is employed in the sheathing. The sheets are hung on racks in large drying ovens through which a current of warm air is circulated by means of a fan placed on the top, which sends the air first through a steam-heated coil.

The rubber is first dealt with, after drying, by masticating machines, fig. 6, on which the material (raw rubber) is applied to a pair of steel rollers, similar in construction to an ordinary mangle, except that they are placed side by side. The rollers, which are steam heated, travel at different speeds, so that the rubber, which is left adhering to the rollers for several hours, is constantly being "churned." According to the class of compounded rubber or ebonite required, sulphur, zinc oxide and various "drugs" are fed into the revolving mass periodically during the process. The mixed compound is run through calenders, fig. 7, into sheets of various thicknesses according to the purpose for which they are required. Thin sheets prepared for the manufacture of gloves, insulating tape, &c., are afterwards rolled in cloth until the rubber is dry. The calenders are of the triple steel-roller type, the rollers being heated by means of steam.

Another interesting operation is that of rubber spreading. The pure rubber for insulating tape is treated by this process, which is effected in an entirely separate building on account of the quantity of naphtha used. The rubber is first put into tubs, where it is served with naphtha until it becomes a plastic substance, when it is suitable for application to the spreading machines

(fig. 8). A pair of rollers force the mixture under a knife-gauge on to a steam-heated table, on which the thin sheet of the mixture is spread on to a travelling

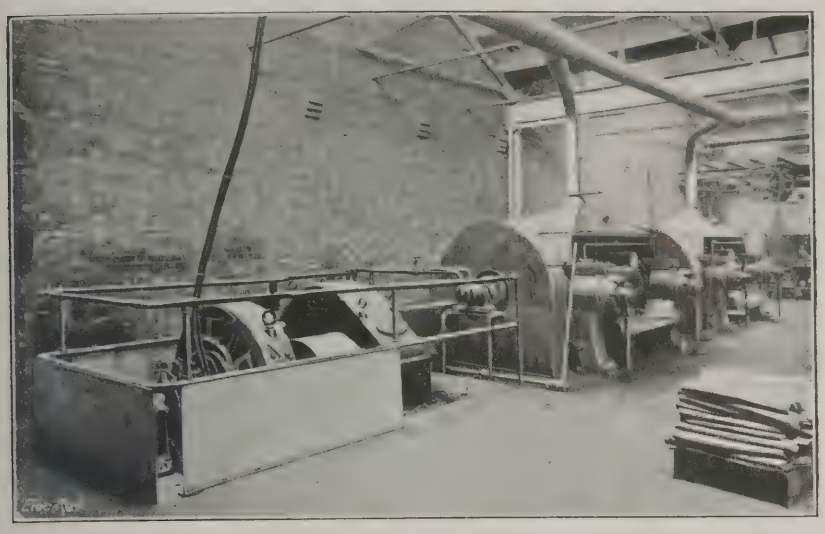


Fig. 6.—Rubber-Masticating Machines.

cloth. Other processes, in which the mixture is forced into the mesh of canvas, result in a reinforced rubber for such articles as pneumatic tires.

Three large vulcanising tanks for dealing with cab-tire cables are installed. Matting presses also form an important feature of the works; in these rubber mats are vulcanised and shaped in one operation. The press pans are steam heated and the face plates have various corrugated designs, giving the required finish to the product. The press is operated under hydraulic pressure. Similar machines to these are used for the preparation of ebonite sheets. A fully-equipped testing room is provided to deal with all the finished electrical products. A 25-kW generator feeds a static transformer from which pressures up to 100,000 V can be obtained. Two 600-V "test-tube"-type accumulators are also installed for the purposes of dielectric tests, &c. An interesting piece of apparatus in this department is a sheet-ebonite testing device, a patent of the firm. It consists of two rollers of small diameter, held about 1/16th in. apart in a suitably insulated frame and handle. A circuit in which a mirror galvanometer is conveniently arranged applies a pressure of 600 V between the two rollers. The latter are wheeled over the surface of the ebonite so that both of their peripheries are in contact with the sheet surface. Any appreciable defect, such as a piece of conducting material in the compound, will result in a current passing between the rollers, giving rise to a deflection of the galvanometer. The water tanks for cable-immersion tests are conveniently placed adjacent to the test room.

One may be justified in assuming that in a rubber factory a fully-equipped laboratory is at least as essential as in any other industrial concern. For each consignment of rubber imported, fresh data for the mixing operations have to be prepared experimentally, because the different rubbers vary in quality to such an extent. Such a department forms a particularly interesting and important branch of the St. Helens works. It is equipped practically as a miniature factory. A masticator, vulcaniser, and hot presses, &c., enable the main and essential processes of the factory proper to be undertaken on a sufficiently large scale to allow the necessary data to be determined. An important piece of apparatus is a tensile testing machine, which registers both the breaking strain and the stretch of samples of rubber automatically. The necessary "pull" is applied to the rubber by means of a small electric motor acting on a highly-geared chain-pulley system; the recording is effected by means of a similar gearing. Many extended time experiments on samples of cab-tire sheathing add to the interest of the laboratory. Pieces of the material are bottled in various acids and other solutions, where in some cases they have remained for several years with no apparent ill effects. A small shop is set aside for the preparation of samples of the firm's products. Some recent additions to these are ebonite sheeting prepared in attractive designs, such as imitation marble, and the like.

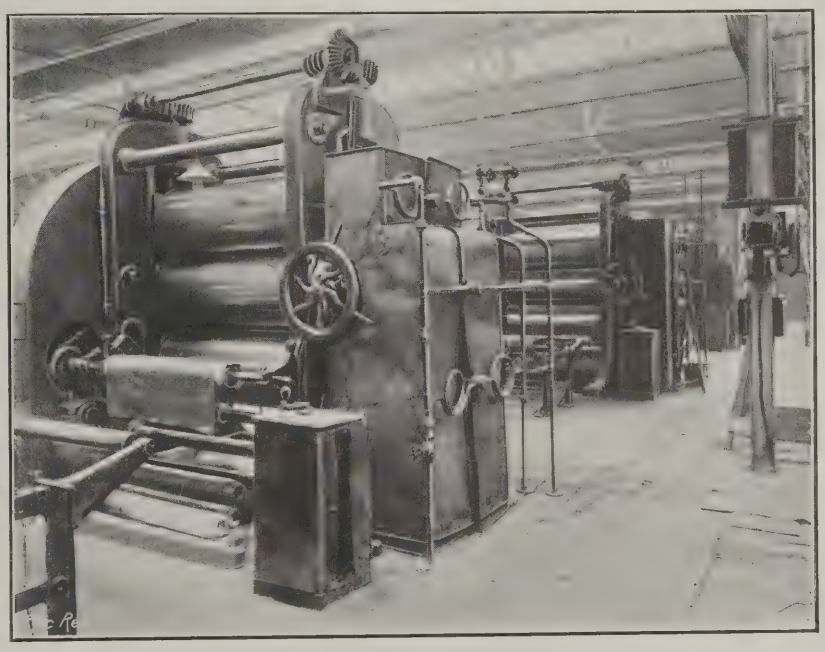


Fig. 7.—Rubber-Rolling Callenders.

The whole of the machines throughout the factory are electrically driven, and in most cases, especially with the larger plant, figs. 6—8, individual motor drive is employed. The motors, some of which were originally installed in the Warrington works, are all d.c. machines and the electricity supply, received from a local company's power station on the estate at 460 volts, is a.c., 3-phase. A transforming and converting station affords the neces-

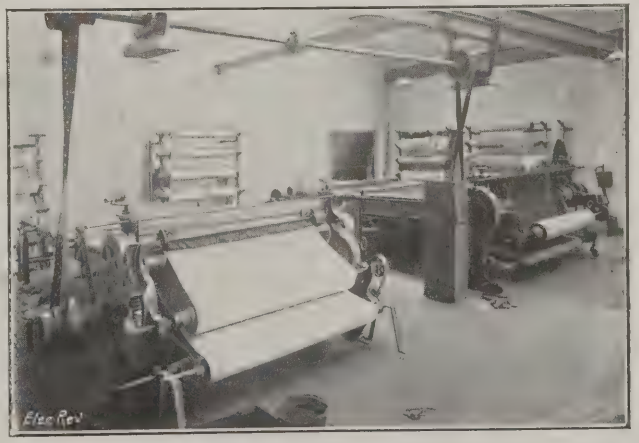


Fig. 8.—Spreading Machines.

sary means of conversion and distribution. It is equipped with three static transformers, supplying three rotary converters, and a 9-panel generating and dis-

tribution switchboard. It is interesting to note that the transformers were originally in use at the previous works, where they dealt with an incoming h.p. supply. They have been re-wound to reduce the present supply pressure to that necessary, 440 V, for the rotaries. Mechanical and electrical workshops are equipped with lathes and other repair gear required to effect the repairs to the running plant, &c. Small outhouses constitute a carpenter's shop and forge for similar purposes. A hydraulic installation serves the vulcanising presses, &c. Pan-type vulcanising tanks to deal with carriage tires are also provided for by this installation. A feature of the vulcanising equipment consists of special tanks in which the Peachey process for rapid vulcanising is employed, the principle being the effect produced by two gases impinging on the material.

Apart from the manufacture of the main products mentioned, numerous articles of all descriptions are prepared from the rubber compounds, including many electrical safety appliances. Specially constructed insulating gloves are a recent development. These are coated at the parts most subjected to wear with an extra layer of red cab-tire material, which, when worn through to the black material beneath, gives a warning of its wear to the user. A jointing "N" tape is another speciality; this consists of a layer of compounded rubber faced with one of the pure material, the object being to combine the high insulating properties of pure rubber with the good mechanical properties of the compounded substance. It is interesting to note that there is still a large output of solid cab tires to India.

The electrical installation is wired throughout with C.T.S. Mains are run externally along the walls of the main building so that they are exposed to the sun and all weathers. Inside the factory mains are run along the steel girders, and in many cases, as shown in fig. 7, the motor leads from the starters, &c., are run down supporting girders and buried direct in the concrete flooring.

It is interesting to note that the ebonite department is at times called upon to turn out as much as 5 tons per week of sheet alone. By far the greater part of the floor space in this department accommodates plant for the manufacture of mouldings, accumulator cells, loud-speaker horns, &c.

Although a considerable number of the employés are housed on the estate, the majority live in the town of Slough—about two miles away. A service of 'buses



Fig. 2.—Kerstelenbach Viaduct.

runs to and from the estate at convenient times, of which many take advantage. Efforts are made to provide social attractions for the employés. The firm runs its own football, tennis, cricket and bowling clubs, and a football ground is situated quite near the works. A club room situated in Slough proves a great attraction for many of the hands.

An association of the occupiers of the various factories, &c., throughout the estate has been the means

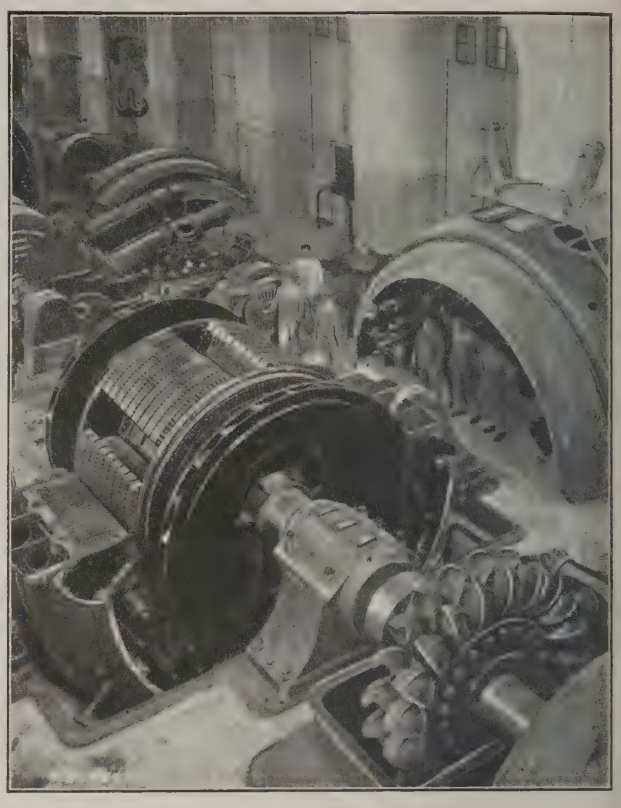


Fig. 1.—Turbine Room, Amsteg.

of adding considerably to the comfort of everybody working there. One example of the useful work done in this direction is the lighting by electricity of the main Bath Road between the estate gates and Slough.

Swiss Electrification.

The first illustration on this page shows the interior of the turbine room of the Amsteg hydro-electric generating station (Electrical Review, October 9th, 1925), one of the principal sources of energy for the Swiss electrified railways. The station utilises the water power of the River Reuss, between Gurtnellen and Amsteg. Provision is made for six 10,000-kW turbine generators, five of which were completed towards the end of last year when the sixth machine was well in hand. The turbines are of the Pelton type, and are served by three steel pressure conduits, each 1,476 ft. long and with a diameter varying from 5.25 ft. at the lower end to 5.9 ft. They are designed to work under a head of 902 ft., with a delivery of 1,045 gallons per second, running at 333½ r.p.m. The turbines are direct coupled to Oerlikon alternators.

Fig. 2 shows the Kerstelenbach viaduct, near Amsteg, on the electrified railways of the Swiss Federal Railways, recent reports on which record an economy of 21 per cent. on the former working expenses, and a gain on the rolling stock, in that 79 electric locomotives have easily done the work of 100 steam engines. The C.F.F. is still using 251 steam engines in the unfinished section of the lines, but at the end of last year it already had in the first "Arrondissement" 29 electric locomotives of the "Séchéron" type, 24 of the "Brown, Boveri"

type, and 8 "Séchéron" auto-motors running on single-phase; also 8, including 7 of the "Brown, Boveri" type, for three-phase working.

While the electrification has introduced a new factor of danger for men working on the C.F.F., if one compares the statistics of railway accidents in Switzerland with those of other European countries, one is forced to admit that fewer accidents take place on the Swiss side of the Alps than anywhere else, and that a record of one traveller killed and four hurt per ten million persons carried is very reassuring as to some of the advantages of electric traction and good engineering.

The construction of a power station not far from Einsiedeln, at Etzel, is being considered by the Federal Railways, but this presents a serious difficulty. The barrage to be constructed would confine a formidable mass of water with a surface area of about 3,800 acres, of which about 1,000 would be redeemed from the valley of Wäggi. The creation of this artificial lake would completely destroy a flourishing agricultural district. It appears that 46.7 per cent. of the land is communal property, but the remaining 53.3 per cent. is private, so the question of indemnity looms large in the new scheme.

Telegraph and Telephone Notes.

(*Continued from page 138.*)

Storms in France.—DISORGANISATION OF TELEGRAPH AND TELEPHONE SERVICES.—Some idea of the extent to which the telegraph and telephone services in France were affected by the incessant storms which raged throughout the country from December 20th to December 31st may be gathered from a communication issued by the Ministry of Commerce, Posts and Telegraphs. In all, the total length of wire lines blown down exceeded 30 kilometres, while thousands of telegraph poles were overthrown. The damage was particularly serious in the Paris suburbs; 53 poles supporting 84 wires came down on the railway at Pierrelays; at Herblay 15 poles bearing 50 wires fell on a train, happily without causing any serious accident. Over a kilometre of the important system of 130 wires connecting Lille with Dunkerque was blown down, while over a distance of several kilometres the Paris-Belfort system collapsed near Troyes. Near Saint Quentin the international Paris-Erquelines line was damaged, and over four kilometres the Paris-Brest line was felled to the ground.

The telephone system was badly interfered with; on December 31st only 584 trunk lines out of 1,153 were working; of the main telegraph lines 355 out of 425 were put out of action. Every effort was made to adopt temporary measures to ensure communication, but often repaired lines were blown down again immediately. It took a full fortnight after the last days of the gale to bring the telegraph and telephone systems back to normal.—*Reuter* (Paris).

Radio-telegraphy rendered good service to the ordinary telegraph service during the stormy period. The French station at Saint Assise, during one day recently, transmitted 32,000 words to London and other destinations when the wire lines were hard pressed owing to breakdowns, says the *Daily Telegraph*. The schedule arranged was faithfully adhered to and every message was sent out on time.

Eastern Europe.—NEW WIRELESS SERVICES.—Marconi's Wireless Telegraph Co., Ltd., announces that new radio-telegraph services have been inaugurated between Great Britain and Yugo-Slavia and Bulgaria; messages for those countries should be marked "*via* Marconi," and the rates are as follows:—Yugo-Slavia, urgent 10½d. per word, ordinary 3½d.; Bulgaria, urgent 1s. per word, ordinary 4d.

India.—NEW RADIO STATIONS.—The wireless station which is being erected at Kirkee, near Poona, in the Bombay Presidency, in connection with the Imperial wireless chain, is expected to be ready in six months' time, and to be able to operate at the rate of 1,000 words a minute. There will be five steel masts, each 280 ft. high, in a line pointing directly to the Skegness reciprocal station. The *Daily Telegraph* expects that shortly the station will be enlarged to communicate with Tokio, and also with South Africa. The receiving station at Dhond, 50 miles away, is also progressing.

Latvia.—NEW TELEGRAPH CABLE.—It is reported from Riga that a new telegraph cable is being laid between that city, Dunaberg, and Roistten.

Marine Radio Operators.—STRIKE INQUIRY REFUSED.—About 1,500 ship's radio operators have been on strike for about eight weeks. The Ministry of Labour has refused the application of the Association of Wireless and Cable Telegraphists to hold a court of inquiry.

Sweden.—AUTOMATIC TELEPHONY.—Mr. Lundgren, of the State telephone service in Stockholm, states that the scheme for the introduction of automatic telephony in that city, which is now in progress, aims at the establishment of automatic connections for 12,000 subscribers at the main exchange, and the apparatus is to be delivered in the course of three years in connection with the transfer from the old to the new exchange. In the other exchanges the automatic principle will be applied to a total of 22,000 lines, and the work is to be completed in 1928. It is necessary for the State to introduce the automatic system in Stockholm and Gothenborg for reasons of economy, as the existing expenses with the manual exchanges are too high. After the latter city has been equipped in this manner, the Malmo area will be converted.

The Telephone Service.—RURAL TELEPHONY.—Farmers and the railway companies are co-operating in an interesting scheme. The *Daily Telegraph* explains that the London and North-Eastern Railway Co. conceived the idea of inducing farmers to install telephone lines between their homes and the nearest railway station, and thus keep in constant communication with the market and save considerable time and many ineffective journeys for inquiries. The L.N.E.R. has practically completed its agreement with the Post Office, and it is hoped that the scheme will shortly comprise the whole of the railway systems of the country.

LIVERPOOL DEVELOPMENT.—In the annual report of the Liverpool and District Advisory Committee it is recorded that last year 6,762 telephones were fitted, a net increase (after deducting cessations) of 4,095, or 8 per cent. more than 1924. New exchange premises have been obtained at Hoylake, Huyton, and Upton; a site has been acquired for a new Garston exchange, and building operations are expected to commence very shortly. A site has also been acquired in Limekiln Lane, Liverpool, for a new North exchange; the new building will eventually accommodate one of the automatic exchanges projected for the Liverpool area. In the last 13 years the total underground mileage of telegraph and telephone lines has grown from 99,444 to 194,749. To meet the demand for increased circuits from Liverpool to Manchester a further cable, providing 254 circuits, is to be provided next year. Direct telegraph communication between Liverpool and Antwerp has been definitely authorised, and arrangements are being made for the installation. The restoration of direct communication between Liverpool and Germany is also being considered.

Venezuela.—TELEGRAPH SERVICE.—Reporting to the Department of Overseas Trade on the economic conditions in Venezuela (under date September, 1925), Mr. H. A. Hobson, H.M. Consul at Caracas, mentions improvements that have been effected in the Caracas wireless station, and states that communication with Trinidad has been well maintained; the Maiquetia station has also been in constant touch with Puerto Rico. The Puerto Cabello and Maracaibo stations no longer work, no satisfactory results ever having been obtained from them. The French Cable Company's report shows an increase of some 12,000 telegrams (about 20 per cent.) in 1924 over the 1923 figures. A concession was granted on September 25th, 1924, to a military official in the Telegraph Service to import and sell wireless apparatus and to establish a service of radio concerts. Up to the present, however, no scheme has been formulated and consequently not a single wireless set (except the official experimental ones) has been introduced into Venezuela.

Radio Notes.

Birmingham Station.—NEW STUDIO.—The new studio and office accommodation at 5IT, which was opened on January 20th, gives the station the distinction of possessing the largest studio in the country. The equipment may be said to represent the high-water mark in the development of broadcasting on the transmitting side, for the whole of the apparatus is of the latest type. A point of interest is the adoption of a new method of controlling echo effect in the studio, for the B.B.C. has definitely discarded the belief, so securely held in the early days of broadcasting, that it was necessary to prevent all echo by means of heavy draping in the studio. It is freely recognised now that these conditions do not give the best results, and that a certain amount of echo imparts a pleasing ringing quality to a transmission and enhances the clarity and carrying power alike of music and speech, though the necessary amount of echo in both cases is not the same. Echo must be very carefully regulated and considered in close relationship with the kind of music which is being sent out. In the new Birmingham station the need for variability is provided for by draping, hung as curtains upon a system of pulleys, which will enable the studio director to vary the amount of echo at will.

Broadcast Wave-lengths.—PROBABLE CHANGES.—In connection with the efforts that are being made to reduce interstation interference, it is understood that Bournemouth is the British station selected to take part in the initial tests, in the course of which its wave-length, at present 386 metres, will be changed at different times to 250, 350, and 500 metres. The foreign stations which will co-operate are *Petit Parisien* (Paris) and those at Berlin and Rome, all of which, says the *Daily Mail*, will broadcast simultaneously on the same wave-length. If the experiments show that the stations can transmit without jamming one another, tests with other groups of stations will be made, and the results will be placed before the International Wireless Conference for drawing up a plan of group wave-lengths.

El Salvador.—NEW STATION.—The Department of Telegraphs and Telephones of the Salvador Government notifies that the new 500-watt broadcasting station erected in the

capital, San Salvador, will be opened for public traffic shortly. The wavelength employed will be between 400 and 500 metres. The demand for radio receivers of the less expensive types shows signs of expansion, and dealers are making larger stock purchases.—*Reuter's Trade Service* (San Salvador).

U.S.A.—WAVE-LENGTH PIRACY.—In connection with the congestion of the ether through the rapid growth of broadcasting, an important step has been taken by the United States Government in ordering proceedings to be instituted against the Zenith Radio Corporation, Chicago, for pirating a wavelength. When the Zenith Co. applied for a licence it was informed that there was no separate wavelength available, and it was only given permission to share a wavelength with a Denver station. Recently the Zenith Co., says the *Daily Telegraph*, commenced broadcasting on a wavelength allotted to Canada, but hitherto unused. The forthcoming action will be the first test of the Government's power to regulate wavelengths.

India.—NEW STATIONS.—Marconi's Wireless Telegraph Co., Ltd., states that broadcasting in India, which, so far, has been carried on only through the efforts of radio clubs in Calcutta, Bombay, Rangoon, and Madras, will shortly be put on a commercial basis by the grant of a licence to the Indian Radio Telegraph Co. It is reported that the broadcasting stations which the company contemplates building at Bombay and Calcutta, as mentioned last week, will each have a power of 12 kW.

Irish Free State.—DUBLIN STATION.—The Staisiun Craoibscaoileachain Ath Cliath, otherwise 2RN, commenced to broadcast on January 1st, 1926, but already, says *The Times*, its adverse critics largely outnumber those who praise its achievements. So far the station has been broadcasting only for two hours every evening, from 8 until 10 o'clock, and there has been no programme at all on Sundays. In view of the fact that a wireless licence in the Free State costs a guinea, purchasers of crystal sets in the Dublin area complain that they are being treated unfairly, more especially as the standard of the 2RN programmes has not been very high. The announcement of the station director that arrangements are being made to give lessons in the Irish language by wireless has not been received with much enthusiasm anywhere.

Patent Royalties.—A WARNING.—Of interest to amateur constructors of broadcast receiving apparatus is the statement which is understood to have been issued by Marconi's Wireless Telegraph Co., Ltd., to the effect that all persons whatever supplying or receiving by way of sale, gift, or exchange, unlicensed broadcast receivers embodying patents controlled by Marconi's Company, are liable to legal proceedings for infringement. By disposing of, or acquiring, such apparatus upon which no royalties have been paid harm is done to the trade, and Marconi's Co. is accordingly only prepared to authorise amateurs to dispose of a broadcast receiver employing its patents on one single occasion, and then only upon payment of the royalty. The Company will then issue the necessary licence plate for the set. Any person, firm, or company wishing to construct and sell a number of instruments must apply to Marconi's Co., which is prepared to grant licences to *bona-fide* manufacturers in this country.

Regional Stations.—POSSIBLE NEW SHEFFIELD STATION.—It is suggested that Sheffield listeners will probably be amongst the first to try the "regional station" scheme of the B.B.C. Subject to the Postmaster-General's consent, the idea is to build a high-power station some miles north-east of the city, which would be additional to the present relay station (2FN), for the purpose of transmitting two programmes simultaneously. Another similar station may be provided further west too.

Transatlantic Tests.—INTERNATIONAL CO-OPERATION.—For the fourth year in succession transatlantic broadcasting tests are to commence on Sunday night, January 24th-25th. The International Radiophony Bureau at Geneva announces that the broadcasting companies of America will commence the week of trials and continue until the following Saturday. Transmission will be made alternately from both sides of the Atlantic, as the Central European stations, as well as some of our own, have all been allotted special transmitting times. Arrangements have been made to ensure freedom from interruption by stations not transmitting, and the prearranged schedule is in itself an indication of the extent to which international co-operation has been reached. The *Daily Telegraph* regards the inclusion in the scheme of stations in Mexico, Cuba, the Panama Canal zone, and Alaska as a hopeful augury for the future of broadcasting.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—Postmaster-General's Department. March 23rd. Telephone switches.*

March 29th. State Electricity Commission. Transformers and auxiliary apparatus.*

March 8th. City Council. Totally-enclosed armoured type switchgear. Specifications from the City Electrical Engineer's Office, Melbourne.

SYDNEY.—February 10th. New South Wales Government Railways. 100 40-h.p. traction motors; March 3rd, 101 electric car equipments, consisting of motors, control equipments, air compressors, pantographs, &c.; April 14th, one 5-ton fixed electric crane. Forms of tender from Chief Mechanical Engineer, Wilson Street, Redfern, Sydney.

February 17th. 1,500-V, d.c. switchgear for St. Leonards and Hornsby sub-stations; March 3rd, 11,000 V ironclad switchgear for St. Leonards sub-station; March 10th, Stokers or pulverised fuel equipment for three water-tube boilers for White Bay power house. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

Municipal Council. February 15th. Twenty transformer tanks. February 8th. L.p. cables. Specifications from the Construction Engineer, Electricity Department, Town Hall, Sydney.

March 2nd. Australian Gas Light Co. One 750-kW turbo-generating set. Specifications from the Engineer, Parker Street, Haymarket, Sydney.

Aylesbury.—February 16th. Electricity Department. Overhead 11,000-V transmission lines and cables. (See this issue.)

Bath.—January 29th. Electricity Department. One 6,000-kW turbo-alternator, one water-tube boiler, mechanical stoker and economiser, and one 1,000-kVA transformer. (January 15th.)

Balearic Islands.—Plant, &c., required in connection with the electrification of the Majorca railway. Particulars from the Campañia de los Ferro-Carriles de Mallorca, Palma de Mallorca, Balearic Islands.—*Reuter's Trade Service* (Madrid).

Clitheroe.—February 23rd. Corporation. Transformers, switchgear, and cable connection for sub-station; e.h.p. and l.p. cables, boxes, &c. (January 15th.)

Edinburgh.—January 25th. Tramways Department. 25 air brakes suitable for electric tramway cars. Specifications from manager.

Glasgow.—January 25th. Corporation. Electric lighting installation in connection with Stockwell Street improvement; new buildings in Trongate. Specifications from Office of Public Works, City Chambers.

Grimsby.—January 30th. Electricity Department. 500-kW traction converting plant, sub-station e.h.p. switchgear, e.h.p. feeder and pilot cables. (January 15th.)

Halifax.—February 20th. Markets and Parks Committee. Electrical engineering work in connection with the erection of the public abattoirs. Particulars from Borough Engineer, Crossley Street.

India.—March 8th. India Store Department. 40 electric freight locomotives in connection with the G. I. P. Railway electrification. (January 15th.)

February 5th. Punkah motors, a.c.

Kilmarnock.—Ayrshire Electricity Board. Supply, delivery and laying of h.p. cables and ducts in the Burghs of Ayr and Prestwick, also transformer kiosks and section pillars. (See this issue.)

Leeds.—February 1st. Board of Guardians. Supplying and laying underground l.p. cables at the Institution, Beckett Street. (See this issue.)

Liverpool.—January 28th. Electricity Department. Twelve months' supply of cables, meters, electrical sundries, electric lamps, &c. (January 15th.)

London.—E.C.—January 30th. Marryat & Place. 113,000 5-amp., 220-V tumbler switches. (January 8th.)

HAMMERSMITH.—February 10th. Electricity Department. Stores for 12 months, including electric light sundries, insulated wire, joint boxes, meters, l.p. cables, &c. (See this issue.)

ISLINGTON.—January 28th. St. Mary's Board of Guardians. Installation of electric lighting at Andover Row Schools. (January 15th.)

February 8th. Electricity Department. One 10,000-kW 3-phase turbo-alternator, condensing plant, condensate, circulating exhaust, steam and water pipes, &c. (See this issue.)

METROPOLITAN WATER BOARD.—February 8th. 12 months' supply of electric lamps. Forms of tender from the Chief Engineer, 173, Rosebery Avenue, E.C.1.

LONDON COUNTY COUNCIL.—January 25th. 4,425 tons of standard steel girder tramway track rails, fishplates and fishbolts, and about 600 tons of conductor rails. Specifications from the Chief Engineer, Old County Hall, Spring Gardens, S.W.

February 22nd. H.p. switchgear for Lewisham tramway sub-station. (See this issue.)

Manchester.—January 26th. Tramways Committee. Motors and trucks for electric tramcars. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

January 29th. Electricity Committee. Wiring for electric lighting and power circuits, offices, stores and workshops at the High Street depôt, Chorlton-on-Medlock. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

Newark-upon-Trent.—February 10th. Electricity Department. E.h.p., medium, and l.p. mains and distribution network, with street-lighting mains and accessories, single- and three-phase house-service pattern meters, two 250-kVA transformers, e.h.p., 11,000-V switchgear. (See this issue.)

New Zealand.—WELLINGTON.—March 8th. New Zealand Government Railways. Two 25-h.p. variable-speed motors, one 125-kW motor-generator set and 17 400-V, 3-pole switches.* Public Works Department. April 6th. Storage battery, motor generator, and switchboard for the Penrose sub-station. March 23rd. Five oil filters, 5 oil-testing equipments, and 5 filter-paper drying ovens.* 22,000-V switchgear and equipment for Penrose sub-station.*

Plymouth. — February 4th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c.; one 350-kW converter. (January 15th.)

Retford.—February 19th. East Retford Gas, Water and Electricity Department. Electricity generating plant, mains, transformers and meters. (See this issue.)

South Africa.—JOHANNESBURG.—February 25th. Municipal Council. Four d.c. switchgear panels and 3-phase truck-type ironclad switchgear panels.*

February 25th. S.A. Railways and Harbours. Two 4-ton electrically-driven fixed wharf cranes for Luderitz jetty.*

Tenterden (Kent).—January 27th. Board of Guardians. Electric lighting installation at the Institution. Master of the Institution.

Uruguay.—MONTEVIDEO.—February 26th. State Electricity Works. Diesel oil engine and a direct-coupled generator.*

Walthamstow.—January 27th. U.D.C. Electricity Department. Two water-tube boilers, mechanical stokers, economisers and pipework, &c. (January 8th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belgium.—The Belgian Post and Telegraph Department has placed an order with the Ateliers de Constructions Electriques de Charleroi for the manufacture, laying and jointing of 350 kilometres (about 218 miles) of special long-distance telephone cable for connecting Brussels with La Panne, Lille and Roosendaal, at a total cost of a little over £600,000.

Billericay.—Board of Guardians. Accepted:—
Electrical equipment of the Institution and the new hospital (£3,775).—Ellis & Ward.

Birkenhead.—Electricity Committee. Accepted:—
Six miles v.i.r. cable (£1,068).—Callender's Cable & Construction Co., Ltd.
Three miles single core cable (£1,057).—Macintosh Cable Co., Ltd.

Carlisle.—Electricity Committee. Accepted:—
Supplementary pipework at new generating station (£291).—Stirling Boiler Co., Ltd.

East Ham.—Electric Lighting Committee. Recommended :—
Transformer plant (£416).—Fuller's Electrical & Manufacturing Co.

Gravesend.—Electricity Committee. Recommended:—
Conveying plant alteration (£276), plus 2s. 9d. per hour for erectors' services.—Bennis & Co., Ltd.

Halifax.—
Electric vacuum plant for Town Hall cleaning purposes (£489).—Sturtevant Engineering Co., Ltd.

Irish Free State.—DUBLIN.—Dublin City Commissioners. Accepted :—
Electric wiring of 422 houses at Croydon Park area (£5,417, £12 16s. 9d. per house) with Continental wire.—Dublin Corporation Electricity Department.

Lamp Contracts.—The British Thomson-Houston Co., Ltd., has received a twelve-months' contract for the supply of "Mazda" lamps to the Great Southern Railway Co. (Ireland).

London. — ISLINGTON. — Electricity Committee. Recommended :—
Switchgear (£17,925).—Park Royal Engineering Works, Ltd.
3-phase transformers and regulators (£10,834).—C. A. Parsons & Co., Ltd.
75-kW motor-generator (£2,087).—Electric Construction Co., Ltd.

HAMMERSMITH.—Works, Cartage and Cemetery Committee. Accepted :—
Renewal of batteries for two electric dust vehicles, £182 each, less £27 each for old batteries returned.—Chloride Electrical Storage Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Cable.—Union Cable Co., Ltd.
A.c. recording voltmeters.—Erskine, Heap & Co., Ltd.
Supply and erection of superheaters at new generating station.—Babcock and Wilcox, Ltd.

South Shields.—Housing Committee. Accepted:—
Wiring Council houses (£6 12s, per non-parlour house, £7 5s. per parlour house).—Embleton & Barker.

Stafford.—Electricity Committee. Accepted:—
Cable in connection with the second 3,000-kW set (£550).—Callender's Cable & Construction Co., Ltd.

Weymouth.—Housing Committee. Accepted:—
Wiring houses on Westham housing estate (£280).—B. P. Darch.

Forthcoming Events.

Royal Institution.—Friday, January 22nd. At 21, Albemarle Street, W. At 9 p.m. Lecture on "The Work of the Davy-Faraday Research Laboratory," by Sir William Bragg.

Institution of Production Engineers.—Friday, January 22nd. At the Society of Motor Manufacturers, Ltd., 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Features of Machine Tools which make for Increased Production," by Mr. G. W. Rawlings.

Physical Society of London.—Friday, January 22nd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Birmingham Electric Club.—Friday, January 22nd. At the Grand Hotel, Colmore Row. At 7 p.m. Presidential address.

Institution of Electrical Engineers.—Monday, January 25th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Informal meeting. Discussion on "Impressions of My Visit to America, mainly about Switchgear," to be opened by Mr. H. M. Clothier.

(Mersey and North Wales (Liverpool) Centre).—Friday, January 29th. At the University Club, Liverpool. Annual dinner.

(North-Eastern Centre).—Monday, January 25th. At the Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "The Past, Present, and Future Developments of Wireless Telephony," by Capt. P. P. Eckersley.

(North-Midland Centre).—Tuesday, January 26th. At the Hotel Metropole, Leeds. At 7 p.m. Paper on "The Use of Induction Regulators in Feeder Circuits," by Mr. L. H. A. Carr.

(North-Western Centre).—Tuesday, January 26th. At the Midland Hotel, Manchester. Annual dinner.

(South-Midland Centre).—Wednesday, January 27th. At the University, Birmingham. At 7 p.m. Paper on "The Power Losses in Magnetic Sheet Material at High Flux Densities," by Mr. C. E. Webb.

(Western Centre).—Tuesday, January 26th. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Faraday Lecture on "Illumination and Light," by Mr. A. P. Trotter.

(London Students' Section).—Friday, January 22nd. At the Institution, Victoria Embankment. At 6.15 p.m. Paper on "Switchgear," by Mr. C. F. George.

(Scottish Students' Section).—Friday, January 22nd. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "Economics and Engineering," by Mr. W. S. Cormack.

Institution of Civil Engineers.—Tuesday, January 26th. At Great George Street, S.W. At 6 p.m. Paper on "The Rugby Radio Station," by Mr. A. S. Angwin and Mr. T. Walmsley.

Electricity Supply Commercial Association (Greater London Division).—Tuesday, January 26th. At the Cannon Street Hotel. From 7.45 p.m. to 11.30 p.m. Dance.

Electrical Power Engineers' Association (Derby and District Section).—Wednesday, January 27th. At the Black Boy Hotel, Long Row, Nottingham. At 7 p.m. Lecture on "Boiler Plant Development in Association with Powdered Fuel," by Mr. F. H. Rosencrants.

Batti-Wallahs' Society.—Wednesday, January 27th. At the Hotel Cecil, Strand, W.C. At 1 p.m. Luncheon. Address by Sir Hugo Hirst, Bart.

Junior Institution of Engineers.—Friday, January 29th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Comfort in Railway Travel from the point of view of the Engineer," by Mr. A. N. Moon.

Institution of Welding Engineers.—Friday, January 29th. At the Philosophical Hall, Park Row, Leeds. At 7 p.m. Paper on "The Arc Welding of Seams in Steel Plates," by Mr. J. T. Carr.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

CONVENIENT table standards.
WHIRLPOOL electric heaters.
YAVAN flexible cementing material.
COOLEX fuse boards.

Notes.

Bay of Fundy Hydro-Electric Scheme.—Some particulars are given in the *Electrical News* of a proposed scheme for the development of the tides of the Bay of Fundy for hydro-electric purposes. Two smaller bays, Passamaquoddy and Cabscook, are separated from the main portion by a number of islands. The suggestion is to generate power by keeping the two pools at separate elevations by means of a number of dams connecting the various islands, and allowing the ocean water to flow from the upper pool through a power house to the lower one. The level of the upper pool would be raised at each high tide by opening control gates at that time and that of the lower pool lowered at each ebb tide. There is a neutral phase when the tides would have no action on the pools and during this period the source of power would be from storages. As the fall between the pools was lessened the number of turbines in service would be increased. The storage area would be 150 square miles. It is estimated that the cost of the scheme would be $85,000,000, and that an average of 500,000 h.p. could be generated while the annual production would be about 3,000,000,000 kWh.

Fatality.—At an inquiry into the death of John W. Green, an electrical engineer employed by the Newcastle-on-Tyne Electric Supply Co., Ltd., at the Castner-Kellner sub-station at Wallsend, it was found that the deceased had died from burns accidentally received from an electric arc. This, the verdict stated, had been set up by his having opened feeder isolator bars, apparently not knowing, or having overlooked, that the pressure was on. Whether the deceased had had some temporary aberration or pre-occupation at the time, or had not been given a definite and correct message by the control engineer as to the position generally, the jury was unable to say.

Tramways and Light Railways Association.—The seventeenth annual congress of the Association will be held at Bristol on June 24th and 25th, 1926.

South African Association of Municipal Electrical Engineers.—The next convention of the Association, says the *South African Engineer*, is to take place in Johannesburg during the week April 12th to 17th next. Mr. B. Sankey, general manager of the gas and electricity undertaking of the Johannesburg municipality, is the president-elect, and it is anticipated that there will be a large gathering of municipal electrical engineers, together with their councillor delegates, from all over the Union.

The Government's Electricity Scheme.—Representatives of the electricity supply industry met on January 19th to discuss the Government's electricity scheme. No official statement in connection with the conference was issued, but the *Financial Times* states that the electrical manufacturers and supply authorities who have been consulted by the Ministry of Transport on certain details have few modifications to suggest, and are definitely in favour of the new legislation, not so much for the technical changes and improvements it will effect as for the prospects it offers of creating a sound home market for their products. The Government has no intention of embarking through the medium of a Power Board on immediate large capital expenditure, and investors who see in the new proposals an opportunity for immediately increased activity in the electrical manufacturing industry are certain to be disappointed. On the other hand, the removal of legislative obstruction will justify existing undertakings in embarking at once on constructive schemes. The benefit to the manufacturer will accrue from the increased activity of existing undertakings, rather than from the provision of capital stations owned by the central authority. The progressive supply authority, whether municipal or industrial power company, will benefit directly, since power as sold by it to the large industrial consumer is as cheap as any national system of power stations and main transmission lines could devise. The Board will deal with policy almost exclusively and the principal factors in administration, while the Electricity Commission will work out the technical, engineering and financial details. It is obvious that the new scheme depends wholly for success on this Board, and if it is unequal to the task, electrical development may be retarded, or even diverted into the wrong channels.

E.P.E.A. Peterborough Dispute.—The protracted negotiations between the Peterborough Corporation and the Electrical Power Engineers' Association have been settled. Following the Association's threat to withdraw its members' services, *The Times* reports that the Town Council has decided to reclassify the electricity undertaking into Class C and to pay the technical staff's salaries increases retrospectively from November, 1924.

Electricity Supply in Canada in 1924.—A preliminary report on the electricity generating station industry in Canada, published by the Dominion Bureau of Statistics, shows that a substantial increase took place during 1924. There was no change in the number of power plants, but transmission and distribution lines were extended in every province and service was supplied to 1,219 municipalities as against 1,146 in 1923. Many additions were made to existing power plants, especially in the hydraulic stations. Water wheels increased by 26 in number and by 425,410 h.p. in capacity; steam turbines and internal combustion engines also increased in both number and capacity, but reciprocating engines showed reductions, the net increase in primary power main plant equipment being 425,605 h.p. and in auxiliary equipment, 18,530 h.p. The increase in capital during the year was 8 per cent. Capital invested in hydraulic stations increased from $464,171,935 in 1923 to $507,116,143, or by 9 per cent., whereas the investment in fuel stations showed a slight decrease. Some of the larger additions made during the year were 120,000 h.p. by the St. Maurice Power Company, 22,600 h.p. by the Montreal Light, Heat and Power Company, 20,000 h.p. by the Quinze Power Company in Quebec, 136,000 h.p. in the Niagara plants, 6,600 h.p. in the Central Ontario system and 25,000 h.p. in the Cameron Falls plant of the Ontario Hydro-Electric Power Commission, and 12,500 h.p. by the Canadian Niagara Power Company in Ontario. In Manitoba, the Manitoba Power Company put into operation 56,000 h.p. and in British Columbia the East Kootenay Power Company added 15,000 h.p. to its Fernie plant. The net revenue of generating stations during the year showed an increase of $7,119,970, or 10.5 per cent. The number of customers also increased in all provinces. The increase in Quebec was 24,671, or 8.3 per cent.; in Ontario, 33,195, or 7 per cent., and in Manitoba, while the increase was not so large (16,760), it was at the rate of 22 per cent. The output was less than during 1923 in Nova Scotia, Saskatchewan, Alberta and in the Yukon, but the increases of 898,408,000 kWh in Quebec, 167,296,000 kWh in Ontario, 124,056,000 kWh in Manitoba, and 30,849,000 kWh in British Columbia, with smaller increases in the other provinces, produced a net increase of 1,216,089,000 kWh, or 15 per cent. The total output of fuel stations was less by 8,695,000 kWh, or 5.5 per cent., decreases being shown in all the provinces except Prince Edward Island, Ontario and British Columbia, where only small increases were made. The hydro-electric stations increased their production in every province. Although the fuel power plants are almost as numerous as the hydraulic plants, they play only a minor part in industry, generally as lighting plants in small municipalities, and their output was only 6 per cent. of the total.

National Research Endowment in the United States.—An official announcement quoted in *Science* states that the National Academy of Sciences has appealed to a body of prominent public men to join with leading scientists in an endeavour to secure larger resources for research in pure science. It is hoped that an annual income of at least two million dollars will be secured to establish National Reearch Professorships, and in other ways to co-operate with universities and other institutions throughout the country which are prepared to do their full share in the encouragement and support of fundamental research in the mathematical, physical and biological sciences. While the United States is in the forefront of industrial research, it is accomplishing much less in pure science than its population and material resources would lead one to expect.

The Academy has created a special board of trustees of the National Research Endowment. Mr. Herbert Hoover has been requested to act as chairman of the board and has accepted.

In discussing the vital need for greater financial support of pure science research, Mr. Hoover said in a recent address: "While we have in recent years developed our industrial research upon a scale hitherto unparalleled in history, we have by no means kept pace in the development of research in pure science. The sudden growth of industrial research laboratories has in itself endangered pure science research by drafting the personnel of pure science into their ranks. Thus applied science itself will dry up unless we maintain the sources of pure science. We must add to knowledge, both for the intellectual and spiritual satisfaction that comes from widening the range of human understanding, and for the direct practical utilisation of these fundamental discoveries. A special study in an industrial laboratory, resulting in the improvement of some machine or process, is of great value to the world. But the discovery of a law of Nature, applicable in thousands of instances and forming a permanent and ever available addition to knowledge, is a far greater advance."

Officials of the academy explain that the problem is to make academic posts so attractive that the ablest men will seek and hold them permanently because of the opportunties they offer to advance knowledge by fundamental research. This can be done by providing adequate salaries, freedom from too much teaching or administration, necessary instruments and apparatus, and skilled assistants to perform the extensive routine operations that scientific research involves. In short, able investigators should be given some such comfort in life, freedom of action, and opportunity for constructive thought as industrial and administrative officers, certainly of no larger calibre, habitually enjoy.

Appointments Vacant.—Relief engineer (£282), switchboard attendant (£282), three junior switchboard attendants (£245 and £195), three junior sub-station attendants (£165) for the Dublin Corporation Electricity Department. Shift charge engineer for the Borough of Warrington Electricity Department. Technical assistants in the Torpedos and Mining Department of the Admiralty (£400+). Electrical clerk of the works at Barking power station, for the County of London Electricity Supply Co., Ltd. Power station superintendent (£952), two charge engineers (£630) for the Municipal Commissioners of Singapore. (See our advertisement pages to-day.)

High-pressure Transmission in Germany.—This problem was discussed by various engineers at a conference of the Electrotechnical Association for the industrial region of Rhenish-Westphalia, held at Essen this month. Herr Weickert, of the Mannheim firm of Brown, Boveri & Co., dealing with high-pressure switching installations, stated that until a few years ago only a few main transmission lines in Germany were operated at 100,000 volts, whereas now the country was covered with a network of 100,000-volt lines, while the Rhenish-Westphalian Electricity Works Co. was constructing the first line at 220,000 volts, which was being erected in the direction of South Germany. It was held that a pressure of 380,000 volts would have to be employed if large power was to be transmitted across Germany. The electrical manufacturing industry in itself, he remarked, was prepared for such a high pressure, but it was a matter for the supply industry to investigate whether such a pressure could be economically employed in Germany. Discussing the question of high-pressure overhead insulators, Dr. Binder, of the Dresden Technical High School, stated that it was of special importance for the insulators to hold good not only in dry weather, but also under the many unfavourable working conditions represented by rain, snow, fog, and thunderstorms. At present insulator chains were used for the suspension and staying of the conductors in connection with the high pressures employed, consisting of an average of six links in the case of 100,000 volts. If in future recourse was had to the use of 220,000 volts as the working pressure, as was required by the great increase in the energy requirements, the result would be the employment of insulator chains of 12 links at the least and a length of over 2½ metres. But as a result of the employment of wire guards or protection trays at the end of the chain, it had been possible to bring about almost a uniform distribution of the pressure and divert arcs from the chain. In conclusion, the professor remarked that it was possible to look forward with complete confidence to the development of installations at 220,000 volts, seeing that one German firm stated that its latest tramway insulators had a breaking strain of 18 tons.

B.E.S.A. Publication.—The British Engineering Standards Association has just issued a glossary of terms used in illumination and photometry which it has prepared for the assistance of all interested in the subject. The terms have been approved by the National Illumination Committee of

Great Britain and are in accordance with the decisions of the International Illumination Commission so far as such decisions are applicable. The glossary covers a wide range of terms and where there are two terms in use for the same definition, the preferred term is given in heavy type and the synonym in lighter type. Copies of the new publication, No. 233—1925, can be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 2d. each, post free.

Engineering Conference in Australia.—The Engineering Conference which was to have been held at the beginning of 1925, is now to take place at Hobart from February 15th to 19th, 1926. An interesting programme has been arranged and in addition to social functions, visits to works and places of interest, &c., the following will be amongst the papers that will be presented during the conference: "Notes on the Development of the Power Resources of Tasmania," by J. H. Butters; "The Commercial Use of Electric Vehicles," by H. A. Child; and "The Construction of a Multiple Arch Dam at Miena," by A. H. Bastow.

The Rural Reconstruction Committee.—A conference has been arranged by the Rural Reconstruction Committee to take place at Denison House, Vauxhall Bridge Road, S.W.1, on January 23rd, to consider what steps should be taken to place its policy before the nation. The chair will be taken by Dr. Gilbert Slater, and the conference will be opened by Mr. Montague Fordham, who will deal with the agricultural problem. Mr. R. Borlase Matthews will deal with the question from the point of view of the applications of electricity to agriculture and rural industries. It is interesting to note that the promoters of this movement realise the importance of an electrical supply in the carrying out of any scheme intended to divert dwellers in towns to rural areas and to prevent the depopulation of the countryside.

Engineer Officers in the Navy.—The First Lord of the Admiralty last week granted an interview to representatives of the engineering institutions, who lodged a protest against the recent Admiralty Fleet Order affecting the status of engineer officers in the Navy. The bodies represented were: The Institutions of Civil, Mechanical, and Electrical Engineers, Naval Architects, and the North-East Coast Institution of Engineers and Shipbuilders, representing an aggregate membership of about 36,000 professional engineers.

Institution Notes.

Institution of Electrical Engineers.—PROGRAMME.—The arrangements for the second half of the session include papers by Messrs. E. V. Clark, on "Power Factor and Tariff," and E. W. Dorey, on "Power Factor Improvement" (February 4th); M. Parodi, on "The Electrification of the Paris-Orleans Railway" (February 18th); R. B. Matthews on "Electro-farming" (March 4th); and L. C. Grant, on "Developments in High-Power Fuses" (March 18th). The annual dinner will be held on February 11th, and the 17th Kelvin lecture will be delivered by Sir J. J. Thomson, O.M., F.R.S., on "The Mechanics of the Electric Field," on April 22nd.

WIRELESS SECTION.—On February 3rd Mr. J. Hollingworth will read a paper on "The Propagation of Electric Waves". on March 3rd, Mr. R. A. Watson Watt will deal with "The Directional Recording of Atmospherics"; and on April 14th, Mr. E. H. Shaughnessy, O.B.E., will describe "The Rugby Radio Telegraphy Station."

INFORMAL MEETINGS.—Discussions will be opened by the following members: Mr. H. W. Clothier, on "A Visit to America —Mainly about Switchgear" (January 25th); Mr. R. J. Mitchell, on "Ball and Roller Bearings" (February 8th); Mr. A. F. Harmer, on "The Application of Electricity to Public Supply" (February 22nd); Mr. F. Creedy, on "A Recent Development in A.C. Apparatus" (March 8th); Mr. G. Rogers, on "The Performance of Mercury-arc Rectifiers" (March 22nd); and Captain P. P. Eckersley, on "Linking together Wireless and Wire Communication Systems" (April 12th).

At the informal meeting which was held at University College, Gower Street, on Monday, January 11th, Mr. W. C. Clinton, B.Sc., supported by Mr. A. G. Hilling as chairman, opened a discussion on "The Electrical Equipment at the Rockefeller Building," which houses the Department of Anatomy, &c., and the Research Laboratories. The installation of electric lighting and power for which a supply is taken from the St. Pancras Borough Council's mains at 220 and 440 volts d.c., is not particularly notable, except for thoroughness and a prolific use of two-way switching, but much of the laboratory apparatus excited very great interest. In the Main Lecture Theatre Mr. Clinton read his paper describing the installation, and detailed with numerous schedules of efficiencies the items of lighting and power equipment. His tables of figures were thrown on a screen by means of the Epidiascope, which projects in natural colours images of prints, books, or any object not too large to be placed in the reflection chamber. The audience then made a tour of the building to inspect the various equipments, which were described by specialists in attendance. On re-assembling in the Lecture Theatre, tributes and minor criticisms were made by Messrs. G. C. Allingham, J. R. Bedford, H. Freeman, A. G. Hilling, C. Lipman, W. E. Rogers, and H. T. Young.

NORTH-WESTERN CENTRE.—Papers will be read on the following dates: February 2nd, by Messrs. E. V. Clark and E. W. Dorey; February 16th, Mr. E. H. Shaughnessy; March 2nd, Messrs. J. L. Thompson and H. Walmsley; March 16th, Mr. L. C. Grant; March 30th, Mr. R. B. Matthews.

WESTERN CENTRE.—Papers will be read on the following dates: January 26th, by Mr. A. P. Trotter (Faraday Lecture); February 1st; March 1st, Mr. T. Carter; April 12th, Mr. R. B. Matthews; May 3rd, Prof. S. Parker Smith.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Readers of the ELECTRICAL REVIEW will learn with regret that Mr. LEONARD G. TATE, secretary of the Electrical Contractors' Association, has to undergo an operation to-morrow (Saturday). He has been unwell for some time, and was unable to be present at the annual dinner of the Association on Tuesday last. Mr. Tate will have the best wishes of a host of friends in the electrical world for a speedy recovery to perfect health.

Sir MAX MUSPRATT, Bart, J.P., the president-elect of the F.B.I. in succession to Col. F. V. Willey, is one of the leading figures in the chemical industry and chairman of the United Alkali Co., Ltd. He was born in Liverpool in 1872 and was educated at Clifton College and at Zurich, entering in 1895 the works of the company of which he is now chairman. In 1901 he became a director on the technical side of the business and succeeded his father in the chairmanship in 1914. Sir Max is not only well known as a business man in the chemical world; he is also himself a chemist of great ability



Lafayette] *[London.*

Sir Max Muspratt, Bart., J.P.,
The President-Elect of the F.B.I.

and is the first Englishman to hold the Diploma in Industrial Chemistry awarded by the Swiss Government. In addition to the chairmanship of his own business, he is the vice-president of the Association of British Chemical Manufacturers; deputy chairman of the Sulphuric Acid Association; chairman of the recently-appointed Lord Mayor of Liverpool's Committee on Trade and Industry of the Port of Liverpool; and chairman of the Liverpool Economic League. He has taken a very active part in politics and was Liberal M.P. for the Exchange Division of Liverpool in 1910. In 1917 he was Lord Mayor of Liverpool, and since entering the City Council in 1903 has been at one time or another connected with almost every municipal activity in that city.

Mr. W. J. PARKER, chief storekeeper of the Raw Stores at the Marconi Company's works at Chelmsford, who is leaving after 26 years' service, has been presented by the staff with an inscribed gold watch.

Mr. H. STONE, of the Urban Electric Supply Co., Dartmouth, has taken up the appointment of assistant electrical engineer to the Lyme Regis Borough Council.

Mr. A. L. C. FELL, who retired from the position of general manager of the London County Council Tramways last year, is to marry Miss FLORENCE WYNN, of Redcar, next month.

SIR CHARLES BRIGHT, F.R.S.E., &c., has accepted the presidency, and SIR WILLIAM S. GLYN-JONES the vice-presidency, of the Wireless Retailers' Association.

Fulham Borough Council Electricity Committee recommends that the borough electrical engineer, Mr. ARTHUR J. FULLER, be granted three months' leave of absence from duty on full pay, to enable him to recuperate and regain his normal health, and that he be paid a sum of £250 as an honorarium towards the expenses of his enforced holiday, and as a mark of the Council's appreciation of the special services rendered by him to the Fulham electricity undertaking in connection with capital extensions, and otherwise, for many years past.

Bacup Town Council has increased the salary of the borough electrical engineer from £500 to £550 per annum.

Mr. P. V. HUNTER, who contributes an article which appears elsewhere in this issue, is the chairman of the Executive Committee of the National Register of Electrical Installation Contractors and is joint manager of Callender's Cable & Construction Co., Ltd. He was born in Norfolk in 1883 and was a student at Faraday House, after which he became associated with Messrs. Willans & Robinson, the Great Yarmouth Electricity and Tramways Department, and the Willesden Urban District Council. In 1903 he joined the consulting engineering firm of Messrs. Robert Hammond & Son as assistant engineer, and from 1904 to 1916 he was with Messrs. Merz & McLellan, being appointed chief of their electrical department in 1909. While he was with this firm he was associated with the building of the Carville and other important power stations and with the electrification of railways in Argentina and elsewhere. During 1916 and 1917 he was engaged in consultative work in connection with the electrical equipment of the armies in the field, and from December, 1917, until the end of the war he was attached to the naval staff as chief engineer to the experimental and research section of the Anti-Submarine Division. For his war services he was awarded the C.B.E. A full member of the Institution of Electrical Engineers, Mr.



Elliott & Fry] *[London.*

Mr. P. V. Hunter, C.B.E.,

Chairman of the Executive Committee of the N.R.E.I.C.

Hunter is a member of its Council and a past chairman of the North-Eastern Centre. He has been an active member of various committees of the British Engineering Standards Association, the British Electrical and Allied Industries Research Association, and the International Electro-technical Commission. He invented the split conductor protective system, the repellent arc switch in which the repelling effect of two arcs, which are electrically in series but physically in parallel, is employed to increase the rupturing capacity of the switch, and the four-conductor system of three-phase cable protection. During the autumn of last year Mr. Hunter visited America principally in connection with the establishment of the Okonite-Callender Cable Co., a company which, as the name indicates, has been jointly formed by Callender's Cable and Construction Co. and the Okonite Co. of America. The joint company has established a factory at Paterson, New Jersey, for the manufacture of paper-insulated cables, and particularly for exploiting in the United States the special methods which Callender's have developed of manufacturing extra-high-pressure cables.

Mr. J. PICTON BAGGE, British Commercial Secretary at Brussels, is to attend at the Department of Overseas Trade from to-day (Friday) to January 29th. United Kingdom manufacturers and merchants interested in trade with Belgium can obtain interviews by appointment, quoting reference 16,056.

When the British Empire Producers' Organisation meets at luncheon at the Mansion House on February 3rd to celebrate its tenth anniversary, it will present the Rt. Hon. L. S. AMERY, M.P., Secretary of State for Dominion Affairs and the Colonies, with his portrait painted by Sir Luke Fildes, K.C.V.O., R.A.

Mr. J. T. WHITELAW, district manager of the Post Office telephones in the Blackburn area, has been appointed to a similar position at Manchester. He entered the telephone service in 1893.

The Kingston-on-Thames Town Council is recommended to increase the salary of the borough electrical engineer (Mr. KINGHAM) by £150 a year.

The *Daily Telegraph* correspondent at Sydney understands that Mr. PERCY HUNTER has definitely accepted the offer of the general managership of the Pacific Cable Board, which is subject to ratification at the next meeting of the board.

Obituary.—MR. A. L. COTTAM.—The death occurred on January 5th, at Redland, at the age of 71 years, of Mr. Arthur Lawrence Cottam, who carried on business as an electrical and engineering merchant and factor at Bristol. Among those present at the funeral on January 9th were representatives of a number of well-known electrical concerns (Messrs. Johnson & Phillips, Ltd., Callender's Cable & Construction Co., Ltd., the British Thomson-Houston Co., Ltd., Philips' Lamps, Ltd., Swedish General Electric, Ltd., and Messrs. Drake & Gorham Wholesale, Ltd.) and Mr. A. H. Dawson, chief electrical engineer to Messrs. W. D. & H. O. Wills, Ltd.

MR. G. D. ATKIN.—We regret to record that Mr. George Duckworth Atkin, a highly-esteemed member of the Stock Exchange who had for many years been prominently connected with the Electric Lighting share market, passed away suddenly on arrival at his office in Drapers' Gardens, E.C., on the severely cold morning of January 14th. Mr. Atkin, who was 66 years of age, was, through his firm, the issuer of the *Atkins Manual*, which is devoted to electricity supply securities, and has been occasionally mentioned in our "Stocks and Shares" article.

VISCOUNT CHILSTON.—The death has occurred, in his 75th year, of Viscount Chilston, of Chilston Park, Maidstone. He was chairman of the Midland Counties Electric Supply Co., Ltd., and of the Tramways, Light and Power Co., Ltd., a director of the South-Eastern & Chatham Construction and Power Co., Ltd., and a vice-president of the Tramways and Light Railways Association.

Will.—The late Mr. WILLIAM BAYLISS, chairman of Bayliss, Jones & Bayliss, left £68,310 gross and £54,320 net personalty.

New Companies Registered.

Modern Radio, Ltd. (211,082).—Private company. Registered January 13th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters, and repairers of, agents for, and dealers in instruments, apparatus, and materials capable of being used in connection with radio telegraphy and telephony, in particular cables, wires, rope or other substances, accumulators, batteries, detectors, tuning switches, induction coils, condensers, headphones, thermionic valves, valve panels and receivers, amplifiers, aerial and other insulators, &c. The provisional directors are:—H. R. Smallwood, "Annacur," Gateshead, wireless engineer; R. H. Smallwood, "Annacur," Gateshead, general medical practitioner. Solicitor: C. F. Bolam, 12, West Street, Gateshead.

Bennett & Fountain, Ltd. (211,071).—Private company. Registered January 13th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of wholesale, electrical and wireless suppliers now carried on by E. T. Fountain and A. E. Bennett at 6, Mortimer Street, W.1, as "Bennett & Fountain." The permanent directors are:—A. E. Bennett, 21b, Belmont Park, S.E.13; E. T. Fountain, 172, Willifield Way, Golder's Green, N.W.11. Qualification, 10 shares. Secretary: A. H. Wilson. Registered office: 6, Mortimer Street, W.1.

Strand & Interchangeable Signs, Ltd. (211,066).—Private company. Registered January 13th. Capital, £2,500 in 2,000 ordinary shares of £1 and 2,000 founders' shares of 5s. Objects:—To acquire and take over as going concerns (*a*) the goodwill of that part of the business of the Strand Electric and Engineering Co., Ltd., which relates to electric signs, and (*b*) the goodwill of the whole of the business of Interchangeable Electric Signs, Ltd. The directors are:—G. Harvey, M.P., J.P., 176, Cromwell Road, S.W.5 (chairman of Connaught Rooms, Ltd., and Burlington Hotels, Ltd.); A. T. Earnshaw, 50, Verdant Lane, Hither Green, S.E.6, electrical engineer; P. G. A. Harvey, 16, Rosary Gardens, S.W.7, underwriting member of Lloyds (director of Connaught Rooms, Ltd.); M. Mansell, 41, Morley Road, East Twickenham, electrical engineer; P. Sheridan, 151, Culverley Road, Catford, S.E.6, electrical engineer (all permanent). Secretary: H. W. Myers. Registered office: 24, Floral Street, W.C.2.

Bath Electrics, Ltd. (211,070).—Private company. Registered January 13th. Capital, £750 in £1 shares. Objects:—To carry on the business of factors and retailers of wireless and electrical goods and apparatus, electricians, mechanical engineers, &c. The directors are:—A. W. Young, Warwick Villa, Kennington Road, Bath, wireless and electrical engineer (managing director); Mrs. E. H. Young, same address; G. Young, 12, Foxcombe Road, Bath, manufacturer's chemist. Solicitors: Stone, King and Wardle, Bath. Registered office: Foxcombe Road, Bath.

Wireless Stores (Payne & Hornsby), Ltd. (7,452).—Private company. Registered in Dublin January 11th. Capital, £100 in £1 shares. Objects:—To acquire the business of radio engineers and wireless assemblers carried on by T. Payne and G. Hornsby at 34, Bachelors Walk, Dublin. The first directors are:—T. Payne, "The Laurels," Woodlands Estate, North Gosforth, Newcastle-on-Tyne; G. Hornsby, 2, Sydenham Terrace, South Shields, Co. Durham, radio engineer. Registered office not stated.

Hertz Radio Corporation, Ltd. (210,958).—Private company. Registered January 7th. Capital, £100 in 2,000 shares of 1s. each. Objects:—To acquire the trade name of the "Hertz Radio Corporation," to carry on business as manufacturers of, and dealers in wireless telegraphy and telephony instruments and component parts thereof, &c. The subscribers (each with one share) are:—H. L. Ledbury-Moore, 62, St. Benedict's Road, Small Heath, Birmingham, accountant; Lily Cantrill, 7, Gladstone Road, Yardley, Birmingham, secretary. The first directors are to be appointed by the subscribers. Qualification, 10 shares. Secretary: H. Oram, 55, Newhall Street, Birmingham.

Official Returns of Electrical Companies.

St. Austell and District Electric Lighting and Power Co., Ltd.—First mortgage debenture dated December 31st, 1925, to secure £20,000, constituting a first fixed charge on freehold and leasehold hereditaments at St. Austell and Luxulyan, rights of way, &c., and a floating charge on the company's undertaking and property, present and future, including uncalled capital. Holder: Solicitor for H.M. Treasury.

Cutting Bros. & Co., Ltd.—Particulars filed of £10,000 debentures authorised December 18th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Altrincham Electric Supply, Ltd.—Mortgage on land and premises, No. 60, Stamford New Road, Altrincham, Cheshire, dated December 23rd, 1925, to secure £6,250. Holders: National Provincial Bank, Ltd., 15, Bishopsgate, E.C.

G. W. M. Electrical Co., Ltd.—Particulars filed of £400 debentures authorised December 24th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Stratford-on-Avon Electricity Co., Ltd.—Particulars filed of £10,000 debentures authorised December 18th, 1925, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

Wireless Novelties, Ltd.—Satisfaction in full on November 23rd of debenture dated February 24th, 1925, securing £1,000.

Fryer & Hartley, Ltd.—Satisfaction is full on December 31st of mortgage or charge dated April 7th, 1925, securing £200.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Belgian Company.—The *Compagnie Centrale de l'Industrie Electrique*, of Brussels, which has an ordinary share capital of 4,000,000 fr., reports profits of 311,000 fr. for 1924-25. After writing off 300,000 fr. for depreciation, the balance is being carried forward. At the recent meeting it was stated that the company, together with a financial group, was participating in an increase in the share capital of the Compagnie d'Electricité de Sofia for the purpose of establishing a new Bulgarian station of 1,800-kW capacity.

Greenwood & Batley, Ltd.—An interim dividend of 2½ per cent. has been declared, as in 1925.

German Companies.—The *South German Telephone Apparatus, Cable and Wire Works Company*, of Nuremberg, after having written off 135,000 marks for depreciation, reports net profits of 280,000 marks for 1924-25.

The *Lloyd Dynamo Works Company*, of Bremen, proposes to reduce its share capital and to apply the book profits of 125,000 marks to depreciation and the covering of a possible loss for 1925. The capital will then amount to 2,150,000 marks, mainly in ordinary shares.

German Loan in America.—ELECTRICITY LOAN.—The Saxe-Anhalt Electric Works has concluded an agreement with Messrs. F. J. Lismann and Co., New York, for the issue of a loan of $1,000,000. The loan will be for a period of two years, and will bear interest at the rate of 6½ per cent.—*Financial News.*

Anglo-American Telegraph Co., Ltd.—The following final dividends are being paid:—Ordinary consolidated stock, £1 10s. per cent., less tax at 4s. 0¾d. in the £, making £3 15s. per cent. for the year; preferred stock, £1 10s. per cent., less tax at 4s. in the £, making £6 per cent.; and deferred stock, £1 10s. per cent., less tax at 4s. 1½d. in the £ (first and final). All the dividends are the same as were paid for 1924.

Vulcanite, Ltd.—A report made up to October 31st last states that foreign competition has reduced the output of the fibre mill. The net profit was £1,232 and the amount brought forward £2,246. After allowing for taxation £2,486 is to be carried forward.

Brazilian Traction, Light and Power Co., Ltd.—A quarterly dividend of 1¼ per cent. has been declared on the ordinary shares. Three quarterly dividends of 1 per cent. have been paid previously.

Tata Companies.—It is reported that the Tata Hydraulic Power Co. has raised a loan of two crores of rupees, part of which (85 lakhs) is to be devoted to the redemption of the company's debentures, while the balance (115 lakhs) is to be used to finance the Tata Power Co.

Traction and Power Securities.—Final dividends of 2½ per cent. on the preference stock and 9 per cent. on the ordinary stock are recommended. The past year's dividend on the ordinary stock is thus 13 per cent., as compared with 11 per cent. for the preceding year.

Reduction of Capital.—VICKERS, LTD. AND REDUCED.—A petition for the reduction of the capital of this company from £26,500,000 to £18,289,678 has been presented to the High Court, and will be heard in London on January 26th.

Stock Exchange Notice.—The undermentioned securities have been ordered to be officially quoted:—

Melbourne and Metropolitan Tramways Board.—Stock and partly-paid scrip for £300,000 5 per cent. stock, 1944.

Shanghai Electric Construction Co., Ltd.—The directors have declared a second interim dividend at the rate of 3 per cent. actual, less tax, in respect of the past year.

Herbert Morris, Ltd.—The dividends for the half-year ending January 31st have been declared on the cumulative preference shares.

Northern Mexico Power and Development Co.—The preference shares are to receive a dividend of 7 per cent. for the past year.

Edmundson's Electricity Corporation, Ltd.—An interim dividend of 3 per cent., actual, has been declared, as in 1925.

Stocks and Shares.

MONDAY EVENING.

THE Government's proposals for a great expansion of electrical distribution have been discussed with interest in the Stock Exchange, and have had a favourable effect upon prices of shares in those companies deemed likely to benefit if the scheme should become operative. The plan is welcomed as a long-overdue contribution to national well-being, but details are awaited while members of the Stock Exchange, who have little belief in the official capacity for running a business organisation, prefer to reserve considered opinions.

The first practical effect has been to put up prices of manufacturing companies' shares. Sharp rises have occurred in British Insulated, Enfield Cable, and Henleys. General Electrics are better at 30s. Electric Constructions and English Electrics have advanced. India Rubbers spurted to 24s. Aron Electricity Meters strengthened to 21s. 3d. It is thought that some of the engineering firms will be advantaged: Babcock and Wilcox are materially stronger at 54s. 6d. bid. The market argument is that any extensive development of electrical work is bound to be beneficial to the undertakings which deal in equipment. There is a shade of doubt as to whether the new arrangement will attract fresh business to the present supply companies.

The balance of price movements lies, however, in favour of shareholders. St. James' and Pall Mall ordinary are 5s. up, at 16; Kensingtons are equally better at 13¾. Bromptons rose to 35s. Several of the provincial issues are good, notably Bournemouths, which at 3⅛ show a 3s. gain. Smaller improvements have been secured by Clyde Valley, Newcastle-on-Tyne, and Yorkshires. Urban ordinary put on 1s. 9d., and are now 20s. Westminsters and County ordinary proved exceptions to the general tendency, being 1/16th easier at 2 7/16ths and 59/6 respectively. The Government's proposals have drawn fresh attention to the various sections of the electricity market, and have served to stimulate business. They have proved useful as a set-off to the talk of a possible national crisis in April or May if the coal industry should push matters to extremes. This last consideration is responsible for a good deal of quiet uneasiness in the mind of investment, and comes inopportunely at a time when markets are depressed by fears of dearer money and disturbed by a widely-spread reaction in rubber shares after their boom.

The Home Railway market is worried by the coal outlook, and most of the prices are lower, the Undergrounds dipping with the rest. London Traction stocks are unaffected. British Electric Tractions maintain their strength. A drop in Brazilian Tractions was recovered, and the remainder of the group has barely moved.

Cable stocks keep steady. Any stock which comes to market is absorbed without difficulty. Great Northerns, ex their dividend, are better at 32, making allowance for the deduction. The wireless department is passive. Canadian Marconis at 4s. 10½d. are the turn better. In the cable manufacturing section, the difficulty is to buy shares, so meagre is the floating supply and so tightly held by investors is the balance.

Rubber shares have come back in sympathy with a drop from 4s. 6d. per lb., to 3s. 1d. per lb. in the price of the raw material. The fall in values has uncovered—to use the Americanism—a bull account which is proving a source of weakness to the market. Evidence shows, now, that the speculator too often helped himself to 5,000 shares when 500 would have been a more discreet number for him to handle. Other markets are affected by the necessity for raising funds, by sales of various stocks and shares, to pay for rubber commitments. Hence a general dullness round the Stock Exchange and a mere bleating of business instead of a lusty roar of activity.

The funeral took place on Tuesday in this week, of the late Mr. George Duckworth Atkin, to whose enterprise and courage the electricity supply market owes no small part of its popularity to-day. He was amongst the first of the Stock Exchange men who realised, years ago, the tremendous part which electricity would play in the life of the community. He started to deal in the shares of the various companies, and founded a business which is now one of the most important in the Stock Exchange. Mr. G. D. Atkin was the best-known man in the House, and his sudden death in his office, on a bitterly bleak morning, came as a blow to his fellow-members, amongst whom he enjoyed a unique measure of popularity. His death is a loss to the electrical industry, as well as to his hosts of friends. Upon his memory there may be fittingly laid the tender tribute of farewell: *Placide requiescat.*

Share List of Electrical Companies.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price Jan. 18 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	18	14	3⅜	+3/-	4 9 7
Brompton Ordinary	1	10	10	1⅞	+1/3	*5 14 8
Charing Cross Ordinary	1	14½	15	49/6	—	6 1 8
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2 7/16	—	5 9 9
City of London	1	15	15	50/9	—	5 18 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/6	+1/-	5 4 11
County of London	1	15	15	59/6	—1/3	5 0 10
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	24/6	—	5 14 8
do. 7% Pref.	1	6	7	22/-	+6d.	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 8 0
Kensington Ordinary	5	14	15	13¾	+¼	5 9 1
Lancs. Light and Power	1	7½	7½	26/6	+6d.	5 13 2
London Electric	1	10	10	33/6	—	5 19 5
do. do. 6% Pref.	5	6	6	5 5/16	—	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	+1/3	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16	+⅜	5 9 3
South London	1	15	15	2⅝	—	5 18 1
South Metropolitan Pref.	1	7	7	1¼	—	5 12 8
Urban Ordinary	1	4	4	1	+1/9	4 0 0
do. 6% Pref.	1	6	6	18/9	—	6 8 1
Westminster Ordinary	1	15	15	2 1/16	—1/16	6 3 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	+3d.	7 11 11
Yorkshire Elec.	1	8	8	31/-	+6d.	5 3 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	"	4	5	69	—½	7 4 11
do. District	"	8½	8½	47½	—1	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2¼	—⅛	Nil
do. do. "A"	1/-	Nil	Nil	7/-	- 6d.	Nil
do. do. Income Bonds	6	6	6	98	—	*6 2 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	"	1½	1½	25	—	6 0 0
Automatic Telephone	1	8	6	53/9	—	2 4 10
Chili Telephone	5	6	5	6 1/16	—	*4 7 0
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	+ ½	*5 11 1
Eastern Tel. Ord.	Stock	10	10	176½	+1	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—1	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1 7/16	—	7 12 4
Marconi Marine	1	10	7½	⅝	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	5	8	8	7⅞	+1/16	5 1 7
Western Telegraph	10	10	10	18	—	*5 11 1
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	8¼	—	8 9 2
do. do. 2nd Pref.	5	6	6	8 1/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	"	6	6	119½	—	5 0 0
do. do. 6% Pref.	"	6	6	105	—	5 14 3
Brazil Traction	100	4	4	84	+½	4 15 3
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	83½	—	5 19 9
do. do. Preferred	"	96/-	96/-	102½	—	*4 12 8
do. do. Deferred	"	129/5	129/5	127	—	*5 2 4
do. do. Deb.	"	4¼	4¼	77	—	5 10 5
Lond. & Sub. Trac. 5% Pref.	1	2½	Nil	3/6	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	81½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	70½	+1½	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	54/6	+ 3/3	*4 8 1
British Aluminium Ord.	1	5	10	38/-	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	... ...
British Insulated Ord.	1	15	15	3 1/16	+5/-	4 16 0
Brush Ord.	1	10	10	28/-	—	7 2 10
Callenders	1	15	15	8¼	—	4 12 4
do. 6½% Pref.	1	6½	6½	22/6	—1/3	5 15 7
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	9/-	—3d.	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	+1/16	5 18 4
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	19/9	+6d.	5 2 7
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6¾	6¾	24/-	—	5 8 4
do. Ord.	1	5	7½	30/-	+9d.	5 0 0
Henley	1	15	16	3⅝	+⅛	4 8 5
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	24/-	+2/9	*4 8 4
Johnson & Phillips	1	10	10	56/3	—	3 11 1
Met-Vickers, Ord.	1	8	8	27/-	—	5 18 6
do. Pref.	2	8	8	2⅝	—	6 14 9
Siemens Ord.	1	—	7½	33/6	—1/6	4 9 7
Telegraph Construction	12	20	20	27	—	*4 9 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price January 19th.	Fortnight's Inc. or dec
a Acid, Oxalic per lb.	5¾d.	...
a Ammoniac, Sal per ton	£60	...
a Ammonia, Muriate (large crystal) "	£52	...
a Bisulphide of Carbon "	...	...
a Borax "	£25	...
a Copper Sulphate "	£25 10s.	...
a Potash, Chlorate per lb.	4d. to 4½d.	...
a " Perchlorate "	5½d.	...
a Shellac per cwt.	£15 15s.	...
a Sulphur, Commercial "	£8 10s.	...
a " Roll "	£8 10s.	...
a Soda, Chlorate per lb.	3¼d. to 3½d.	...
a " Crystals per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots per ton	£120 to £125	...
b " Wire per lb.	1/9 to 2/6*	...
b " Sheet "	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I per ton net	£251	£6 dec.
Grade II " "	£178	£4 dec.
Grade III " "	£101	...
c Brass (rolled metal 2" to 12" basis) per lb.	9⅞d.	...
c " Tubes (solid drawn) "	1/- to 1/0¼	...
c " Wire, basis "	10¾d.	...
c Copper Tubes (solid drawn) "	1/1	...
c " Bars (best selected) per ton	£90	...
c " Sheet "	£90	...
c " Rod "	£90	...
d " (Electrolytic) Bars "	£65 10s.	15/- dec.
d " Sheets "	£143 10s.	...
d " Wire Rods "	£75 10s.	15/- dec.
d " H.C. Wire per lb.	9½d.	¼d. dec.
f Ebonite Rod "	2/3 to 2/6	...
f Sheet "	2/3 to 2/6	...
n German Silver Wire "	2/2	...
h Gutta-percha, fine "	6/6	...
h India-rubber, Para fine "	3/2	8d. dec.
l Iron Pig (Cleveland Warrants) per ton.	nom.	...
l " Wire, galv. No. 8, P.O. qual. "	£12	...
g Lead, English Pig per ton.	£35 15s.	25s. dec.
g Mercury per bot.	£15 2s.6d.to £15 5s	...
e Mica (in original cases) small per lb.	8d. to 8/-	...
e " medium "	4/- to 8/-	...
e " large "	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings "	1/3½	...
p " " drawn bars & rods "	1/8	...
p " " rolled strip & sheet "	1/2½	...
p " " wire "	1/8½	...
o Platinum per oz.	£26	...
d Silicium Bronze Wire per lb.	1/0½	...
r Steel, Magnet, in bars "	7½d.	...
n Tin, Block (English) per ton.	£277 to £278	£9 10s. to £10 dec.
n " Wire, Nos. 1 to 16 per lb.	4/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
o C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Proposed Electricity Supply to Sicily.—According to the *Electrical World* a scheme is at present under consideration to supply electricity to the island of Sicily from the hydro-electric power station in Calabria, the southern province of Italy. Three plans for transmission at 130,000 volts across the Straits of Messina, which at the narrowest point are 2.15 miles wide, have been prepared. The first provides for an overhead line, supported at each end on steel towers, 993 ft. high. It is estimated that there would be a sag of 770 ft. from the horizontal in the centre of the line. The second scheme provides for the construction of two 656-ft. shafts and a 2⅜-mile tunnel beneath the Straits at a distance of 378 ft. below sea level. The third scheme proposes a new type of submarine cable, made by Pirelli's. This cable, although laid on the bed of the sea, would, it is claimed, be capable of successfully transmitting the necessary electrical energy.

Proposed Duty on Imported Electricity.—A Swiss correspondent informs us that the rumour that Italy is going to tax imported electrical energy is causing a certain anxiety in Switzerland. For some years it has been a very important "article" of exportation from Switzerland, the power provided for Italy during last year being about 76,000 kW. Several power stations have been set up specially with a view to exporting electricity to Italy, and if the latter country taxes Swiss energy, the suppliers will be faced with unexpected difficulties. It is said that the proposed tax will be 30 per cent. of the wholesale price of the electricity, which is considered excessive in electrical circles, but as the Italians are determined, so far as lies in their power, to protect Italy, it is quite probable that the new duty will be as high as the figure mentioned.

Exports and Imports of Electrical Goods and Machinery in December, 1925.

Two Years' Figures Compared.

THE Board of Trade Returns for December mark the close of another year, and we are therefore enabled to give, in addition to our monthly table, a comparison of the individual items for the years 1924 and 1925. To illustrate further the course of trade, we have also prepared a number of curves relating to the principal items of export and import.

A study of the December figures reveals a fairly satisfactory increase in the export section, an increase which was well distributed over the items. The most important rises occurred in the cases of unenumerated electrical machinery, "other motors and generators," and submarine telegraph and telephone cable; the last item sprang up by over £57,000, and it is perhaps worthy of mention that this item fluctuated during 1925 between the upper and lower limits of £442 and £424,913, greatly influencing each month's figures. The only decrease of importance during December was the fall of £21,000 in the exports of glow lamps. Comparing the figures with those for December, 1924, it will be seen that, although there were one or two serious decreases, generally the increases predominated, and the net result was an increase of £70,226.

There was also an increase in the import section as compared with November, 1925, rises in unenumerated goods, apparatus and machinery, and cables more than compensating for a drop of £50,786 in batteries and accumulators. Comparing the figures with those for December, 1924, there was a decrease of £36,683, due mainly to a fall of £63,537 in telegraph and telephone instruments and apparatus, and one in batteries and accumulators, which were not counterbalanced by the rises in cables and unenumerated goods. The re-export section does not present much of interest, but it may be pointed out that there was a general rise as compared with the preceding month, and only two decreases of any importance.

Turning to the yearly figures, it will be seen that unenumerated electrical machinery reached the first place during 1925, although the exports of telegraph and telephone apparatus, which were the chief items in 1924, continued to grow. The greatest jump was made by submarine telegraph and telephone cable, and here it may be pointed out that the total given for 1924 shows a considerable difference from that given in the December, 1924, returns. This discrepancy, which amounts to about £500,000, is apparently due to the inclusion of a large item or some large items which were for some reason not available until after the close of the year. Important increases occurred in several other items, for instance, batteries and

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Dec., 1925.	Inc. or dec. as compared with Nov. 1925.	Inc. or dec. as compared with Dec., 1924.	Electrical imports for Dec., 1925.	Inc. or dec. as compared with Nov., 1925.	Inc. or dec. as compared with Dec., 1924.	Electrical re-exports for Dec., 1925.	Inc. or dec. as compared with Nov., 1925.	Inc. or dec. as compared with Dec., 1924.
Electrical goods and apparatus (unenumerated)	£156,476	— £3,723	— £5,216	£130,825	+ £11,648	+ £23,445	£5,642	— £1,076	+ £1,435
Insulated wires and cables ...	253,414	+ 5,753	+ 22,769	74,159	+ 26,367	+ 23,248	661	+ 88	— 330
Glow lamps	40,289	— 21,263	+ 9,595	36,941	+ 3,731	+ 691	425	+ 338	— 189
Arc lamps and parts	1,003	— 160	+ 344	1,518	— 519	— 339	12	+ 7	— 34
Batteries and accumulators ...	75,137	— 3,344	— 19,922	50,528	— 50,786	— 23,953	544	+ 35	— 1,509
Meters and instruments ...	28,228	— 5,590	— 6,894	22,767	+ 4,455	+ 6,602	1,699	+ 1,132	+ 723
Carbons	1,120	+ 691	— 61	9,262	— 4,466	+ 1,168	454	+ 335	+ 372
Electrical Machinery—									
Electrical machinery (unenumerated)	301,035	+ 77,830	+ 48,529	102,306	+ 23,706	— 7,767	7,805	+ 43	+ 2,259
Railway and tramway motors	45,750	+ 1,872	+ 7,590	—	—	—	—	—	—
Other motors and generators ...	197,633	+ 69,382	+ 22,922	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	9,100	+ 3,038	+ 2,409	225	— 151	+ 174	30	+ 30	+ 30
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	62,794	+ 8,819	— 1,197	14,565	— 3,393	+ 3,585	64	— 1,486	+ 64
Submarine telegraph and telephone cable	58,237	+ 57,795	— 31,141	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	217,196	— 7,887	— 41,783	70,936	— 808	— 63,537	5,412	+ 1,972	+ 1,396
Totals ...	£1,447,412	+ £183,213	+ £70,226	£514,032	+ £10,054	— £36,683	£22,748	+ £1,418	+ £4,217

[The Figures for 1924 and 1925 compared.]

	Exports.			Imports.			Re-exports.		
	Electrical exports, 1925.	Electrical exports, 1924.	Inc. or dec. in 1925 as compared with 1924.	Electrical imports, 1925.	Electrical imports, 1924.	Inc. or dec. in 1925 as compared with 1924.	Electrical re-exports 1925.	Electrical re-exports 1924.	Inc. or dec. in 1925 as compared with 1924.
Elecl. goods and apparatus (unenumerated) ...	£1,823,520	£1,886,683	— £63,163	£1,186,481	£1,005,659	+ £180,822	£87,611	£67,471	+ £20,140
Insulated wires and cables	2,664,433	2,506,467	+ 157,966	608,171	455,588	+ 152,583	16,187	4,230	+ 11,957
Glow lamps...	510,504	341,246	+ 169,258	426,299	215,234	+ 211,065	8,333	8,551	— 218
Arc lamps and parts ...	16,312	10,547	+ 5,765	16,025	13,654	+ 2,371	2,137	1,118	+ 1,019
Batteries and accumulators	973,097	742,134	+ 230,963	638,129	377,780	+ 260,349	13,673	4,696	+ 8,977
Meters and instruments ...	351,100	446,204	— 95,104	270,211	190,415	+ 79,796	11,353	12,308	— 955
Carbons	23,417	27,385	— 3,968	101,536	119,129	— 17,593	2,306	2,087	+ 219
Electrical Machinery—									
Electrical machinery (unenumerated)	3,060,459	2,454,125	+ 606,334	1,084,686	1,072,446	+ 12,240	66,861	87,361	— 20,500
Railway & tramway motors	545,637	577,819	— 32,182	—	—	—	—	—	—
Other motors and generators	2,155,831	2,321,141	— 165,310	—	—	—	—	—	—
Switchboards (not telegraph or telephone) ...	88,154	90,918	— 2,764	1,784	501	+ 1,283	1,408	1,753	— 345
Telegraph and Telephone Cable and Material.—									
Telegraph and telephone wires and cable (not submarine)	705,357	1,021,999	— 316,642	186,483	122,132	+ 64,351	8,371	3,859	+ 4,512
Submarine telegraph and telephone cable	1,601,401	948,156	+ 653,245	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus...	2,831,403	2,659,214	+ 172,189	835,744	871,830	— 36,086	72,539	54,794	+ 17,745
Totals	£17,350,625	£16,034,038	+ £1,316,587	£5,355,549	£4,444,368	+ £911,181	£290,779	£248,228	+ £42,551

accumulators (£230,963), telegraph and telephone apparatus (£172,189), glow lamps (£169,258), and insulated wires and cables (£157,966). There was a large decrease in non-submarine telegraph and telephone cables, and the exports of "other motors and generators" and meters and instruments also declined to a considerable extent.

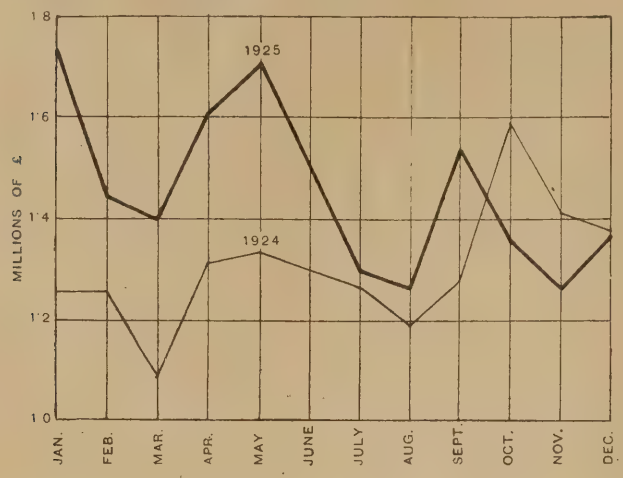


Fig. 1.—Monthly Exports During 1924 and 1925.

In the import section there were only two decreases as compared with 1924—in carbons and in telegraph and telephone apparatus. In the case of the latter, this was accompanied, as has been shown, by an appreciable increase in exports, as well as in re-exports. The growth of the radio industry is

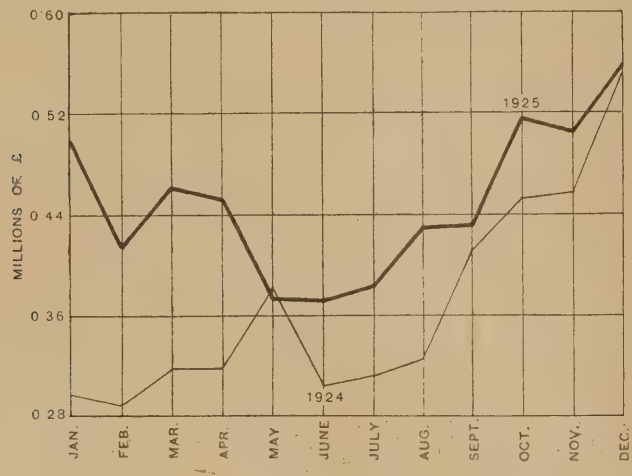


Fig. 2.—Monthly Imports During 1924 and 1925.

no doubt indicated by the rise of £260,349 in the imports of batteries and accumulators, and improved lighting may account for the rise of £211,065 in glow lamp imports. Other notable increases occurred in imports of unenumerated electrical goods, insulated wires and cables, and meters and instruments. The

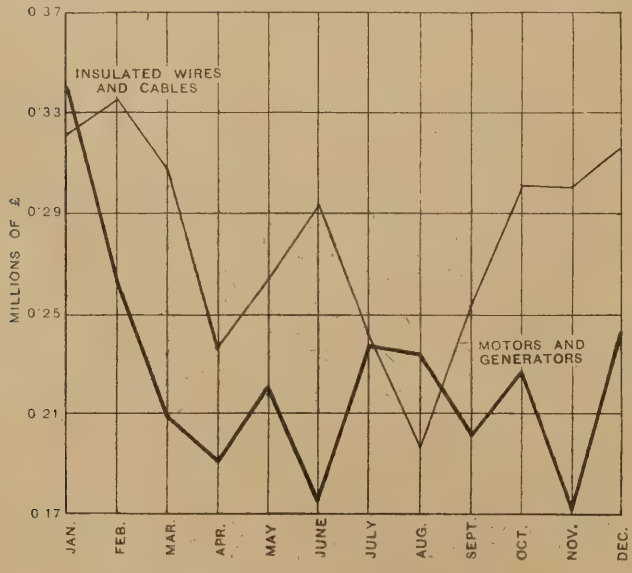


Fig. 3.—Exports of Cables and Motors and Generators.

re-export list shows principally increases resulting in a net rise of £42,551.

The curves are practically self-explanatory. The first (fig. 1) shows that exports remained above those of 1924, month by month, until October, but they practically regained the 1924 level by the end of the year. Fig. 2 compares the monthly imports during 1924 and 1925, and it is seen that, except for the drop in May, the figures remained above those for 1924 throughout the year. Fig. 3 shows the monthly exports of two outstanding items. For convenience the items "railway and tramway motors" and "other motors and generators" have been combined, and the curve relating to insulated wires

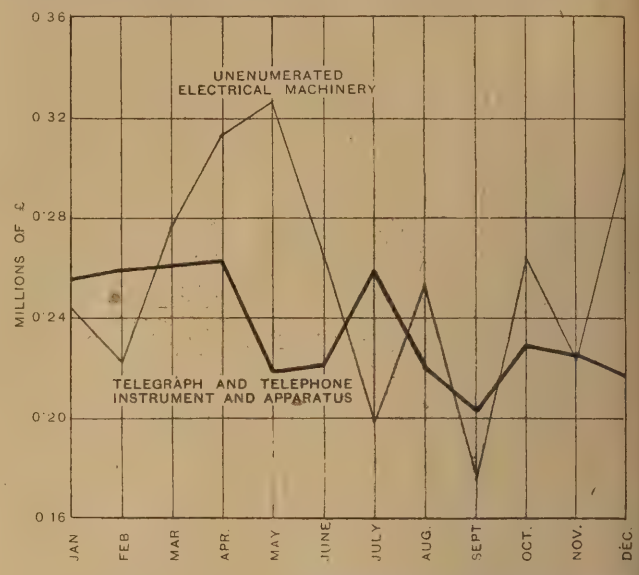


Fig. 4.—Exports of Machinery and Telegraph and Telephone Apparatus.

and cables includes non-submarine telegraph and telephone cables. Two other leading export items are illustrated in fig. 4, telegraph and telephone instruments and apparatus and unenumerated electrical machinery. The item fifth in im-

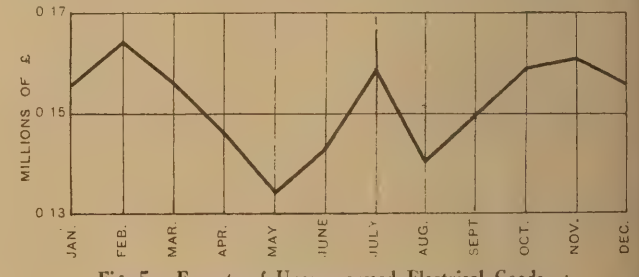


Fig. 5.—Exports of Unenumerated Electrical Goods.

portance in the export section is depicted in fig. 5. A larger scale is used which exaggerates the fluctuations, although unenumerated electrical goods was the item with the smallest variations. Fig. 6 presents curves of the three principal

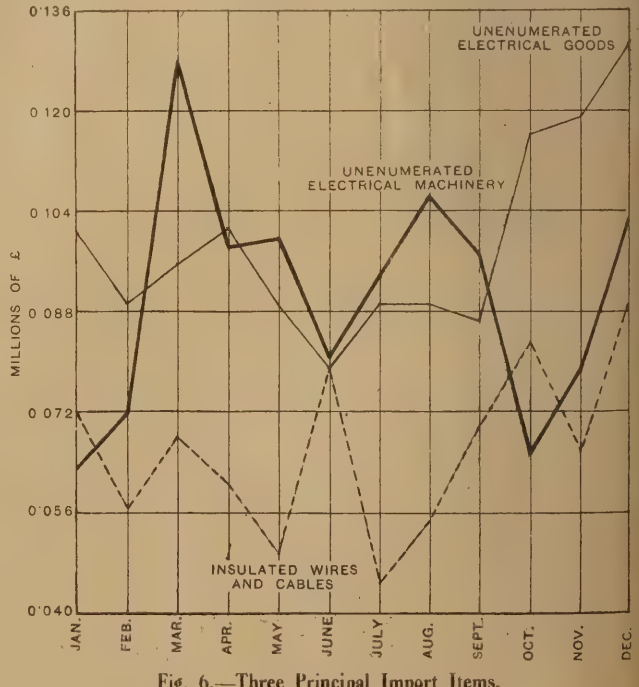


Fig. 6.—Three Principal Import Items.

import items, and again the curve of insulated wires and cables includes non-submarine telegraph and telephone cables.

It is satisfactory to note that although exports during 1925, as a whole, decreased from £800,967,000 to £773,086,000, the section with which we are particularly concerned showed a substantial rise. Again, while there was generally an excess of imports over exports of £549,772,000 (excluding bullion and specie), in the electrical branch there was a favourable balance of £11,955,076.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page 92.*)

Morgan Crucible Co., Ltd.

The various articles on this stand illustrated the scope of "Morganite" material for the manufacture of resistor elements of either low or very high ohmic value, with a specific

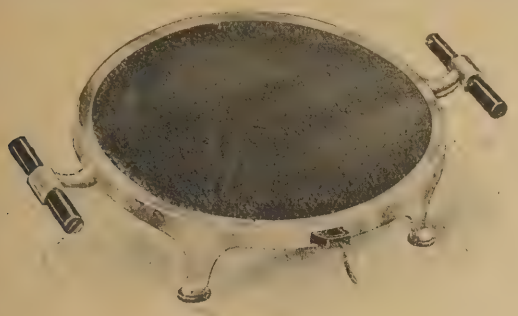


Fig. 9.—Circular Hot Plate.

resistance ranging from 0.01 to 100×10^3 ohms inch cube. Domestic hot plates are shown in figs. 9 and 10, fig. 11 illustrating one of several patterns of portable radiators. Heaters are also made for fixing flat on a wall or floor skirting without

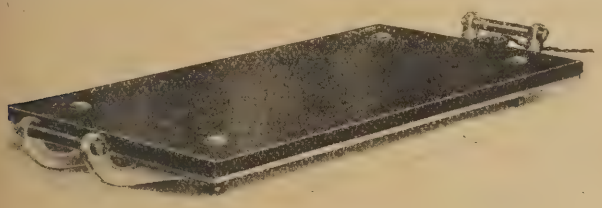


Fig. 10.—Domestic Hot Plate.

risk of scorching; as they occupy the minimum space, they should be very serviceable in confined spaces. For laboratory and industrial use a plain hot plate is made, resting on an



Fig. 11.—Portable "Morganite" Radiator.

earthenware tile. The ceramic, porcelain-like nature of these heaters enables them to be washed like china ware, and there are no metal parts to require cleaning.

Evershed & Vignoles, Ltd.

The representative display on this company's stand included two new items. One instrument is a development of the well-known "Megger," and has been designed to overcome the difficulties which have been experienced in measuring the resistance of earth plates. The trouble has been to eliminate back e.m.f. due to electrolysis under moist soil conditions and stray leakage currents. It has been necessary to find a method of eliminating these outside factors and making sure that the resistance measured is that of the earth plates alone, and also that this value should be accurate, for the "three-reading" method involves complex calculations and is not always accurate, as conditions may change during the test. It would seem that the use of alternating current would cancel out both electrolytic back e.m.f. and vagabond currents, but it has been impossible in the past to use a.c., because the true ohmmeter, such as that used in the "Megger" testing set, is of the moving-coil type, which requires direct current. The difficulty can be overcome in a very simple manner by providing a.c. for the earth plate and d.c. for the ohmmeter; which has been accomplished by using a specially-constructed "Megger" set having a mechanically-operated reversing switch on the same shaft as the generator armature, interposed electrically between the earth plate and ohmmeter section of the testing circuit.

The electrical recorder has made very rapid strides of late, and Messrs. Evershed & Vignoles have constructed several special instruments recently of considerable interest. The integrating weight recorder shown in fig. 12 is similar to those

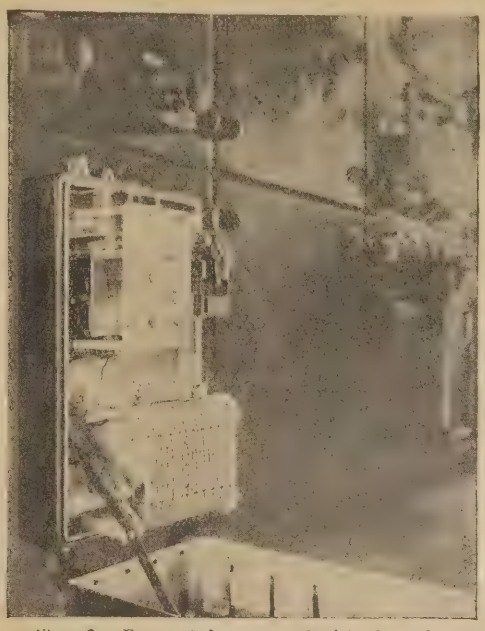


Fig. 12.—Evershed Integrating Weight Recorder.

supplied to Messrs. Henry Simon, Ltd., for installation in grain elevators, the purpose being to provide a record of the operation of an automatic tip weigher. The movements of the latter are shown in the form of a stepped chart, each step representing one movement of the weigher. An arrangement is provided by means of which the pen is returned automatically to its zero position at hourly, or other, intervals (fig. 13), the

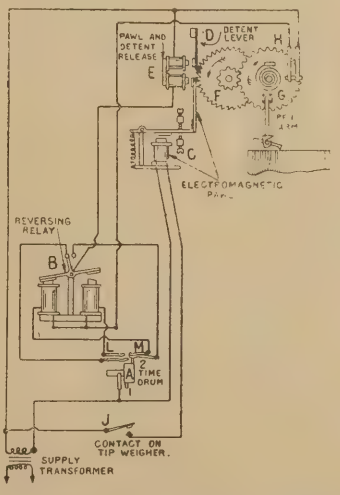


Fig. 13.—Diagram of Integrating Mechanism.

total amount handled by the tip weigher hourly being shown by the length of the hourly total. The recorder shows the regularity, or otherwise, of the operation of the tip weigher in addition to the total number of operations per hour. The instrument is of the duplex type, the record of the operations of the tip weigher being shown on the same chart roll with the power consumption of the operating motor. (Current, pressure, speed, &c., could be shown.) The value of a duplex chart of this kind can readily be appreciated from the fact that irregularities in the operation of the tip weigher can be checked against corresponding fluctuations in the power consumption of the motor. The tip weigher may be concerned with grain, or it may deal with fuel, or any other material in bulk, and

the same principle of operation may be used for checking any automatic machine operations, indicating the headway of tramcars, &c.

The method of operating the "weight" portion of the recorder is shown by fig. 13; a transformer supplies operating current at 25 volts, and the pen-arm mechanism includes the gear wheels F and G, the latter carrying the pen, and the wheel movement being controlled by the electro-magnetic pawl C and the lever D. When the tip weigher moves, contact J closes momentarily, the circuit including C being completed, and the arm attached to C is pulled down; the gear train is moved one notch and held by lever D, carrying with it the pen one step to the left on the chart. The next operation of the weigher again closes J, repeating the cycle and carrying the pen another step to the left. The integrating mechanism by means of which an hourly total of the weight handled is provided, is controlled by the drum A, which carries arms 1 and 2, making contact with L and M alternately at intervals of one hour (as the arms are diametrically opposed on the drum, which revolves once in two hours). When arm 2 reaches M it energises electro-magnet E, which pulls down pawl C and lever D from the ratchet wheel, thus allowing the spring-controlled gear train to return the pen to its zero position. Contact H is consequently closed, and B switches F out of circuit, so that the pawl and detent lever fall into position again ready to operate at the next movement of the tip weigher. At the end of the next hour arm 1 closes contact L, and the cancellation is made in a similar manner to that described above.

Two new ranges of the "Meg" insulation tester are shown for the first time; the 100-volt 20-megohm and the 250-volt 50-megohm ranges, both supplied with variable or constant-pressure generator, for testing grid leaks, anode resistances, the insulation of low-pressure lighting circuits, and for the telegraph companies. The recording "Dionic" tester provides a continuous record of the changes in the impurity content of condensate, boiler feed, &c., and has been considerably improved in detail. The instrument exhibited was similar to those installed in Valley Road electricity works, Bradford, Barton Bridge power station, Manchester, and the new Barking station.

Nalder Bros. & Thompson, Ltd.

Amongst the apparatus on this firm's stand the well-known "N.C.S. Ideal" series of a.c. instruments included watt-meters, ammeters, voltmeters, rotary power-factor indicators, rotary synchroscopes, and deflectional frequency meters. The latter three classes of instruments are of the "Nalder-Lipman" moving-iron pattern and a novelty was the combined power factor meter and ammeter for use in the control rooms of large stations (fig. 14). The two meters are housed in a rectangular case measuring 10¼ in. by 5¼ in. by 5 in., which can thus be mounted side by side, taking up very little space.

Another new apparatus is the steam turbo-alternator efficiency indicator (Turner's patent), the electrical portion of which is illustrated in fig. 15. The complete indicator may be considered as a combination of two pieces of apparatus: (i) An indicating wattmeter operating the "Willans line" drum, and (ii) a Venturi, or any other, watermeter indicating the steam

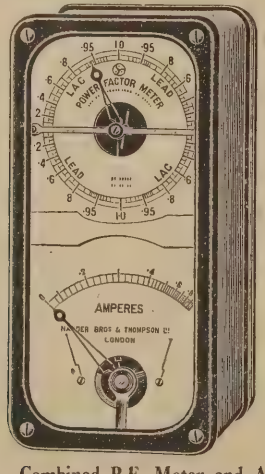


Fig. 14.—Combined P.F. Meter and Ammeter.

consumption of the machine. Alternatively, a steam-flow meter can be used, but it is not considered that this is as satisfactory as a water-flow meter. The wattmeter is of the unbalanced-load induction type of special design, but, instead of being fitted with a pointer, the scale of kilowatts is delineated on the lower periphery of a drum. On the drum is delineated the "Willans line" of the particular machine in connection with which the instrument is to be used, as well as lines above and below this, showing definite percentage variations therefrom.

As the drum rotates the portion of the "Willans line" corresponding with the load on the machine is visible and the guaranteed steam consumption at this load is read on a vertical scale which is parallel with the axis of the drum and at right angles to the wattmeter scale. On the opposite side of the same vertical scale a pointer moves up and down which is actuated by the water or steam-flow measuring apparatus dealing with the condensate or steam. This indicates the actual steam consumption against the kilowatt output, and it can be seen immediately whether the consumption is in accordance with, or is better or worse than, the guaranteed figure without the necessity of having to make a number of carefully-organised simultaneous readings on the different instruments usually situated in different places, and a subsequent reference to the guaranteed steam consumption figures of the machine. This combined instrument should be of material use in ensuring that the general conditions of working of the machine are being properly maintained.

Should the steam consumption be indicated as too high, and it is observed that this is not due to a low steam pressure, steam temperature, or vacuum, then the reason may be looked

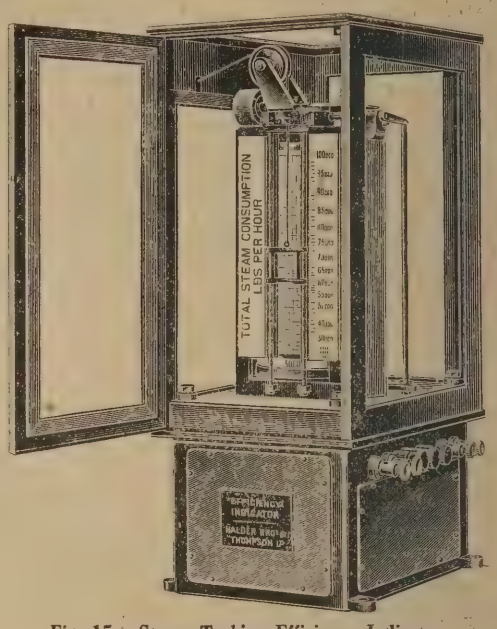


Fig. 15.—Steam Turbine Efficiency Indicator.

for in hot bearings or in deterioration or damage to turbine blading, nozzles, and/or diaphragms, or in leakage of steam through blading running clearances and labryinths or other glands. Causes which, without the instrument, might continue untouched for a considerable period can thus be detected without unnecessary and costly delay, and the risk of possibly a serious breakdown can be obviated. The readings can be logged as part of the regular station routine and thus provide a continuous check on any deterioration from the guaranteed efficiency, and incidentally show any improvement that there may be in the running.

A complete line of protective relays was also shown, including super-sensitive (Fawssett Parry patent) types and relays for Merz-Price protection systems and developments thereof.

Dubilier Condenser Co. (1925), Ltd.

This firm's products need no introduction; they included devices of varied kinds, both for "broad-catchers" and commercial work. Condensers for high-power circuits can be supplied for radio-frequency currents up to 250 amperes and for audio-frequency voltages exceeding 60,000 volts. Mica insulators for continuous-wave radio apparatus involve small losses and are reliable in prolonged service, and a compact arrangement of condensers in a metal box is made for reducing radio interference due to sparking dynamos, motor-cars, &c. Besides the neon-lamp wavemeter the firm's short-wave heterodyne wavemeter has a tuning range of from 50 to 500 m. and is provided with a screened case to eliminate hand-capacity effects. As its name implies, the "Univane" condenser is so arranged that the rotation of the knob of the condenser moves only one vane of the set at a time. As soon as one movable vane interleaves with the fixed vanes, a second is rotated into position as the knob is turned, and thus the full movement from minimum capacity to maximum requires several complete revolutions of the knob, which enables very fine tuning to be obtained. The number of times that the knob has been turned is shown on a small auxiliary indicator attached to the front of the instrument alongside the dial.

Mullard Radio Valve Co., Ltd.

Besides the Holweck molecular pump, a fine range of valves was on view, and it was noticed that a new range of modulating valves has been added to cope with the increase of broadcast telephony transmission, ranging from 150 to 600 watts; also a rectifying valve of special low impedance for service use, and a special valve for dealing with small powers at voltages up to 30,000 r.m.s. The glass transmitting valves have been modified to permit of satisfactory operation on wave-lengths down to 20 metres, and a recent addition to the range is the T.5A, rated at 1 kW anode dissipation, suitable for transmission on the shorter wave-lengths. Two new water-cooled transmitting valves displayed can deal with an input of from 30 to 35 kW.

(To be continued.)

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Agricultural Electric-Motor Outfit.

The accompanying illustration, fig. 1, is of a 6-h.p. electric motor and starting equipment combination, one of a range of such portable sets which is being produced in Austria for agricultural purposes. The equipment is mounted on

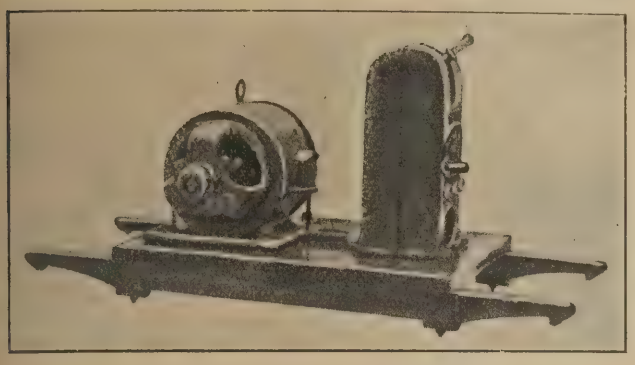


Fig. 1.—Agricultural Electrical Equipment.

either hand carriers or two- or four-wheel trucks. In the former case the hardwood bearers are provided with four short spikes by which a secure foundation for the set on the ground is secured.

An Electro-Magnetic Fuel Pump.

A considerable advance will probably be made in the direction of the fuel feed for automobiles by the introduction of the "Autopulse," fig. 2, a production of Zephyr Carburettors, Leamington, in this country, for which MESSRS. R. M. PAPELIAN, LTD., Wolseley House, Piccadilly, London, W.1, are the sole concessionnaires for Europe. The device forms, it is claimed, a small, durable and very efficient pump, giving about 5,000 strokes to a gallon of fuel at the rate of from 800 to 1,000 strokes per minute. The length of the stroke is from 0.025 in. to 0.030 in. The pumping element takes the form of a bellows into which the petrol is drawn through a strainer and a valve situated in the centre. Attached to the bottom of the bellows is a metal disk or armature, which is actuated by a special electro-magnet element. The coil of the latter is controlled by an ignition switch, and the attraction

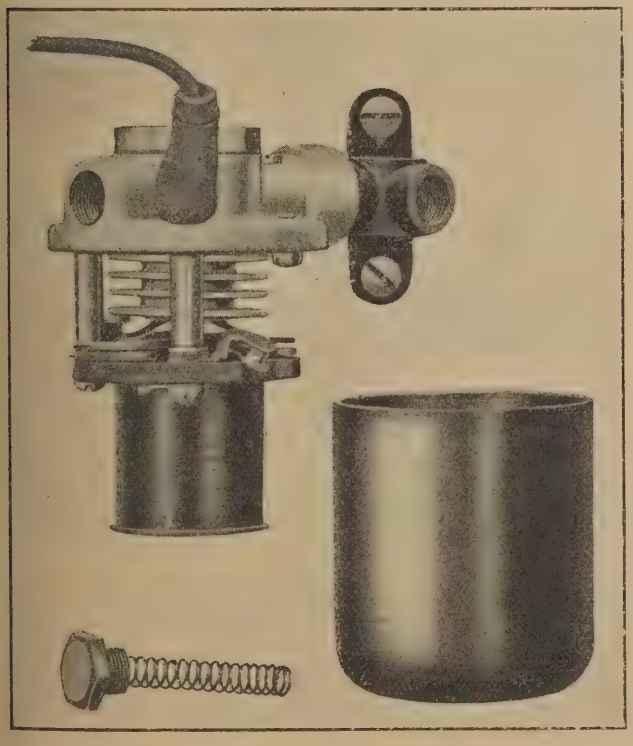


Fig. 2.—Electro-Magnetic Fuel Pump.

of the armature when the coil is energised represents the suction stroke. The delivery stroke is effected, when the coil is de-energised, by a spring placed vertically and centrally in the coil. This is stressed by the magnetic pull on the armature during the suction stroke, and in consequence applies the necessary pressure to close the bellows in return. Arcing at the switch contacts is claimed to be reduced to vanishing point by means of a "short-circuited" secondary winding in which a demagnetising current is induced, neutralising the effect of self-induction at the time of the break. The device is made up in combinations suitable for any number of cylinders.

A Novel Electrical Cooker.

An interesting electric cooking device in which, it is claimed, a whole meal may be cooked in one utensil, is described in *Electrical Merchandising*. The cooker, fig. 3, which is a pro-

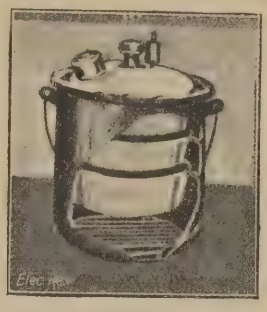


Fig. 3.—One-Utensil Electric Cooker.

duction of the SELFSEAL PRESSURE COOKER COMPANY, 92, 150th Street, Jamaica, N.Y., consists of a cylindrical outer vessel of strong enamelware, in which white-enamel inset dishes are accommodated in a combined meat rest and lifting rack.

An Electric Light Extension Bracket.

A recent introduction into the electric-lighting field is an extension-bracket lighting fitting, fig. 4, produced by the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2. It is designed for use in workshops and offices, &c., where it is desirable to vary within small limits the

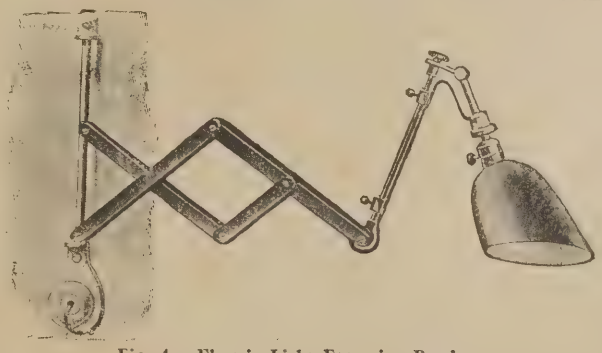


Fig. 4.—Electric Light Extension Bracket.

position of the source of light. The brackets are adjustable in any position within a radius of 180 deg. and at any distance up to 5 ft. extension. The reflectors are of aluminium, especially designed to effectively shield the eyes of the user from all harmful glare. The device is supplied in either black enamel or nickel-plate finish.

An Improved Conduit Fitting.

A new design of continuity conduit fitting which should prove of interest to electrical contractors, wiremen, &c., has recently been put on the market by the SECURITY FOUNDRY CO., LTD., Birmingham Road, Oldbury. The fitting is of the split pattern, the two halves being hinged at one side. Near each aperture are provided two internally-projecting collars, half on each section, which are designed to grip the conduit when the fitting is tightened up. Lugs with free and screwed eyelets are provided on the opposite side to the hinges so that the gripping is effected by means of small screws, which are tightened up after the conduit and wires have been assembled. It is claimed that efficient continuity is obtained with this device. Accessibility for inspection and the other advantages of the split fitting are also features of interest.

A New Electric-Lamp Lock.

We have received a sample of another form of electric lamp lock, designed to prevent the removal of lamps by unauthorised persons, which is being marketed by MESSRS. FRANCIS LAMP LOCKS, LTD., 83, Pall Mall, London, S.W.1. The device consists of an inner collar which is screwed into an outer one. A clutch gear allows the two parts to be turned in one direction only so that the combined device can be lengthened but not shortened. It is placed over the bottom of the holder with the inner collar at the top, and the lamp is inserted afterwards. The combination is then "expanded" so that a turn-in flange on the inner collar will lock at the ridge at the bottom of the thread on the lower portion of the holder, and the bottom of the outer collar will lock at the top of the glass bulb below the cap.

The Institution of Electrical Engineers.

South Midland Centre, Annual Dinner.

THE annual dinner of the South Midland Centre of the Institution of Electrical Engineers was held at the Grand Hotel, Birmingham, on Wednesday, January 13th, the chair being occupied by Mr. F. J. Moffett, chairman of the Centre. Covers were laid for some 300 members and guests.

Mr. J. SMEDLEY-CROOKE, M.P. for Deritend, Birmingham, proposed the toast of "The Institution of Electrical Engineers." He spoke of the great influence which the Institution had attained in the country, and emphasised the value of the work which had been done for the industry both during and since the war.

Mr. R. A. CHATTOCK, president of the Institution, in responding, pointed out that the uses of electricity were growing from day to day and it was the duty and work of the Institution to help that development along. The success of the Institution seemed to have inspired certain members of the engineering profession to try to go one better. He referred to the proposals made recently to form new institutions dealing only with small sections of the electrical engineering profession. It looked as if the proposal to form a wireless institution would be carried through. Surely the parent institutions were large enough and knew sufficient to foster the sections of the industry. He did not think there was any justification for forming smaller institutions which only tended to fritter away the strength of the industry and to divide its members when they might very much more advantageously get together and benefit each other. He felt that the duplication of papers to be read was very unwise and also, with new institutions springing up, time was demanded which it was very difficult for a busy man to give. Turning to the proposal to supply hot water to a district from a generating station, Mr. Chattock said that the capital cost of supplying water to a district was very heavy, and in addition to that there were pumping costs. He went into the matter some years ago in connection with the Summer Lane station and came to the conclusion it would be much cheaper for a householder to heat water by coal or coke. There was another proposal which had been made, to take the generating station to the pit head, but electrical engineers required water even more than coal and an enormous quantity would have to be available before economy could be obtained.

Mr. S. T. ALLEN, borough electrical engineer, Wolverhampton, submitted the toast of "The Electrical Industry." He laid stress on the value of co-operation and suggested that the time had arrived when they ought to consider and bring about what might be termed the first British National Electrical Congress. If such a gathering could be got together, representing all sections of the industry, it could review the present position and determine the best and most efficient methods of dealing with the great developments they could all foresee, so that all sections could go forward in step.

SIR T. O. CALLENDER, in reply, referred to the enormous changes and advances which had been made in the industry. He spoke of his visit to the United States, and pointed out that electricity was almost universally used in that country, not only in the large towns but also in out-of-the-way places.

A presentation of a silver fruit dish was made to Mr. Chattock to celebrate his election to the position of president of the Institution.

Mr. F. J. MOFFETT, in proposing Mr. Chattock's health, spoke of him as a member of the Institution, as an engineer, and as a man. Since his first coming to Birmingham, Mr. Chattock had been a consistent supporter of the Institution and in particular of the local Centre. Twice he had occupied the chair, and he had done much personally for the success of the Centre. The great and successful undertaking of which Mr. Chattock was the chief, was sufficient evidence of his abilities as an engineer, and as a man they would agree that while much of the success of the undertaking was due to the engineering abilities of their president, yet a considerable element had been his human side.

Mr. CHATTOCK, in returning thanks, said his work in Birmingham had been a pleasure, and it had been contributed to very largely by the wholehearted support he had received from the committee and staff of the electric supply department.

Principal GRANT ROBERTSON (Birmingham University) proposed the toast of "The City of Birmingham and Electricity Supply." He spoke of the time when electricity might do much to make Great Britain prosperous, happy and strong. He hoped that would be realised, but there were two requisites; one was that they should do nothing to prevent, and everything to promote, the study, research and teaching of science as a national duty. The second was that they had to get the public to understand what could be done for civic life if they took science seriously and then applied it in every possible way to the amelioration of civic and other conditions. In this country we had been held up by the apathy and ignorance of the general population.

Coun. C. T. APPLEBY (chairman of the Works Sub-Committee of the Electric Supply Committee) responded.

The toast of "Kindred Societies and Guests" was proposed by Col. J. F. Lister and responded to by Mr. H. E. Yerbury, deputy city electrical engineer, Sheffield.

The Annual Dinner of the Western Centre.

The annual dinner of the above Centre was held at the Hotel Metropole, Swansea, on January 11th, about 150 members and guests being present. Mr. J. W. Burr, M.I.E.E., presided, and was supported by Messrs. Roger T. Smith and J. S. Highfield, past presidents of the Institution, and Mr. P. F. Rowell, secretary.

Among the guests were: Prof. F. Bacon, M.A., Swansea; Mr. H. Spence Thomas, president of the South Wales Institute of Engineers, Mr. Martin Price, Cardiff, Sir Arthur Whitten Brown, K.B.E., Swansea, Mr. A. J. Ostler, Bristol, president-elect of the Electrical Power Engineers' Association, and a number of representatives of various electrical and engineering undertakings. Mr. R. A. Chattock, president of the Institution, was unable to be present owing to a hastily convened Joint Industrial Board meeting.

Mr. WILLIAM MORGAN, president of the Swansea Chamber of Commerce, proposed the "Institution of Electrical Engineers." He said the Institution was formed in 1871, and now had 12,000 members, including practically every prominent authority connected with the profession. They had in Mr. Burr an excellent chairman of the Western Centre.

In reply, Mr. ROGER SMITH said that the Institution's efforts had been crowned with success, and the Western Centre was the brightest jewel in its crown. "Kindred Associations" was given by Mr. William Nairn, Bristol, and in reply, Mr. SPENCE THOMAS welcomed co-operation between the Institution and the body he represented. The South Wales Institute of Engineers was only too ready to afford other institutions any facilities it possessed. Mr. THEODORE STRETTON, president of the Association of Mining Electrical Engineers, said that his Association was not a rival to the Institution, but a nursing ground for it. Mr. T. E. ALGER, president of the Electrical Contractors' Association, said that his Association fully appreciated the splendid work done by the Institution. It was the Institution of Electrical Engineers, under the able guidance of Mr. Wordingham, that inaugurated the scheme of a National Register for Electrical Contractors. At the present time it was a matter of voluntary registration only, but he was hoping that it would become compulsory for every electrical contractor to have a certificate of registration before carrying out work to be connected to supply mains. The compiling of a code of rules by the Institution for the installation of electric lighting and power had, to his knowledge, been a long and tedious process, and much valuable time had been given to it by the Committee responsible. In the past this country had suffered through the want of standardisation of electrical materials, and the code would simplify matters not only for contractors but also for manufacturers. He was pleased to note that the Fire Offices Committee had issued a list of some 90 or 100 insurance companies, which had adopted the regulations of the Institution of Electrical Engineers.

Mr. W. J. BACHE, Cheltenham, proposed "The Visitors," to which Alderman I. BARCLAY OWEN, Mr. F. G. WAINWRIGHT and others replied. "The Land We Work In" was proposed by the CHAIRMAN, who advised greater advertisement by Wales of her manufactures. It had been rightly said that the British were too prone to self-depreciation, and would advertise foreign goods which were very often the offspring of British brains.

Canadian Hydro-Electric Development.—In the field of hydro-electric power Canada has made remarkable strides. At the end of 1924 the power actually harnessed was 3,590,000 h.p., calculated on the basis of 80 per cent. efficiency and 24-hour flow. In 1925 a further 725,000 h.p. was installed, bringing the total to 4,315,000 h.p., and work upon an additional 1,100,000 h.p. is proceeding. The use of water-power is estimated to effect an annual saving of 90,000,000 tons of coal. —*Reuter's Trade Service.*

Electrolytic Disinfectant Plant.—We have received a copy of a special report on "Twenty Years' Working of the Electrolytic Disinfectant Plant of Poplar," by Fredk. Wm. Alexander, medical officer of health for that borough. A new building and plant has recently been added to the installation, and some particulars of the new equipment are embodied in the report. The plant was supplied by Messrs. Mather & Platt and consists of five 30-A Graphode electrolysers, each with eight cells and arranged for series working from the 230-V d.c. supply mains. Each electrolyser is provided with a vulcanite tank, a draw-off cock and a cooling coil. The electrical equipment comprises a 30-A d.p. reversing switch, a pressure regulator, and a suitably scaled ammeter and voltmeter. The circulation of the electrolyte is maintained by the action of the electrolyser. The current is reversed periodically to ensure even wearing and cleaning of the electrodes. The total output of the plant, assuming four 2¼-hour runs per day, is 157½ gallons of sodium hypochlorite at a concentration of 10 grms. of available chlorine per litre, which is equivalent to approximately 300 gallons per day at the concentration of fluid distributed from the existing magnesium hypochlorite machines. With the cost of salt at £4 per ton and electricity at 2.25d. per kWh, it is estimated that the cost of the sodium hypochlorite at the above strength will be 1.6d. per gallon.

The quantity of fluid prepared and distributed since the initial installation of the old plant amounts to over one and a quarter million gallons at a total cost of £2,858, £1,575 for materials and £1,283 for electrical energy.

Electricity Supply in Great Britain.

Particulars of the Government Scheme.

ON Friday last, at a meeting of the Midland Union of Conservative and Unionist Associations at Birmingham, Mr. STANLEY BALDWIN, the Prime Minister, outlined the scheme which has been adopted by the Cabinet for the development of the supply of electricity in Great Britain. He said it was known that the consumption of electricity in this country was very much less than in many countries overseas. He could not agree with those who claimed that industrial efficiency could be attained by increasing the use of electrical power; nevertheless, electricity offered great advantages to the industrialist and to the domestic consumer. Exaggerated views had been put forward on this subject; cheaper power by itself would not revive industry, for the cost of power formed but a small proportion of the total manufacturing costs. But within the next 15 years a conservative estimate indicated that the consumption of electricity, at present 200 units per head per annum, would be at least 500 units per head; and it should be possible during that period to save many millions of pounds by cheapening electricity supply. It was of the first importance that ample supplies of power should be available where they were wanted; that the sources from which it was derived should possess adequate reserves; and that those sources should be interconnected, so that any industry could be certain of obtaining power whenever it was required.

He asked whether they were to-day making the best use of the national resources. The subject was investigated some years ago by a strong Committee over which Sir Archibald Williamson [now Lord Forres] presided, which concluded that the system of generation of electricity in this country should be radically changed; the parochial system must be abandoned, and industrial consumers should be supplied from a common source, thus adding to the economy of large-scale production the advantage of improved load factor, which was of vital importance.

Briefly reviewing the history of the electricity supply industry and the recommendations of the Williamson Committee, Mr. Baldwin referred to the creation of the Electricity Commission in 1919, and outlined the work which the Commissioners had accomplished; he said that the difficulties of reorganisation which they had met with had been very great, and the present Government, with the aid of a committee of which Lord Weir was chairman, had re-examined the whole position. It was found that in this country there was an excessive number of small generating stations with high working costs, and that there were 16 frequencies in use which differed from the standard frequency. As a result of these investigations the Government had formulated proposals which would be laid before Parliament in the next Session, and which had for their purpose the improvement of the system of generating electricity. He emphasised the fact that the generation and the distribution of electricity were separate processes, each with its own problems; the former was an engineering question, the latter primarily commercial. It was not sufficient to provide a cheap supply of electricity; a good selling organisation was also essential. The distribution of electricity was already carried out on a large scale by competent organisations, such as the power companies and the big municipalities; smaller companies and municipalities were also actively dealing with the distribution of electricity to local consumers. The great need was to reduce the cost of distribution and to facilitate the formation of new authorities to undertake the supply of electricity in areas not yet covered.

As for generation, the process of concentrating all demands on large, efficient, and interconnected stations was proceeding slowly, and legislation was necessary to hasten it. The Government proposed to strengthen the powers of the Minister of Transport and the Commissioners and to set up an Executive Board covering the whole country, to establish interconnecting lines and to co-ordinate existing and future large power stations in large areas. By "Board" he did not mean a Government Department; what they had in mind was a board controlled by practical men in close touch with the industry, such as the Port of London Authority. The new Board would raise its own capital and would work on commercial lines. After it had earned interest and sinking fund on its capital, any surplus that might remain would be applied to the reduction of charges to the undertakings which it supplied.

A Government subsidy would not be required, but in order to enable the scheme to be carried out, a Government guarantee would have to be extended to it, like that given under the Trade Facilities Acts. The Board would construct interconnecting lines so that undertakers whose stations were inefficient could close them and obtain a cheaper supply from the Board's stations. The larger stations would be operated by their present owners, and future stations by those who built them, but all would work together under the Board, producing a common supply of electricity which the Board would purchase and place at the disposal of the distributors. The Board would be provided with the necessary powers to bring everybody into line, and one of its duties would be to make the frequency uniform in all the areas as they were co-ordinated. He knew that the necessity for this standardisation was not universally accepted. It was true, in the case of a non-standard area, that so long as it could remain isolated the advantages of a change-over were reduced by the cost and inconvenience of the change, but taking the country as a whole, and having regard to the anticipated rapid increase in the use of electricity, the benefits to both the consumers of electricity and the manufacturers of electrical apparatus of a single standard frequency, he was informed, were very great.

The Board would have to carry out standardisation of frequency at its own cost in all the areas as they were connected up, and they were advised that this outlay would be fully off-set by economy in generating costs. At the same time, the work of standardising frequency and constructing main transmission lines would be of material assistance to industry, whilst the outlay would be remunerative and would provide work for the electrical and allied industries.

They were satisfied that Government action was necessary to free the industry from the restrictions under which it laboured, and they believed that the scheme proposed would effect this object with the minimum disturbance to existing conditions. It was directed to the single purpose of generating electricity in the most efficient manner, and when this cheap supply was assured they believed that everyone would be able to obtain the electricity that he required.

They did not suggest that this scheme would be the salvation of industry, but every year's delay made co-ordination more difficult and expensive, and they believed that under the stress of modern competition they could not afford longer to neglect the sound organisation of power supply.

On Monday the Electricity Commissioners further explained the Government's proposal to the technical Press. We understand that they anticipate that within 15 years the annual consumption of electricity per head will increase from about 200 kWh at present to at least 500; already on the North-East coast the figure is 800, and at Rotherham it is between 400 and 500. It is hoped by the improved system to make electricity cheaper and more generally available, the latter consideration being as important as the former. The result of utilising a greater horsepower per employé in a factory is, as experience shows, a greater output and a higher rate of wages.

Out of 584 electricity supply undertakings, last year 42 produced half of the total output, at a much less cost than that of the 542 which produced the other half. The Electricity Commissioners have had data prepared for certain districts with great care, using the actual load curves, actual invested capital, estimated cost of changing the frequency, &c., and find that by concentrating generation in the best modern stations, linked up with one another, instead of in the numerous existing stations, the results would be so much improved as to effect savings sufficient to cover the cost of transmission and standardisation, and to lower the price of electricity as well. These figures, we understand, have been checked by independent authorities, and the Commissioners are satisfied that in advising the Government to proceed on the lines set forth in the Prime Minister's speech they are proceeding on the best engineering and economic grounds.

The standardisation of frequency, a necessary preliminary to complete interconnection will, it is claimed, be of enormous benefit to manufacturers, who agree that by standardising their products and manufacturing in bulk they will be able to sell apparatus at lower cost and be better able to meet foreign competition.

An important feature of the scheme is the reduction of the heavy burden of reserve plant made possible by interconnection. Last year 68 per cent. of the capacity of generating plant installed in British works was standing by; when interconnection is complete, 10 per cent. will suffice.

There will be no interference with existing distributors, who, relieved of the task of generation, will be free to concentrate on the distribution problems arising from the new demands, for which their existing mains will be inadequate. The rights of the Power Companies to supply electricity will be respected; the Board will not deprive them of their legitimate output, but care will be taken to see that economies effected by the Board's operations shall be passed on to consumers, and the working of all stations will be controlled by the Board.

It is anticipated that many of the new transmission lines will pass through rural areas and make a supply of electricity available to them, these lines serving both as interconnectors and as supply mains.

The Board will raise its own capital with a Government guarantee, but no subsidy; during the first few years it will pay interest out of capital, and the sinking fund will be suspended. It will not be a profit-making body, any surplus being passed on to the distributors. The compulsory powers of purchase cut out of the 1919 Bill will be restored; selected stations will be retained and worked by their owners under the general direction of the Board, which will decide the load factor at which each station shall operate, so as to secure the most advantageous conditions, as is already done in certain large existing systems. It is hoped to bring about a new era with the minimum disturbance. Compulsory powers will be provided to deal with undertakers who fail to appreciate the advantages of complying with the Board's requirements.

When a cheap bulk supply has been brought about by the Board with the help of the existing stations, and accompanied by standardisation of frequency, pressure, and systems of charging, the British electrical house will have been set in order.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

An Electric Vehicle Association.

I read with interest Mr. J. C. Elvy's suggestion as stated in his letter on page 118 of your issue of January 15th, putting forward the desirability of forming immediately "an association, institution, or society, consisting of those who are interested in any way whatsoever in electric vehicles."

It seems rather strange, after all the work that has been done by various persons interested during the past twelve years, not to mention the activities of the Electric Vehicle Committee and the continuous publication of a journal specially devoted to this subject which has now reached its 98th number, that this Rip-van-Winkle-like project should be put forward. One would think that Mr. Elvy had been living on another planet.

Mr. Elvy's doubtless well-meaning proposal should be regarded, in my opinion, in the light of Mr. L. L. Robinson's recent very timely remarks anent the undesirability of redundant and quite unnecessary further institutions, associations, or societies.

The Electrical Development Association, under the able direction of Mr. J. W. Beauchamp, assisted by the *personnel* of the Electric Vehicle Committee, may very safely be left to take whatever steps are practicable to maintain and advance the interests of the electric vehicle industry.

As Mr. Elvy wishes to assist this industry, I am sure he will agree that his efforts will be best directed towards co-operating with existing Institutions.

Raymond J. Mitchell, M.I.E.E.

London, *January 15th*, 1926.

Overhead Distribution.

As Mr. Redgment is retiring from the lists after his letter in your issue of the 8th, I will not occupy much of your space. I trust, however, that in the coming developments in the district, with which I hope he will be concerned, he will remember the æsthetic considerations which have been so largely neglected by engineers.

My main point is that a pole line is essentially ugly, and if sometimes it is a necessity, it is a very unfortunate one.

If, as foreshadowed in the original article, compulsory powers are given, I do not see where the difficulty of cross-country runs comes in, as compared with roadside way-leaves. It is to be hoped, however, that whatever Government authority is responsible will prove as enlightened as the Road Board, who in their treatment of the countryside, and their consideration for ancient bridges and interesting buildings, have shown that modern needs are not incompatible with the more abstract amenities of life.

In conclusion, I would assure Mr. Redgment that I did not challenge the statement of relative costs to save myself the trouble of working out the figures, but because I had already roughly done so.

S. E. Glendenning.

Norwich, *January 16th*, 1926.

Hidden Dangers.

I trust that the leading article in your current issue will receive the serious consideration it deserves.

Apparently the Home Office electricity officials are powerless to act; therefore, may I be allowed respectfully to suggest to electricity supply authorities that they could render a public service by circularising their customers with an inexpensive "warning" leaflet. Do not wait for a fatal accident as a means of warning, which incidentally would reflect adversely on the electrical development movement.

There should be no need to convince *bona-fide* electrical engineers that the danger is real, but I may inform them that in response to a letter I wrote to the lay Press (published on December 9th last) apropos electric model railways, I have received documentary evidence of shocks and injuries received.

Taking one, for instance, the writer is resident in S.W.12 postal area, and the electricity supply is 205 volts a.c. pressure, which I believe to be the County of London Electric Supply Co.'s area.

He appeals to me to do all I possibly can "to stop this kind of diabolical toy being sold." It appears that in adjusting the rails he received a severe shock and could not release himself from contact until someone who was fortunately in the room switched off; he dreads to think of the consequences if it had been his child, for whom the toy was purchased as a Christmas present; the shock might easily have proved fatal in that case. As it was, the writer had to be treated for burns and shock to system.

Obviously the risk is still existing when the lamp is removed in view of the "earth" neutral return and the possibility of metal work unintentionally "earthed" being in the room where the toy may be erected.

J. C. Elvy.

London, *January 15th*, 1926.

Telephone Charges.

No doubt many telephone subscribers will be rather startled by what is termed "An Important Notice" in the form of a leaflet attached to their accounts, which refers to non-payments.

Amongst the contents thereof we read: "Recent investigations show that the cost entailed by temporary suspensions of the service owing to non-payment has now reached a sum of about £25,000 per annum.

The layman who reads this may gasp at such a huge sum, but the *bona-fide* electrical man who knows anything about the subject will look upon these figures as absurd, unless the operator who withdraws and replaces the plug of the defaulter is paid a specially high rate for the simple operation.

The telephone has now become a great public advantage, and should not be hampered by high and unnecessary charges.

I wonder how many business men, especially in the electrical trade, have gone into figures as to the cost of a telephone installation when they are charged £1 15s. per quarter for hire of the Exchange line.

Considering that they pay full price for all their calls, the sum is perhaps round about that of a full-blown money-lender. Would not the popularity of electricity supply soon fade if station engineers so charged for their "lines"?

In my district we should be pleased to lay a great many yards of heavy underground cable to a consumer if he would pay seven pounds per annum for the hire of it, plus all he used, like telephone calls, into the bargain.

Archie Gamble.

Electricity Works, Chirk.
January 14th, 1926.

Tough Rubber Trailing Cables.

With reference to Mr. Brooking's letter on the above subject, I would state that I have been purchasing trailing cables with the earth braid fully surrounding the conductors.

However, I do not think that it is standard practice to purchase this type of cable, and many collieries are still using the type with the parallel earth wire. The fact that cable makers are manufacturing this class of cable, with the surrounding earth shield, only serves to emphasise my point that such cables are safer than the type with a separate earth wire incorporated in the cable.

As my paper was only published in extract form, it is quite possible that Mr. Brooking may have been misled.

I. Sclar.

Dunfermline, *January 11th*, 1926.

A Pneumatic Flexible Coupling.

I was very surprised to see, in your January 8th issue, the pneumatic tire form of flexible coupling described as a new idea. I would like to draw your attention to patent specification No. 123,482, and French patent 537,452, whilst as long ago as No. 21,692, of 1895, the same principles were applied between driving and driven members.

C. H. Clarke, F.C.I.P.A.

Snaresbrook, *January 13th*, 1926.

Electrical Engineering in Nigeria.

I should be extremely obliged if you could put me in touch with any electrical engineer who has had service in Nigeria.

P.T.2384 Stockton.

January 14th, 1926.

"Of the Making of Books——"

A gentleman who either acquired, or had thrust upon him, a reputation for great wisdom, on one occasion is said to have remarked: "Of the making of books there is no end." As that gentleman lived and died during the 10th century B.C. one trembles to think what he might have said had he been here to-day.

In 1920 I received an announcement from some publishers that a certain book was in the press and would be completed shortly. The approximate price would be 50s. I was invited to order, and I fell. In 1921 the first volume, price 25s., came along. In 1923 the second volume, price 35s., was delivered. In 1924 the third volume, price 55s., which no one had expected, completed the contract.

Even with this experience I hadn't learnt wisdom, for some two years ago I received a notice to the effect that yet another book was to be produced—one day. Approximate price 25s. It was a subject which interested me, and I 'phoned asking when it might be expected. The reply was "In a few months." In a few months I 'phoned again and the reply was "Early in the New Year" (1925)—they seemed annoyed at my persistence. Two weeks ago a beautiful tome came along—size outside covers 10 in. by 7.5 in. by 1.5 in.—containing less than 300 pages, price 36s. In the introduction it is remarked that while the subject was progressing it was deemed advisable to split the work into two volumes and the next would be ready shortly—or in the next New Year, or sometime, price ——? Will it, think you, be necessary further to sub-divide this volume, and let us wait yet another year?

I have some technical books averaging 1.7 inches between covers, and averaging 700 pages, price—present day, not pre-war—25s. Is it therefore necessary to double the thickness, and nearly treble the weight of paper to run up the price?

I appreciate to the full nice binding, nice paper, nice printing, and so on, but surely *editions de luxe* are unnecessary in technical books? Books without number were bad enough, but anyway one had a book. Now that it is a matter of books of limitless size, and each work a small library, I suggest that it is time to call a halt. Most technical books are out of date in quite a few years, and I suggest that publishers should not mulct the poor wretches who have to buy them further than is necessary to secure a fair return to themselves, to their printers, and, if anything is left over, to the authors.

I put this wail forward in all deference and shall be interested to hear if any other victims share my views, or if my complaint is unreasonable.

January 7th, 1926. **F. T. Fawcett.**

How Will "Government" Electricity Affect Us?

Let us take the good points of the scheme first. Unification of generating systems and a spread of transmission systems over the country is certainly desirable if it can be accomplished without increasing the cost of electricity to the public, and so far the scheme is all to the good; at any rate, it will ensure that these problems are carefully thought out.

The scheme, within a reasonable period, will provide a lot of work for the cable makers, plant manufacturers, and their employés.

The bad part of the scheme as it is presented by the Press is that it is dressed up to impress the public that they may expect immediate reductions in the cost of electricity. As usual, the public comes last; he may hesitate, expecting more favourable conditions, and so produce a slump. In my opinion, cheaper prices cannot result at once. The scheme is one which will not begin to show its effect much under 10 years, and will not be really beneficial to any large extent under 20 years.

The scheme, as presented by the Press, leads the public to believe that the cost of generation is the alpha and omega of the electricity supply business. This is by no means the case.

Let us assume for a moment that the provision of super-stations can save 15 per cent. of fuel and 20 per cent. of the plant cost, as compared with a good modern medium-sized station. Even then these advantages will be counterbalanced largely by the extra cost of transmission.

The promoters claim that the load factor on super-stations will be so large that it will counterbalance the disadvantage of high cost of transmission, but nobody has ever taken the trouble to prove this.

A few years ago I collected the whole of the load curves for the London area, super-imposed them, and thereby compared the load factor for the large area with the load factors of the individual areas. It was not materially greater.

The Government scheme appears to me to overlook the enormous importance of improving the load factor within each distributing area. This can only be done by making it possible for the consumers to use electricity for all purposes, such as water heating, lighting, heating, power, cooking, &c., quickly, instead of being satisfied with having so many consumers who use electricity for lighting only and not worrying about the other uses.

Electricity for lighting is cheap, owing to the great economy of modern lamps, even if the charge per unit is so high as 6d. or 8d. Electricity for lighting can never be supplied very cheaply, because the capital involved is used for so few hours during the year. However, if lighting is made to bear its proper proportion of capital cost and other overhead charges, as it easily can, the other uses can be supplied at extraordinarily low rates; in fact, I have several consumers using electricity for all purposes, who on our normal sliding scale get their supply to-day for less than 1d. per unit.

In my area, where we have realised the importance of sales and development, we already have one out of every 10 consumers cooking by electricity, and a consumer who cooks, heats and warms his bath-water will, without any alteration to his service connection to the main, use over 2,000 units per annum, whereas with lighting only he might not have consumed 200 units.

In the area with which I have the honour to be connected, I do not find that the cost of the electricity is the bar to large consumption. The difficulty is the cost of installation and apparatus, and I think the Government will enormously improve their scheme if they give to all undertakers full powers to sell and hire apparatus and installations, and full powers to enable them to provide large demonstration establishments for the education of the public in the proper use of electricity. Probably under the Trade Facilities Acts, the distribution and installation side of the business could have the help which is being proposed for the generation side of the business, and in my opinion it is at this end of the business that Government assistance will produce results more rapidly.

L. L. Robinson.
Borough Electrical Engineer.

Electricity Department, Hackney,
January 18th, 1926.

[Several letters have been received too late for insertion.—EDS. ELEC. REV.]

Electrical Imports of Java.

THE following statement, based on the recently-issued official statistics, shows the values of the imports of electrical and allied material into Java and Madura during 1924. Comparative figures for 1923 have also been given for purposes of comparison and notes of increases or decreases added.

	1923. Guilder.	1924. Guilder.	Inc. or dec. Guilder.
Electric lamps, incandescent.—			
Total	733,000	704,000	– 29,000
From Holland	320,000	462,000	+ 142,000
,, Germany	278,000	163,000	– 115,000
,, Japan	57,000	28,000	– 29,000
Electric lamps, other.—			
Total	194,000	116,000	– 78,000
From Holland	83,000	60,000	– 23,000
,, Great Britain	4,000	5,000	+ 1,000
,, Germany	92,000	38,000	– 54,000
Electrical apparatus.—			
Total	845,000	736,000	– 109,000
From Holland	212,000	264,000	+ 52,000
,, Great Britain	16,000	30,000	+ 14,000
,, Germany	452,000	344,000	– 108,000
,, Japan	56,000	38,000	– 18,000
,, United States	68,000	37,000	– 31,000
Electric wire and cable, copper.—			
Total	998,000	1,000,000	+ 2,000
From Holland	318,000	609,000	+ 291,000
,, Great Britain	31,000	7,000	– 24,000
,, Germany	572,000	203,000	– 369,000
,, Japan	31,000	153,000	+ 122,000
Dynamo-electric machinery.—			
Total	655,000	899,000	+ 244,000
From Holland	327,000	560,000	+ 233,000
,, Great Britain	21,000	13,000	– 8,000
,, Germany	242,000	245,000	+ 3,000
,, France	5,000	2,000	– 3,000
,, Italy	53,000	48,000	– 5,000
,, United States	3,000	28,000	+ 25,000
Other electrical machinery.—			
Total	734,000	635,000	– 99,000
From Holland	230,000	194,000	– 36,000
,, Great Britain	35,000	52,000	+ 17,000
Germany	383,000	308,000	– 75,000
,, United States	19,000	51,000	+ 32,000
Iron and steel wire for electrical transmission.—			
Total	145,000	325,000	+ 180,000
From Holland	16,000	138,000	+ 122,000
,, Great Britain	8,000	8,000	—
,, Germany	81,000	156,000	+ 75,000
,, United States	14,000	10,000	– 4,000

Guilder = 1s. 8d.

Reviews.

Transmission Circuits for Telephonic Communication: Methods of Analysis and Design. By K. S. JOHNSON, Member of Technical Staff, Bell Telephone Laboratories. Pp. viii + 326; illustrated. London: The Library Press, Ltd. Price 21s. net.

This volume is the evolutionary product of notes made by the author during the past 15 years. In their original form they were utilised by him during the session 1918-19, when conducting a special course for other members of the Western Electric Co., who were interested in the analytical study of telephonic transmission. In the winter of 1921-22 they were used in a series of lectures at Harvard University at the invitation of the Electrical Engineering Department of that college.

The scope of the work is "to cover the general theory and principles which are applicable to the development and design of circuits and lines for association with such telephonic instruments as transmitters, receivers, and vacuum tubes."

The reader is expected to be familiar with the elements of alternating-current theory, the operations of the differential calculus, and with the notations and operations of the "complex quantity" method of representing alternating functions.

There are in all 19 chapters and seven appendices dealing successively with the acoustical properties of the voice, ear, transmitter and receiver; measures of telephonic frequencies; circuits involving simply transmitters and receivers; simple series circuits; Kirchoff's laws and reciprocity theorem; characteristics of ideal transformers; transformer and transition losses, Thévenin's theorem and equivalent T networks; computation of transmission losses; substation circuits; treatment of passive networks as equivalent smooth lines; transmission characteristics of telephone lines; loaded circuits; telephone repeaters; resonant and anti-resonant circuits; theory and

design of wave filters; corrective networks or equalisers, and superimposed circuits. It will, therefore, be seen that the problems of transmission which the telephone engineer has to deal with at the present day have been adequately covered. Not the least interesting chapter in the book is that in which the author, in dealing with measures of telephonic frequencies, discusses the "transmission unit." Although there is much to be said in favour of the American definition of this unit, it is somewhat premature, pending the decision of the International Conference, to call it "the new transmission unit." The "βl" form has still to be reckoned with.

From first to last, the entire treatment of the subject is thorough; the reader being led gradually from the simplest line problems to those of considerable complexity, as in the case of passive networks. The increasing importance of filters has been fully appreciated by the author, who discusses the theory and design of the various types of wave filters in a clear and exhaustive manner. In fact, the clarity of exposition is one of the many excellent features of this manual—a statement which cannot be applied indiscriminately to works of this class.

The compendium of mathematical formulæ and the mathematical appendices given at the end is the most complete we have yet seen. The text is exceedingly well printed, and numerous diagrams are given illustrative of the associated subject matter.

The book will undoubtedly take its place as one of the best manuals that have yet appeared on the subject of telephonic transmission.

The Nagaoka Anniversary Volume. Pp. xvi+423; illustrated. Tokio: The Imperial University.

This volume is dedicated to Prof. Hantaro Nagaoka by his friends and pupils to mark the completion by him of 25 years' professorship, and has been in preparation, under the guidance of a committee, since February, 1921, but publication was delayed by the great earthquake in Japan. Prof. Nagaoka, who was born in 1865, took the degree of D.Sc. at the Tokio Imperial University in 1893, and as a Government student studied in Europe under such men as Helmholtz and Planck. In 1896 he was appointed to the chair of Physics at his mother University, his present post. He has received many distinctions, including that of Hon. Fellow of the Physical Society of London, in company with Mme. Curie, Lorentz, and Michelson. His scientific work has been specially directed towards magnetism and geophysics, and, more recently, radio-transmission. He is credited with being the first to propound the nuclear structure of the atom, in December, 1903, a subject in which he is keenly interested.

The splendid volume before us contains a list of Prof. Nagaoka's published papers, and a symposium of more than 40 papers by different authors on physical subjects, of which a considerable proportion deal with electrical phenomena. Amongst the latter are the following: "A sensitive electroscope," by T. Shimizu; "Electrically deflagrated mercury filament as a flash light for instantaneous photography," by K. Suychiro; "A component anemometer," by K. Fuji; "The effect of magnetic fields on electrical resistance of some alloys," by J. Obata; "Studies on dielectric hysteresis and allied phenomena," by H. Saegusa; and "The electric resistances of tungsten wires," by J. Tsukamoto.

The book is admirably produced, the paper, printing, and illustrations being of the highest order, and worthy of the notable occasion which it celebrates.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 13th. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Hush-A-Phone, New York (lettering and design). No. 457,459. Class 8. Sound-muffling devices for use with telephones.—The Hush-A-Phone Corporation, 19, Madison Avenue, New York. (Dr. A. L. Mond, 19, Southampton Buildings, W.C.2.)

Director (lettering and design). No. 459,088. Class 8. Apparatus for use in automatic telephony.—Automatic Telephone Manufacturing Co., Ltd.

Nanazo. No. 458,865. Class 8. Electric cables.—Cable Makers' Association.

Solex Signs (lettering and design). No. 459,774. Class 8. Electrical advertising signs.—Solex Signs, Ltd., Windsor House, Victoria Street, S.W.1.

Radiovim (lettering and design). No. 464,154. Class 8. Apparatus for use in radio-telegraphy and telephony.—Radiovim, Ltd., 24, The Elms, Dingle, Liverpool.

Listron. No. 464,598. Class 8. Detector crystals for use in radio-telephony and telegraphy.—G. J. Barley, 30, Ranelagh Gardens, Barnes, S.W.13.

Enoni. No. 461,832. Class 13. Electric lamps (ordinary).—Osram Gesellschaft, Berlin. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

Orion. No. 464,223. Class 13. Electrical fittings.—Magyar Wolfram Lampa-Gyar Kremenezky Janos Reszvenytarsasag, Budapest. (Dicker and Pollak, 20-23, Holborn Viaduct, E.C.1.)

Orca. No. 464,612. Class 50. Electrical insulating goods.—Etablissements Poulenc Frères, Paris. (Carpmaels & Ransford, 24, Southampton Buildings, W.C.2.)

Shannon Scheme Dispute Ended.—It is reported that the strike which was holding up the Shannon hydro-electric scheme has been brought to an end by a decision of the Limerick dockers to unload the steamers which are bringing materials for the scheme to the Free State.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

14,602. "Quick-acting electric voltage regulator for dynamo-electric generators." F. B. Dehn (Neufeldt & Kuhnke). June 17th, 1924. (244,803.)

14,642. "Electric discharge devices." Dr. E. F. Huth Ges. June 27th, 1923. (218,276.)

17,803. "Electrical windings." S. Z. de Ferranti. July 25th, 1924. (244,807.)

19,296. "Electrical heating apparatus." J. A. Law (W. E. Hudson). August 14th, 1924. (244,808.)

19,974. "Wireless signalling." Soc. Française Radio-Electrique. August 23rd, 1923. (220,958.)

21,953. "Synchronising systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). September 17th, 1924. (244,814.)

22,052. "Plug-and-socket members for use in connection with wireless apparatus." Igranic Electric Co., Ltd., A. H. Curtis, and G. F. Dandridge. September 18th, 1924. (244,817.)

22,064. "Selectors and telephone systems operating with selectors." F. Aldendorff. January 14th, 1924. (227,792.)

22,440. "Electrical fuses." H. P. L. Higman. September 23rd, 1924. (244,825.)

22,672. "Moulded battery boxes." British Thomson-Houston Co., Ltd., A. P. Young, and A. G. Salisbury. September 25th, 1924. (244,833.)

22,758. "Electro-pneumatic hammer." A. C. J. Guenee. October 6th, 1923. (222,858.)

22,779. "Means for inductively coupling electric circuits." Igranic Electric Co., Ltd., and W. K. Alford. September 26th, 1924. (244,841.)

23,310. "Controllers for electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). October 2nd, 1924. (244,850.)

23,452. "Means for locking and unlocking electric switch plugs." J. H. Gath. October 4th, 1924. (Addition to 175,794.) (244,851.)

23,960. "Control devices for electric illuminating signs." W. Ostermayer. October 9th, 1924. (244,854.)

24,491. "Electrical transforming devices and associated telephonic receivers." E. A. Graham. October 15th, 1924. (244,858.)

24,674. "Small electric arc lamps." T. C. Angus. October 17th, 1924. (244,862.)

24,699. "Method of, and means for supporting electrodes in thermionic valves and the like." W. R. Bullimore. October 17th, 1924. (244,864.)

24,921. "Electric welding and the like." G. B. Ellis (T. E. Murray). October 20th, 1924. (244,866.)

24,967. "Manufacture of thermionic valves." W. J. Pattison, A. J. Holyoak, and W. L. Turner. October 21st, 1924. (244,867.)

25,058. "Loud-speaking telephones and like sound-emitting and converting apparatus." British Thomson-Houston Co., Ltd., A. P. Young, and J. H. Butcher. October 21st, 1924. (244,868.)

25,351. "Contact drums for electric controllers." Igranic Electric Co., Ltd., and C. F. Tubbs. October 24th, 1924. (244,871.)

25,663. "Circuit arrangement for transmitting current impulses in automatic telephone exchanges." Siemens & Halske Akt.-Ges. and M. Langer. October 28th, 1924. (244,874.)

26,294. "Insulator bushings for switchgear and other electrical apparatus." British Thomson-Houston Co., Ltd., H. C. Heath, and H. E. Cox. November 4th, 1924. (244,878.)

26,352. "Variable inductance devices." E. W. Hovenden. November 5th, 1924. (244,879.)

26,400. "Construction of multiple-way coil-holder for wireless telegraphy or telephony." E. T. P. Kerridge and F. W. Trendell. November 5th, 1924. (244,880.)

26,595. "Automatic circuit-breakers." Crompton & Co., Ltd., and W. F. Jones. November 7th, 1924. (Addition to 199,526.) (244,885.)

27,762. "Lead or like metal-sheathed electric cables." British Insulated Cables, Ltd., and J. L. Packer. November 20th, 1924. (244,889.)

28,568. "Process for regulating the speed of alternating-current machinery." British Thomson-Houston Co., Ltd. November 28th, 1923. (225,564.)

29,094. "Electromedical appliances." C. A. Baker and J. Bell & Croyden, Ltd. December 4th, 1924. (244,901.)

29,099. "Wireless distributor boards." W. H. Bushell and J. Merrett. December 4th, 1924. (244,902.)

30,155. "Selective protective apparatus for electrical circuits." Akt.-Ges. Brown, Boveri et Cie. December 15th, 1923. (226,240.)

30,365. "Electromagnetically-actuated electric switch mechanism." Commanditaire Vennootschap Froger's Electriciteits Maatschappij. January 19th, 1924. (227,810.)

30,898. "Means for establishing or breaking the connection of two electric conductors." J. D. Coenraads. January 5th, 1924. (227,101.)

31,124. "Telephone table sets." F. Merk. December 13th, 1924. (244,389.)

31,165. "Advertising and electrical testing device." General Electric Co., Ltd., and J. F. Turner. December 29th, 1924. (244,917.)

1925.

131. "Process for the manufacture of articles in fused silica, more especially intended for electro-technical uses." Quartz & Silice. October 30th, 1924. (242,214.)

172. "Device for hermetically sealing electric leading-in wires in a glass wall." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 23rd, 1924. (234,441.)

506. "Sound-emitting devices." British Thomson-Houston Co., Ltd., and A. P. Young. January 7th, 1925. (244,926.)

2,402. "Gaseous electric space current device." American Appliance Co. March 1st, 1924. (230,026.)

3,071. "Electric cables." W. T. Henley's Telegraph Works Co., Ltd., and W. W. Watkins. February 3rd, 1925. (244,944.)

4,554. "Testing apparatus for sparking plugs." H. J. C. Forrester (Wankmueller & Co. Ges.). February 18th, 1925. (244,949.)

4,750. "Apparatus for improving the power factor of induction motor combinations." British Thomson-Houston Co., Ltd. February 26th, 1924. (230,054.)

5,741. "Process for the manufacture of large crystals." General Electric Co., Ltd. May 26th, 1924. (234,449.)

6,490. "Terminal connector." Brandes, Ltd. (M. C. Rypiniski). March 10th, 1925. (244,962.)

6,771. "Suspension insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). March 12th, 1925. (244,965.)

7,061. "Telephone table set." F. Merk. February 9th, 1925. (244,968.)

8,586. "Incandescent cathodes for discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenbrieken. April 8th, 1924. (232,201.)

10,592. "Protective arrangement for alternating-current generators." Siemens Schuckertwerke Ges. April 24th, 1924. (232,972.)

10,975. "Electric insulators." G. V. Dowding and K. D. Rogers. April 28th, 1925. (244,981.)

13,588. "Floor-levelling devices for electric elevators." Waygood-Otis, Ltd. June 18th, 1924. (235,858.)

15,681. "Electric oil switches." International General Electric Co., Inc. August 8th, 1924. (238,194.)

15,819. "Electric lamps." S. D. Angelo. June 18th, 1925. (245,008.)

15,982. "Inductance coils for use in wireless systems." F. Hasnip. June 20th, 1925. (245,010.)

16,664. "Electric protective devices for the discharge of high potentials." British Thomson-Houston Co., Ltd. September 5th, 1924. (239,491.)

The

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The Government Scheme.

IN our last issue we dealt at some length with the proposals outlined by Mr. Stanley Baldwin in his speech at Birmingham, devoting special attention to the features which involved a heavy capital expenditure—namely, the establishment of a huge grid of interconnecting mains, and the standardisation of frequency which is a corollary to it; we felt it incumbent upon us to utter a vigorous protest against this course at the earliest possible moment, and our action has received support from various quarters. It will be within the recollection of our readers that the president of the Institution, Mr. R. A. Chattock, expressed similar views with great earnestness in his inaugural address to the Institution of Electrical Engineers; and his immediate predecessor, Mr. W. B. Woodhouse, in the course of an interview with a representative of the *Yorkshire Post*, adopted a similar attitude, pointing out that there did not appear to be any advantage in linking-up power stations situated in different coalfields. In his opinion it would be preferable to ascertain in each area what was in the best interests of the public. As long ago as last April we adversely criticised a scheme which closely resembles that embodied in the proposals of the Government, and over a year ago we questioned the advisability of erecting long mains all round the country, and the wholesale standardisation of frequency. Similar views are expressed by contributors elsewhere in this issue, and last week Mr. L. L. Robinson sent us a letter to the same effect. It is interesting to note that Prof. G. Forbes, so well-known in connection with the inception of the Niagara scheme, favours the retention of the 25-cycle frequency.

But we did not pretend to exhaust the discussion of the scheme, which embodies many other features, less controversial than those to which we have referred. The new Executive Board will be charged with the duty of building new power stations wherever they are required and are not otherwise provided, and will control the operation of all the large power stations so as to secure the best possible results. It would appear, therefore, that in some respects it will perform the functions and possess the powers which were outlined for the proposed Joint Electricity Authorities in the Bill of 1919, but which were cut out by the action of the House of Lords.

It is not clear to us why the original intentions are not to be carried out, or why a nation-wide district should thus have been superimposed upon the Electricity Districts which have been delimited by the Electricity Commissioners during the past six years. Apart from the famous grid and the standardisation of frequency, the new Executive Board appears to be a glorified Joint Electricity Authority with the difference that its members will not be elected. If the full powers were conferred upon the existing J.E.A.'s and the various Advisory Boards were abolished and fully representative Authorities armed with the necessary powers, were constituted in their place, development could proceed on the normal lines contemplated in the 1919 Bill. Each District would be licked into shape by its own Authority; the existing works would be purchased where necessary, and new stations would be erected as the need arose, all such stations within the bounds of a given District being interlinked. Inefficient stations would be closed or converted into substations, and the supply would be extended by the activities of the Authority into those areas where it is not at present available. Each area having thus been developed up to its boundaries, would eventually link up with adjoining areas by a natural sequence, and the national network would come into existence automatically. That capital would be forthcoming for these purposes without the aid of the State cannot be questioned, in view of the readiness with which the public has over-subscribed for the new issues of electricity supply companies in recent years. The Authorities were empowered by the Act of 1922 to lease the undertakings to private enterprise, over which, of course, they would retain control to ensure that prices and dividends were regulated in the interests of the consumers, as is done by the Public Service Commissions in the United States. Such a procedure would involve the minimum of disturbance to existing conditions and would facilitate rapid development on normal lines. The standardisation of frequency could be undertaken as and when it was required, and each District would remain under the control of men who were familiar with its needs and its resources. Unfortunately, an unsensational programme such as this would have lacked the political attractiveness of such a magnificent "gesture" as that presented by a proposal to cover the whole country with a grid of super-high-pressure mains and to scrap all a.c. apparatus not endowed with the magical frequency of 50 cycles.

As the Prime Minister pointed out, one of the greatest needs of the present time is to hasten the introduction of electricity supply into the areas which do not yet enjoy that advantage. How many and how large are those areas will be gathered from the series of maps which we are publishing from time to time, for the express purpose of drawing attention to these uncultivated fields. Whether the occupation of such areas would be hastened by the installation of a "grid" of overhead mains at a pressure of 100,000 volts is somewhat questionable. It must be borne in mind that to tap a 100,000-volt main is no light matter; it involves the erection of switchgear capable of breaking an enormous wattage at every tapping point, together with step-down transformers, at a prohibitive cost, and as the time pressure would be subject to very wide fluctuations, pressure-regulating apparatus must be provided under the control of a competent staff. Such tapping points, therefore, must be limited to the smallest possible number. Far less expense would attach to the use of automatic substations on distribution mains at 20,000 volts, which would suffice if there were no question of linking far-distant stations, as in the case of a supply from the Joint Authority's mains. That the Electricity Commissioners contemplate the tapping of their interconnecting mains, thus converting them into busbars, cannot be doubted in view of their own statement that these mains would pass through rural districts and distribute electricity to the local townships on the line of route, a system which appears to us highly objectionable on technical grounds.

Big Men and Big Policy.

In a leading article entitled "Men of Vision" (ELEC. REV., October 23rd, 1925, p. 641), in referring to the greatness of the future of electricity supply business in the United Kingdom, we ventured the opinion that big and commanding personalities would be required—"men of the grand vision type." We quoted an American view, which showed that, in spite of the advanced state of electrical development in the States, the need was felt for more big commercial men with vision at the head of their public utilities. Mr. Lloyd, the chairman of the Commercial Section of the National Electric Light Association, expressed the need of commercial departments of utilities for more leaders with broad enough vision to see the real problem that lay ahead—men of outstanding ability to see that the big problems of those departments were economic as well as technically commercial. We expressed the hope that as the day of big areas was with us, the parochial spirit would give place to the larger view and create conditions favourable to the development of big men. The subject is of interest in connection with excusable speculation that is being indulged in regarding the *personnel* of the new Board of business men that was referred to in Mr. Baldwin's Birmingham speech. But apart from that bearing of the subject, we are interested in a further view expressed in the States. This time the counsel comes from the president of Mr. Lloyd's Association, the N.E.L.A., and it is issued as a "Challenge to Commercial Men." If anybody else follows a recent newspaper stunt lead and suggests that Britain needs to look to the States for experts to help her in the work of electrical development, let him read the views of Mr. James E. Davidson, the aforesaid president, in his challenge in the *Electrical World* for January 2nd, where he shows emphatically that the American electric light and power industry needs a better merchandising spirit and greater activity in building up the residential load. Mr. Davidson says that, while any company with a reasonably good organisation and sufficient credit can build up a physical property, it requires a well-organised operating and sales organisation to bring complete success. Much of the success so far has "naturally gravitated" to the systems with little aid from sales-work. "Sales activity alone would take the unprofitable valleys out of the landscape of the electric light and power industry." All that is required to adequately serve the consumer and to increase earnings of the shareholder is "sufficient interest in the sale of energy and in merchandising, 'bang-up' sales organisation, careful planning, and the expenditure of good, hard energy."

Having said these things ourselves so frequently, though in our own terms, we quote them with full approval, because they apply appropriately to the situation on this side. Let us hope that the importance of sales organisation will be appreciated in its true light by those who have the selection of the right men to guide our national commercial electrical policy.

Super-Sales Organisations.

THERE was one sentence in Mr. S. Baldwin's Birmingham speech which deserves to be isolated as a particularly fruitful subject for meditation. Here it is: "It is not enough to have cheap electricity available, there must be a good selling organisation ready to meet the particular requirements and idiosyncrasies of the actual individual consumer, who is the man we want to benefit, able also to extend the uses which consumers make to-day of electricity—in short, to apply all the skill and energy peculiar and necessary to the salesman." Mr. Baldwin has nearly, but not quite, hit the nail on the head. He is right as to the indispensability of a "good selling organisation," but that dictum would equally apply to any industry, say to the ready-made clothes business. But in the latter case a manufacturer establishes a factory routine by which he turns out a stock of suits at very low prices and then sends out an army of salesmen to dispose of them. It was this somewhat faulty

analogy that Mr. Baldwin seems to have had in mind when he premised that "it is not enough to have cheap electricity available." As a matter of fact, you cannot have "cheap electricity available" in the sense that you can have ready-made suits available. You can have, of course, a highly-efficient station, but whether the electricity turned out is cheap or not depends on what the salesmen sell. If they don't sell enough, the station is insufficiently loaded and the cost is dear, and the same applies if the salesmen do not sell a *varied* supply. So, in a sense, you do not have "cheap electricity available" for the salesman to sell—but his selling makes the electricity cheap or dear, as the case may be. Mr. Baldwin, therefore, was right in his estimate of the importance of the selling organisation, but he under-estimated it by an unconscious assumption that the sales organisation was provided beforehand with cheap electricity to sell instead of its being itself a factor in making it cheap. Of course, it may be retorted that this is only a quibble, as in actual practice a salesman is sent out with prices. But such prices are the result of the previous salesmen's successes or failures. It is the sales that, within limits, regulate the costs. For instance, a London company had not a "cheap supply" to offer to the Southern Railway—but it knew that when its "sales organisation" had secured the load its costs would be such as to allow it to give a cheap supply with a margin of profit. So the "sales organisation" is, as Mr. Baldwin premised, a most important factor in bringing into actuality a "cheap supply," given, of course, as an antecedent, efficient plant and a comprehensive distribution system. But has this importance of the "sales organisation" been adequately appreciated up to the present? In some undertakings it may be so, but in many this side of the business is not accorded much dignity, to say the least of it. But how, as we have shown in the preceding leaderette, when groupings and co-operation are tending towards bigger units of administration, the importance of the "sales organisation" will be proportionally increased, and it is to be hoped that the Prime Minister's words quoted above will not fall on deaf ears. Super-power station development must be accompanied by super-sales organisations, if they are to result in cheap electricity!

A National Electrical Convention.

At the dinner of the South-Midlands Centre of the Institution of Electrical Engineers, Mr. S. T. Allen, borough electrical engineer of Wolverhampton, put forward with much emphasis a proposal that a great national convention comprising all the leading British electrical societies should be brought together. This is an idea with which we are in hearty sympathy. We have made similar suggestions from time to time during the past twenty years, and it will be remembered that in 1921 the matter was under serious consideration at the instance of Major H. Richardson, who was then burgh electrical engineer of Dundee, and was also that year president of the I.M.E.A. Mr. Allen is a past president of that Association, and for some years served as chairman of the Electrical Development Association; he has also been chairman of the South-Midland Centre of the I.E.E., and has taken an active part in many other organisations. He is therefore well acquainted with the conduct of conventions on the modest scale which they have hitherto attained in this country, and is fully aware of the enormous amount of labour involved in the preliminaries and in the actual performance on such occasions; he is also, we believe, well informed regarding the methods adopted and the procedure in vogue at the huge conventions of the National Electric Light Association, which are held annually in the United States. The fact, therefore, that he is advocating such an assembly encourages us to believe that the suggestion is practicable. It has been urged in opposition to previous proposals of this nature that it would be impossible to find accommodation for an attendance of, say, 2,000 persons at any suitable town in this country; but in refutation of this objection we may point out that the British Association annually holds a convention of similar magnitude and succeeds in finding accommodation for its members at various centres in turn. It would seem, therefore, that this particular difficulty is not insuperable, though it may be necessary to choose the month of September for the purpose of the Convention.

It may be questioned whether the advantages derived from holding a joint meeting counterbalance the drawbacks attending such a huge gathering; obviously there would have to be several meetings in progress at the same time, and the proceedings, if printed, would constitute a bulky volume of which only portions would be of value to individual members. On the other hand, full weight should be attached to the enormous influence that would be exercised by such a convention upon the minds of the outside public. On such an occasion the lay Press would be represented in full force, and the publicity that would result would be of immense value to the electrical industry in all its branches. There is no doubt that efficient advertisement is of the first importance to the development of the electrical industries, and there is no better advertisement than such a congress as that which we have in view.

The organisation of the convention would occupy many months; it could not possibly be held before the autumn of 1927, even if the preparations were set on foot at once. If, therefore, Mr. Allen's suggestion meets with general approval, and it is desired to hold a congress next year, immediate action must be taken to ascertain the views of the various councils concerned, and if they are favourable, to set up the necessary machinery for the purpose. Expressions of opinion from those who are interested in the scheme would be welcomed.

How?

The engineer who knows how, is the man to consult. The other man who doesn't may pose admirably; but he cannot always pose.

No engineer, nor any man, knows *how* all round, however. The *bona fide* engineer is always progressing because always learning. This questing spirit becomes a habit. Such a man is always respected if not liked. The slacker or the impostor knows him and shuns him as poison. He remains a learner to the end, and thus may be truly named *master*. He carries through life his child's thirst for information. He asks many questions, and patiently wins an answer. He finds things out. Every time he makes an experiment, he asks a question; often it takes months, sometimes years, to obtain a definite reply. Usually he spells out the answer slowly, painfully; and only partially. Other and kindred inquiring minds carry the solution a stage further.

There is no royal way to learning; research wins most of its trophies hardly and slowly. Yet the gains which are gathered amply repay those who toil. More than anything else, however, it is the quest which is at once its own lure and its own superabundant reward. So men—engineers—are learning to apply X-rays for the inspection of metals. Flaws, it is claimed, can be detected even though they be hidden under three inches of steel. With almost infinite patience other men are building up non-ferrous alloys. All this is done by the informed and persistent asking of questions—the finding out *how*.

It is not every one who can be a pioneer, nor everyone who has the opportunity or the ability to prosecute elaborate and important research work. All, however, can use and develop the natural powers of observation; all can cultivate the true spirit of inquiry, and can learn *how* things are done, and how these things function. It means carrying on through maturity that passion for knowing the inwardness of things which characterises the earlier years of life. In the case of the engineer, this temper naturally expresses itself in the determination to understand and master processes. The young engineer especially should keep eyes alert and mind active. The thing after a time becomes almost second nature. It is the Sherlock Holmes instinct applied to the physics of the workshop, the test bed, and design. It is akin to the quest of a Pasteur, a Marconi, a Sorby, a Parsons, a Bragg.

Electricity Supply in Great Britain.—X.*

South Wales and Monmouthshire.

THE South Wales Electricity District, as provisionally determined by the Electricity Commissioners in 1920, includes the following areas:—

The County Boroughs of Cardiff, Merthyr Tydfil, Newport and Swansea;

The Administrative Counties of Brecknock, Carmarthen, Glamorgan, Pembroke and Radnor;

The Administrative County of Cardigan, except so much as comprises—The Municipal Borough of Aberystwyth, the Rural District of Aberystwyth, and the Rural District consisting of the Township of Ysgubor-y-Coed;

The Administrative County of Monmouth, except so much as comprises—The Municipal Borough of Monmouth, the Urban District of Chepstow, the Rural Districts of Chepstow and Monmouth.

The accompanying maps cover the whole of this Electricity District, as well as the parts of Cardiganshire which are included in the North Wales and South Cheshire Electricity District, and the parts of Monmouthshire included in the Lower Severn Electricity District (as provisionally determined).



Electricity Supply in Glamorgan and Monmouthshire.

The South Wales Electrical Power Distribution Company has various powers under its Acts over the whole of the county of Glamorgan and that part of Monmouthshire which lies to the west of the River Usk, including the associated County Boroughs, as well as several Electric Lighting Orders and Electricity Special Orders over certain areas for general supplies.

The following is the list of existing authorised undertakers (whose areas are shown hatched); those owning generating stations are printed in heavy type:—

LOCAL AUTHORITIES.

Aberdare Urban District Council.
Abersychan Urban District Council.
Abertillery Urban District Council.
[1]Aberystwyth Corporation.
Ammanford Urban District Council.
Bedwas and Machen Urban District Council.
Bedwellty Urban District Council.
Bridgend Urban District Council.
Caerphilly Urban District Council.
Cardiff Corporation.
Cardiff Rural District Council.
Ebbw Vale Urban District Council.
Gelligaer Urban District Council.
Llandilo Urban District Council.
Llandrindod Wells Urban District Council.
Maesteg Urban District Council.
[2]**Monmouth** Corporation.
Mountain Ash Urban District Council.
Mynyddislwyn Urban District Council.
Neath Corporation.
Neath Rural District Council.
Newport Corporation.
Ogmore and Garw Urban District Council.
Penybont Rural District Council.
Pontypridd Urban District Council.
Port Talbot Corporation.
Rhondda Urban District Council.
Risca Urban District Council.
Swansea Corporation.
Tenby Corporation.
Tredegar Urban District Council.

COMPANIES.

Aberayron & Dist. Elec. Supply & Power Co., Ltd.
Carmarthen Electric Supply Co., Ltd.
[2]**Chepstow** Electric Lighting & Power Co., Ltd.
[1]**Chiswick** Electricity Supply Corporation, Ltd.
Glantawe Electric Supply Co., Ltd.
Gorseinon Electric Light Co., Ltd.
Llanelly & Dist. Elec. Lighting & Traction Co., Ltd.
Merthyr Electric Traction & Lighting Co., Ltd.
Ogmore Valley Elec. Light & Power Supply Co., Ltd.
Penarth Electric Lighting Co., Ltd.
Pontypool Electric Light & Power Co., Ltd.
South Wales Electrical Power Distribution Co.

All the above undertakers (except where otherwise indicated) are in the South Wales Electricity District;

[1] In North Wales and South Cheshire Electricity District.

[2] In Lower Severn Electricity District. (The Chepstow E. L. & P. Co.'s area extends into Gloucestershire.)

* Parts I-IX of this series appeared in the ELECTRICAL REVIEW of October 9th, 16th, 23rd, and 30th; November 13th and 30th, December 1th and 25th, 1925, and January 15th, 1926.

this coincides with Area No. 12 of the Electricity Commissioners' publication "Generation of Electricity in Great Britain," in which the following figures are given for this District:—

Year ending March 31st.	kWh generated.
1922	124,596,623
1923	144,579,252
1924	172,929,418
1925	206,611,941



The total h.p. of electric motors in the coal-mining industry of South Wales and Monmouthshire is nearly half a million, but it is estimated that the public supply stations generate about one-third only of the electricity used for power purposes in this District.

Unfortunately the frequency of the Power Company's supply is 25 cycles, whereas the plant of the Corporations of Swansea, Cardiff and Newport is nearly all 50 cycles, but with a standardisation of frequency and a linking-up of stations in this District, new records might be set up in the electricity supply industry.

The areas for which applications have been lodged are also shown hatched on the maps. Certain particulars of these are given in the Fifth Annual Report of the Electricity Commissioners and also in the *London Gazette*.

The application of West Gloucestershire Power Company, Ltd., includes the Urban District of Usk, the Rural District of Monmouth, and parts of the Rural Districts of Chepstow and Pontypool.

The South Wales E.P.D. Company have applied for Special Orders in respect of the Urban Districts of Llantarnam and Llanfrechfa Upper, and for parts of the Rural Districts of Llantristant and Llantwit-Fardre and Cowbridge. Other applications have been made by the following local authorities:—

Pontardawe Rural District Council.

Brecon Corporation.

Llantarnam Urban District Council.

Barry Urban District Council.

Porthcawl Urban District Council.

Bridgend Urban District Council.

The Brynamman and District Electric Supply Company, Ltd., has also applied for statutory powers.

The following particulars are taken from the 1921 Census:—

Administrative County and Associated County Boroughs.	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Brecknock ...	469,281	61,222	13,350	885
Cardigan ...	443,189	60,881	14,909	1,128
Carmarthen ...	588,472	175,073	39,056	2,317
Glamorgan ...	520,456	1,252,481	263,857	10,314
Pembroke ...	393,003	91,978	21,131	2,649
Radnor	301,165	23,517	4,913	463
Monmouth ...	349,552	450,794	96,346	4,091
Total ...	4,004,013	2,115,946	453,562	21,847

*These maps are reproduced by permission of the Controller of H.M. Stationery Office. The originals were prepared by the Ordnance Survey Department for the 1917 Boundary Commission.

The following alterations of areas, &c., have been made since 1917:—

(1) The Parish of Pontyberem has been created by uniting parts of the Parishes of Llanelly Rural, Llannon, Llanarthney, Llanddarog and Llangendeirne.

(2) Part of the Parish of Llanstadwell has been added to the Urban District and Parish of Neyland.

(3) The County Borough of Swansea has been extended so as to include the Urban District and Parish of Oystermouth, the Parishes of Brynau, Cockett and Llansamlet, and parts of the Parishes of Clase Rural and Penderry. The remaining parts of these two Parishes have been united to form the new Parish of Llangyfelach. The Parish of Brynau has been added to the Parish of Oystermouth, and the Parishes of Cockett and Llansamlet, and the included parts of the Parishes of Clase Rural and Penderry have been added to the Parish of Swansea.

(4) The Parish of Saint Kingsmark and part of the Parish of Saint Arvans have been added to the Urban District and Parish of Chepstow.

(5) The Parishes of Henfynyw Lower and Llanddewi Aberarth Lower have been amalgamated to form the new Parish of Aberayron, co-extensive with the Urban District of Aberayron.

(6) The Urban District and Parish of Margam, the Parish of Michaelston Lower and part of the Parish of Baglan Lower have been added to the Borough and Parish of Aberavon, which have been re-named the Borough and Parish of Port Talbot.

(7) The remaining part of the Parish of Baglan Lower (see alteration No. 6) was added to Urban District and Parish of Briton Ferry.

(8) The Urban District and Parish of Briton Ferry (as enlarged by alteration No. 7), and part of the Borough and Parish of Port Talbot and part of the Parish of Llantwit Lower have been added to the Borough and Parish of Neath. The remaining part of the Parish of Llantwit Lower was added to the Parish of Clyne.

(9) The Rural District of Llandaff and Dinas Powis has been re-named the Rural District of Cardiff.

(10) Parts of the following Parishes have been added to the County Borough and Parish of Cardiff: Caerau, Llandaff, Llanedeyrn, Llanishen, Michaelston-super-Ely, Saint Fagans and Whitchurch. The remaining parts of the Parishes of Caerau, Llandaff, Llanishen and Michaelston-super-Ely have been added to the Parishes of Michaelston-le-Pit, Leckwith, Lisvane and Saint Fagans, respectively.

(11) The Urban District and Parish of Goodwick have been created by uniting parts of the Parishes of Jordanston, Llanwnda and Manorowen.

(12) The Parish of Clyne has been divided into two new Parishes, called the Parish of Clyne and the Parish of Tonna.

*1917 Boundary Commission Maps (scale: four miles to one inch) are obtainable, price 6d. each, from Messrs. Edward Stanford, Ltd., Long Acre, London, W.C.2.

The Shift Engineer Abroad.

By A. E. HAMPSON.

"HELL!" said the Driver, expressively, "it's 'ot." It was. At 8.30 on a mid-December night in Central West Africa it generally is, but in a power house with two gas-engine units running full blast, to those who have experienced it, "hot" becomes a totally inadequate description, and for them the prospects of after-life can hold no terrors. Flies, moths, mosquitoes, and flying ants circle in ever-increasing and never-ending swarms round the four three-hundred candle-power lanterns that illumine the station: bright, questioning eyes of natives, drawn by the magnetising influence of this brilliantly-lit "ju ju" house, peer in—then silently pass on into the black, outer wall of darkness.

Despite the fact that the two huge swing doors at either end of the station, and every available window, have been opened wide in an endeavour to catch the mythical land breeze, the thermometer remains steadily registering a temperature in the region of 100 degrees, and the rank smell of hot oil permeates the whole atmosphere.

In the top corner of the station, writing at his desk in a meshed-in alleged mosquito-proof office, the Shift Engineer sits checking up the daily log, deciphering Amadu's weird and wonderful figuring, and vaguely wondering why on earth his coal consumption should always be considerably higher than any of the other shifts'. A fairly new hand this, as his immaculately-pressed white ducks and fresh complexion betray. He shifts uneasily in his seat as a slight variation in the monotonous hum of the engines gives warning to his trained senses of a change in load, and as he moves, huge globules of perspiration drop from his face and bespatter the sheets in front of him. He brushes them off impatiently with his handkerchief and rises to his feet as a glance at the clock reveals to him that the time for his half-hourly inspection is overdue.

The engine-room round having been completed to his satisfaction, he enters the sweltering heat of the producer house to find his two native firemen soundly snoring on a bed of matting. Shaking is of no effect, but by dropping a firing tool he manages to awaken them, and an interesting dialogue in "coast" English ensues:—

"Wassamarrer you sleep for work? You think this work be baby palaver? Suppose you think so, I go give you small boy wages."

"Massa," in reproving tones, "We savvy proper this be big man job, so we no sleep. We do sit for ground small and close him heye, but we no sleep."

"You think I be bushman? Why you no wake when I shout for you?"

"Plenty, plenty noise from them engine, Massa, so we no fit to hear you. Look, Massa, we do work proper. We do put coal for them boiler for ten-o'clock time."

And a slate is produced showing their loading figures for that hour. The fact that it is even now only nine o'clock does not discountenance them in the least, and a sound lecture only has the effect of making them lose what knowledge of the English language they possess.

Somewhat wearily, the Shift Engineer returns to the engine room, but only to discover that in the interim his native greaser has fallen asleep hanging on to an engine inspection ladder, the oil-can in his hand dripping a brown stream on to the tiled floor. Thoroughly exasperated, he aims a flying kick at the offender, and greaser and oil-can vanish with a clatter.

He resumes his seat and proceeds with the log checking. The pad-pad of the switchboard attendant's bare feet on the gallery above him has now become more regular, for Amadu has noticed his new master's methods with regret, and has no desire to meet with the same fate as befell the greaser.

Another disturbance, and cries of "Tornado!"—that dreaded African storm—recall the Engineer from his job, and all hands rush to close doors and windows, but not quite quickly enough. A gale of high velocity sweeps through the station, bringing with it flying and stinging particles of sand that cover men and machinery indiscriminately; log-sheets, pens, and almost everything portable, go by the board and leave the station in a fluttering mass. Down comes the rain in a solid wall, blinding and deafening in its roar; but inside all is safe, for doors and windows are now closed. The Shift Engineer breathes a sigh of relief, for the air has become perceptibly cooler, though the thermometer drops slowly, as though reluctant to register any change.

And so things go on. At long last his relief arrives, and the Shift Engineer prepares to depart for a well-earned rest, but as he leaves the station for the comparative dimness of the street, he stumbles into the slinking figures of his native firemen, bearing between them a sack of best Welsh anthracite. The secret of his rising coal consumption is out!

Inventions and Patents in the United States.

The American and British Systems Compared.

By V. C. SAMPSON.

THAT pushful and prosperous land, the United States of America, is so often belauded as the inventor's Elysium that perhaps a brief outline of the actual position, as regards inventing and patenting, may prove of interest. The writer served for some considerable time as chief specification writer, and occasional draughtsman, under a prominent patent-attorney out there, and so may claim to possess some little knowledge of the conditions ruling.

Indubitably, in many aspects, the U.S.A. patent law is much superior to that of Great Britain, or, indeed, that of any other European country, not excepting the far-famed German system. But there are contra disadvantages of weight. There is, for example, no equivalent to our "provisional specification." An application has to be filed complete. This is a serious drawback, especially in complex devices. The provisional protection of British law gives immediate protection to the inventor, but at the same time does not bind him down to a rigid adherence to the original outlining of his conception. By utilising the benefits of a "cognate" application, the inventor can incorporate any detail improvements in the final complete application so long as the fundamental scope of the device is not materially altered or widened. This is a concession of great value; it affords adequate protection to the British inventor during the period of working out the details of his device. With a U.S.A. application, the specifications and drawings as originally filed must go to issue. The only alterations allowable are those compulsorily made in compliance with the examiner's reading of the Rules of Procedure. That is to say, only rectifications of errors are allowed.

Another serious disadvantage is the often quite unreasonable demand for minute sub-division of the subject-matter. Of course, even with a British application, the covering of two distinct inventions by one application would not be allowed. But in the U.S.A. Patents Office the examiners carry this rule to extreme lengths. Often a dozen applications have to be filed to cover one complex contrivance. Readers will have noticed, often, the long string of patents detailed on any American machine of intricate mechanism. This constitutes a grave defect in the U.S.A. patent law. It means that a really strong, or basic, patent is nearly unobtainable. Hence a plethora of weak patents results in endless law suits and interference actions. The protection afforded by a U.S.A. patent is seldom as trustworthy as that of a British one.

These are the main defects; they probably are quite well counterbalanced by the very considerable advantages. For example, the U.S.A. patent is amazingly cheap; it can be obtained with ease and expedition by any person skilled in the procedure; and the search into novelty is penetratingly thorough, so that the issuance of a patent carries reasonable assurance of freedom from that bugbear of the manufacturer—anticipation. Finally, after issuance, the patent runs tax free for the full term of seventeen years, which is an inestimable boon to the poor and struggling inventor.

The Development of the American System.

A brief review of the history and present status of U.S.A. patent law may be of interest. A few patents were granted in the old Colonial days by various governors, but there was no comprehensive law on the subject. It seems to have been mainly a matter of luck—or bribery—whether a patent was obtained or not. Soon after the Republic was constituted, a national patent law was passed in 1790. Under this Act a patent was to be granted for "any useful art, engine, machine, or device, or manufacture, or any improvement therein, not before known or used." Applications under this Act had to be made to a board consisting of the Secretary of State, the Secretary for War, and the Attorney-General. The concurrence of any two of these members was sufficient for the issuance. The life of a patent under this Act was indefinite, the term was agreed upon at the time of granting, but could not exceed fourteen years. Only a nominal fee, about five dollars, was charged for these early patents. The grant of one of these patents was an occasion of state ceremonial. The first was granted on July 31st, 1790, and covered a process invention for the making of pot and pearl ashes. It bore the famous signatures of George Washington, Thomas Jefferson, and Edmund Randolph. This Act was repealed in 1793, on the grounds of inadequacy. Under the new Act, the grant

of patents was restricted to citizens of the United States, or resident aliens; applications had to be made to the Secretary of State, and conflicting applications were pronounced upon by a board of three arbitrators. An important feature was the power given to the District Court to declare fraudulent applications void, on due proof. Supplementary laws and amendments were passed in 1794 and in 1800. In the latter year the rights of aliens to patent grants were reinstated, provided the foreigners were not of British nationality! In 1802 a Superintendent of Patents was appointed to aid the Executive Department. In 1836 Congress passed an Act repealing all previous patent laws, and substituting one embodying some radical changes. A Patent Office was created, with a Commissioner of Patents at its head. The search system was instituted, and a Board of Appeals constituted to hear appeals from the examiners and Commissioner. A fee of thirty dollars was charged under this Act to citizens and resident aliens; subjects of other nations had to pay three hundred dollars, excepting the subjects of Great Britain, who had to pay five hundred! The term of a patent was for fourteen years. In 1861 this was extended to seventeen years, and the discrimination between United States citizens and foreigners was abandoned, a uniform schedule of fees being adopted. Except for a few minor amendments—the law relating to *caveats* was repealed in 1910, for example—the present-day patent law of the U.S.A. is based on this 1861 Amending Act.

Conditions and Fees for Patents.

In brief, then, a United States patent is granted for a term of seventeen years to any person who has invented "A new or improved device of utility." The Government fee is 35 dollars, 15 dollars being payable on application, and the final 20 dollars within six months after notice of allowance is forwarded. No other fees or taxes are charged, and the patent, after issuance, stands for the full term of seventeen years. An exhaustive search is made into the novelty of the device for which a patent is sought. Not only are all United States records examined, but also those of all other countries having a patent system. Further, any technical publication that the examiner may think likely to hold a pertinent reference is searched.

The words "of utility" are important is relation to the grant of a patent. Perpetual motion and kindred schemes cannot be patented in the United States, although in Great Britain such devices, if novel, would be allowable. In past years the examiners held up many valuable, but, at the time, commercially impractical inventions, on the ground of inutility. They are more broad-minded in their reading of the rule at the present day, but, even so, no obviously wild-cat scheme would ever be granted a patent.

A United States patent dates from the time of issue, not application, as in the British practice. The documents do not differ greatly from those used in our own Patent Office, but there are a few minor variances. For one point, in the United States every invention is considered as an "improvement," and this word opens the preamble. Another rule is quite alien to our practice, and, at times, is the cause of considerable inconvenience. That is, when the papers are ready for filing, the inventor must swear, or affirm, that he is or believes himself to be the actual inventor of the device substantially as set forth in the documents. The whole of the papers have to be threaded through with a red ribbon or tape, prior to the taking of the oath, the object being to prevent any alterations whatsoever. This oath must be sworn in the presence of a public notary or commissioner for oaths, with all the documents laid before him. This practice stresses how rigidly enforced is the rule as to alterations.

The rules relating to drawings are meticulously construed, as in our own Patent Office. But the United States Office offers the services of its draughtsmen, at a very reasonable fee, to ensure satisfactory work, and if advantage be taken of this there is little trouble.

"Claims" are a source of considerable dissension between examiner and applicant. By reason of the exhaustive nature of the novelty search, few claims, as originally cast, are allowed. The examiners are almost certain to dig up anticipating references. In fact, practically the whole art of the American patent attorney is devoted to the formulation of strong claims which are yet sufficiently limited in scope to pass the examiners A few examiners are utterly unreasonable in this referencing, and appeals to the Commissioner are frequent. Still, on the whole, with good subject-matter, the prosecution of a successful patent application is not more difficult in the United States than similar work in Great Britain.

The Value of Patents.

Now let us consider the standing of the inventor in the Republic. Undoubtedly, American manufacturers are far keener on new inventions than their British compeers. The man with a good idea, protected by a strong patent, has little to fear over there. He is certain to be taken up at an early date. For him there is seldom the weary, heart-breaking months, or even years, of soliciting that the English inventor so often has to endure. Many of the big corporations keep a private inventors' staff in full employment, and also are ever on the alert to secure good outside inventions. A capable attorney is retained solely to dissect the scope and potentialities of all issued patents relating to the firm's productions. In this connection there is a very unsavoury feature. Some few unscrupulous concerns do not hesitate to set their inventors working to "get round" the issued patent, and only if this attempt prove unsuccessful will they commission their attorney to approach the true inventor with an offer for his device. This sharp practice is not a speciality of the American manufacturer, however. It is a little dodge frequently worked by some English concerns, as many a poor inventor knows to his cost. The only remedy is to make sure of a "holeproof" patent. Taken in the lump, American manufacturers are very fair and just in their patent dealings, and they are often very helpful with the ground work. Inventions, in the United States, are looked upon as wealth-mines of inexhaustible scope and potentialities.

There is a professional association—the Inventors' Guild—and there is at least one weekly of wide circulation devoted entirely to the interests of inventors and their devices. Practically every technical journal sets apart several columns of both news and advertising space to the subject. Even in the lay Press, the "patents for sale and wanted" columns occupy quite as much space as that devoted to "small bus., sweets and tobacco" in our own dailies! Unfortunately, these extensive ramifications attract a huge army of swindlers. Both the Patent Office and the postal authorities do as much as possible to combat the activities of these gentry, but they are experts in sailing along the borderline without actually crossing it, and so not a great deal can be really done to combat their schemes. A number of patent attorneys are not above suspicion. Many accept fees for material which on the face of it is manifestly non-patentable. Some advertise extensively, practically seeking this class of work, as they guarantee "a patent or money back." Under the U.S.A. patent law it is quite easy to obtain a worthless patent in any art by formulating claims covering one or two non-essential details. The records are clogged with thousands of such "patents." One fee-snatching scheme that eventually landed its authors into disbarment proceedings was the offer of silver medals for inventions of "outstanding merit," and the subsequent awarding of such medals to anyone who put up the application fees. This firm was proved to have purchased these medals on several occasions in 5,000 lots! *Inter alia*, this point shows how great is the interest taken in invention in the States. "Patent specialists" abound, and, unfortunately, are beyond the jurisdiction of the Patent Office. They unmercifully rook thousands of inventors (or would-be inventors, to be more accurate). Some of the "stock-selling" schemes originated by these gentry are the last word in misapplied ingenuity. The postal authorities do all they can to scotch these schemes by confiscating the literature and communications sent through the post, when they are recognised,

but many of the less reputable papers, circulating in the rural districts, aid them by accepting their advertisements without question.

Apart, however, from these swindling activities, an amazing amount of perfectly legitimate business is transacted annually. A recent conservative estimate placed the turnover on attorneys' fees alone at more than three million dollars. Then, in the States, practically every attorney runs a sales department in connection with his business, and the profits accruing therefrom represent a considerable addition to that figure.

Chances for British Inventors.

Thus it will be seen that an enormous amount of money changes hands annually over patents in the United States. It is up to the British inventor to go for a share of those "sweets." Provided his device is of fair merit, he need have little fear as to the ultimate success of his venture. Inventions in textile machinery and appliances are especially welcomed, and there is always a wide market for domestic devices. It must be remembered, however, that American domestic life is markedly different from our own—it is far more "mechanicalised." For example, it would be useless to try and market a patent firelighter, because domestic fires are practically unknown. There are numerous lines, however, in which the British inventor could score heavily, for indubitably British inventive genius stands highest in the world for quality, and the American manufacturer is keen on the real good thing. An intensive study of American magazines would soon put the inventor on the right track.

Patent fees in the United States are so low that, to the writer, it has ever been a source of constant wonder that the British inventor does not more frequently avail himself of this wide market for his abilities. The position of the patentee in the States is particularly strong. He can, and does, enforce various penal clauses relative to the selling price and renewal of parts in his device. Invariably it is made a condition of sale that only spares supplied by the manufacturer, or repairs carried out by him, or his authorised agent, are allowed. The Courts construe such inhibitions in the most liberal spirit, and the patentee can often extort heavy damages for the slightest breach of the contract. In one case, the replacement of a simple tie-rod, by the village smith, in a piece of patented agricultural machinery involved both smith and farmer in the payment of very substantial damages.

Inventors in the United States dispose of their rights by (*a*) Outright sale; (*b*) royalty and cash premium; (*c*) "territorial rights"; (*d*) shop rights; (*e*) licence by annual fee or rental, independent of the sales achieved; or (*f*) a combination of such methods. No comment is necessary on the first two schemes, which represent the usual British methods of disposal of patent rights. The granting of "territorial rights" is an interesting and remunerative idea. A manufacturer is licensed to make and sell the device solely in his native territory or state. By this system the inventor gains a plurality of manufacturers marketing his device, with each one possessing an intimate knowledge of the idiosyncrasies of the particular ground which he covers. This enhances the profits, often to a remarkable extent. Under the shop-rights scheme the manufacturer is restricted to the use of the device in his works. In general, this idea is only applicable to costly and intricate process machinery, but the rental charged is invariably high, and taxes for some of the best-paying inventions known are collected under this system. The various patents of the Shoe Machinery Trust are a case in point. Licences by annual rental independent of sales are granted mostly on patented automatic vending machines and amusement devices. Many inventors holding strong patents of great utility combine these methods in their disposal of rights, granting territorial licences to manufacturers in thickly-populated districts, licences by annual fixed rental in sparsely-populated areas, and sometimes exacting a royalty and cash premium in addition.

In conclusion, it will be seen that the potentialities of patents in the United States are exceedingly rich. By carefully studying the rules of procedure, and drawing up the specification in meticulous accordance with them, and especially by concentrating on the claims, a good idea can be strongly protected. The market for patents is much wider than in Great Britain. Not only is the population greater than ours, but, more important, it is one keenly responsive to the appeal of novelty—and it has the cash to gratify its whims. The British inventor who does not take into account the American market is neglecting what is, in patents, the richest field in the world.

A Small Scottish Hydro-Electric Scheme.

The Utilisation of an Old Dam for Hydro-Electric Purposes.

THERE has recently been completed on the River Don a private hydro-electric installation which will be of interest on account of its small initial cost, considering the low head available in the river, and the size of the plant. The latter has been put down for the purpose of generating electricity for a supply to the Castle of Lord Forbes, fig. 1. Normally, in a comparatively slow-moving stream like the Don, the cost of obtaining the necessary head would render the installation of a small plant uneconomical, but by taking advantage of the existence of an old weir which formerly supplied power to a saw-mill of which nothing remained but a few of the foundation stones, and by making use of the old head and tail races which remained, although they had become completely silted up and overgrown, the initial cost of obtaining a five-foot head was greatly reduced.



Fig. 1.—Castle Forbes.

The dam, fig. 2, which is situated about 400 yards below the Bridge of Keig, is composed of large, heavy stones packed together and made tight with cut sods. Several breaches were made good with mass concrete, and a gap was left in the middle to act as a salmon pass. This gap is approximately 6 feet inside, and allows for a depth of 18 in. of water flowing through it when the river is at its lowest level. The normal flow of water in the river above the dam was estimated at 28,000 cubic feet per

minute. Taking into consideration the width, depth, and slope of the old head race, and the necessity of always having an adequate supply free to flow through the gap so as to allow the passage of salmon at all times,

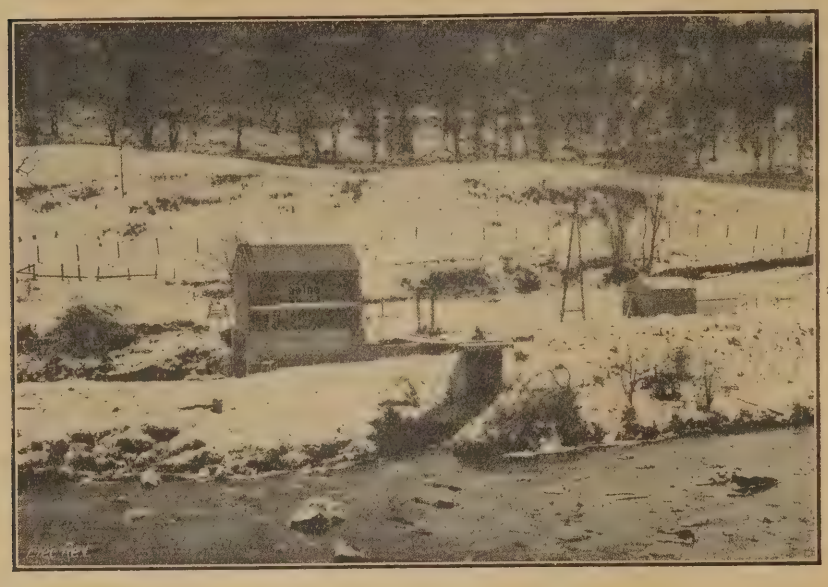


Fig. 2.—The Power House and Dam.

it was found that 4,500 cu. ft. of water per minute could be delivered, with an effective head of 4 ft. 6 in., to the turbine, which would thus develop approximately 30 h.p.

A 33-in. vertical-shaft Francis turbine, capable of developing 29 b.h.p. under a head of 4 ft. 6 in., and utilising 4,380 cu. ft. of water per minute at a speed of 87 r.p.m., is installed. The power is transmitted through bevelled gearing to a countershaft and pulley, thence by belt-drive to a dynamo, fig. 3, running at 800 r.p.m. The desired load from the plant is 14.3 kW, and 16 kW was obtained during a test taken on completion of the scheme. The dynamo, which was manufactured by the Electric Construction Co., of Wolverhampton, is of the over-compounded type, having an output of 16 kW at 285 volts when running at full speed. The compounding is arranged so as to give a constant pressure of 250 volts at all loads. The speed is kept constant by means of an oil-pressure compensating governor which controls the turbine by opening or closing the guide vanes.

The plant runs continuously except for a period of about ten minutes daily, when it is necessary that the governor should be stopped for oiling. The machines are controlled from the power house at the river, and are looked after by an estate pensioner, who spends little more than an hour a day oiling and cleaning the machinery and clearing the gratings.

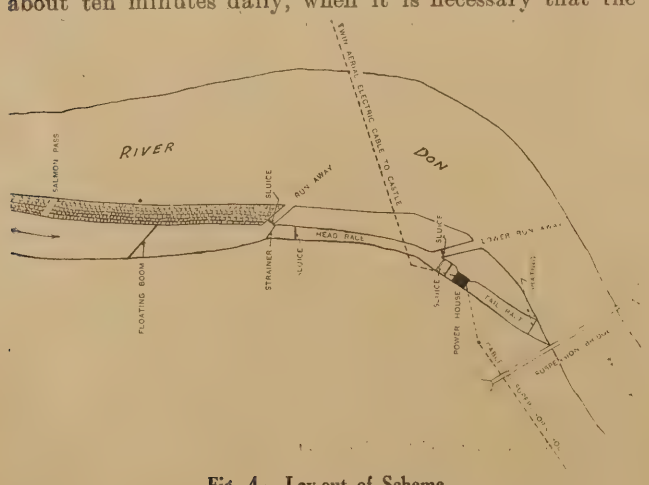


Fig. 4.—Lay-out of Scheme.

Fig. 4 shows the general lay-out of the scheme. It should be noted that two runaways have been put in, one above the top end of head race and the other at the bottom. These enable the head race and the lower end of the dam to be scoured out when necessary. A floating boom has also been placed in the dam to deflect ice, trees, and other débris which would damage or block up the strainer. A longitudinal section through the turbine pit and power house is shown in fig. 5. The electrical transmission from the power house to the Castle, a distance of about 800 yards, is effected by means of an overhead line consisting of a hard-drawn copper stranded cable supported on poles and protected at each end by lightning arresters.

The Castle is wired on the Henley wiring system, and has installed 150 lighting and 11 heating points, and six 2-kW immersion heaters, which are inserted into the domestic-heating boilers. The installation is controlled by a main switchboard equipped with the usual instruments.

The contract was placed with Messrs. Underhill and Ritchie, Ltd., of Glasgow. The water-power scheme was designed and supervised by Messrs. Formans & McCall,

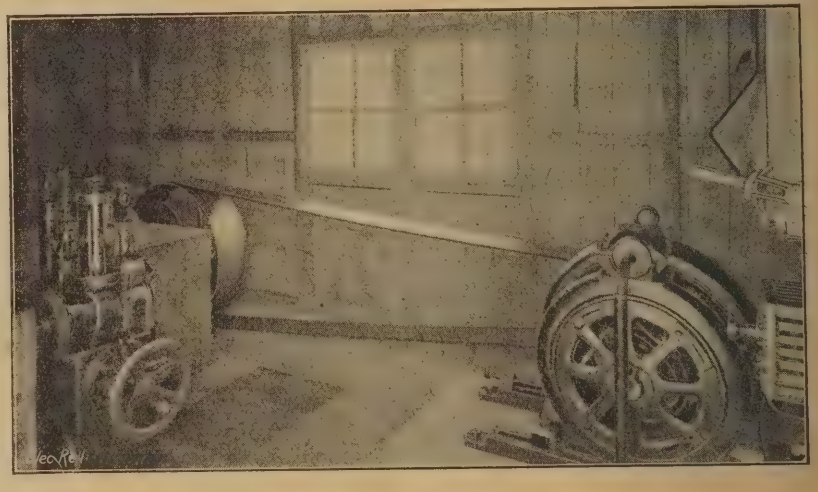


Fig. 3.—Turbine and Dynamo.

C.C.E., Glasgow. Mr. J. Alex. Bell, of Aberdeen Corporation, acted as advisory engineer to Lord Forbes.

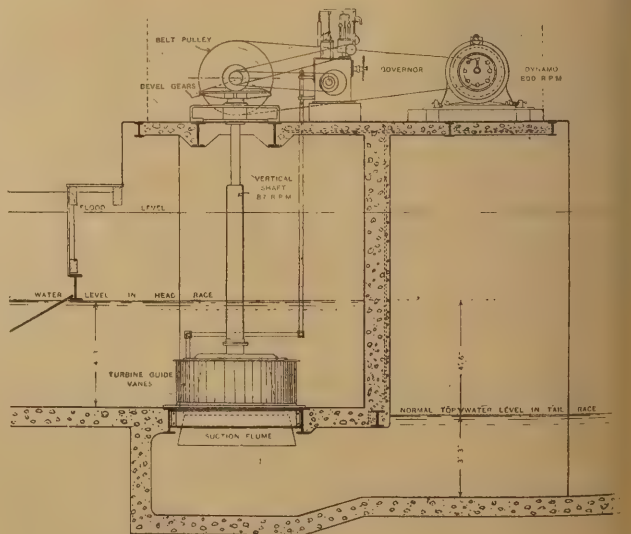


Fig. 5.—Section through Installation.

The Electricity Supply Scheme.

Views from Various Quarters.

Cheap and Abundant Electricity: Is Centralisation the Way?

By "RUSTICUS."

For the past six years we have been hearing about the backwardness of electricity in this country, and we have been persistently told that centralisation, standardisation, and interconnection are the only means by which this can be corrected.

I believe it is a fact that if any commercial enterprise will persistently advertise its particular product to a sufficient extent, and will monopolise the front sheets of the daily papers for a sufficiently long period, the product in question will become a household word, although it may be no better than many similar, but less advertised, commodities. I am inclined to think that this is what has happened over the centralisation of electricity supply. Have the many committees and commissions which have considered the matter really come on the scene unbiased, or have they approached the matter with the firm conviction that the super-station is the only solution? Have any of them started with a clean slate and considered all alternatives? Broad and sweeping statements of what a particular party proposes to do may be excellent for political purposes, but, to put it vulgarly, do they cut any ice when reduced to concrete facts?

I am interested in the question of electricity supply in a small agricultural town, and as rural electricity supply has attracted a great deal of attention lately, perhaps I may be pardoned if I bring our own case forward as a concrete example.

The small town in question, which I will call B, decided two years ago that it wanted a supply of electricity. At a distance of 18 miles a town A had an enterprising and successful electricity undertaking, which was approached with a view to obtaining a bulk supply. A has recently installed additional plant at a cost of £18 per kilowatt, and the new plant will probably result in a fuel cost per unit of 0.3d. The town B, in the course of three or four years, will probably require 1,000 kW. The cost of the transmission line was estimated at about £60,000. Reckoning interest and repayment at 8 per cent., A's annual charge per kW for generation only will be £1.44. The capital charges on the transmission line will be £4,800, and if we spread these over 1,000 kW (which will not be the case for the first few years), there will be £4.8 to add to the generation cost, making £6.24 per kW at B. The price which A would have to quote at B would therefore be in the neighbourhood of £7 per kW and 0.4d. per kWh, and even on these terms B could not be regarded as a very profitable consumer, particularly as A would have 18 miles of transmission line to look after.

Under these circumstances B was forced to look into the cost of making its own electricity, and finds that it can install internal-combustion engines and alternators complete with land, buildings, and all accessories at £25 per kW, which at 8 per cent. as before gives an annual charge of £2 per kW, or allowing for one-third of the installed plant being stand-by, £3 per kW for peak-load purposes. From the experience of existing internal-combustion stations, the fuel cost per kWh should be below 0.4d. (say, 0.7 lb. of oil at 85s. = 0.32d. per kWh).

Evidence in favour of B's generating its own supply was therefore overwhelming, and B has now received instructions to go ahead with its station.

It may be argued that with the bulk supply and transmission line the intermediate villages would have taken supplies, and that this would have altered the financial aspect of the case. On investigation it will probably be found that the revenue from a village, after covering its own distribution costs and the costs of its transformer station, will leave nothing to contribute to the costs of the main transmission line.

With reference to the foregoing, the policy outlined at Birmingham on Friday, January 15th, is of interest, explaining the intentions of the present Government with regard to electricity supply. This policy, applied to our particular case, introduces a third party or middle-man, described as an "Electricity Board," which we will describe by the letter C. Under the suggested arrangement C will buy energy from A, will provide the transmission line from A to B, and will sell energy to B. I cannot understand how this is going to improve the financial aspect of the case—rather I am afraid it will add a further expense. C is to be guaranteed, but not subsidised by Government funds, and therefore its only source of revenue will be the difference between the price at which it buys from A and sells to B. Now out of this revenue it has got to provide the charges on the transmission line and *its own expenses*. It is also apparently going to provide 10 millions for standardisation of frequency, and is then in a few years going to have millions to spare to distribute as a sort of bonus to B and similar consumers. It seems to me probable that by that time B will have contributed more to the general fund than it is ever likely to see back. As a rule the introduction of a middle-man does not reduce the price paid by the consumer, and I fail to see how this case is going to be any exception to the rule.

We have heard a lot about the parochial spirit lately. Perhaps this has been exaggerated. Supply station engineers as a rule know their business, and would not object to being relieved of the worry of a generating station if the bulk supply offered them were at terms as good as they could hope to reach themselves *with improved plant*. At the same time, a great many of them appreciate that centralisation, if carried to anything like the extent suggested, will not bring with it advantages commensurate with the enormous expense that transmission lines involve.

We hear a great deal about the small and inefficient stations. Has the cost of making these efficient ever been gone into and compared with the cost of the super-stations, plus that of the transmission lines? Also is their present relative inefficiency in any way due to the fact that loans for new plant, which might have made them efficient, have been consistently withheld for years past? In any case the Birmingham announcement admits that more than half of our electricity supply is already being turned out by highly efficient stations. Is it worth spending 10 millions on the standardisation of frequency, plus the cost of transmission lines, plus the expenses of an Electricity Board, in order to reduce the cost of production of less than half of our output?

Standardisation of frequency without interconnection is an unnecessary expense. It would surely therefore be well to look very closely into the results already obtained by the interconnection of large stations before spending on standardisation a huge amount which without interconnection must be regarded as an unproductive expenditure. Have any great economies in stand-by plant been made by interconnection after taking into account the cost of transmission lines, voltage regulation, &c.? Parallel running means power-factor complications and also extends the area affected by faults. In some cases I believe it is considered that these disadvantages more than cancel the advantages.

We all appreciate that standardisation of frequency would provide a great deal of work for our manufacturing firms, but when completed it will not increase the revenue from electricity supply, and except from the doubtful economies to be obtained from interconnection

it would in no way cheapen generation. Would not a similar amount spent in encouraging electricity supply in districts not yet provided for be far more productive? It would give just as great an impetus to the manufacturing side, and would lead to increased output on the generating side.

The future of electricity supply depends entirely, I believe, on the cost to the consumer. Reduce this cost and you at once open new markets. These mean increased production and better load factor, which again react on the cost of production, and so on to the all-electric age. Let us by all means adopt centralisation so far as it can be proved to be economic, but let us have a fair field for the small station. I recently canvassed a prospective consumer to take a public supply in preference to running his own somewhat antiquated plant. Naturally I tried to keep the argument to his present costs. "No," he replied, "I am going to argue on the cost of the most economical plant I can put in *now* to meet my present requirements." I had to agree with him. If those in authority will adopt the same plan with regard to the small stations I do not think we shall go far wrong.

By the way, I was recently informed that a private individual had just put in an internal-combustion engine and was making electricity in the shadow of the latest super-station because he could save money by so doing. This does not look very well for the prospect of the super-station at a 50-mile radius, and leads one to believe that the modern internal-combustion engine will go a long way to alter the outlook with regard to the small station if given a fair field.

Why not a Commission to look into the desirability of a system of small stations, probably 12 miles apart, each serving a 6-mile radius with light high-pressure mains which could diminish in size as they approached the boundary radius?

National Electricity Supply.

By F. J. MOFFETT, B.A., M.I.E.E., M.Cons.E.

THE proposals of the Government with reference to the "cheap and abundant" supply of electricity, about which rumours have long been floating in the air, have at length crystallised: their scope was described by the Prime Minister in his speech at Birmingham on January 15th.

The proposals in brief appear to be as follows:—

(1) The generation of electric power is to be concentrated, as far as possible, in a comparatively small number of what are usually termed super-stations.
(2) All these super-stations are to be interconnected by heavy trunk lines, so that they will be able to mutually assist one another.
(3) In order to allow of this being done throughout the country, the frequency is to be standardised at 50 periods.
(4) All small generating stations are to be closed down as soon as possible, or converted into distribution stations.

I believe many leading electrical engineers will agree with me that in the main these proposals are entirely on the wrong lines, both from the technical and the economical points of view.

We are told that the super-station will be able to generate more economically than the smaller station, owing both to the large size of generating units and also to the improved load factor. There is no doubt that the super-station can usually generate at a lower works cost per unit than the small station, though this is not always true. Several cases could be quoted where a small station can show better works costs than the larger station.

But the works costs are not everything. The electricity has to be carried to the house of the consumer or to the factory, and the losses in distribution are roughly proportional to the distance through which the electric power is transmitted. Further, a large part of the total cost per unit is due to the capital charges—in other words, to the interest and depreciation (or sinking-fund payments) on the money invested. If this is increased to a considerable degree by the expenditure of huge sums on interconnecting extra-high-pressure cables, transformers, switchgear, and other accessories, and also by the heavy expenditure rendered necessary to standardise the frequency, the total cost per unit will be brought up to a figure of which the works cost will form only a moderate proportion.

One of the advantages of this interconnection of the large generating stations is stated by the Prime Minister to be the improvement in the load factor which would be effected thereby.

The load factor of a generating station depends on the number of hours during which the plant is usefully employed, and this depends eventually on the number of working hours in the factories which derive their electric power supply from that station. In the early days of electricity, when the load was chiefly lighting, the load factor was very low, but the enormous increase during the war in the amount of energy used for driving machinery has increased the load factor owing to the longer hours over which electricity is required for power purposes.

I entirely fail to see how the load factor of the Birmingham area can be improved by interconnecting it with the Manchester area, for instance. The working hours in Manchester are very similar to those in Birmingham, and the load factors in the two areas are almost identical.

By the advent of such a load as would result from the electrification of the railways, the load factor would be greatly improved, since the demand from the railways would cover a good proportion of the 24 hours of the day.

The president of the Institution of Electrical Engineers in his presidential address, delivered in October, 1925, deprecated the interconnection of the chief supply centres, and pointed out that the cost of standardising the frequency over the whole country would be something like £27,000,000. To this would have to be added a sum of the same order to cover the cost of the "interconnecting trunk mains and other necessary apparatus." The total cost for the whole country for interconnection and standardisation of frequency would probably be in the neighbourhood of 40 to 50 million pounds.

I understand that the National Scheme is to be worked without placing any burden on the National Exchequer. The new Board which is proposed is to be authorised to obtain loans on a Government guarantee, but where are the interest and repayment charges on such a large sum to be obtained from?

They can only be recovered by adding the appropriate proportion to the price charged per unit, or as a maximum-demand rate. I fail to see how this will assist in the cheap supply of electricity.

Doubtless manufacturers of electrical plant of every kind will be disposed to look with the eye of favour on the Government proposals, since if carried into force, they would mean an era of unexampled prosperity for them. But manufacturers of electrical plant are also citizens of this country, taxpayers, and ratepayers, and they will, I feel sure, look at the matter from the national standpoint as well as from that of inflated profits for their firms.

Finally, all small generating stations are to be closed down on account of their being unable to generate at as low a works cost as the super-station.

I have recently been contending in the public Press that we are quite on the wrong lines in devoting all our energies and efforts to the advancement of the "all-electric" generating station, which has at most a thermal efficiency of 20 per cent. and an average efficiency of only 15 per cent., considering the figures for comparatively large modern stations only. It is practicable to increase the thermal efficiency to 50 per cent., or even 60 per cent., by combining the supply of heat and electrical energy.

There are no serious engineering difficulties in the

design and erection of combined heat and electricity supply stations, or "heat-electric stations," as I suggest they should be called, and no obstacles to their success provided the right conditions are chosen.

For household purposes hot water is of prime importance—it is far more essential than anything else. No householder can live without it. For cleaning, cooking, and baths it is indispensable, while for the heating of rooms its advantages are generally recognised. Why not supply hot water as well as electric current, particularly when, by so doing, electricity can be supplied at a cost far below that possible in the case of supply from the present standard "all-electric" supply system?

America in particular, and Germany to a certain extent, have made progress on these lines, and since the "heat-electric" principle rests on an absolutely sound basis, I feel no hesitation in stating that we, as a nation, will make a huge mistake if we do not seriously consider this means of reducing the enormous waste of fuel that is taking place in our present all-electric super-stations.

Instead of scrapping the small generating stations, I strongly urge that they should be converted into heat-electric stations for the simultaneous supply of hot water and cheap electricity to the residences and factories situated in the neighbourhood.

I believe that the adoption of this course would involve greater activity on the part of manufacturers of many engineering products, such as pipes, &c., besides bringing considerable grist to the mills of the electrical industry both in connection with the conversion of existing small "all-electric" stations and in the equipment of new "heat-electric" stations.

The electrical current for such "heat-electric" generating stations would be a secondary product, the primary being hot water. For this reason the cost per unit could be brought down below that obtainable under the all-electric system unless it relied for its power to supply electricity cheaply on a Government subsidy.

In conclusion, I trust sincerely that all electrical engineers will look at the question from a national standpoint, not from the angle of personal profit, and use their best endeavours to prevent legislation on the lines laid down by the Prime Minister from being carried into effect.

Some Published Opinions.

Sir HUGO HIRST, in the *Financial News*:—"Small scale enterprise might have been suitable for pioneer development in the early stages of the industry, but such a system is uneconomical under present conditions, and standardisation and closer working are necessary for the production of cheap electrical power. Co-ordination by a central authority of both production and distribution of electrical energy is vitally needed. Through the standardisation of voltages and frequencies," said Sir Hugo, "electrical manufacturers in this country will at last be able to lay themselves out for mass production.

"The effect of mass production will be that the cost of industrial and domestic labour-saving appliances will be so cheapened that I predict a great expansion of demand, which must inevitably have a reflex action on other industries which supply the raw materials required by the electrical industry.

"So vast a scheme cannot, of course, be put into operation in one year. There must be a gradual development, and, in my opinion, the scheme will provide an opportunity for the solution of some of the problems of the coal industry. While it will involve the setting up of a number of super-stations, I visualise—if the coal situation is handled to the satisfaction of both parties—a grouping of pits large enough to allow central stations for each group of mines. These will provide supplies of electricity and gas which will be transmitted to industrial areas by means of the omnibus mains contemplated by the scheme. Electrical power can be produced at so cheap a rate at mining centres that it would not only be a paying proposition for the mines, but it would reduce also the average cost of production per unit throughout the country. The waste gas from the blast furnaces could be utilised in a similar manner to generate electricity.

"Finally," he concluded, "I hope that it is the Government's intention to preserve the benefits of the scheme for British industry. It will not help us much if other countries with a lower standard of living and depreciated currencies are allowed to reap the advantage. Wherever Government facilities and support are given, the bulk of the production should be for the benefit of British labour."

Dr. J. F. CROWLEY, in the *Yorkshire Post*:—"There is naturally a great deal to be said from a national point of view for having one standard frequency throughout the country. It would facilitate the manufacture of electrical machinery, but one may pay too dearly for the latter advantage. Interconnection facilitates concentration of generation, and it is undoubted, and was indeed pointed out by the Electricity Supply Committee of 1918, and by the Coal Conservation Sub-Committee on the same subject, that concentration of generation in large stations, where the circumstances justify it, means comparatively cheap generation.

"There are, however, very definite limits to the advantages that can accrue in this direction, and one may well venture to doubt whether the heavy costs involved in the changing over of frequency over wide areas will, in our generation at any rate, justify the expenditure involved.

"One thing is, however, certain, and that is that the cost of the changes over should be borne by the State, and not by the present consumers, the benefit to whom will be more than problematical. As regards interconnection, there is in general no question in the minds of power engineers that concentration of generation in reasonably large stations is desirable, and should be carried out in the national interest.

"This was the intention of the Electricity Supply Committee when it formulated the District Board method, and it is, in the writer's opinion, very much to be regretted that the local authorities and companies in each of the delimited areas could not have made common cause in the national interest.

"It is, however, a matter for congratulation that the Government proposes to retain to a large extent the advantages of private enterprise in electricity generation, and where it exists and operates successfully, of municipal ownership also.

"The proposed Board is not to be an elected body, as in the proposals submitted to the Royal Commission on the Coal Industry by the Miners' Federation during the last few days, but a nominated Commission of men with commercial and administrative experience on the lines of the Mersey Harbour Board, or of the Port of London Authority.

"Commissions or Committees responsible to an electorate are in universal experience at a grave disadvantage in the conduct of commercial undertakings. If such bodies are to deal successfully with commercial business, they must have security of tenure, and be independent of undue pressure with regard to all matters that may come before them for decision."

Sir PHILIP DAWSON, in the *Morning Post*:—"The essence of the national electrification scheme is the co-ordination and co-operation of power stations," said Sir Philip. "When this has been accomplished a tremendous reduction of running costs and capital outlay for new stations will be possible. The co-ordination of power stations will enable individual stations to dispense with an immense amount of plant which has to be kept for emergencies. If all the stations are linked up, only a small emergency equipment will be necessary.

"Experience has shown that in other countries where electrification has been extensively introduced, the gas industry has not been affected. I believe that in the future the gas and electrical industries will work in close co-operation. It will, I think, be found necessary within a few months to adopt a process of low-temperature distillation of coal. The result will be that wherever there are electrical power stations there will be gas generating stations and chemical works. When the coal has been distilled, the gases will be distributed for use as gas, the fuel will be used for heating boilers in the electrical power scheme, and the hydro-carbonates which will be yielded as by-products will be utilised by chemical factories on the spot.

"I am greatly in favour of the standardisation of frequencies and pressures. Standardisation will allow electrical appliances of all sorts to be produced at much less cost than at present, and it will also allow any one appliance to be taken from house to house.

"I am absolutely antagonistic to nationalisation in any form, and should oppose any suggestions of subsidies or subventions. I am sure that if proper facilities in the form of an expansion of the Trade Facilities Act are given, we have sufficient enterprise to do it without any such help."

PROF. GEORGE FORBES, in *The Times*:—"The difficulty, involving at first sight enormous expense, is that the standard frequency for light and power distribution in this large scheme must be 50 cycles per second; the voltage must also be standardised. In Birmingham, to take one example (and so it is in Scotland), we find an enormous area supplying electric current at the power-rate of 25 cycles per second. It has been asserted that in these areas all the generators and all the transformers, besides other items, must be scrapped at enormous cost and replaced by others made for 50 cycles per second in order that they may all feed into the same network for the whole country.

"It is now suggested as a more economical policy that such areas shall continue to be supplied as at present at 25 cycles, but the connections of their own mains to the general network of the whole of Britain shall be made through motor-generators, which shall receive energy at 25 cycles and give it out at 50 cycles and the standard voltage, or *vice versa*, according as Birmingham has at the moment an excess or a deficit of supply for its own wants. This item of cost may thus be reduced from millions to thousands of pounds."

Legal.

Charge of Fraud.

AT Darwen, on January 21st, Richard Haworth, electrical engineer, Richmond Terrace, was summoned for fraudulently obtaining money from Mrs. Mary Eccles. It was stated that defendant had done work at the lady's house and had made a wireless set for her brother. He was asked to quote for another one, and his price was £17. He was given £13 with which to buy the material. Later he was given £4 in advance for a £7 cabinet. Defendant's contention that the money was in part payment for a bill for £54 for electrical work, &c., was denied by the complainant, who said she had paid defendant over £66 for electric light, wireless, &c. Subsequently she learnt that defendant was an undischarged bankrupt. Defendant denied the allegations made, and said that he had rendered service for money paid. He was fined £5 and £4 4s. costs. Other charges were withdrawn.

Mullard Radio Valve Co., Ltd., v. Orgel.

MR. JUSTICE RUSSELL, in the Chancery Division on January 22nd, had before him a motion against Hy. Orgel, of Bishopsgate, to restrain the defendant from infringing a patent valve of the plaintiffs.

For the plaintiffs, Mr. K. E. SHELLEY intimated that it had been agreed to treat the motion as trial of the action. The defendant said he was innocent. The plaintiffs did not ask for damages. The defendant would pay £5 as agreed costs and submit to a perpetual injunction.

The judge sanctioned this agreement.

Mullard Radio Valve Co., Ltd., v. Braham.

IN the Chancery Division on Tuesday, before Mr. Justice Russell, the Mullard Radio Valve Co., Ltd., moved to restrain an infringement of letters patent by John Braham, of Bishopsgate, E.C. Counsel for defendant consented to a perpetual injunction against him and this was granted, it being also agreed to treat the motion as the trial of the action.

Theft of Electricity.

AT Pontypool on January 16th, William T. Hales, described as an electrical engineer, was charged with fraudulently abstracting electricity from the mains of the Pontypool Electric Light and Power Co. It was stated that the defendant had short-circuited the meter in his house, the value of electricity so taken being estimated at £17 9s. The defendant stated that he carried on a battery-charging business and found that the five-ampere meter fitted would not stand the current which he required. He alleged that he had the authority of the manager of the supply company to shunt the meter to avoid burning it out. It was denied that this authority was given, and the magistrates imposed a fine of £10.

False Pretences Charge.

AT the Old Street Police Court on January 19th, Charles Frederick Kidby, 29, gramophone dealer, Rushcroft Road, Brixton, and Alfred Sidney Taylor, 42, engineer's fitter, Stoke Newington, were charged on remand with being concerned together in knowingly obtaining by false pretences a quantity of wireless goods, value £44 8s. 4d., from Ernest Edward Rooke, with intent to cheat and defraud, at 7-9, City Road, E.C. In opening the case, Mr. Clayton had stated that there would be also charges of conspiracy and further charges of obtaining goods by false pretences. The men had been trading as a company, C. F. Kidby, Limited, with premises in City Road. Mr. Singleton appeared for the defence. A clerk in the Company Record Department, Somerset House, produced the file of C. F. Kidby, Ltd., which was registered on January 30th, 1924, with a nominal capital of £1,000, divided into 1,000 shares of £1 each. The two defendants were the directors of the company, and Kidby was also the secretary. Two subscribers' shares only had been subscribed. The registered office was at City Road.

MICHAEL PAPIER, proprietor of the firm of M. Papier, general merchants, Westminster Bridge Road, said that in April, 1924, they commenced doing business with Kidby, Ltd. The amount owing to them was £113 5s.

JOHN WILLIAM AVERY, chief cashier to Thompson, Diamond and Butcher, Farringdon Road, E.C., said that £20 was owing to his firm for violin sets.

Further evidence showed that amounts were due to M. and A. Wolff, general merchants; Hobdell, Way & Co., engineers, for ebonite; and Jack Mills, Ltd., Regent Street, for wireless sets.

Mr. SINGLETON asked for an adjournment of the case as he thought evidence should be presented before the magistrate that it was a genuine business. Unfortunately last year the defendants had had a succession of losses. A further remand was ordered, bail being renewed.

Attorney-General (St. Pancras Corporation) v. County of London E.S. Co., Ltd.

MR. JUSTICE TOMLIN, in the Chancery Division on January 20th, reserved judgment after hearing at great length the arguments in the case of the Attorney-General at the relation of the St. Pancras Corporation against the County of London Electric Supply Co., Ltd. (*vide* our last issue, p. 131).

The plaintiffs claimed an injunction restraining the defendants from supplying outside their statutory area electrical energy to part of the property of E. Hulton & Co., Ltd., Gray's Inn Road, W.C., on the ground that the property in question was within the Corporation's area of supply.

The defendants denied that they were intending to supply outside their area, or that the Corporation had always been ready and willing to supply energy on reasonable terms. Alternatively, if they had committed any breach (which was denied) defendants said that the Corporation was not entitled to the relief for which it asked, because if any breach had been committed the Electricity Commissioners were the only authority who could deal with it.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Electrical Showrooms.

The recent article by Mr. W. A. Gillott, A.M.I.E.E., was of great interest to me and also, I hope, to a large number of readers. Mr. Gillott remarks that "there are comparatively few really good showrooms in existence." I thoroughly agree with him.

For several years I have been interested in, and connected with, the development of electricity showrooms and exhibition work. There is a great art in this work if it is to be a success.

Personally, I think that every employé for the work, whether male or female, no matter how young, should first of all learn the current consumption of the various appliances, the meaning, for instance, of the mark "200 Watts" on a flat iron, and explain to a customer that as 1,000 watts equals one unit consumed per hour, the iron would consume one-fifth of a unit per hour; and again, point out that, assuming the rate is 2½d. per kWh, the cost of using the iron would only be one half-penny per hour.

A few simple explanations of this nature, giving definite facts showing how economical the various domestic appliances are to use, would, I am sure, result in larger sales.

Another point which is often overlooked, especially in exhibitions, is the lady demonstrator's clothing. I remember at one exhibition about four years ago seeing a lady demonstrating an electric washing machine. She looked very far from what she was supposed to represent—a happy young housewife enjoying the ease of an electric wash day. Instead, she wore a dark print frock with a still darker overall and, with sleeves rolled up and somewhat bedraggled hair, she looked, as an onlooker expressed it, "too much like home."

I do not advocate dressing-up for the occasion, but I do say: Look neat and attractive and demonstrate with ease and confidence, and the article is already half-sold.

Passing through a large provincial town a few days ago, my attention was drawn by huge placards: "Electricity for Cleanliness and a Healthier Home." On approaching the windows of this beautifully situated showroom, I was dismayed at the utter neglect; not only were the articles badly displayed, with flat irons apparently being heated on boiling rings, but, worst of all, everything was dusty and unpolished. Of what use then the placards?

An electrical showroom should be decorated with care, kept scrupulously clean and the appliances bright and shiny. Even the tiniest of showrooms can be very attractive with very little expense. I opened one in a small town and was congratulated by many for its attractiveness.

It is up to every supply authority to have a showroom, the finest form of advertising and, most important of all, a tremendous help, as Mr. Gillott remarks, "to fill up the valleys" which, to my mind, is more important than many engineers realise.

Ethel Prentice.

Stowmarket, *January 19th*, 1926.

The Metering of Three-phase Power.

Mr. H. H. Jaques states that the condition $e1+e2+e3=0$ will only be fulfilled if:—

(1) The voltages are exactly equal.
(2) They are exactly 120 degrees apart.
(3) They are pure sine waves.

I do not agree, and if Mr. Jaques will go more thoroughly into it he will realise that if, for instance, E1 and E2 were vectorially equal and opposite, and E3 was zero, the condition $e1+e2+e3 = 0$ (where $e1$, $e2$ and $e3$ are instantaneous values taken at any and every instant during a complete cycle), would be satisfied and a 3-phase, 4-wire, 2-element meter would correctly register the energy. Again, if E1 and E2 were each, say, 100 volts, and were in phase with each other, while E3 was 200 volts and displaced 180 degrees from E1 and E2, the condition $e1 + e2 + e3 = 0$ would be met. I mention these two extreme conditions as samples; more normal departures from the conditions of equal voltages 120 degrees apart may be dealt with in the same way, and provided the vector sum of the voltages is zero (E1 + E2 + E3 = 0) the sum of the instantaneous voltages will always be zero, namely, $e1 + e2 + e3 = 0$. Thus we see that the voltages need not be exactly equal nor need they be exactly 120 degrees apart.

With regard to the shape of the voltage waves, the actual shape is immaterial provided that $e1 + e2 + e3 = 0$. The in-

troduction of 5th, 7th, 11th, &c., harmonics, corresponding harmonics in each phase having the same percentage of its fundamental will not affect this relation. In a 3-phase transformer having a delta primary any resultant voltage in the delta would be practically suppressed just as the 3rd harmonic is suppressed; thus in the primary winding the condition $e1 + e2 + e3 = 0$, is enforced by the nature of the circuit, and provided the ratio of each phase is the same the condition $e1 + e2 + e3 = 0$ is also obtained on the star-connected secondary of the transformer, and we obtain accurate results on a 2-element, 3-phase, 4-wire meter, as the figures I gave in my last letter showed.

With reference to paragraph 57 of the B.E.S.A. meter specification I have shown that a 3-phase, 4-wire, 2-element meter will register accurately without requiring currents or pressures to be symmetrical as regards magnitude or phase angle.

A Meter Superintendent.

January 25th, 1926.

How Will "Government" Electricity Affect us?

The letter from Mr. L. L. Robinson in your issue for January 22nd goes to show that the public cannot, and must not, expect to obtain electricity at a very much (if any) lower rate under the new scheme than at present.

If this be so as regards such a district as Hackney (I quite agree with Mr. Robinson), how much more so will it be in the case of the small outlying towns.

As an instance, we here are supplying electricity at the following rates:—Lighting 9d., heating and power 3d., cooking 1½d., or on the Dundee Tariff at 8s. per 100 sq. ft. of floor area plus 1½d. per unit for all purposes.

If we were to take a bulk supply, the standing charges due to our small output of 180,000 units per annum and the length of the necessary transmission line would be round about twopence per unit, to which must be added the cost of energy in bulk at, say, 1d. per unit, *i.e.*, total 3d. per unit purchased. How, then, could we continue to sell at 1½d. per unit?

Conditions in this country are vastly different from those obtaining in America and Canada, and, whilst the Government scheme from an engineering point of view may be practicable, from a financial point of view it is one in which I should be sorry to be interested, and must surely operate to the disadvantage of the public.

C. Culmer Hodges, A.M.I.E.E., A.M.I.Mech.E.

Electricity Works, Dawlish,
January 25th, 1926.

Situations Vacant.

Having recently had cause to seek employment, I have replied to several of the advertisements in your paper, and although in every case I enclosed a stamped envelope, I have not had the pleasure of one acknowledgment.

If each applicant has had a similar experience, then advertisers must find this a paying proposition.

Is there not any way in which this kind of thing can be stopped?

May I venture a further suggestion with regard to advertisements of situations vacant, and that is the inclusion of the name of the town or district? This would save many from applying, where distance alone precludes any chance of being selected.

I trust my remarks will receive some consideration at your hands.

Blackpool, *January 20th*, 1926. **John Frame.**

We have received a letter from Mr. J. C. Elvy on "An Electric Vehicle Association," too late for inclusion in this issue.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Birmingham Electric Club.—Mr. A. E. Cunningworth, in his presidential address to the Birmingham Electric Club last Friday evening, spoke of the present position and prospects of the electrical industry. He said that electrical power must be sold at a fraction of the present price. This could not be until the power-station engineer could buy machinery, &c., at a very much lower price than at present. The whole of the machinery needed speeding up. The improvement to the alternator during recent years had been very slow. The Electricity Commissioners had assisted matters by adopting 50 cycles. The super-power station of the future had great potentialities if developed on proper lines.

Dust Collectors at Birmingham.—The Birmingham Corporation recently ordered 19 flue dust collectors from Messrs. Davidson & Co., Ltd., Belfast, and it has now placed an order for a further 12. It is calculated that each of these collectors takes up 49 lb. of dust per hour, and thus Birmingham will free the atmosphere of 5,000 tons of dust a year when the whole of the collectors are in operation.

Electricity Supply Workers' Wages.—At a meeting of District Council No. 2 for the Electricity Supply Industry (Yorkshire, &c.), on January 13th, an application was submitted by the trade union side of the Council for an increase of 1d. per hour in the wages of all grades in the Council's schedule and for the general payment of double time on Sundays. The claim was based on the ability of the undertakings to pay the increased rates. The employers' side decided that the prosperity and ability of undertakings to pay the increased rates were not adequate reasons for a rise. It was considered that the wages at present paid in the supply industry were sufficiently high having regard to the level of wages paid in other industries. No settlement was reached in the matter.

The employés represented upon the District Council No. 10 (Greater London) for the Electricity Supply Industry recently claimed an increase of 10s. per week in their wages. This claim was referred by the National Joint Industrial Council to a final appeal court consisting of five representatives appointed by the employers' side of the No. 10 District Council and five appointed by the trade union side, with an independent chairman (Mr. C. P. Sparks). At a meeting held on January 11th, the Court unanimously came to a decision to award an advance of 6¼ per cent. on the existing total rates of pay to all manual workers within the scope of the "London Agreement" of January 18th, 1921. It is provided that the total rates of pay shall not include overtime, and the 6¼ per cent. shall be fixed on the present rates of pay, and shall not be varied according to the cost of living. The advance was to come into force for the first full week following the date of the award (January 15th), and is to continue until determined by three months' notice from either side.

Lead.—Reporting on January 23rd, Messrs. James Forster and Co. said that the demand from consumers in this country still left much to be desired. The main strength of the lead position continued to be derived from America. Conditions in Germany seemed to be going from bad to worse, and the revival in demand from consumers in this country confidently expected in January had not so far materialised.

The Holophane Lighting System.—It is stated that the Holophane lighting system is now in use in 500 towns in all parts of the world. The bulk of these towns (298) are in the United States.

Suggested Shipbuilding Subsidy.—At a recent conference in Newcastle representatives of a number of trade unions associated with the shipbuilding industry, including the Electrical Trades Union, decided to bring before shipbuilding employers and others affected the question of a subsidy or other Government assistance for the shipbuilding industry.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, January 26th:—No change in electrolytic copper prices. Messrs. James & Shakespeare report, January 26th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £30 10s., 5s. dec. Messrs. Edward Till & Co. report, January 26th:—India-rubber, Para fine, 3s., 2d. dec.

Electricity in Tin Mining.—Speaking at the recent annual meeting of Rahman Hydraulic Tin, Ltd., Col. C. Rae, the chairman, said that in order to complete the company's hydro-electric scheme, a further $500,000 would be needed owing to the necessity for stronger foundations.

The Importance of Turnover.—In the course of some notes on the contractor-dealer's business *The Electragist* (New York) says that the measure of profit in a business greatly depends upon the movement or turnover of the invested capital. It is shown that if the turnover on an investment is 1.5 times per annum, the net return, on a 6 per cent. basis, is 9 per cent. If, however, the turnover is increased to 1.7 times, the net return, on the same basis, is increased by 13⅓ per cent., while if the figure is 2, the increase is 33⅓ per cent. A turnover of 12 times increases the original profit by 700 per cent., giving an annual net return of 72 per cent. on the investment.

Social Events.—The first annual dinner and smoking concert of the West Gloucestershire Power Co., Ltd., was held at the Swan Hotel, Lydney, on January 16th. The general manager and chief engineer (Mr. H. S. Ellis) presided over a gathering of about 85. Mr. W. A. H. Parker proposed the toast of the company, and the chairman, in replying, outlined the good progress made by the undertaking for the first complete year's working.

The annual social gathering of the staff and friends of Messrs. Robson & Coleman (Newcastle) took place on January 15th, about 120 attending. Two whist drives were held, the prizes being given by Mr. and Mrs. Robson and Mr. and Mrs. Lowrey. Mr. N. B. Ridley gave prizes for dancing. Mrs. Robson presented the prizes.

The Igranic Electric Co., Ltd., held its annual carnival dance on January 15th at the Café Dansant, Bedford, where a party of 500 danced from 8 p.m. until the early hours. A large majority of the dancers were in fancy costume, and 20 prizes were awarded by a special judging committee, the prizes being presented by Mrs. Curtis. Among those present were Messrs. G. A. Mower, A. H. Curtis, J. T. Mould, and A. Thornton, and contingents from the London, Birmingham, Manchester, and Leeds offices.

Turkish Tax on Electricity.—The Budget proposals of the Turkish Government for the next financial year include a tax of 10 per cent. upon the consumption of electricity and gas.

Calendar.—We have received a novel "perpetual" calendar from the Union Cable Co., Ltd. The day and month appear in openings near the top, while the date is indicated by a pointer upon a dial. The centre of the dial consists of an illustration of some of the company's cable products.

Remission of Australian Duty.—The Tamworth (N.S.W.) Municipal Council recently ordered a large electricity generating plant from England, and it was found that under the new tariff schedule the duty upon it would amount to £1,100. The Council objected to such an imposition as every effort had been made to obtain the plant in Australia but without success. The Minister of Customs therefore remitted the duty, stating that he was sympathetically disposed towards country municipalities which were endeavouring to provide improved facilities for their citizens. If they had failed, after inquiry, to obtain supplies locally they were entitled to every possible concession.

Hungarian Industrial Progress.—The Mid-January *Review of Central Europe* published by the Anglo-Austrian Bank, Ltd., quotes statistics as to Hungarian industry compiled by the Hungarian Statistical Office. These show a tremendous increase since 1913, particularly in food-producing industries. The machine and electrical industry was represented by 229 factories in 1913; in 1924 there were 301, an increase of over 33 per cent. The average production per factory, however, declined from 1.10 million gold crowns in 1913 to 0.52 million crowns in 1924, and the average output per worker from 5,370 crowns in 1913 to 3,415 crowns in 1924.

The British Industries Fair.—The Fair authorities have published a list of exhibits specially designed to supplant articles of foreign manufacture, or as a direct challenge to foreign competition. Included in the list are wireless terminals and accessories, vacuum self freezers, electric motors suitable for any climate, electric switches, coal pulverisers, phenolic condensation products, *e.g.*, mouldings and impregnating varnishes, electrically-propelled one- and two-ton trucks for factories, special compact radio components, magnetic separators, and electric lampholders and wall plugs.

Argentina's Electrical Imports.—From statistics contained in the annual report of the British Chamber of Commerce in the Argentine Republic, it appears that the imports of electrical machinery and material into Argentina during the first six months of 1925 were valued at 31,988,077 gold pesos, as compared with 23,285,036 pesos in the first half of 1924.

Employment During December.—The *Ministry of Labour Gazette* states that employment in the engineering industry during December was again bad on the whole, especially in the marine section, although there was a tendency to improvement. In the electrical section employment remained fairly good. The "overall" proportion of unemployed in the engineering industry was 11 per cent. In the marine section it was 25.2 per cent., while in electrical engineering it was only 5.1 per cent., a decrease of 0.5 per cent. in a month. The percentage of unemployed in the electrical wiring and contracting industry was 6.7, an increase of 0.2 per cent.; in the electric cable, wire and lamp manufacturing industries the figure was 5.5 per cent., an increase of 0.1 per cent.

An All-Electric Restaurant.—Within a stone's throw of our offices, at 33, Ludgate Hill, E.C.4, the City of London Electric Lighting Co., Ltd., has opened an all-electric restaurant and showrooms. Upon the ground floor a display of all kinds of electrical appliances has been arranged, including domestic and business apparatus, while part of the restaurant is at the rear. In the basement is the other half of the restaurant—a very clean, neat and comfortable room, and the kitchen and store-rooms. We hope to say more regarding the new premises at a later date. For the present we must content ourselves with saying that they are well and tastefully lighted and decorated, and everything, including the time-keeping, is carried out electrically.

Works Visit.—A party of South African students who recently visited this country included the Witton works of the General Electric Co., Ltd., in their itinerary. Mr. R. Orsettich, the company's chief designer, presided at afternoon tea and said that he hoped that what they had seen would make them realise that England was still in a position to deal with contracts of any dimension. Dr. M. Rendl, in voicing the visitors' thanks, said that the students were in Europe to gain first-hand information of the conditions and they had been impressed with the great generosity extended to them everywhere.

Engineering Employés' Wages.—It is reported that London members of the Amalgamated Engineering Union are becoming impatient at the delay in receiving a definite answer to the union's claim for an increase of 20s. per week in the wages of its members. They urge that the employers be again approached on the matter, which was opened in 1924. A meeting of representatives of the union and employers was to be held last Tuesday, but was abandoned owing to the continuance of a dispute between a London printing-press manufacturing company and its employés.

In the meantime a resumption of the national negotiations was to be made in London yesterday (Thursday).

A New "Exide" Poster.—We have received from the Chloride Electrical Storage Co., Ltd., one of its new posters advertising "Exide" high- and low-pressure accumulators for radio work. This is somewhat different from the usual poster, having been produced by a photogravure process which gives a clear-cut sepia picture. The design depicts a happy *ménage à trois*, a cabinet receiving set and "Exide" batteries being given prominence.

Large American Power Merger.—It is reported from New York that the power and lighting companies in New York and the New England States have combined under the title of the North-Eastern Power Corporation. Among the companies represented upon the board of the new amalgamation, which is said to involve a total investment of $5,000,000, are the General Electric Co., the New England Power Corporation, the Mohawk Hudson Power Corporation, and the Power Corporation of New York.

New Italian Companies.—Among the new companies recently formed in Italy in connection with the electrical engineering industry are the Compagnia Lampade Elettriche Nazionale "C.L.E.N.," Milan, capital 200,000 lire, to manufacture electric lamps; la Società per Intraprese Trazione Elettrica, Asti, capital 200,000 lire; la Società per Finanziamento di Imprese Elettriche "La Centrale," Leghorn, capital 1,000,000 lire; la Società Lombarda Applicazioni Elettriche, Voghera, capital 200,000 lire; la Società Italiana Porcellane Elettrotechniche Pohl, Milan, 125,000 lire; and la Compagnia Italiana Strumenti di Misura Milan, 500,000 lire.

New Zealand's Electrical Imports.—Figures just to hand show that the imports of electrical machinery into New Zealand during the third quarter of 1925 attained a value of £435,234. Of the total, £280,917 is attributed to Great Britain, £78,479 to the United States, £19,910 to Canada, £6,312 to Australia, and £68 to Japan.

Trade Announcements.—Messrs. Osler & Faraday, Ltd., have recently opened showrooms at Lanthorne House, 98-100, Queen Street, Cardiff, where Mr. Arthur E. Luen is their representative.

The County of Durham Electrical Power Distribution Co., Ltd., has opened a new showroom and offices at 19, North Road, Durham.

Mr. J. A. Woods, A.M.I.E.E., 7, Stoneyhurst Road, Gosforth, Newcastle-on-Tyne, has been appointed representative of the Vincent Switchgear Manufacturing Co., Ltd., for the North-East Coast.

The business of Messrs. L. Weekes, Ltd., electrical engineers, of Langley Street, Luton, Beds., has been acquired by Mr. T. H. Dryden.

Catalogues and Lists.—Magnum Electric Appliances, Upper Elmers End Road, Elmers End, Kent.—Illustrated price card, giving some particulars of the "Magnum" electric automatic kettle.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—A comprehensive illustrated and priced catalogue of radio receiving sets, components, and accessories. The publication contains a glossary of radio terms and wiring diagrams. Catalogue Sections S (1) and F (2), dealing respectively with electric lighting supplies and electric light fittings accessories. Both publications are well-illustrated and give full prices. Also a well-illustrated brochure on flood-lighting and a mailing card advertising bells and accessories.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—An illustrated and priced pamphlet dealing with the Marconiphone "Die-Cast" variable condenser.

John W. Barnes, Ltd., Railway Works, Rock Ferry, Cheshire.—Priced pamphlets advertising loose blade reamers and patent floating chucks and straight-shank drills.

F. Hodgson & Co., Ltd., 24, Queen Victoria Street, E.C.4.—A blotter advertising the company's registered contracting business.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publications Nos. 738 and 739, illustrating and describing "English Electric" oil-immersed circuit-breakers, Class "OKB," sizes III, IV, and V.

The Dowsing Radiant Heat Co., Ltd., Bollo Lane, Acton, W.3.—A comprehensive illustrated price list of electric heating and cooking apparatus, "sun baths," and other electro-medical appliances.

Siemens & English Electric Lamp Co., Ltd., 38 and 39, Upper Thames Street, E.C.4.—Leaflet No. Z107, giving illustrations and prices of "Ideal" switches and fuses; and Leaflet No. 147, giving details and prices of "Siemens" neon lamps.

Mr. Alan Wright, Sentinel House, Southampton Row, W.C.1.—A priced and illustrated folder advertising the "Winter" inter-locking switch plug.

The Ernest Sinclair Hoist & Trolley Co., 14, Brompton Road, S.W.1.—A series of illustrated leaflets dealing with leather-tired wheels, vulcanised-fibre, wood, steel, and iron wheels, tramway points, trucks, turntables, hoists, cranes, castors, trolleys, &c.

The Parsons Motor Co., Ltd., Southampton.—Publication No. 77, an illustrated catalogue of marine and stationary oil and petrol engines.

Premier Electric Heaters, Ltd., Keeley Street, Watery Lane, Birmingham.—List No. 79, containing illustrations and prices of new designs of electric fires.

Hans Renold, Ltd., Didsbury, Manchester.—A priced booklet dealing with Renold standard chain drives.

Superlamp, Ltd., 92-94, Paul Street, E.C.2.—A net trade price list of electrical material and accessories.

Private Arrangements.—MAURICE MARTIN, electrical contractor, 23, Royal Arcade, 32, West Street, and Electron House, Kewstoke, all Weston-super-Mare, trading as the D.B.M. Electrical Co.—A meeting of creditors was held recently at Bristol, when a statement of affairs was submitted, which disclosed liabilities of £884 and net assets of £691, or a deficiency of £193. The debtor had employed a manager to conduct the business at a salary of £3 10s. per week, while he himself was holding a position at Bristol. It was stated, however, that if any adverse proceedings, such as bankruptcy, were taken, he would probably lose that position. The debtor commenced business in 1919 with his father-in-law, who died in 1922. At that date figures were prepared showing a credit of capital due to the father-in-law's trustees of about £60. The debtor continued trading on his own, and was successful for two years. During 1925, however, the takings had gradually diminished, and in the last two or three months had seriously fallen off. The debtor stated that the turnover for 1924 was £2,500, and for 1925 £1,900. Several creditors had threatened proceedings. The debtor had no offer to put forward, but stated that he had had several inquiries for the purchase of the business at a price sufficient to clear off the whole of the liabilities. It was decided that the debtor should execute a deed of assignment in favour of Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C. A committee of inspection was also appointed, consisting of the representative of the Sloan Electrical Co., Mr. Griffiths, Mr. Collins, and Mr. W. Eastwood, of Messrs. Simpson & Baker.

Bankruptcy Proceedings.—P. W. HORNE (Horne Bros.), electrical engineer, 260, Linthorpe Road, Middlesbrough.—Receiving order made January 13th, on debtor's own petition. First meeting, January 29th, at the Official Receiver's offices, 80, High Street, Stockton-on-Tees. Public examination, February 12th, at the Court House, Middlesbrough.

W. G. CONWAY (Lestron), wireless component dealer, 88-90, Chancery Lane, W.C.—Trustee, Mr. C. Latham, 78, New Oxford Street, W.C., appointed January 13th.

W. P. YOUNG, Leicester, mechanical and electrical engineer.—A supplemental dividend is being declared and proofs must be sent to Mr. Evan Barlow, Official Receiver, 1, Berridge Street, Leicester, by February 6th.

D. D. RAYNER & Co., Derby.—A meeting of the principal creditors was held at Derby on Tuesday last to discuss the future of the business.

J. RIGG and F. STEAD (Rigg & Stead), radio engineers, 17, Old Chapel Street, Blackburn.—Receiving order made January 16th, on debtors' own petition.

A. KERSHAW and C. H. WOOD (Kershaw & Wood), electrical engineers and merchants, 9, Bradford Road, Dewsbury.—Last day for proofs for dividend February 5th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

S. A. WARDELL, electrical engineer, 83, Raleigh Road, Richmond, Surrey.—Last day for proofs for dividend February 6th. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C.1.

T. BARTON, electrical engineer, The Electric Works, Ainsworth Street, Blackburn.—First dividend of 15s. in the £, payable January 29th, at the offices of the Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

JOHN BRODIE, lately carrying on business as an electrical engineer at Music Hall Lane, Dunfermline.—The adjourned examination of this debtor took place on January 21st, and was closed.

D. A. GRIFFITHS and R. L. H. HUGHES, trading as Griffiths and Hughes, 13b, Whitcombe Street, Aberdare, Glamorganshire, electrical engineers.—The public examination of these debtors was held on January 22nd, at Aberdare. The statement of affairs showed a deficiency of £441. Debtors commenced business in partnership and at first were successful, but two years later depression set in, and losses were also sustained on contracts. The examination was closed.

Company Liquidations.—EAGLE ELECTRICAL MANUFACTURING CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. H. Henry, Ruskin Manor, Denmark Hill, S.E. Meeting of creditors held January 27th, at the George Hotel, Strand, W.C.

MARCONI SCIENTIFIC INSTRUMENT CO., LTD.—Winding up voluntarily. Liquidator, Mr. C. R. Dormer, 14, George Street, Mansion House, E.C. Meeting of creditors at 14, George Street, E.C.4, on February 3rd. Particulars of claims to the Liquidator by February 13th.

Dissolutions of Partnership.—CENTRAL RADIO DEPOT, vendors of radio apparatus, 4, Church Lane, Banbury.—Messrs. C. H. Ward, L. Ward, and A. J. Shelley have dissolved partnership. Messrs. C. H. and L. Ward will continue the business.

RADIO ELECTRICAL CO., electrical and wireless dealers, 12, South Queen Street, and 70, High Street, Morley, York.—Messrs. H. B. Philpott and A. Midgley have dissolved partnership.

American Power Scheme for Europe.—The European-American Utilities Co. of New York is projecting the establishment of large electrical works and the distribution of electrical energy over long distances and at cheap rates in the countries of Central Europe. The scheme includes Czecho-Slovakia, Poland, Rumania, Austria, and Hungary. It is understood that representatives of the company are already negotiating with a view to acquiring suitable plots of land. The company is also preparing plans for the electrification of railways and tramways in the countries mentioned.—*Financial Times.*

Book Notices.—The issue of the *Graphic* for January 16th is a special one containing a number of interesting articles and imposing advertisements relating to twenty-five years' progress in various departments of human activity. A large section devoted to the "Wonder of the Twentieth Century" has an introduction by Mr. Leo Scheff, who has acted as Special Commissioner in connection with this very creditable production. There are signed articles by Sir Hugo Hirst, the Hon. F. Vernon Willey (F.B.I.), Dr. J. A. Fleming, the late Captain H. Riall Sankey, Prof. G. W. O. Howe, Mr. V. W. Dale (E.D.A.), and Sir Alex. Roger (Telephone Development Association), on subjects in which they are specially interested, and a great deal of space is devoted to interesting publicity matter regarding the works and operations and manufactures of the G.E.C., Ltd., Standard Telephone & Cables, Ltd., the Chloride Electrical Storage Co., Ltd., Doulton & Co., Ltd., Burndept Wireless, Ltd., the Marconiphone Co., Ltd. (Sterling), and other companies.

"*The Wireless Trader* Year Book and Diary." London: Trader Publishing Co., Ltd. Price 5s. 6d.—We have found the first (1925) edition of this work useful during the past year and are accordingly glad to note that the 1926 edition has been revised and brought up-to-date; in addition to a "one week at view" interleaved diary, the principal contents include alphabetical lists of trade and professional addresses, proprietary names of sets and components, a comprehensive guide to goods supplied and services rendered, a list of factors (arranged territorially), data on technical and broadcasting matters, and other trade information. An effort has been made to include only *bona-fide* factors and manufacturers connected with the retail trade, and a time-saving feature is the addition of their telephone numbers.

"The *Practical Engineer* Electrical Pocket Book and Diary, 1926." Edited by Conrad Arnold, A.M.I.E.E. Pp. cxx +736; illustrated. Oxford University Press. London: Humphrey Milford.—The sections of this 27th edition of the work have been revised and brought up to date, and in many cases re-written. The section on Switchgear and Circuits has been so dealt with by Mr. H. Trencham, A.M.I.E.E., who has carefully set basic principles so as to guide the engineer in meeting the varying requirements of his work.

"Broadcast Reception in Theory and Practice," by J. L. Pritchard. Pp. xi + 259; figs. 160. London: Chapman and Hall, Ltd. Price 8s. 6d. net.

"The Radio Year Book, 1926" (fourth year). London: Sir Isaac Pitman & Sons, Ltd. Price, 1s. 6d. net.—This work deals with the most important developments in broadcasting in 1925; most listeners will find items of interest amongst the many reproduced photographs of "notabilities before the microphone," whilst the section on the "Children's Corner" contains hitherto unpublished information. Various articles in the technical section can be read with profit, and useful data and a trade directory portion are included.

We have received from the Clyde Valley Electrical Power Co. a copy of the first issue of the "C. V. Magazine." We find this to be a well-balanced journal in which technical matters, social events, and other notes and news all receive a fair share of attention. There are numerous illustrations, and one drawing takes the form of an unsolicited testimonial to the ELECTRICAL REVIEW.

"The Technology Reports of the Tôhoku Imperial University, Sendai, Japan." Vol. V, No. 4, 1925. Tokyo and Sendai: Maruzen Company, Ltd.

"The Mining Electrical Engineer. Vol. VI, No. 64. January, 1926. The Association of Mining Electrical Engineers. Price 1s.

"Elements of Electricity," by W. H. Timbie. Second Edition. Pp. xi + 624; figs. 428. Price, 17s. 6d. net. "House Wiring," by G. A. Willoughby. Pp. xi + 219; figs. 209. Price, 10s. net. London: Chapman & Hall, Ltd.

Increased Prices.—Owing to the increased cost of rubber, Messrs. Fuller's United Electric Works, Ltd., Chadwell Heath, Essex, have increased the price of v.i.r. lead-covered cable by 17½ per cent., and of v.i.r. braided cable by 15 per cent., from January 22nd.

A West Ham Poster.—A large poster, measuring about 4 ft. by 3 ft., has been issued by the West Ham Corporation Electricity Department (engineer, Mr. F. W. Purse). It is headed with the county borough arms, and asks "Why be old-fashioned and out of date?" It compares, by means of pictures, ancient and modern methods of travelling and cooking, and concludes with the words, "Why not use electricity and be right up-to-date?"

Newcastle Contractors' Dinner.—The annual dinner of the Newcastle Branch of the Electrical Contractors' Association (Inc.), was held at the Crown Hotel, Newcastle, on January 21st. In the absence, through ill-health, of the chairman, Mr. T. Atkinson, the vice-chairman, Mr. Lowrey, presided, and Mr. T. E. Alger, the president of the Association, and the Deputy Lord Mayor, Councillor W. V. Longfield, were present. In responding to the toast of "The Lord Mayor and Corporation," proposed by Mr. A. Andrews, the Deputy Lord Mayor mentioned a number of important developments which were in progress in the city. Mr. W. Horsfall proposed the toast of "The Electrical Contractors' Association," mentioning the lead which Newcastle had taken in electrical development, and Mr. T. E. Alger replied. The Deputy Lord Mayor proposed the toast of "The Institution of Electrical Engineers," which was responded to by Mr. W. Cross. A musical programme followed the dinner.

Private Hydro-Electric Development in New Zealand.—The Wellington correspondent of *The Times* reports that the New Zealand Government has granted licences to a private syndicate to develop water power in Smith Sound and Lake Manapouri, and on the Southern Fiord in Lake Te Anau. These are the first licences issued for any great private hydro-electric development scheme, the previous work having been undertaken by public bodies. The intention is to produce, ultimately 300,000 h.p. for the manufacture of nitrate fertilisers. The licences are for a period of 60 years with a Government right of purchase after 30 years.

An E.T.B.I. Ballot.—The annual ball of the North-East Coast Section of the Electrical Trades Benevolent Institution took place on January 22nd at Newcastle, and in connection with it an electrical ballot was organised. The purchasers of tickets were asked to place a number of electrical appliances in order of popularity, and eleven prizes were presented by electrical firms in the district. The net proceeds amounted to £115. In the list of prize-winners, which has been sent us by Mr. R. E. Robson, we notice the following names:—Third, Mr. W. Findlay (Edinburgh); seventh, Mr. R. W. Gregory (Newcastle); and ninth, Mr. W. E. Bush (E.L.M.A.). The secondary object of the ballot was to further the "electrical idea," and it was found that the most popular appliance was the electric iron; this was followed, in the order named, by the sweeper, kettle, oven, radiator, washer, grill, toaster and fan (level), sewing machine, milk warmer and coffee percolator (level), shaving pot, and hair drier.

A Belling Sports Club.—The staff and employés of Messrs. Belling & Co., Enfield, have formed a social and sports club.

Local Exhibition. — BURNLEY.'— An electrical exhibition organised by the Corporation Electricity Department was opened at the Pavilion Picture Palace yesterday; it will remain open until February 6th. Eighteen stands have been arranged, and many leading electrical firms are represented. The Department has a varied collection of appliances, and the stand is shared with the Burnley Components, Ltd., Santon, Ltd., and Whittaker Bros. Other exhibitors are:—Standard Telephones and Cables, Ltd.; Siemens and English Electric Lamp Co., Ltd.; Thorwash, Ltd.; the Electric Lamp Manufacturers' Association; the Jackson Electric Stove Co., Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.; Carron Company; the Hotpoint Electric Appliance Co., Ltd.; the General Electric Co., Ltd.; Credenda Conduits, Ltd.; the British Electric Transformer Co., Ltd.; the Cable Accessories Co., Ltd.; the English Electric Co., Ltd.; Messrs. Bastian & Allen; the Singer Sewing Machine Co., Ltd.; and the British Thomson-Houston Co., Ltd. The catalogue produced in connection with the exhibition sets out very clearly the favourable terms for the supply of electricity and the hire or hire-purchase of appliances which the Department has instituted.

Swiss Industries Fair.—It is announced that the tenth Swiss Industries Fair will be held at Basle from April 7th to 17th.

Electricity at the Ideal Home Exhibition.—An Electric House, which is being organised by the British Electrical Development Association, will prove one of the chief attractions of the forthcoming Ideal Home Exhibition at Olympia. The structure will contain an old-fashioned kitchen, a modern kitchen, an old-fashioned living room, a modern living room, and, in addition, an up-to-date bedroom and laundry. Visitors will thus be able to appreciate by contrast the comfort and convenience obtainable to-day by electrical means, but utterly unthought of a few generations ago. In each apartment will be found a complete range of modern British electrical appliances in actual operation, and the fullest information will be available concerning their cost, manner of use, and the cost of the necessary energy. The lighting of the house will form a very special and interesting feature. Electric heating will be represented by examples of the most modern types of radiant fires. Continuous demonstrations of electric cookery will take place in the modern kitchen daily. Many semi-portable and table appliances will also be exhibited. In the bedroom the conveniences of a well-wired house will be displayed in the facilities for warming without waste or work, for dressing, making morning tea and other adaptations of electricity. Water heating will be a feature of the bathroom. Electric ironing, washing, mechanical washing of plates and dishes, silver cleaning, and other tasks will be seen in the laundry. An inquiry bureau will enable visitors to obtain information concerning the supply facilities in the districts in which they reside. Literature will be provided and everything possible done to make a visit to the electric house as educational and practical as possible.

The Business Controller.—We have received from the American Management Association a copy of a paper dealing with the functions of the controller in American businesses. While these functions necessarily vary in different spheres, it appears from the paper that generally it is the duty of the controller, among other things, to devise, install and maintain the accounting system; to supervise the receipt and disbursement of moneys; to look after the pay roll; to control stocks and supplies, and take inventories; to maintain a check upon the treasurer's receipts, disbursements and bank balances; to prepare detailed statements of accounts and analyse and summarise these; and to supervise the operation of the company's "budget."

For Sale.—Mr. Fred. Lake, of Devonshire Street, Theobald's Road, London, W.C.1, has 500 miles of British-made electric cables for sale. Cheadle and Gatley U.D.C. Electricity Department invites offers for a number of maximum demand indicators. East Ham Corporation Electric Lighting and Tramways Department has for disposal one 350-i.h.p. horizontal cross-compound engine direct coupled to a 225-kW Dick-Kerr generator. Messrs. H. Butcher & Co. will sell by auction on February 9th, at the late Whitehead Aircraft Co.'s works, Feltham, power plant, including generating sets, panels, switchgear, motors, &c. (See our advertisement pages to-day.)

Appliance Sales by Electricity Suppliers.—*Electrical Merchandising* states that during 1924 electrical appliances to the value of $47,601,000 were sold by 2,644 companies in the United States whose principal business is the supply of electricity. As the total sales of appliances in their territory reached $111,892,000 during the year in question, the companies' share was no less than 41 per cent. The remainder was supplied as to 26.9 per cent. by electrical dealers, 15.4 per cent. by department stores, and 15.2 per cent. by "other stores." Another interesting fact brought out in the article to which we refer is that the number of residential consumers in the areas dealt with was 8,274,900, giving a *per capita* expenditure of $12.82 upon electrical appliances.

New Spanish Company.—La Sociedad de Fuerzas Motrices de Covadonga is the name of a new hydro-electric company recently organised in Barcelona with a capital of 525,000 pesetas.

Encouraging Registered Contractors.—Mr. J. H. Parker, the borough electrical engineer of West Hartlepool, has decided that in future only registered electrical contractors will be given Corporation contracts.

The Norwegian Electrochemical Industry.—Dealing at length with the present and future prospects of the electrochemical industry in Norway, Mr. Ove Collett, although not acting as an engineer in this industry at the moment, has responded to a request made by *Norges Handels og Sjofartstidende* for information on the subject. At the outset he points out that the total of the water powers now in use represents 1,400,000 electrical horse power, of which about one-half, or 750,000 h.p., is arranged for the use of the electro-chemical industry, whose works and corresponding plants have a value of from 400 to 500 million gold kroner, and whose net export of products (value of exports less the value of the imported raw materials) is estimated at 126 millions of gold kroner when working at full output. The actual net value of the exports in recent years, however, has been appreciably lower than the last figure as the production in the case of many works is far below the capacity and some works have discontinued their activity. As to the future of the Norwegian electrochemical industry, Mr. Collett reaches the conclusion that the nitrogenous branch will remain the principal part of the industry. The only other branch of the various sections of the industry, based upon the methods at present employed, that can be thought capable of developing so as to consume a really large part of the unutilised water powers, seems to be the aluminium branch, and possibly also zinc production. If employment is to be found for large powers outside these branches, he considers that other methods of manufacturing than those now now in use in Norway will have to be provided, and it is probable that these will be found.

Lighting and Power Notes.

Ashburton.—SCHEME REJECTED.—The Urban District Council has been informed that the Electricity Commissioners have rejected an application by Mr. Hartree for powers to supply electricity to the town.

Australia.—TASMANIA.—We have received from Mr. H. A. Curtis, chief engineer and general manager of the Tasmanian Government Hydro-Electric Department, a copy of his report for the year ended June 30th last, together with branch reports. The operation branch earned a revenue of £164,141, the major part of which was derived from the sale of electricity in bulk. The working expenses amounted to £17,652, and the gross profit was thus £146,489. The revenue from the Hobart branch amounted to £103,995. Working expenses were £15,148, and the purchase of bulk supplies amounted to £46,552, leaving a gross profit of £42,294. The Derwent Valley service showed a revenue of £3,795, and working expenditure of £2,379, leaving a gross profit of £1,415, which was transferred to a main joint account, together with the gross profits from the Operation and Hobart branches, and interest, making a total of £190,373 available. Interest and other charges absorbed £210,546, and the net debit balance for the year amounted to £20,170. The output of the Waddamana power station increased by 8,258,800 kWh to 284,125,900 kWh. With regard to the Shannon scheme, a contract for the civil work has been placed with Armstrong, Whitworth Pty., Ltd., and good progress with the scheme is anticipated during the coming summer. In the Hobart district a further portion of the 6,600-V supply area has been changed over to 11,000-V, and new feeders have been laid and now extend to Taroona. Additions have been made to the sub-station at Electrona, and a supply made available to the Channel towns as far as Port Cygnet, and to Kingston and Brown's River.

Bedford.—ELECTRICITY SUPPLY.—The Rural District Council has given consent to an application by the Town Council for the use of overhead wires for the supply of electricity to the parishes of Cardington, Cople, and Potton.

Bingley.—PURCHASE OF DOMESTIC APPARATUS.—The Lighting and Tramways Committee is applying for sanction to the borrowing of £5,000 for the purchase of domestic electrical apparatus to be let out on hire.

Bradford.—STREET LIGHTING.—The special joint sub-committee of the Corporation appointed some time ago to make experiments in both electric and gas street lighting with a view to general improvement, has failed to come to any decision, and has reaffirmed a former decision to call in outside expert advice. The former decision was to call in the lighting superintendent of the Glasgow Corporation, but the Finance Committee of the City Council rejected the proposal.

Brierfield.—PROPOSED CHANGE-OVER.—The Urban District Council has decided to apply to the Electricity Commissioners for sanction to borrow £9,000 for converting the present system of electricity supply from d.c. to a.c.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical News*, the ninth unit in the Queenston power house has been in operation for a short time now. This brings the output from the Queenston-Chippawa development up to something in excess of half a million horse power, which is the maximum possible under the present limitations regarding the diversion of water from the falls.

Cheltenham and Gloucester.—ELECTRICITY SUPPLY.—The question of bulk purchase of electricity by the Corporations of Gloucester and Cheltenham has been referred to the Electricity Commissioners. Formal objection has been lodged by those two authorities to the application of the Bristol Corporation to establish a generating station at Portishead in view of its possible effect upon the proposals to develop the undertakings at Gloucester and Cheltenham.

Continental.—GERMANY.—According to the Frankfurt correspondent of *The Times*, plans for carrying out the largest hydro-electric scheme in Europe, that of the Ourtal dam on the frontier between Luxemburg and Germany, have now been approved. The essential feature of the scheme consists in erecting a large dam, 348 ft. high, which will impound the water of the rivers Our and Irsen and create a lake about 13 miles long and about a mile wide, extending between Stolzembourg and Ouren. By erecting another dam above Vianden a small additional lake will be formed and a powerful pumping station will carry back the water to the larger lake. The carrying out of this scheme will necessitate a capital expenditure of 500,000,000 fr., and this money will be provided by the district of Bitburg, the A.E.G., and the German Reich.

ITALY.—The Società Elettrica Bergamasca is erecting a 50,000-V transmission line between the transformer station at Dalmine of the Società Generale Elettrica Adamelli and its sub-station at Santa Lucia (Bergamo).

An important hydro-electric scheme in the Upper Borbera valley, in the Ligurian Appenines, is at present under consideration. It involves the construction of an artificial lake nearly 4½ miles long by one mile in width. It is estimated that the lake could supply about 1,320 gallons per sec., which would be utilised by two 20,000-h.p. hydro-electric power stations to be erected at Cellio and Cavi.

FRANCE.—La Société Savoisienne de Constructions Electriques, of Aix-les-Bains, has recently completed an outdoor 60,000/15,000-V transformer station at Romainville for the Société de l'Union d'Electricité de Paris. The plant has a capacity of 18,000 kVA.

Dearne Valley.—ELECTRICAL DEVELOPMENT.—The Dearne District Electricity Board is offering to wire small houses for domestic purposes on the instalment system at an average weekly cost for five years of 1s. 6d.

Hamilton.—ELECTRICITY SUPPLY.—It was reported at a recent meeting of the Town Council in connection with the hydro-electric installation, that offers would be received at an early date from firms willing to submit schemes for the necessary plant. With reference to the extensions at the electricity works, Mr. Gavin Paterson, architect, is to prepare a plan and estimates.

Irish Free State.—DUBLIN.—At a recent meeting of the City Administrative Commissioners, the following modified charges for electricity were recommended:—As an alternative to the ordinary rates of charges, residential or domestic consumers will be given the option of paying a fixed annual charge, based on 15 per cent. of the valuation of the house, plus 1½d. per kWh for electricity for all purposes, which includes meter rents. The rate for electricity through slot meters to be 9d. per kWh, to include rent of meter. The present rate of 2d. per kWh for power to be reduced to 1½d. A flat rate of 3d. per kWh for advertising purposes after 6 p.m. Cookers to be supplied and fitted by the Corporation, subject to a quarterly charge varying from 15s. to 10s., according to the size of cooker. The recommendation was adopted.

THE RIVER LIFFEY TUNNEL.—The Dublin City Administrative Commissioners have decided to invite tenders for the construction of a tunnel under the River Liffey connecting the North and South quays. The cost will be between £45,000 and £60,000, and provision will be made for carrying the city electric cables through the tunnel.

ELECTRICITY SUPPLY (SPECIAL POWERS) BILL.—At the recent sitting of Dail Eireann, the Electricity Supply (Special Powers) Bill was passed, an amendment thereof by the Senate having been accepted by the House.

Japan.—ELECTRICAL DEVELOPMENT.—The Railway Minister, Mr. Wengoku, is reported to have decided to construct a steam power station at a cost of about 20,000,000 yen, in the place of the present Yaguchi power station, which will be abolished upon completion of the former station. The scheme will ensure a supply of electricity for the Government electrified railways. The site for the new station will probably be at Rokugo or Tsurumi, and plant with a capacity of 60,000 kW will be installed.

It is understood that the scheme to establish the Tenryugawa Electric Power Co. is making good progress. There will be nine hydro-electric power stations to be built along the Renryu River. The work will be divided into three parts, the first of which will consist of the first and third power stations of 21,000 kW, and the second will be the sixth power station of 38,800 kW, the remaining stations being included in the third period. The total output will amount to 210,000 kW, and the total cost is estimated at 87,400,000 yen.

Keighley.—PROPOSED EXTENSION OF SUPPLY.—A proposal is to come before the next Council meeting that application be made for power to include the townships of Keldwick, Cowling Cross Hills, and Glusburn in the Council's area of electricity supply.

London.—ST. MARYLEBONE.—The Electric Supply Committee has recommended the following reductions in the charges for electricity:—Lighting: Flat rate, from 4½d. to 4d. per kWh; slot meters from 5d. to 4½d. per kWh. Annual contract demand (telephone) and long term rate: The "unit" charge from 1d., ¾d. and ⅝d. to ⅞d., ⅝d., and 9/16d. per kWh. The Committee has also recommended that ten-year agreements be entered into with H.M. Office of Works and the Crown Estate Paving Commissioners for the lighting of 283 lamps in Regent's Park within the borough for the sum of £4 4s. per annum for single burner lanterns and £6 6s. per annum for double burner lanterns, and that the Council approve the expenditure of £3,300 for carrying out the work of converting the lamps from gas to electricity.

STEPNEY. — The Finance Committee has recommended that application be made for sanction to the following loans:—£148,410 for h.p. feeders to the new St. George's sub-station from Limehouse, l.p. feeders from the sub-station to various feeding points, additional h.p. and l.p. feeders in connection with the Mile End sub-station, a h.p. feeder terminating at the Bethnal Green boundary, and a l.p. feeder from the Whitechapel sub-station; £81,550 for mains and disconnecting boxes. A further sum is also allocated for house services. Of this total expenditure of £274,960, £32,210 has already been sanctioned by the Electricity Commissioners.

New Zealand.—HAWKES BAY.—The Hawkes Bay Power Board recently conducted a poll of the ratepayers with regard to the borrowing of £300,000 by the Board, for the purpose of reticulating Hawke's Bay County and the Taradale town district for Mangahao power. The ratepayers have voted in favour of the scheme.

Northern Ireland.—ARMAGH.—The Urban Council has decided to seal an agreement with Mr. P. A. Spalding, electrical engineer, of Dundalk, for the lighting of the town by electricity.

LURGAN (ARMAGH).—At a meeting of the Urban District Council on January 18th, it was decided to proceed with the electricity scheme which was commenced in 1914, but had to be postponed. The engineer stated that the completion of the scheme would cost £15,000.

Preston.—LOAN.—The Electricity Committee has recommended to the Corporation that application be made for sanction to the borrowing of £20,000, being the estimated cost of changing over to 3-phase supply in Avenham and Deepdale districts, and laying new feeder mains.

STREET LIGHTING.—The Streets Committee has recommended a scheme of electric street lighting on the new arterial road at a cost of £1,080. The annual running cost of 36 lamps will be £360.

Rawtenstall.—NEW PLANT.—The Corporation has received formal consent to its application to increase the plant at the electricity works to reach 6,000 kW.

LOAN.—The Corporation is applying for sanction to a loan of £20,000 for mains.

South Shields.—WIRING OF SMALL HOUSES.—At a recent meeting of the Electricity Committee, the engineer reported that up to date over 10,000 applications had been received under the assisted wiring scheme, the number of consumers actually connected to date being over 3,750; the total revenue collected amounts to £1,009, whilst the total amount of energy sold amounts to 36,570 kWh.

South Africa.—ELECTRICAL DEVELOPMENT.—According to the *South African Engineer*, on November 12th, a new 3,000-kW turbo-alternator was officially started up at the Port Elizabeth electricity works. This set brings the capacity of the station up to 9,500 kW, and the present annual output varies between seven and eight million kWh.

Rapid progress is now being made with the Witbank electricity undertaking. The station will contain three 20,000-kW sets, with accommodation for the introduction of another two sets, equal to a total capacity of 100,000 kW. The current from the station will be sent out at a pressure of 132,000 V along 65 miles of overhead transmission lines to the Brakpan station of the Rand system. It is hoped to have one of the sets in operation in a few months' time.

Spalding.—Electricity Supply.—According to *The Times*, at a special meeting of the Urban District Council on January 22nd, it was reported that the Electricity Commissioners were still strongly opposed to the erection of a generating station for Spalding, their attitude being consistent with the electricity scheme of the Government. The Commissioners were prepared to sanction an underground main from the Peterborough Corporation works to Spalding, at a capital cost of approximately £20,000, and to extend the loan period. They would also support an application from the Spalding Council to include the districts of Crowland, Holbeach, Sutton Bridge, and Bourne in its area supply. The Council appointed a sub-committee to consider the matter.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Sussex Electric Supply Co., Ltd., to supply electricity in the urban district of Littlehampton.

Applications have been made for Special Orders by the following authorities:—The Midland Electric Corporation for Power Distribution, Ltd., for the supply of electricity in certain parishes within the rural district of Seisden; the Oxford Electric Co., Ltd., to extend its area of supply so as to include the urban district of Wheatley, and certain parts of the rural districts of Culham and Headington.

United States.—Electrical Development.—According to *Power*, the new steam power station near Cincinnati of the Columbia Power Co., was formally inaugurated on December 10th. The initial capacity of the station is 90,000 kW, furnished by two 45,000-kW tandem-compound turbo-generators.

Weymouth.—Loan.—The Electricity Committee is applying for sanction to the borrowing of £3,000 for services and £3,000 for mains.

Worcester. — Electrical Development.—Extensions are being made to the electricity undertaking at a cost of £58,724. The extensions include the installation of a 6,000-kW turbo-alternator with all accessories at a cost of £23,758, and a continuous flow condenser at a cost of £6,200. The matter of establishing a reciprocal service between the Worcester undertaking and that of the Shropshire, Staffordshire and Worcestershire Power Co., Ltd., at Stourport has been in hand for some time, and consideration is also being given to the question of purchasing a supply in bulk from the Stourport undertaking.

Worksop.—Price Reductions.—The Urban District Council has decided to make the following reductions in the charges for electricity on and after April 1st next:—Lighting: A reduction of 1d. per kWh. Heating: A reduction of ½d. per kWh. Power: Business tariff reduced to 1d. per kWh, all the year round, and the maximum demand charge from £10 to £8 per kW; baths tariff reduced by ½d. per kWh. Domestic tariff: Fixed rateable value charge reduced from 20 to 10 per cent. Public lighting: A reduction of 5 per cent.

Tramway and Railway Notes.

Australia.—Brisbane.—According to the *Electrical Engineer of Australia and New Zealand*, the Brisbane tramway, which has been under the administration of the Tramway Trust for the past three years, has been handed over to the Greater Brisbane Council. The administration of the undertaking will still be carried on by the existing staff, but matters of policy will be decided by the transit committee of the Council in place of the Tramway Trust.

Geelong (Vic.).—Authority has been given for the Melbourne Electric Supply Co. to construct a new electric tramway in Geelong, running from the city through Geelong West to the suburb of Corio. Application is being made for authority to lay another route from the present Moorabool Street terminus across the Barwon bridge and along the Colac Road through Belmont.

Continental.—Spain.—The Compañia Metropolitano Alfonso XIII, which operates the underground electric railway in Madrid, has recently secured a concession for a new line in the city between Cuatro Caminos and El Estrecho.

Corsica.—The Société Générale d'Entreprises, of Paris, has drawn up a scheme for the electrification of the Sarteni district of Corsica. The plan includes the establishment of a railless-car service for the transport of both goods and passengers in the district which is at present not provided with any railways.

France.—A scheme is under consideration for the establishment of a railless-car service in the Lorient district of Brittany for the transport of both passengers and goods. The plan includes the use of special trailers on which railway trucks carrying material from the kaolin quarries at Lann-Vrian and Kergantie would be transported to the Orleans railway, so avoiding the necessity of transhipping the kaolin.

Italy.—The Italian Government has recently granted subsidies in connection with the electrification of the tramways between Brescia and Ponte Aglio, and between Padua, Santa Soffa and Bagnoli.

Gloucester.—Abandonment of Route.—The Light Railways and Electricity Committee has recommended to the Corporation that the tramway service between Barton Street and Tuffley, and from Stroud Road Junction and St. Paul's Church be discontinued, and that some other form of transport, to be considered at some future date, be substituted.

Japan.—Tokyo.—It is understood that a plan has at last been adopted for the construction of an underground railway in Tokyo. The total cost amounts to 187,000,000 yen, to be defrayed in 13 consecutive years, beginning with the fiscal year 1926-1927. The total length of the railway will be 41 miles, of which one mile will be built in the fiscal year 1926-1927, three miles in 1927-1928, and 3½ miles in each of the subsequent years. The cost includes 6,306,600 yen for track, 7,360,000 yen for stations, 20,160,000 yen for rolling stock, 1,690,000 for machinery, 6,957,700 yen for transmission lines, and 2,727,400 yen for two sub-stations.

London.—Tube Fire.—Traffic on the Hampstead tube between Golder's Green and Camden Town stations was delayed on the morning of January 19th. An official statement issued by the Underground Railways reports that, due to the short-circuiting of some cables immediately adjacent to a storeroom, a small fire occurred which affected the signals between Camden Town and Golder's Green, causing a partial stoppage to the train service during one and a half hours. The station staff dealt with the outbreak immediately, but work on the repair of the signal cables occupied some time before the service could be restored to normal.

Perth.—Tramway Position.—The *Electric Tramway and Railway World* states that the Town Council has resolved to consider in committee the whole question of the present condition of the Corporation's tramway track. The decision follows on a report by officials received by a joint meeting of the Tramways and Finance Committees, from which it appeared that the estimated cost of the work required to put the permanent way in a condition to last another ten years was £30,350; and that two cars and two more omnibuses proposed to be purchased would cost £3,000 and £2,800, respectively.

United States.—Railway Electrification.—Plans are being prepared for the extension of the electrification of the Virginian railway to Roanoke, a distance of 134 miles, at an estimated cost of $15,000,000.

Telegraph and Telephone Notes.

Canada.—Wireless Direction Finding.—The first test of wireless direction finding on the Great Lakes has been completed. The necessary equipment was installed by the Canadian Marconi Co. on the steamer *Gleneagles*, and the results are reported to have been most satisfactory. During the coming navigation season the system will be operated in conjunction with lake-shore stations erected for the purpose.—*Reuter's Trade Service* (Port Arthur, Ontario).

Continental Telephony.—New Lines.—Three new telephone lines have just been put into service between Paris and Geneva, which addition is expected greatly to improve communications between the two centres.

According to the *Daily Mail*, the completion of the line from Mülheim-Ruhr by Wesel, Emmerich, and Bapperich to the Dutch frontier brings the day nearer when telephone conversation between England and Germany will be possible. The line is connected in Holland with England and in Mülheim with Berlin, and will later be connected to towns still further apart.

France.—Rate Increase.—Proposals for an all-round increase in French inland letter, telephone, and telegraph rates are before the Finance Committee of the Chamber. The scheme is estimated to bring in an additional revenue of 315 million francs, and provides for a change in the method of charging for inland telegrams. It is suggested that they should in future be divided into two categories; those destined for the same department or neighbouring departments, and those for more distant departments. The first category would be charged for at the rate of 20 centimes a word, with a minimum of ten words, and a surtax of 50 centimes on each telegram; the charge in the second category would be 25 centimes per word. Local telephone calls from public boxes would be increased from 25 centimes to 50 centimes, and from private telephones from 15 centimes to 25 centimes; semi-local calls would cost 1 franc and 50 centimes, respectively, and for calls within the same department not classed as either of the above, a uniform rate of 2 francs.—*Reuter* (Paris).

Telephone Development Association.—Annual Meeting.—The annual general meeting of the above-named Association took place at Magnet House, London, on January 20th. Sir Alexander Rogers, chairman, pointed out that the report covered the period from the date of incorporation on December 5th, 1924, to October 31st, 1925. The number of subscribers had increased, and the Association had derived assistance from many branches of the telephone industry. Instead of 1,388,000 telephones, their aim was to secure an additional 3,000 000 within seven years. Development on that basis would involve a capital outlay of £150,000,000, which expenditure should be remunerative and self-supporting. The Association experienced no opposition in its work, but plenty of passive indifference; it had had a busy year, and its propaganda and advertising were doing good, and out of 371 inquiries in the London area only 18 (4.8 per cent.) decided

against becoming subscribers; 190 applied for service, and the remaining 163 were cases still in hand. Results in Newcastle, Manchester, Blackburn, Reading, Glasgow, Canterbury, and so on, were better than in London, the conclusion being that the public was not informed previously of the facts concerning the actual cost of telephone facilities offered. Information and experience that is being accumulated is being placed at the disposal of the Post Office.

The Telephone Service.—PUBLIC CALL BOXES.—The Telephone Department of the G.P.O., recognising that there is a need for more public telephones, has decided to install in the London area 108 more telephones, including those in 67 street kiosks, 21 call boxes at the railway stations, and 20 ordinary boxes at convenient centres. This number will be increased as soon as negotiations with the authorities concerned, such as the borough councils and the railway companies, can be completed. In London there are only 4,472 public telephone call boxes, with 3,000 private call offices. There are 932 call boxes at the different railway stations, and 226 street telephone kiosks.

TEN PER CENT. INCREASE.—Figures for the past year show an increase of barely 8½ per cent. in the number of telephones in use in this country. The total has risen to about 1,357,500, an increase during the year of 113,900, while in London, which is responsible for about one-third of the whole, the number has risen from 439,223 to 476,500, an increase of about 37,000. In the view of the Telephone Development Association these figures hardly show the progress that might have been expected. The Association points out that the figures for the State of New York, for example, for the first nine months of last year show a more rapid expansion, despite the fact that New York State already possessed more telephones than the whole of Great Britain. On January 1st, 1925, there were in N.Y. State 1,883,795 telephones, and on September 30th 1,996,902, or a net increase in the nine months of 113,107. New York City itself added in the first nine months 74,604 instruments, a rate of increase nearly three times as great as London's.

Radio Notes.

Australia.—LICENCES CANCELLED.—Although during October, 1925, the number of people holding listening licences increased, no fewer than 3,513 licences were cancelled during that month. The State where broadcasting was first developed, New South Wales, was responsible for almost the entire number of cancellations. During the month, 1,672 new licences were issued, but 3,361 were cancelled. In New South Wales, 37,203 licences were in force in November, 1925, compared with 28,442 in Victoria. In making these figures available, the Director of Postal Services (Mr. H. P. Brown) said that the Department had got in touch with a large number of persons who had not renewed their licences with the object of finding out if any common motive had inspired them, says the *Sydney Morning Herald*. Only a small proportion said that the programmes did not appeal. The others had all sorts of private reasons in which the expense of renewals figured largely. Mr. Brown added that steps were being taken to introduce more effective policing to discover unlicensed listeners.

China.—BROADCASTING.—Interest in radio broadcasting is increasing in China, says the *Daily Mail* special correspondent, who explains that news is broadcast from a shop in Shanghai and music from a local dance hall. He says: "Many of the wealthier Chinese own expensive high-powered receivers. Receiving sets are forbidden in China by a quaint law which classifies them as munitions of war. However, officials ostentatiously ignore its infraction. There are thousands of sets in Shanghai, how many no one can even estimate. The majority are of local construction from 'knockdown' kits imported from America. They range from the humble cat's whisker type to ten-valve super-heterodynes that howl miserably in the night. The lesser sets must depend upon the Shanghai shop aforementioned and the voluntary ministrations of amateur transmitting stations, of which there are many. The majority of the latter are European-owned. I have not seen a single British-made set anywhere, but American receivers are almost universal, and representatives of the big American radio companies are waiting in Shanghai for permission to import material in bulk."

Holland.—NEW PLANT.—Subject to the necessary consent of the Government, a second transmitting installation is to be erected at the broadcasting station at Hilversum, says the *Daily Mail*, which will allow of regular weekly programmes in addition to those broadcast by the religious and educational societies.

WIRE RELAYS.—The Hague telephone administration has succeeded, says *The Times*, in working out the plans for a system by which it will be possible to distribute wireless programmes to telephone subscribers. The wireless connection will be automatically cut out when an ordinary telephone call is put in and come into operation again when the call is finished. One large antennae and a receiver will have to be installed in the Central Telephone Office. Connection will be obtained through apparatus which will be supplied to telephone subscribers for ten florins (18s. 6d.). Additional earpieces can be supplied at 14s. 6d. each, and the annual charge for the service will be 30s. The manager of the telephone service will be responsible for selecting the programmes, which might be from any station. There is a possibility that, by means of the new service, operas or concerts might be transmitted directly to local subscribers. The entire cost of installing the new apparatus in the Central Telephone Office will not exceed £200. The municipality will shortly decide whether the scheme is to come into operation.

Licences.—DEMAND MAINTAINED.—It is understood that during December, 1925, the number of licences purchased by broadcast listeners amounted to 69,593. The average monthly purchase is between 40,000 and 50,000, the total number issued at the end of the year being 1,644,325.

Station Mishaps.—STAND-BY PLANT USED.—The London station of the British Broadcasting Co., Ltd. (2 LO in Oxford Street), has experienced bad luck during the last few weeks. Of the several interruptions of the programme which have occurred lately, the breakdown on January 21st was the most lengthy; no transmission took place between 1 and 2 p.m., and it was not till 4.10 p.m. that broadcasting was resumed by means of the plant employed when transmission took place from Marconi House. The old aerial in the Strand was only employed for about an hour and a half, but the permission of the Postmaster-General and the Air Ministry had to be obtained before it could be made use of, in order that as little interference as possible should be caused to the Air Force wireless service.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—Postmaster-General's Department, March 23rd. Telephone switches and magneto trunk switchboards.

March 29th. State Electricity Commission. Transformers and auxiliary apparatus.*

March 8th. City Council. Totally-enclosed armoured type switchgear. Specifications from the City Electrical Engineer's Office, Melbourne.

April 27th. 2,000-kW rotary converter, switchgear with accessories, and a.c. control gear. Specifications from City Electrical Engineer's Office.

SYDNEY.—February 10th. New South Wales Government Railways. 100 40-h.p. traction motors; March 3rd, 101 electric car equipments, consisting of motors, control equipments, air compressors, pantographs, &c.; April 14th, one 5-ton fixed electric crane. Forms of tender from Chief Mechanical Engineer, Wilson Street, Redfern, Sydney.

February 17th. 1,500-V, d.c. switchgear for St. Leonards and Hornsby sub-stations; March 3rd, 11,000-V ironclad switchgear for St. Leonards sub-station; March 10th, stokers or pulverised fuel equipment for three water-tube boilers for White Bay power house. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

Municipal Council. February 15th. Twenty transformer tanks. February 8th. L.p. cables. Specifications from the Construction Engineer, Electricity Department, Town Hall, Sydney.

March 2nd. Australian Gas Light Co. One 750-kW turbo-generating set. Specifications from the Engineer, Parker Street, Haymarket, Sydney.

Aylesbury.—February 16th. Electricity Department. Overhead 11,000-V transmission lines and cables. (January 22nd.)

Bath. — January 29th. Electricity Department. One 6,000-kW turbo-alternator, one water-tube boiler, mechanical stoker and economiser, and one 1,000-kVA transformer. (January 15th.)

Bedwas.—February 11th. Bedwas and Machen U.D.C. Electricity Department. H.p. transmission line, l.p. distribution, h.p. and l.p. switchgear and static transformers. (See this issue.)

Belfast. — February 20th. Electricity Department. Twelve months' supply of stores, &c., including electrical accessories, lamps, carbon brushes, electricity meters, &c. (See this issue.)

Chesterfield.—February 13th. Electricity Department. One 1,000-kW rotary converter equipment. (See this issue.)

Clitheroe.—February 23rd. Corporation. Transformers, switchgear, and cable connections for sub-station; e.h.p. and l.p. cables, boxes, &c. (January 15th.)

Croydon. — February 4th. Electricity Department. 25,000 tons of coal suitable for chain-grate mechanical stokers over a period of 12 months. (See this issue.)

Faversham.—February 12th. Electricity Department. Cables. (See this issue.)

Grimsby. — January 30th. Electricity Department. 500-kW traction converting plant, sub-station e.h.p. switchgear, e.h.p. feeder and pilot cables. (January 15th.)

Halifax.—February 20th. Markets and Parks Committee. Electrical engineering work in connection with the erection of the public abattoirs. Particulars from Borough Engineer, Crossley Street.

India.—March 8th. India Store Department. 40 electric freight locomotives in connection with the G. I. P. Railway electrification. (January 15th.)
February 5th. Punkah motors, a.c. (January 22nd.)

Kilmarnock. — Ayrshire Electricity Board. Supply, delivery and laying of h.p. cables and ducts in the Burghs of Ayr and Prestwick, also transformer kiosks and section pillars. (January 22nd.)

Leeds.—February 1st. Board of Guardians. Supplying and laying underground l.p. cables at the Institution, Beckett Street. (January 22nd.)

London.—HAMMERSMITH.—February 10th. Electricity Department. Stores for 12 months, including electric light sundries, insulated wire, joint boxes, meters, l.p. cables, &c. (January 22nd.)
ISLINGTON.—February 8th. Electricity Department. One 10,000-kW, 3-phase turbo-alternator, condensing plant, condensate circulating exhaust, steam and water pipes, &c. (January 22nd.)
METROPOLITAN WATER BOARD.—February 8th. 12 months' supply of electric lamps. Forms of tender from the Chief Engineer, 173, Rosebery Avenue, E.C.1.
LONDON COUNTY COUNCIL.—February 22nd. H.p. switchgear for Lewisham tramway sub-station. (January 22nd.)

Newark-upon-Trent.—February 10th. Electricity Department. E.h.p., medium, and l.p. mains and distribution network, with street-lighting mains and accessories, single- and three-phase house-service pattern meters, two 250-kVA transformers, e.h.p., 11,000-V switchgear. (January 22nd.)

New Zealand.—WELLINGTON.—Public Works Department. April 6th. Storage battery, motor generator, and switchboard for the Penrose sub-station.*
March 23rd. Five oil filters, 5 oil-testing equipments, and 5 filter-paper drying ovens.* 22,000-V switchgear and equipment for Penrose sub-station.*

Plymouth. — February 4th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c.; one 350-kW converter. (January 15th.)
February 17th. Electricity Department. Twelve months' supply of electricity meters, cables and transformers. (See this issue.)

Retford.—February 19th. East Retford Gas, Water and Electricity Department. Electricity generating plant, mains, transformers and meters. (January 22nd.)

South Africa.—JOHANNESBURG.—February 25th. Municipal Council. Four d.c. switchgear panels and 3-phase, truck-type ironclad switchgear panels.*
February 25th. S.A. Railways and Harbours. Two 4-ton electrically-driven fixed wharf cranes for Luderitz jetty.*
PRETORIA.—February 25th. Postmaster-General's Department. Supply of a manual telephone exchange for Hatfield, Pretoria. Controller of P.O. Stores, Pretoria.—*S.A. Mining and Engineering Journal.*
February 25th. Union Tender Board. Miscellaneous telegraph and telephone materials (C×1880).*

Uruguay.—MONTEVIDEO.—February 26th. State Electricity Works. Diesel oil engine and a direct-coupled generator.*

Watford.—February 23rd. Board of Guardians. Electric lighting installation, consisting of wiring old buildings, new power mains, motors, main switchboard, &c. Specifications from the Master's office, 60, Vicarage Road, Watford, or from the consulting engineer, Mr. W. M. Benny, 39, Carlton Road, Putney, S.W.15.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—State Electricity Commission of Victoria.
Switchgear and accessories.—A. Reyrolle & Co., Ltd. (£21,095); English Electric Co. of Australia (£31,443); Metropolitan-Vickers Electrical Co., Ltd.
3,000-kVA transformers and spares (£34,092).—Johnson & Phillips, Ltd.
6,600-V transformers and spares (£14,351).—Weymouths, Ltd.

Melbourne and Metropolitan Tramways Board.
Storage battery plates (£7,892).—Tudor Accumulator Co., Ltd.

At the City Council meeting last month, the Electricity Supply Committee recommended the acceptance of a tender for the supply of a 6,000-kW turbo-alternator by Messrs. C. A. Parsons & Co., Ltd. Thirty-one tenders were received, including one from Thompsons Engineering and Pipe Co., Ltd., for a Metropolitan-Vickers designed machine of 5,000 kW, partly made in Australia. Although it was stated that the landed price and running costs of the Parsons' machine was considerably less than the lowest Australian tender (Messrs. Thompsons', Castlemaine), there was a strong feeling in the City Council against accepting the recommendation. The consideration of the matter has, therefore, been postponed, in order to enable the Council to obtain further information.—*Industrial Australian and Mining Standard.*

Postmaster-General's Department.—According to the *Sydney Morning Herald*, tenders involving an expenditure of more than £400,000 for the erection of automatic telephone exchanges and the supply of telephone equipment have been accepted by the Postmaster-General's Department. The following are the principal tenders accepted :—
Supply of automatic private branch exchange requirements, New South Wales (£10,640); automatic telephone exchange equipment for Randwick, Waverley, and Gordon (New South Wales) (£125,117).—Automatic Telephones, Ltd. Erection, supply, &c., of automatic telephone exchanges, South Australia (£101,429).—British General Electric Co., Ltd. Erection, supply, &c., of automatic exchanges, Unley and Norwood (S.A.) (£141,680) and Deewhy (N.S.W.) (£9,406).—Western Electric Co. (Aust.), Ltd.

SYDNEY.—City Council.
L.p. underground cables (£6,817).—W. T. Henley's Telegraph Works Co., Ltd.

New South Wales Government Railways.
Two 3,000-kVA rotary converter sets, &c. (£23,169).—Australian General Electric Co., Ltd.
—*Tenders.*

Belgium.—Keen international competition was again shown last week for a contract for 10 kilometres of h. and l.p. armoured cables for the municipal authorities of Schaerbeek, Brussels, tenders being received from Dutch, British (Callender's Cable & Construction Co., Ltd.), Czecho-Slovakian, French, Belgian, and German concerns. The lowest offer, however, was that of a home firm, the Société des Ateliers de Construction Electriques de Charleroi.

Brighton.—Tramways Committee. Recommended:—
100 tons of steel girder tram rails (£9 2s. 6d. per ton).—Anglo-Belgian Improvements Corporation.
The prices of the two British firms who tendered were £10 14s. 6d. and £11 per ton respectively.—*Sussex Daily News.*

Brimsdown.—According to the *Daily Mail*, a contract for a super generating station for the North Metropolitan Electric Supply Co. at Brimsdown, to cost £300,000, has been placed with International Combustion, Ltd. It is stated that the Brimsdown station will be the largest in the country using exclusively the pulverised coal system.

Croydon.—Electricity Committee. Recommended:—
Circulating water piping (£558).—Mechans, Ltd.

Dublin.—Electricity Department. Accepted:—
Flame arc lamps.—General Electric Co., Ltd. (£506); Photector Co., Ltd. (£550).
Maintenance of electricity meters for 12 months (£700).—General Electric Co., Ltd.
Single-phase transformers.—British Electric Transformer Co., Ltd.
3-phase transformers.—British Electric Transformer Co., Ltd.; J. G. Statter & Co.
—*Irish Builder and Engineer.*

Dundee.—Housing Committee. Accepted:—
Electric lighting of new houses (£1,015).—R. M. Lindsay & Co.; D. J. Macdonald, Ltd.

Falkirk.—Town Council. Accepted:—
Electrical work in connection with the housing scheme (£271).—J. P. Simpson.

Government Contracts.—The following Government contracts were placed during December, 1925 :—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.
Battery gear.—D.P. Battery Co., Ltd.
Inert cells.—General Electric Co., Ltd.
Air compressors.—Belliss & Morcom, Ltd.
H.p. fans.—James Keith & Blackman Co., Ltd.
Motor generators and panels.—W. H. Allen, Sons & Co., Ltd.
300 b.h.p. motors, &c.—Laurence Scott & Co., Ltd.
Motors, &c.—Crompton & Co., Ltd.
Electric radiators.—Edison Swan Electric Co., Ltd.

WAR OFFICE.
Secondary batteries.—Pritchett & Gold & E.P.S. Co., Ltd.
Inert cells.—Siemens Bros. & Co., Ltd.
Resistance frame.—E. F. Moy, Ltd.
Generating set and spares.—Newton Bros., Ltd.; Small Electric Motors, Ltd.
Installation of electric lighting, Caterham Barracks.—Alpha Manufacturing and Electrical Co., Ltd.

AIR MINISTRY.
Generators, &c. (Kidbrooke).—Electric Construction Co., Ltd.
Underground cables (Catterick).—G. E. Taylor & Co., Ltd.
Petrol-electric sets.—Stuart Turner, Ltd.
W./t. valves.—Mullard Radio Valve Co., Ltd.
Voltmeter.—E. Turner.

POST OFFICE.
Manufacture, supply, drawing-in and jointing cable.—Tottenham-Walthamstow, Western-Riverside, and Eltham-Sidcup Junction: W. T. Henley's Telegraph Works Co., Ltd.
Manufacture, supply, laying, &c., land and submarine cable.—Anglo-French (1926); Siemens Bros. & Co., Ltd.
Electric goods lift.—Manchester (Newton Street sorting office): W. Wadsworth & Sons, Ltd.
Electric lighting.—Halifax P.O. and telephone exchange: Headen and Brennand.
Radio receivers.—St. Albans radio station: Marconi's Wireless Telegraph Co., Ltd.
Telephone exchange equipment.—Franklin (London), S.W., Portsmouth, Willesden, Nottingham: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Tudor Accumulator Co., Ltd., for batteries; Crompton and Co., Ltd., for charging machines; Newton Bros. (Derby), Ltd., for ringing machines. Dartford: Automatic Telephone Mfg Co., Ltd. Sub-contractors: The D.P. Battery Co., Ltd., for batteries; Electric Construction Co., Ltd., for charging machines; Newton Bros. (Derby), Ltd., for ringing machines. Sydenham, S.E.: Standard Telephones and Cables, Ltd. Manchester (relief): General Electric Co., Ltd. Leicester: Siemens Bros. & Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Romford: British L. M. Ericsson Mfg. Co., Ltd. Wigston, Syston, and Western Park (Leicestershire): Siemens Bros. & Co., Ltd.
Private branch exchange equipment.—Owen Owen, Ltd. (Liverpool); Lewis, Ltd. (Manchester); Spillers & Bakers, Ltd. (Bristol); Watney, Combe, Reid & Co., Ltd. (Pimlico, S.W.); Newton, Chambers and Co., Ltd. (Thorncliffe Colliery, near Sheffield); Hawkes & Son (London and Edgware): Relay Automatic Telephone Co., Ltd.
Telephone repeater station.—Four-wire repeater equipment: General Electric Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works; Phœnix Telephone & Electric Works, Ltd.; Plessy Co. (1925), Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone and Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing and protective apparatus.—Peel-Conner Telephone Works; Telephone Mfg. Co., Ltd.

Battery stores.—D.P. Battery Co., Ltd.
Cable.—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; St. Helens Cable & Rubber Co., Ltd.; Siemens Bros. and Co., Ltd.
Loading coils.—Standard Telephones & Cables, Ltd.
Telephone cords.—Phœnix Telephone & Electric Works, Ltd.
Ducts.—Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; Jas. Oakes and Co., Ltd.; Oates & Green, Ltd.
Earth plates.—Walkers, Parker & Co., Ltd.
Solder.—British Insulated Cables, Ltd.
Wallboards.—Venesta, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.

H.M. OFFICE OF WORKS.

Electric mains, Invergordon housing estate.—Siemens Bros. & Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Cable.—W. T. Henley's Telegraph Works Co., Ltd.; Callender's Cable and Construction Co., Ltd.
Ceiling fans, &c.—General Electric Co., Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
Telephone apparatus.—Standard Telephones & Cables, Ltd.; Telephone Mfg. Co., Ltd.; Peel-Conner Telephone Works; British L. M. Ericsson Mfg. Co., Ltd.

Glasgow.—Housing Committee. Recommended:—
Electrical installations in connection with the housing schemes at Balornock and Possil (£575 and £1,109 respectively).—R. Mickel.

Hemel Hempstead.—Town Council. Accepted:—
Installing electric lighting at Boxmoor Hall.—H. G. Gibbons & Sons.

Ilkeston.—Ilkeston and Heanor Water Board. Accepted:—
Electrically-driven borehole pump.—Mirrlees, Watson Co., Ltd.

London.—STEPNEY.—Electricity Supply Committee. Recommended:—
50 cast-iron boxes, frames, and covers (£97).—E. & F. Wright, Ltd.
50 tons of pitch (£150).—Smart's Tar Distillery.
27,000 tons of best Scotch washed peas and/or Blairhill washed nuts and washed small (19s. 9d. per ton).—W. Cory & Sons, Ltd.
23,000 tons of best Wemyss Scotch washed peas (20s.).—E. Foster & Co.

Northampton.—Education Committee. Accepted:—
Installing electric lighting at Military Road schools (£184).—Lowke & Sons.

Peterborough.—Town Council. Accepted:—
50-ton crane (£1,754).—Herbert Morris, Ltd.
L.p. switchgear (£8,666).—English Electric Co., Ltd.

Richmond-on-Thames.—Town Council. Accepted:—
Installation of electric lighting at the water works buildings.—Richmond Electric Light & Power Co., Ltd.

South Africa.—DURBAN.—South African Electricity Commissioners.—A contract for the erection of part of the equipment for the new super-power station at Durban has been placed with International Combustion, Ltd. (£250,000 approx.).

Tynemouth.—Electricity Committee. Accepted:—
Cables (£463).—Hackbridge Cable Co., Ltd.

Worthing.—Electricity Committee. Accepted:—
Diesel engine with B.T.H. generator (£12,635).—Mirrlees, Bickerton and Day, Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, January 29th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Comfort in Railway Travel from the Point of View of the Engineer," by Mr. A. N. Moon.
Friday, February 5th. Questions and discussions evening.

Institution of Welding Engineers.—Friday, January 29th. At the Philosophical Hall, Park Row, Leeds. At 7 p.m. Paper on "The Arc Welding of Seams in Steel Plates," by Mr. J. T. Carr.

Glasgow Corporation Electricity Department Engineering Society.—Monday, February 1st. At the Welfare Hall, St. Andrew's Cross Works. At 7.45 p.m. Paper on "Non-Ferrous Alloys in Relation to Engineering," by Mr. H. McEwen.

Society of Engineers.—Monday, February 1st. At Burlington House, W. At 5.30 p.m. Presidential address by Mr. G. O. Case.

Paisley Association of Electrical Engineers.—Tuesday, February 2nd. At 16, High Street, Paisley. At 7.30 p.m. Paper on "Control of Motors for Special Purposes," by Mr. D. Fife.

Roentgen Society.—Tuesday, February 2nd. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Tuesday, February 2nd. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Annual general meeting.

Electrical Society of Glasgow.—Tuesday, February 2nd. At Glasgow. Paper on "Internal-combustion Engines," by Mr. A. H. Crowther.

Edinburgh Electrical Society.—Wednesday, February 3rd. At the Royal Society of Art, 117, George Street. At 8 p.m. Paper on "The Influence of Light in Industry and Commerce," by Mr. H. E. Hughes.

Royal Society of Arts.—Wednesday, February 3rd. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "Investigations in Agricultural Science at Rothamsted," by Sir E. J. Russell, F.R.S.

Institution of Electrical Engineers.—Thursday, February 4th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Papers on "Power Factor and Tariff," by Mr. E. V. Clark; and on "Power Factor Improvement," by Mr. E. W. Dorey.

(Wireless Section).—Wednesday, February 3rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Propagation of Electric Waves," by Mr. J. Hollingworth.

(North-Eastern Centre).—Friday, February 5th. At Tilleys, Blackett Street, Newcastle. At 7 for 7.15 p.m. Annual dinner and reunion.

(North-Western Centre).—Tuesday, February 2nd. At the Engineers' Club, Manchester. At 7 p.m. Papers on "Power Factor and Tariff," by Mr. E. V. Clark; and on "Power Factor Improvement," by Mr. E. W. Dorey.

(Western Centre).—Monday, February 1st. At the Merchant Venturers' Technical College, Bristol. At 6 p.m. Paper on "Testing of Static Transformers," by Mr. J. L. Thompson.

(North-Midland Students' Centre).—Tuesday, February 2nd. At the University, Leeds. At 7 p.m. Paper on "Tests on Electrical Plant," by Mr. C. F. Fowler.

Electrical Power Engineers' Association (Southern Division).—Friday, February 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "The Testing of Switchboard Instruments and Transformers," by Mr. G. Tilstone.

Notes.

The Government Scheme.—CORRECTION.—In the seventeenth line from the end of the leader, on p. 162, for "time press. . " read "line pressure."

Rural Reconstruction.—A conference convened by the Rural Reconstruction Committee was held at Denison House, London, on Saturday last, with Dr. Gilbert Slater in the chair, to consider what steps should be taken to place the committee's policy before the nation, and it was decided to form an Association for this purpose. The objects of the Association are set forth in a book entitled "A National Rural Policy," prepared by a special committee (Noel Douglas, price 2s. 6d.); in this volume, which deals broadly with the existing situation, sets forth a suggested code of principles of reconstruction, and describes an outline policy, there are several references to the rôle of electricity in agriculture. It is regarded as of great importance that the English countryside should be equipped with a complete though inexpensive system of electricity supply, as a national public service; and it is stated that the development of mechanical power on the farm should enable large areas of land at present untilled to be brought into cultivation. The programme included an address by Mr. Montague Fordham, dealing with the standardisation of prices and quality, and the organisation of distribution, and one on "Electricity and Rural Reconstruction" by Mr. R. Borlase Matthews, Wh.Ex., who explained how a supply of electricity could add to the amenities of country life by the provision of adequate lighting and cheap power. He pointed out that electricity generated from coal could be sold more cheaply than that derived from water power, and stated that the average price paid by the Continental farmer was 8d. for lighting and 4d. for power per kWh, but at this price it was cheaper to him than any other source of power or light. For example, a cream separator could be driven electrically for 30 hours at a cost of 4d. If Mr. Baldwin's proposals could be carried out with freedom from political intrigue, this country would be placed in a very favourable position. With the extension of the distribution of electricity, large numbers of people would return to the countryside. The difficulty of obtaining wayleaves offered a greater handicap in this country than in any other, and should receive attention. Mr. Matthews gave some particulars of the Government scheme, and explained the importance of mechanical power to the farmer in view of the high cost of labour and heavy taxation. He said that to-day there were over 500 British farmers who used electricity, and held that by providing the farmer and the country dweller with electricity, the whole nation would be benefited.

Meter Engineers' Technical Association.—At a meeting of meter engineers held at Anderton's Hotel, Fleet Street, London, on January 22nd, under the chairmanship of Mr. G. F. Shotter, it was resolved, after a full and interesting discussion, "that an Association to be known as the Meter Engineers' Technical Association shall be and is hereby formed." It was further agreed that membership of the Association would be open to all fully qualified technical engineers engaged in the electricity supply industry, or in the service of electricity meter or electrical instrument manufacturers. The following were elected to act as officers and members of Council for 1926:—President, Mr. G. F. Shotter; hon. secretary, Mr. G. D. Malcolm; hon. treasurer, Mr. W. E. C. Alliss; Council, Messrs. A. H. Jacks, E. Mathews, G. F. Shotter, J. T. Haynes, E. W. Hill, and W. A. Anderson. The Association will function in a purely technical and scientific capacity, and there is no intention of adopting, either directly or indirectly, any form of protective policy.

Automatic Steering of Ships.—An invention for the automatic steering of ships made by a London engineer, Mr. J. W. Kirkland, will, it is claimed, take the place of the gyroscope compass now in use in many big vessels. It is based on the use of two valves set at an equal angle with the keel. They are so adjusted that the electric currents passing through them to relays which operate the steering gear are exactly neutralised. If the ship deviates from its course the change in the earth's magnetic field is sufficient to upset the balance and the motor operating the rudder is set in action. With this apparatus, says the *Daily Mail*, the course of a ship can be set and the vessel then steers itself automatically.

Appointments Vacant.—Scientific assistant for research in connection with electrical ignition appliances (£250+) for the R.A.F. establishment, South Farnborough. Consumers' engineer (£457) for the Southampton Corporation Electricity Department. Plumber-jointer for the Borough of Furness Electricity Department. Shift charge engineer for the Bath Corporation Electricity Department. Shift charge engineer for the Corporation Electricity Works, Gt. Yarmouth. Mains superintendent (£428) for the Tunbridge Wells Corporation Electricity Department. Temporary engineer-in-charge for the Worcester City Electrical Works. (See our advertisement pages to-day.)

Electricity Supply Rifle League.—The following were the final scores of the teams in connection with the League championship for the past season:—*1st Division*: Central A 5,892, County 5,832, Shoreditch 5,830, City A 5,755, St. James 5,640, Central B 5,535. Central A and County head the list with 18 points each. *2nd Division*: City B 5,126, Central C 5,099, Shoreditch B 4,934, Hackney 4,886, St. James' A 4,854, Epsom 2,061. City B heads the list with 16 points.

Local Society.—The Edinburgh Electrical Society held its annual social evening, including a whist drive and dance, on January 8th in the Albyn Rooms, Edinburgh. Whist prizes were supplied by the Edison Swan Electric Co., Ltd., the General Electric Co., Ltd., the Sloan Electric Co., Messrs. Baxendale & Co., Ltd., Messrs. Aikman & Co., Ltd., and Messrs. Crabtree. By a coincidence Mr. Sharp, the Scottish representative of Messrs. Crabtree, won the prize presented by his firm. A thoroughly enjoyable evening was spent, music being provided by a special orchestra.

Mining Electrical Engineers' Dinner.—The annual dinner of the South Wales Branch of the Association of Mining Electrical Engineers was held at Cardiff on January 16th, when Mr. A. C. MacWhirter, M.I.E.E., the branch chairman, presided, and Mr. Theodore Stretton, M.I.E.E., president of the Association, was the guest of the evening. Mr. Stretton, in reply to the toast of the "Association of Mining Electrical Engineers," proposed by Mr. D. Hannah, said that the South Wales branch of the Association was in a very healthy condition and was the second largest in the country. Accidents were becoming fewer, and where they did occur they were almost in every case attributable to carelessness. The Association was concerned in the question of diminishing electrical accidents, but it was also essentially a matter of individual interest. Mr. Idris Jones proposed "Kindred Associations," and remarked that the branch was greatly indebted to the technical institutions for the kindly help extended to it. Mr. C. T. Allan, in responding, declared that he was looking forward to the time when they would have one institution of engineers to which all the various branches could be affiliated as constituent sections. Major Ivor David proposed the health of the chairman.

Shipping Coal in South Wales.—Mr. J. Auld's recent paper before the Institute of Transport, describing developments in the shipment of coal at the South Wales ports contained nothing novel; it is an account of a very definite effort which has been made by the Great Western Railway Co. to place the handling of mineral traffic over its system, and especially in South Wales, on a sound economic basis. The Railways Act of 1921 and the subsequent grouping constituted the Great Western Railway Co., the owner of the largest dock system in the world. Previously, the whole of the dock working in South Wales had been carried out by independent companies, and the total tonnage dealt with at these docks in a normal year is round about 50,000,000.

The method of shipping coal by hoisting at either end, or side-tipping, the railway wagon is often criticised, although the operation is quite a common one, both in this country and in America. The principal objection is that unnecessary work is done. Electrically-driven conveyor belts are being tried out by the Great Western Railway Co., although this method does not find universal favour with the shippers where large coal is being dealt with.

At present there are four hoists to serve a length of quay of 900 ft., although when this side of the dock is fully equipped there will be 11 hoists. Some parts of the gear are driven by electric motors, others being operated by hydraulic power. As there were already 10 power stations, it was decided to do away with six of them by modernising one which would work in conjunction with the other three. As there was bound to be a fairly constant demand for pressure from this station, it was decided to install electrically-driven multi-stage turbine pumps absorbing 575 b.h.p., supplied with three-phase, 50-cycle alternating current purchased from the Cardiff Corporation.

Possibly the Great Western Railway Co. may be criticised for extending the use of hydraulic power, which, in these days, is sometimes apt to be compared unfavourably with electricity. At the whole of the docks under consideration, the Company was committed to the use of hydraulics and, even if it were convinced of the superiority of electricity, a very large amount of capital would be involved if a change were made. Moreover, the author holds that, in certain cases, hydraulically-operated machinery in the hands of semi-skilled men is more trustworthy and easier to maintain than is the case with similar machinery operated electrically. The Company's present policy is that for all general cargo work, where variable loads are handled, and for all belt-conveyor type coal-handling machines, electricity will be used. For the ordinary coaling hoist raising a constant load, the Company, in the meantime, continues to use hydraulic power, although it is investigating the merits of electrically-operated hoists.

Electricity on Board Ship.—The launching of the s.s. *Carnarvon Castle* at Belfast on January 15th, is particularly interesting, because this is the first motor passenger vessel built for the Union Castle Line. When completed, she will accommodate 1,500 passengers, and be equipped with Diesel engines of 20,000 horse power. Electricity is being used very extensively on the boat instead of steam, and all the winches, windlass, and capstans are electrically driven. In case of emergency the lifeboats will be launched by electricity. The cooking will also be done by electricity.

Electric Colliery Winders.—At a recent meeting of the North of England branch of the Association of Mining Electrical Engineers, in Newcastle-on-Tyne, Mr. R. W. Mann, A.M.I.E.E., read a paper on the economics of the problem of coal winding at Northumberland and Durham collieries. He compared the advantages of steam and electricity for winding plant, and expressed the opinion that the electrically-operated plant was, under local conditions, the better arrangement.

Accident Prevention.—Valuable work is being done by the Accident Prevention Department of the National Employers' Mutual General Insurance Association, Ltd., London, which issues a large variety of posters printed in colours designed to interest workers in practices and conditions which tend to ensure safety. The department offers service to any industrial company desirous of preventing accidents, and it is



A Safety-First Poster.

claimed that the efficacy of the service is such that reductions ranging from 40 to 87 per cent. on a man-hours-worked basis have been obtained. A number of companies in the electrical industries are associated with the Department. We reproduce herewith on a miniature scale one of the posters, which are issued weekly. A large variety of designs to suit different occupations is constantly being produced.

The British Association.—It is announced that Sir John Snell, chairman of the Electricity Commissioners, is to be president of the Engineering Section at this year's meeting at Oxford.

Corrosion of Lead Cable in Sea Water.—The corrosion of lead used as a covering for cables or other conductors in sea water is a subject of considerable importance, and in this connection a particular case is of interest. About 20 years ago a lead pipe was laid from the water works at Rio de Janeiro to the Ilha das Cobras which crossed an arm of the sea about 200 yards wide, the pipe being used to carry drinking water to the island. The pipe was 65 mm. in diameter, and the thickness of the pipe wall was 6 mm.; it was protected with an impregnated jute covering and an armouring of galvanised wire which, again, was covered with impregnated jute protection. In 1923 it was noticed that the water delivered from this pipe had a distinct salt taste and on making an examination of the pipe it was discovered that in several places (where the pipe was free in the water) the armouring had been completely destroyed and in the lead pipe itself were several holes, through which the sea water entered and mixed with the fresh water. The depth of water covering the pipe was about 4 metres above the parts which had been corroded. In seeking to ascertain the reason for this corrosion the investigators were at first puzzled to account for it, and were inclined to think that it was due to the very large number of molluses which had attached themselves to the pipe. However, it was noticed that corrosion of the pipe and its coverings had taken place only where the pipe lay free in the water, and that where the pipe had been covered with sand or mud no damage had occurred, either to the pipe or the armouring. This led to the conclusion that the corrosion was due to chemical action of the air contained (in the form of bubbles) in the sea water, and that the fact that covered portions of the pipe had escaped damage was due to the protection from this air given by the sand or mud in which it was buried. A contributing cause was also considered to be a small amount of tin in the lead which was unequally distributed through it, and which, in the presence of sea water, would set up electrolytic decomposition. In this case the corrosion became apparent after 20 years' use, but a lead cable laid under similar circumstances became unusable in a much shorter time because of the penetration of the salt water through the outer covering. The movement of sea waves reaches a depth of as much as 20 metres, and even at this depth the sea water contains minute air bubbles. On the assumption that it is this air in the sea water that accelerates corrosion it is recommended that in laying a lead pipe or cable in shallow sea water, they should so far as is possible, be placed where they are likely to become covered by sediment, or if this is not practicable, the lead should receive a specially thorough protection.—*Elektrische Nachrichtentechnik*, Vol. 2, No. 6, 1925.

Fatality.—At the Horsea Island radio station, Portsmouth, on January 23rd, a naval telegraphist, H. C. Taylor, was found dead in the transmitting room. It is believed that he had come into contact with wires carrying a current at 20,000 V.

The P.O. Telegraph Lines and Linesman.—The accompanying illustration represents that very imposing individual, the telegraph linesman of the "fifties." When on duty he carried, according to the *Manchester City News*, a set of one-man-gang tools, ladder, spanner, draw-tongs, draw-vice, cutting-pliers, wire, fire-pot, &c. In those days the P.O. lines



A Telegraph Linesman of the "Fifties."

were all overhead and the linesman was as important a personage as his successor of the present day. The latest P.O. returns show that there are now 3,657,000 miles of underground cables on its communication system, as against 1,063,000 miles of overhead line. The programme of underground extension is being advanced as rapidly as possible.

Electric Haulage Systems in Chile.—The Andes Copper Company at Potreillos, Chile, and the Chile Exploration Company at Chuquicamata, Chile, have just placed orders for 23 industrial electric locomotives, for the purpose of inaugurating the electrification of the haulage systems at these two mining properties. The former company requires eight 10-ton trolley-type locomotives and two 15-ton battery type locomotives. The Chile Exploration Company has ordered six 70-ton combination trolley and battery-type locomotives, three 25-ton pusher-type locomotives with sub-station equipment and switchgear, and four small battery locomotives. All of these locomotives are to be built jointly by the Westinghouse Company and the Baldwin Locomotive Works. The complete electrification eventually will require some 50 additional 70-ton locomotives, to be used in moving cars of copper ore from the electric shovels at the mine to the mill and in general haulage about the plant. These large locomotives are the first of the combination type to be built with articulated or connected trucks, a construction hitherto used only on powerful railroad locomotives. Power at 600 volts d.c. is furnished to the locomotives by a third-rail system, and when the locomotive reaches the end of the third rail the shoe used to collect the current is automatically picked up and the locomotive propelled by current drawn from the storage batteries it carries.

The smaller pusher locomotives are designed to run on a narrow gauge track alongside of the tracks upon which the ore cars are operated. An arm on the pusher locomotive may be swung behind a car on the adjacent track and the car "spotted" for unloading at any desired place. This does away with the necessity of moving an entire train of cars in order to move any particular car to a certain location. These locomotives and the 70-ton type utilise duplicate equipment wherever possible.

The electric power for this haulage system of the Chile Exploration Company is generated by steam turbines and oil-fired boilers located on the seacoast at Tocopilla, 75 miles away, and transmitted to the mining property at 110,000 volts.

Both of these mines are the property of the Anaconda Copper Company.

B.E.S.A. Specifications.—The British Engineering Standards Association has recently issued the following specifications:—No. 216, 1926, Vulcanised Fibre for Electrical Purposes, and No. 231, 1925, Pressboard for Electrical Purposes. These publications, together with the recently-issued specification for ebonite for radio purposes (No. 234), are the first of a series of British standard specifications for electrical insulating materials. The preparation of these specifications has entailed a large amount of research work on the properties of insulating materials, and the values given, together with the methods of testing, have been based on the results of the researches carried out by the British Electrical and Allied Industries Research Association. These methods of testing have been devised for the guidance of all interested to secure the best available methods of test in the development of improved material, and uniformity of practice so that data obtained by different observers may be comparable. Specification No. 231 applies to non-impregnated pressboard only. The preparation of a specification for pressboard impregnated during manufacture with varnish, oil, wax and the like, is under consideration. Copies of these publications may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d. each, post free.

Electrical Association for Women.—On Saturday last a musical afternoon was held by the Association at Aeolian Hall, London, the chairman being Mrs. Wilfrid Ashley, vice-president. The programme included performances on the electric "Duo-Art" pianola piano, played as an ordinary piano by Mr. H. V. Spanner, M.R.C.O., L.R.A.M., and also reproducing records by famous pianists as an electric piano. In addition to these items, which were rendered with excellent technique, addresses were given on "Electricity and Music" by Mrs. M. L. Matthews, Graduate I.E.E., and on "Music in the Home" by Mr. H. V. Spanner. There was a large attendance, including some well-known electrical engineers, and the demonstration of the reproduction of good music in the home was very enjoyable and instructive.

Educational.—BOROUGH POLYTECHNIC INSTITUTE.—The annual prize distribution will be held at the Institute, Borough Road, S.E., on Friday, February 12th, at 7.30 p.m.

Electrical Research Association.—The annual general meeting of the British Electrical and Allied Industries Research Association will be held at the Savoy Hotel, London, on Friday, February 12th.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL CONCERT CANCELLED.—The smoking concert that had been arranged to be held on March 15th at the Engineers' Club has been cancelled by the Informal Meetings Committee.

Junior Institution of Engineers.—On January 22nd, Mr. E. Granville-Smith delivered a lecturette on the subject of "The Engineer and his Relation to the Tea Industry." He said that a tea estate engineer would be well advised to have a fair practical knowledge of electricity, steam and oil fuel power, and of the smithy and fitter's shop. He would have to design and erect buildings, and lay down new and repair old machinery. He described briefly the method of tea manufacture, and the machines used on a tea estate.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Science reports that the third annual $1,000 prize of the American Association for the Advancement of Science has been awarded to Dr. DAYTON C. MILLER, professor of physics at the Case School of Applied Science, for his presidential address before the American Physical Society on "The Michelson-Morley Ether Drift Experiment."

Mr. WILLIAM L. ABBOTT, chief engineer of the Chicago Edison Company, has been elected president of the American Society of Mechanical Engineers.

Brighton Corporation Lighting Committee recommends that the salary of the borough electrical engineer (Mr. J. CHRISTIE) be increased from £1,500 to £1,650 per annum; and the Tramways Committee recommends that the salary of the engineer and manager (Mr. W. MARSH) be increased from £640 to £700, with a further £50 in twelve months' time.

Peterborough City Council has appointed Mr. R. B. CANNING as resident engineer to act under the supervision of the electrical manager in connection with the extension of the power station, at a salary calculated at the rate of £600 per annum.

Mr. W. HAINSWORTH, of Stoke-on-Trent Corporation Electricity Department, has been appointed to the position of commercial assistant at Croydon Borough Electricity Department.

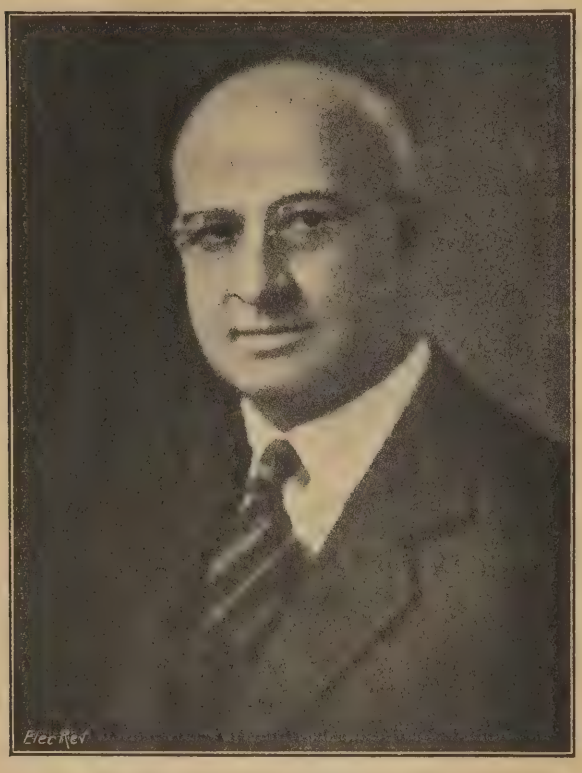
The Council of the Institution of Electrical Engineers has made the fifth award of the Faraday Medal to Colonel R. E. B. CROMPTON, C.B., honorary member of the Institution. The Faraday Medal is awarded by the Council of the Institution not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science without restriction as regards nationality, country of residence, or membership of the Institution. Colonel Crompton, who has twice been president of the Institution, is one of the early pioneers of electrical engineering, and has played an outstanding part in the development of electricity supply in this country.

Three chief officials of the Leeds Corporation Tramways Department have just retired on pension.—Mr. J. BURBRIDGE, electrical engineer to the department; Mr. J. RAMSEY, line superintendent; and Mr. T. BURNETT, chief inspector. Mr. Burbridge was formerly in the service of the British Thomson-Houston Company in British Columbia, and returned from there when the company electrified—in 1891—the Harehills and Beckett Street section of Leeds tramways, followed by the Sheepscar-Roundhay section, the running beginning on

July 3rd, 1896, when Mr. Burbridge was engaged by the Leeds Corporation. Mr. Ramsey had been in the service of the Corporation since 1893, and Mr. Burnett since 1899.

Mr. F. J. PEARCE, who has been with Messrs. George H. Scholes & Co., Ltd., Blantyre Street, Manchester, for 19 years, has been appointed a director of the company.

Accompanying these notes we publish a photograph of Mr. JAMES E. DAVIDSON, president of the National Electric Light Association, reproduced from our contemporary, the *Electrical*



Mr. James E. Davidson.
President of the National Electric Light Association.

World, in which journal Mr. Davidson recently urged upon American electricity supply men the importance of a well-organised operating and sales organisation, as mentioned in our leaderettes to-day.

Sir HOLBERRY MENSFORTH, K.C.B., C.B.E., whom readers will remember as formerly general manager of works with the Metropolitan-Vickers Electrical Co., Ltd., is resigning the post of Director-General of Factories at the War Office at the end of February to take up the position of managing director of Messrs. Bolckow, Vaughan & Co., Ltd., Middlesbrough.

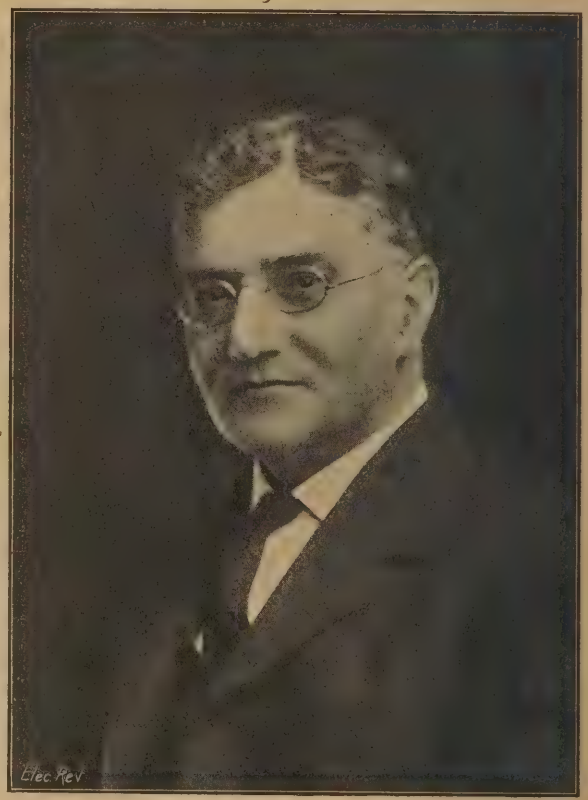
Mr. F. R. TURNER has been appointed to the recently advertised position of shift charge engineer at the West Bank, Widnes, power station of the United Alkali Co., Ltd.

Mr. M. W. SINGER, M.Sc. Tech., having taken up a position with the London branch of Messrs. Erskine, Heap and Co., Ltd., is no longer with Messrs. J. S. Statter & Co., representing the firm of W. Smit & Co., of Nymegen, Holland.

Obituary.—MR. J. VINCENT KITCHENER.—We regret to learn from our contemporary, the *Electric Railway and Tramway Journal*, of the death of Mr. John Vincent Kitchener, which occurred on January 18th, at his residence in Manchester. "Mr. Kitchener was associated with the British Electric Traction Co. for 30 years, having joined the B.E.T. (Pioneer) Co. in 1896, as secretary. He subsequently became district superintendent for Manchester and district, and was latterly a director of the Middleton and some other associated companies of the B.E.T. Co. Mr. Kitchener was associated with the telephone industry in the North of England before joining the B.E.T. Co."

MR. J. BROWNE MARTIN.—We regret to record the death, which occurred on January 20th, at Brighton, of Mr. J. Browne Martin. He was for some years prominently associated with a number of electricity supply companies and many other concerns as chairman or director—among them being the Westminster Electric Supply Corporation, the Central Electric Supply Co., Ltd., and the Smithfield Markets Electric Supply Co., Ltd. He was 91 years of age.

MR. LEONARD G. TATE.—It came to us as a personal shock to learn that Mr. Leonard George Tate, M.I.E.E., passed away on Sunday evening last, aged 60 years. We announced in our last issue that he was to undergo an operation on Saturday. This operation took place, apparently successfully, in a nursing home at Richmond, but he died on the evening of the following day. He was greatly missed at the annual dinner of the Electrical Contractors' Association held on the previous Tuesday, but that, it was hoped, was only a temporary absence. Now, however, the Association as an organisation, large numbers of its members individually, and an even larger circle of friends in other and allied branches of the industry, will feel very keenly the permanent loss which has fallen upon them. If, as Mr. Chattock said at the dinner last week, Mr. Tate was regarded as the father of the Association, our own feelings toward him will be better understood when we remark that the ELECTRICAL REVIEW bore the pangs of motherhood and gave it birth. Mr. Tate will be remembered mainly for his work as general secretary of the E.C.A. Allied Associations and Director of the National Electrical Contractors' Trading Association, Ltd. In the ELECTRICAL REVIEW for January 6th, 1922, we concluded a biographical sketch of his career by describing him as an expert of the first rank with regard to the manifold problems that had arisen affecting electrical contracting interests and stating that that branch of the industry owed much to his unfailing activities on its behalf. He joined the old "National Electrical Contractors' Association" in 1902 and was elected to the "Managing Committee." In this capacity he assisted in the incorporation of the present Association and in the formation of its present constitution. In 1905 he first accepted the position as honorary secretary to the Incorporated Association; and in this capacity he continued to act until 1918, when he severed his connection with the firm of Leonard G. Tate and Company, electrical contractors, of Bucklersbury, E.C. (under which title he had traded from 1894), and became the whole-time general secretary of the E.C.A. Allied Associations. On the occasion of the E.C.A. annual general meeting held in June, 1925, the Allied Associations presented Mr. Tate with a silver salver and cheque "as a token of esteem and mark of appreciation for the valuable services rendered by him during the past 21 years." In making the presentation, Mr. Walter Riggs, then president, paid enthusiastic tribute to Mr. Tate's twenty-one years' active E.C.A. service, very hearty supporting tributes being forthcoming from Mr. T. E. Alger, Mr. H. Willoughby-Ellis, Mr. W. A. Shaw, Mr. R. Robson, Mr. H. J. Miles, Mr. E. M. Parsons, and others. Mr. Tate's



Elliott & Fry] [*London.*

The Late Mr. Leonard G. Tate.

early training was with the Pilsen Joel and General Electric Engineering Company, which he joined in 1883. Here he was engaged in the incandescent lamp department, first under the late Mr. Margary and afterwards with Mr. Charles Robertson, of Robertson lamp fame. One year later Mr. Tate accepted the management of the lamp department of the Schuyler Electric Company of Hartford, Conn., U.S.A., and he remained in America for five years. In 1899 he joined the Brush Electrical Engineering Co., Ltd., under Mr. Dawbarn; and in 1892 he joined Mr. Leslie Fuller in founding the business of Fuller and Tate at 20, Bucklersbury, E.C.; it was this business which Mr. Tate carried on alone as Leonard G. Tate & Company prior to associating himself wholly and wholeheartedly with the E.C.A. Mr. Tate married in April, 1913, and he leaves a widow and three children, for whom we have feelings of the deepest sympathy. The funeral service took place yesterday (Thursday) morning at Richmond Parish Church. It will be remembered that last summer we announced that Mr. Tate had very kindly consented to act as one of the judges (together with Messrs. J. W. Beauchamp and L. L. Robinson) in the ELECTRICAL REVIEW Advertisement Competition. We had hoped that the judging could have taken place this week, but that is not now possible.

Will.—MR. JOHN ASHBY, a director of the Woking Electric Supply Co., Ltd., left £148,720 gross and £88,510 net personalty.

New Companies Registered.

A. Cunningham & Co. (Manchester), Ltd. (211,192).—Private company. Registered January 20th. Capital, £4,000 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor now carried on by A. Cunningham at 129, Rocky Lane, Monton, near Manchester, and elsewhere as "A. Cunningham." The life directors are:—A. Cunningham, 129, Rocky Lane, Monton, near Manchester; H. Rothwell (chairman), St. Keverne, S.O., Cornwall. Qualification of life directors, 1,000 shares; of other directors, 100 shares.

International Mica Syndicate, Ltd. (211,245).—Private company. Registered January 21st. Capital, £1,000 in £1 shares. Objects: To carry on the business of mica importers, exporters, merchants, dealers, brokers, manufacturers, agents, &c. The subscribers (each with one share) are:—E. R. Godar, 110, Castlenau, Barnes, S.W.13, mica importer; C. Anning, 123, Whips Cross Road, Leytonstone, E.11, solicitor's clerk. The first directors are:—G. Fodor (chairman), A. Ormai and E. R. Godar (all permanent, subject to each holding 5 ordinary shares). Solicitors: Walter Burgis & Co., 31, Budge Row, E.C.4. Registered office: 110, Castlenau, Barnes, S.W.13.

The Wireless Association of Great Britain, Ltd. (211,248).—Registered on January 21st as a company limited by guarantee and not having a capital divided into shares, with 1,000 members, each liable for £1 in the event of winding up. The income and property of the Association is to be applied solely towards the promotion of its objects. Objects: To encourage and develop in Great Britain wireless receiving and electrical apparatus and other allied industries, to protect and advance the legitimate interests of users of wireless receivers and listeners-in interested in or associated with the wireless and other allied industries; and generally to afford members all the advantages, conveniences and accommodation of an association and centre of information, instruction and advice on the rights and all matters appertaining to wireless receiving and listening-in, &c. The first directors (to number not fewer than 3 nor more than 20) are:—The Earl of Drogheda, C.M.G., 8, Victoria Road, W.8; Col. R. Halsey, 18, Mount Street, W.1, insurance broker; Major C. P. C. Jarvis, Doddington Hall, Lincoln, member of Lloyds; Lt. L. M. Robinson, R.N. (Retired), Grad. I.E.E., 40, Norfolk Square, W.2, electrical engineer; G. Gordon, 42, Park Lane, W.1, solicitor (all permanent). Remuneration as fixed by the board. Solicitors: Gordon, Dadds & Co., 175, Piccadilly, W.

Western Counties Electrical and Engineering Co., Ltd. (211,219).—Private company. Registered January 20th. Capital, £6,000 in £1 shares (3,000 6 per cent. cumulative preference and 3,000 ordinary). Objects:—To adopt an agreement with F. H. Merritt, and to carry on the business of electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of, and dealers in railway, tramway, electrical, agricultural, magnetic, galvanic, wireless, and other apparatus, &c. The directors are:—F. H. Merritt, 1, West Park, Yeovil, Somerset; F. H. Walker, 79, Lightwoods Road, Bearwood, Birmingham; E. B. Merritt, 11, Avenue Road, Penge, S.E.20. The first two named are permanent. Qualification, 100 shares. Remuneration, 10 guineas per annum. Secretary: F. H. Walker. Solicitor: E. W. W. Veale, 14, Orchard Street, Bristol. Registered office: Electricity House, 19, Princes Street, Yeovil, Somerset.

Official Returns of Electrical Companies.

Birkdale District Electric Supply Co., Ltd. (70,259).—Capital, £50,000 in £5 shares. Return dated June 18th, 1925. 9,200 shares taken up. £46,000 paid. Mortgages and charges, £6,000, issued to bankers as collateral security.

Julius Sax & Co., Ltd. (63,371).—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 each and 35,000 ordinary shares of 4s. each. Return dated October 19th, 1925. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Charles Fitz-Hugh, Ltd.—H. Brown, of 71, Temple Row, Birmingham, was appointed receiver on January 7th, 1926, under powers contained in debentures dated December 23rd, 1925.

Browning & Lambert, Ltd.—Satisfaction in full on December 10th, 1925, of mortgage dated December 13th, 1919, securing all moneys due or to become due.

Marconi's Wireless Telegraph Co., Ltd.—Satisfaction to the extent of £72,163 between January 1st to December 4th, 1925, of trust deed dated November 17th, 1922, securing £1,500,000.

Oco Electrical Appliances, Ltd.—Debenture dated January 6th, 1926, to secure £250, constituting a specific charge on the company's land in London and all other freehold and leasehold property for the time being and a floating charge on the company's undertaking and other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Magneto Repair Depôt and Motor Works (Christchurch), Ltd.—Particulars filed of £1,500 debentures authorised January 1st, 1926, charged on the company's undertaking and property, including uncalled capital, the whole amount being now issued.

R. & T. Patents, Ltd.—A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, accountant, was appointed receiver and manager in place of S. J. Watson, on December 17th, under powers contained in debenture dated March 26th, 1925.

Houghton's Electrical Engineering Co., Ltd.—F. Tingle, of 14, Bloomsbury Square, W.C., C.A., was appointed receiver and manager on January 13th, 1926, under powers contained in instruments dated July 3rd, 1924, and September 23rd, 1925.

Erith Electrical Co., Ltd.—R. B. Tyler, C.A., of 1, Queen Victoria Street, E.C., was appointed receiver and manager on January 7th, 1926, under powers contained in debentures dated February 23rd, 1925.

Electro Pocket Cinemas, Ltd.—H. Chapman, of 171, High Street, Lowestoft, ceased to act as receiver or manager on December 18th, 1925.

Re-Echo Radio Co., Ltd.—Debenture dated January 4th, 1926, to secure £900, charged on the company's property, present and future, including uncalled capital. Holder: W. Taplin, 187, Holland Road, Willesden, N.W.10.

Peacehaven Electric Light & Power Co., Ltd. (181,255).—Capital, £20,000 in 15,000 10 per cent. preference shares of £1 each and 20,000 ordinary shares of 5s. each. Return dated December 29th, 1925. 14,038 preference and 16,052 ordinary shares taken up. £17,909 18s. 1d. paid. £141 1s. 11d. in arrears. Mortgages and charges, nil.

Europe & Azores Telegraph Co., Ltd. (39,452C).—Capital, £200,000 in £10 shares. Return dated June 24th, 1925. All shares taken up. £144,320 paid. £55,680 considered as paid. Mortgages and charges, nil.

Southern Electric Free Wiring Co., Ltd. (64,550).—Capital, £5,000 in £1 shares. Return dated December 30th, 1925. 1,510 shares taken up. £1,510 paid. Mortgages and charges, nil.

Hexham and District Electric Supply Co., Ltd. (83,869).—Capital, £30,000 in 7,605 "A," 6,479 "B," and 15,916 "C" shares of £1 each. Return dated August 7th, 1924 (filed June 30th, 1925). 7,605 "A," 6,479 "B," and 15,825 "C" shares taken up. £22,430 paid. £6,479 considered as paid. Mortgages and charges, £25,000.

Grierson, Ltd. (180,410).—Capital, £10,000 in 6,000 ordinary and 4,000 preference shares of £1 each. Return dated October 28th, 1925. 2,501 ordinary shares taken up. £2,501 paid. Mortgages and charges, nil.

Shoreham and District Electric Lighting and Power Co., Ltd. ((176,995).—Capital, £27,500 in £1 shares. Return dated December 31st, 1925. 17,329 shares taken up. £10,579 paid. £6,500 considered as paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Ferguson, Pailin, Ltd.

The net profit for the year ended November 30th last amounted to £37,383, and to this is added £24,615 brought forward (after adjustment of corporation profits tax), making £61,998. The interim dividends absorbed £4,302, leaving £57,696 which it is proposed to distribute as follows:—Final dividends at the rate of 9 per cent. on the preference shares (making 8 per cent.) and at the rate of 19 per cent. on the ordinary shares (making 13 per cent.), absorbing £11,250; to reserve, £10,000; to writing down the value of goodwill and patents, £1,215; leaving a balance of £35,231 to be carried forward. The report states that progress was maintained during the past year, and the directors are satisfied with the trading results. The writing-down of the value of goodwill and patents to £1 was effected by means of a premium upon the ordinary shares issued during the year (£4,706) and the amount shown above. The meeting is to be held in Manchester on February 4th.

Chatham and District Light Railways Co.

The report for the year ended December 31st last shows a revenue of £76,833 and a net profit of £9,539, after providing for rent and depreciation. The addition of £1,601 brought forward gives an available balance of £9,936. Interim dividends absorbed £3,900, and it is proposed to distribute the balance as follows:—Final preference dividend, £1,250; 2½ per cent. on the ordinary shares (making 5 per cent. for the year), £2,650; carried forward, £9,396. It is stated that while the expenses increased by £3,160, the revenue showed an increase of only £568. The annual meeting is to be held on February 2nd.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

American Telephone and Telegraph Co.—$941,100 capital stock.

County of London Electric Supply Co., Ltd.—2,000,000 six per cent. cumulative preference shares of £1 each fully paid, Nos. 2,725,001 to 4,725,000.

Montreal Tramways Co.—$17,826,500 series "A" thirty-year five per cent. general and refunding mortgage sinking fund gold bonds, Nos. M1 to M8,599 and M8,601 to M15,902 ($1,000), D1 to D2,750 ($500) and C1 to C5,505 ($100).

Montreal Light, Heat and Power Co.—A dividend of $2 per share has been declared on the common shares in respect of the quarter ending January 31st.

Elliott's Metal Co., Ltd.—An interim dividend of 1s. per share has been declared on the ordinary shares, as in 1925.

Dublin United Tramways Co., Ltd.—Out of the past year's profits £60,000 has been set aside for track renewal, £7,000 for overhead lines, standards, &c., and £5,000 for cars. A final dividend at the rate of 7 per cent. is being paid, making 5½ per cent. for the year, and £15,230 is being carried forward.

Traction and Power Securities Co., Ltd.—The net revenue for the past year was £52,054, and the addition of £20,083 brought forward makes a total of £72,137 available. A final dividend of 9 per cent. on the ordinary shares is recommended (making 13 per cent. for the year), and the balance (£28,748) is to be carried forward. During the year 4½ per cent. debenture stock to the extent of £65,036 was issued.

Westinghouse Brake & Saxby Signal Co., Ltd.—A dividend of 6 per cent. has been declared as compared with 1¼ per cent. in 1923-24. No dividend was paid in 1922-23.

German Companies.—The *West German Telephone Works Company*, of Düsseldorf, after having made provision for depreciation, reports a net profit of 30,000 marks for 1924-25, which has been carried forward.

The *Berlin Northern and Southern Railway Company*, which belongs to the city and is operated by the Berlin Elevated and Underground Railway Company, reports profits of 1,820,000 marks for 1924, the method of disposal of which is not disclosed.

Western Union Telegraph Co.—The "earnings report" for 1925 (December estimated) shows a total gross revenue of $129,260,353, as compared with $115,235,563 in 1924. The expenses increased from $99,581,556 to $110,753,748, and the net income from $12,336,682 to $15,170,089. A dividend of 2 per cent. has been paid on the capital stock for the quarter ended December 31st last.

A. J. Stevens & Co. (1914), Ltd.—The offer to shareholders of 150,000 ordinary £1 shares at par, and 100,000 cumulative preference shares at 23s. 6d. each, was oversubscribed.

Stocks and Shares.

MONDAY EVENING.

THE course of Stock Exchange markets, like that of a well-known sentiment, never runs smooth for long at a time. At the present juncture, it happens to be labour conditions that press, as a pall, upon the spirits of investor and speculator. The continual jolts which public confidence receives by reason of the railway conferences, are quoted as being such cause for uneasiness as leads, not only to selling, but to marked restraint upon the part of the usual buyers. Cable equipment and electrical manufacturing issues show further rises, and, the upward movement having made very material headway in the last fortnight, some of the previous holders have deemed it prudent to secure the profits that they are offered. As a consequence, the prices show a tendency to halt. In some cases, they have declined from the recent top levels touched.

Nevertheless, there are substantial rises remaining in several instances. Callenders have gained 5s., Henleys and Johnson and Phillips 3/16, Telegraph Constructions—hitherto almost neglected—10s., Metropolitan Vickers 2s. 3d., British Insulated ⅛, and so on. Enfield Cables ordinary have strengthened to 3 7/16. English Electrics went a little over par: Electric Constructions are 1/16 up, Siemens 1s. 6d., and General Electrics put on a shilling. Pause was given to this boomlet by the realisations just mentioned, and by the consideration that, on dividend yields, the movement had gone perhaps far enough for the present. It will be noticed, by reference to our tables, that the return on the money at current prices is very moderate, taken on the basis of the last-paid dividends. To this the optimist naturally retorts that dividends are likely to be increased; that the leading companies are well supplied with orders; and that, when the Government's electricity scheme is working, the equipment undertakings will do remarkably well. Furthermore, he contends, expansion of work will call for the provision of more capital, and he has recently tasted the sweets of new issues made at prices that afforded bonuses. It always seems churlish to damp the ardour of an investor, particularly when he is not of the merely speculative class, so all that shall be said now is to quote the invariable experience of Stock Exchange markets after a good rise has taken place. There are always people ready to sell on the top of such an advance. Events generally prove the wisdom of making sure of a good profit when this accrues.

The market for London electricity supply shares is rather heavy. There are uncertainties and doubts in the present prospect, and these have the effect of bringing to market a certain number of shares from ultra-cautious holders. Falls are marked against the prices of Charing Cross, City, County, South Londons and Westminsters. Kensingtons stand out as the exception to the prevailing disposition, and the price is 15s. higher at 14½. This has resulted in the shares now standing at the top of the London group in relation to the yield on the shares. For a long time, County ordinary have been offering the smallest return, but their place is taken by Kensingtons, which pay £5 1s. 8d. per cent. on the money, while County ordinary give about eighteenpence per cent. more.

The provincial shares remain very firm. Bournemouth and Poole, after their last week's rise of 3s., are another 9d. up. It is assumed that the provincial power undertakings are bound to benefit by the Government's scheme.

It may easily be that the non-technical proprietor (if such there be) of electricity supply and power shares is liable to suffer confusion from the complications introduced by the learned into the newspaper discussions now raging around the various points. Parliament passed, last year, two Acts, Nos. 1 and 2, that settled the future of this branch of the industry. It seems very unlikely that the House of Commons will tolerate interference with legislation that, after years of talk and opposition, has succeeded in reaching the Statute Book. The London and Home Counties Electricity District Order is another step which it is hardly probable will be removed. Provincial supply and power companies should do well, as possessing organisations of which the Government may take advantage. The next announcements are awaited with a curiosity, not untinged with a mild apprehension for which no real warranty exists.

The dividend season of the home railway companies starts this week, with the declaration of the Metropolitan results. The company is expected to repeat the 5 per cent. dividend paid for 1924, but the price is duller on the week, at 68½. Central London ordinary has gained a point at 69, and the Underground issues are unchanged. British Electric Traction ordinary is 2 lower at 117½.

Cable stocks and shares exhibit no feature of fresh interest. Chili Telephones are a good market at 6⅜ ex the dividend. The wireless shares have not changed. We understand that the Eastern companies did exceedingly well with the special facilities that they offered at Christmas time for the transmission, at cheap rates, of greetings by cable. The efforts made to popularise this exchange of seasonable messages were rewarded by prompt public appreciation of the concessions in regard to cost.

Babcock & Wilcox are easier at 53s. 9d. Shares changed hands to-day, Monday, at 52s. 6d. The rubber market is very subdued, owing to the drop in the price of rubber to 2s. 9d. per lb. This compares with 4s. 7d. per lb. as the recent highest touched. Sales of shares in other markets, made in order to meet engagements in the rubber department, are contributing to the somewhat dull tone that prevails in many markets round the Stock Exchange.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923	1924.	Price Jan. 25, 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	13	14	63/3	+9d.	4 8 7
Brompton Ordinary	1	10	10	1⅜	—	*5 14 3
Charing Cross Ordinary	1	14½	15	48/-	−1/6	6 5 0
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2⅛	—	5 9 9
City of London	1	15	15	49/6	−1/16	6 1 2
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/6	—	5 4 11
County of London	1	15	15	58/3	−1/3	5 3 1
do. do. 6 % Pref.	1	6	6	22/6	+6d.	5 6 8
Edmundson's Ordinary	1	7	7	24/-xd	—	5 16 8
do. 7% Pref.	1	6	7	22/6	+6d.	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14½	+⅜	5 1 8
Lancs. Light and Power	1	7½	7½	26/6	—	5 13 2
London Electric	1	10	10	33/-	−6d.	6 1 3
do. do. 6% Pref.	5	6	6	5⅝	—	5 7 10
Metropolitan	1	10	11	40/6	—	5 8 7
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅛	+⅛	5 8 3
South London	1	15	15	2⅛	−1/16	5 17 1
South Metropolitan Pref.	1	7	7	1½	—	5 12 0
Urban Ordinary	1	4	4	1	—	4 0 0
do. 6% Pref.	1	6	6	1	+1/16	6 0 0
Westminster Ordinary	1	15	15	48/3	−6d.	6 4 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/9	—	7 11 11
Yorkshire Elec.	1	8	8	31/-	—	5 3 0
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	69	+1	5 16 0
Metropolitan	,,	4	5	68½	−½	7 6 0
do. District	,,	3½	3½	47½	—	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2¼	—	Nil
do. do. "A"	1/-	Nil	Nil	7/-	—	Nil
do. do. Income	Bonds	6	6	98	—	*6 2 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	102xd	—	5 17 8
do. Def.	,,	1½	1½	24xd	+¼	6 5 0
Automatic Telephone	1	3	6	53/9	—	2 4 10
Chili Telephone	5	6	5	6⅜xd	+⅛	*3 18 5
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	176½	—	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1⅝	—	7 12 4
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord.	1	12	12	42/6	—	*5 12 11
United R. Plate Tel.	5	8	8	7 13/16	−1/16	5 2 7
Western Telegraph	10	10	10	18	—	*5 11 1
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	+⅛	8 3 0
do. do. 2nd Pref.	5	6	6	3 7/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	−2	5 2 2
do. do. 6% Pref.	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	86	+2	4 13 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	83½	—	5 19 9
do. do. Preferred	,,	96/-	96/-	102½	—	*4 12 8
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 4
do. do. Deb.	,,	4¼	4¼	77	—	5 10 5
London & Sub. Trac. 5% Pref.	1	2½	Nil	8/6	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	12	53/9	—9d.	*4 9 1
British Aluminium Ord.	1	5	10	38/-	—	5 5 3
British Elec. Transformer Pref.	1	Nil	7	1	—	... ...
British Insulated Ord.	1	15	15	3 3/16	+⅛	4 14 0
Brush Ord.	1	10	10	30/6	+⅛	6 13 6
Callenders	1	15	15	3½	+¼	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	+6d.	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	35/-	+1/16	5 14 4
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	+6d.	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/-	+1/-	4 16 9
Henley	1	15	16	3 13/16	+3/16	4 4 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	25/-	+1/-	*4 0 0
Johnson & Phillips	1	10	10	60/-	+⅜	3 11 1
Met.-Vickers, Ord.	1	8	8	29/3	+2/3	5 9 6
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	35/-	+1/6	4 5 7
Telegraph Construction	12	20	20	27½	+½	*4 7 0

*Dividends paid free of Income Tax.

How to Sell Electrical Goods.

An E.D.A. Salesmanship Conference.

AT the monthly salesmanship conference of the Electrical Development Association on January 15th, Mr. Ll. B. Atkinson read a paper on "Suggestion and Auto-Suggestion in Salesmanship." Sir Philip Nash presided.

The CHAIRMAN, in opening the conference, said that that day was an important one in the electrical industry on account of the Prime Minister's announcement with regard to the Government's proposals concerning electricity supply. One remark of the Prime Minister which had been reported was an important one, *viz.*, that the generation of electricity was an engineer's task, but the selling of it was a commercial undertaking.

Mr. ATKINSON said that salesmanship was a science of which we were only beginning to have glimmerings. The final aim of all salesmanship was to raise in the minds of all possible purchasers the desire to possess something, which desire, in those whose purchasing power was limited, would be stronger than the desire to possess anything else, or in the case of those of relatively unlimited purchasing power, to excite a desire in a mind already satiated. Thus, salesmanship implied some action on the mind of the possible purchaser, and the study of the science of salesmanship must finally end in the study of the causes which affected the conscious action of the mind. But consideration would show that that conscious mind was not everything. There were actions which were automatic and were brought about by the subconscious mind. He asked his audience to take as proved beyond discussion the fact that under suggestion, mental and physical processes were carried on in an extraordinarily powerful manner of which we had no conscious guidance or control.

The act of suggestion was generally considered from a two-fold point of view. There was auto-suggestion, where the suggestive act was done by an individual in his own case, and there was hetero-suggestion, where the suggestion was made by another. It was agreed, he believed, that in normal people and normal conditions, no such control as the latter existed apart from hypnotism. It was true that in a particular physiological condition known as hypnotism, there seemed to be a control by an outsider of the subconscious mind of another, by which his acts were controlled, but he would not pursue this, as salesmen could not deal with masses of people in an hypnotic condition. Therefore, auto-suggestion was the more important phase, *i.e.*, the planting in the subconscious mind of an individual by his own conscious mind, of the idea which was to fructify in action. There was first, the use of auto-suggestion by a salesman on himself for his own increased usefulness, and, secondly, there was the production of the auto-suggestive action on the sub-conscious mind of those whose actions it was desired to precipitate in the direction of buying the goods. The mental state to be established by auto-suggestion was a deep conviction that what one thought was the absolute truth was necessary and, further, and even more important, the absolute certainty in one's own mind that one would succeed in convincing others. The successful salesman was the man who had a perfect confidence, and absolutely unreasoning certainty in himself that he had already sold the goods and had merely come to fetch the order. An obsession of having always succeeded and of continuing success, was the dominating fact and the dominating necessity in the highest type of salesmanship. How could that mental attitude be attained? The general and most fruitful way was to realise that suggestion must be spontaneous and that those spontaneous suggestions came at moments when the whole body and mind were in a state of relaxation. With relaxation, meditation and contemplation, ideas would come with the minimum of guidance and the subconscious mind would take them up and do the rest.

Passing to the methods of suggestion as they related to the customer, Mr. Atkinson said that if they considered the case of a customer who wanted a specific object, where the decision would rest on his being satisfied as to scientific conditions being fulfilled, there was probably not much scope for suggestion, because the conscious mind was so much to the forefront. All that could be done there was to implant on the conscious mind the advantageous combination of qualities possessed by the article, bringing these into touch with individual predilection, such, for instance, as the saving of trouble, or the convenience to the particular individual, with the intention that at suitable moments this suggestion might present itself to his mind and be impressed on his subconscious mind. But in articles less the subject of detailed specification, and requirements, the implanting of agreeable suggestions relating to profit, comfort, &c., coupled with the particular article being offered, would fruitfully lead to the auto-suggestive act. The same ideas followed for publicity work, and it appeared to him that engineers leaned too much upon the reasoned advertisement or announcement appealing to the conscious mind. Advertisements with attractive illustrations were valuable; they were pictures which began to arise spontaneously in the relaxed, resting and semi-automatic condition, if they were cleverly coupled with the goods which it was desired to sell.

In conclusion, Mr. Atkinson said that the whole question was at a stage when experiment on a larger scale was necessary and in bringing it up for discussion at one of the E.D.A. conferences, he did so in the hope that others would study the methods of suggestion and would experiment on themselves and others. If they did so, he believed they would gradually find systematic lines for the development of a great and ever-acting process for self-improvement and mutual guidance.

Discussion.

In opening the discussion, Mr. H. T. YOUNG remarked that it was often said that some men were born salesmen whilst others were able to develop themselves by study, but in either case it seemed to him that a salesman could learn a great deal by following up the lines suggested by Mr. Atkinson. To a large extent, he imagined, auto-suggestion was very much the same as intuition, that sense by which we were often able to size up an individual and deal with him or her in a particular way. Men who had been through a school of salesmanship were inclined to exaggerate the claims of their goods and that was a dangerous thing to do. It was essential to stick to the truth. Mr. Atkinson, of course, had been speaking of what might be termed pure salesmanship, but what it was necessary to consider also was applied salesmanship in the electrical industry. One of the difficulties of the salesman in the electrical industry to-day was that he had so many little things to sell that he had not time to concentrate on the manner in which he should do his work, on the lines suggested by Mr. Atkinson.

Mr. WATTS (Epsom) mentioned an instance in which auto-suggestion had given him an idea in connection with pre-payment meters. He had to prepare a report on the matter and the thought occurred what was going to happen when the people using the pre-payment meters put in cookers and other apparatus. Later on he was speaking to a lady who had just come back from the Continent and she referred to a slot meter which had a double attachment. The result was that he had been able to find the meter he wanted.

Mr. PAGE suggested that in dealing with auto-suggestion there was a danger of becoming overbalanced and we should endeavour to keep our minds on the right lines with regard to salesmanship in the electrical industry. It was important to keep physically fit and live correctly and so keep a mind capable of thinking clearly at all times.

Mr. A. W. BLAKE (Willesden) said that he was not sure that Mr. Atkinson was on the right lines. He believed that there might be some other equally good reason for getting the same results that had been attributed to the sub-conscious mind. He was inclined to think that auto-suggestion, in a great many cases, came from the source which had been used by successful salesmen for a great many years—taking customers out to lunch.

Mr. L. GASTER said the essence of good salesmanship was to know what one had to sell, and, perhaps what was more important, to know what the "prospect" wanted to buy. It was essential to get the right mentality of the buyer and to show him that he would get what he wanted.

Mr. CHANDLER (Tottenham) emphasised the importance of meditation and concentration on the part of the salesman, as advocated by Mr. Atkinson, because in reading books we were only reading the views of other people. It should be possible for electrical salesmen to carry on their business without trespassing on rival forms of energy.

Mr. R. W. HUGHMAN urged salesmen to be careful not to talk a man into giving an order and then talk him out of it. That was often done, he said, by the salesman's over-elaborating his arguments and making the possible customer think that he knew nothing about it at all. After all, in spite of auto-suggestion, the lowest tender most often got the order.

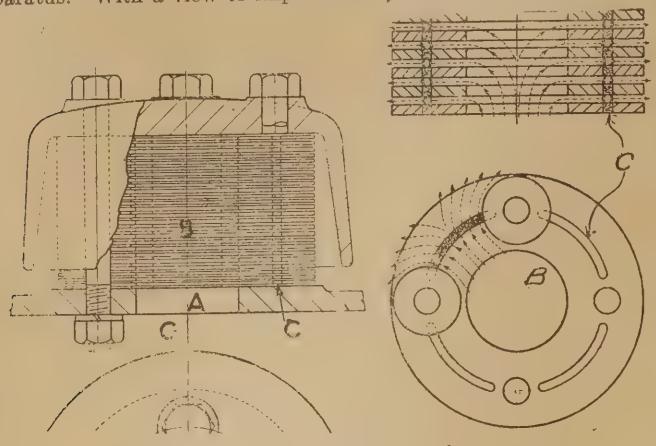
Mr. ATKINSON, replying to the discussion, said he had not wished to give the impression that salesmanship consisted in the main of suggestion and auto-suggestion. If, as rather appeared to be the case, he had given that view, it was a wrong impression. All he wanted to do was to direct the thoughts of salesmen into a study of suggestion and auto-suggestion as one phase of salesmanship, and he imagined from what had been said, that he had succeeded in doing that. Mr. Blake's remarks were a reminder of times that had passed. The buyers in most concerns to-day who were doing big business were not only men who could not be convinced by that kind of argument, but were the men who resented it. The main point which he wanted to make was that there was an extraordinary force in some part of our mind which moved without our consciously operating it. If he could get that into the minds of those who were present so that it was given consideration with the other factors operating towards good salesmanship then he would have achieved his object.

Electrical Household Activity in America.—The Hurley Machine Co., of Chicago, manufacturers of washing machines, ironing machines, and vacuum cleaners, is to change its name to the Electrical Household Utilities Corporation and increase its capital stock from 300,000 shares of no par value to 600,000 shares having a par value of $10. It will extend its merchandising activities in the electrical household appliance field.

Flame-proof Electrical Mining Gear.

Improved Forms of Plate-type Vents.

The design of flame-proof gear for use in fiery mines involves the use of vents that will allow such plant as motors to be ventilated and also permit the escape of gas or vapour, in the case of oil-immersed switches, &c., without the issue of sparks or products of combustion in such a condition as will enable them to ignite inflammable gas external to the electrical apparatus. With a view to improvement, vents of this class are



Figs. 1 & 2.—E.C.C. Flame-proof Vent.

the subject of constant experiment and two patterns are described below which possess features of interest.

An Oil-switch Vent.

Whilst there is no novelty about the plain rectangular plate type of vent, the design recently described by Mr. F. W. Close in the *Mining Electrical Engineer* is claimed to be more efficient than the usual form. It is of the multi-path class, used by the Electric Construction Co., Ltd., and consists of a pile of annular plates or flat rings, having a large central hole, smaller bolt holes, and some special slots.

The plates are assembled by threading them on steel bolts one above the other, having between them spacing washers, which are also threaded upon the same bolts. On the top of the column thus built a metal cap, of inverted cup shape, completely closes both the centre hole and the slots of the topmost plate, and also protects the plates from damage and dirt. The complete vent may be fixed to the case or cover of any switch, controller, motor, or other apparatus, by drilling the necessary holes in the case to coincide with the holes of the vent plates.

Referring to figs. 1 and 2, the products of combustion under pressure in the spaced marked G will escape through the hole A in the case into the central hole B of the vent. Its mass is then split up and it passes out radially by the many paths between the circular plates for about half the radial distance, when it reaches the slots C referred to previously; here the individual streams of gas have an opportunity of equalising any differ-

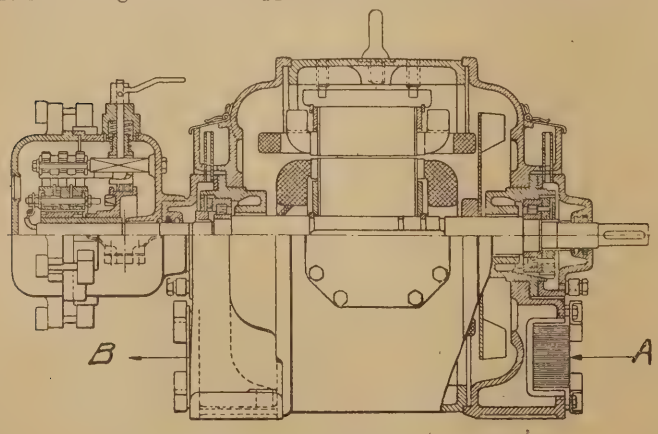


Fig. 3.—Oerlikon Motor with Flame-proof Vents.

ences in their respective pressures should some of the streams have escaped through some slots with greater force than through others. The gas again divides and passes through the remainder of the paths between the plates to the outside of the vent. The narrow slots C in the plates not only serve the purpose described above, but should it happen that some of the plates become distorted at their outer periphery by mischance, the distortion would probably be arrested at the slot, and the inner portion of the plate would remain symmetrically spaced, and thus the vent would still function with safety.

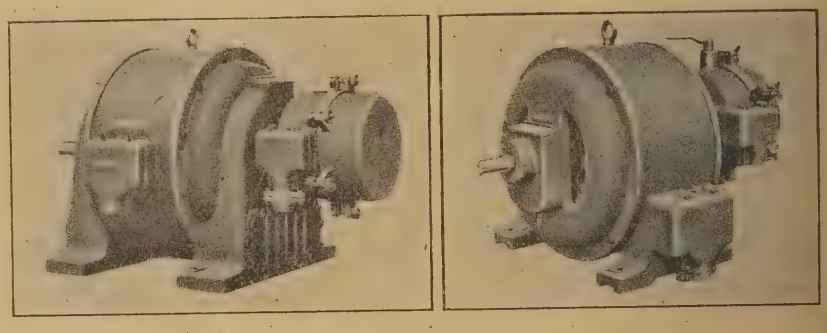
Another feature in connection with the escape of the hot gas through the slots is the shape of the path between the plates; its cross sectional area increases rapidly during the second half of the radial distance through the plate, due to the circular shape of the spacing washers, and the gas can thereby expand during the last portion of its journey. As one of the physical attributes of gases is a lowering of temperature due to expansion, this action also takes place in addition to the cooling of the gas by conduction while it passes in thin streams between the separate metal plates.

Mr. Close has also experimented with gauze vents, but he found that they are unsatisfactory.

Electric Motors for Fiery Mines.

The Oerlikon Co., of Switzerland, has recently placed on the market a new series of explosion-proof motors that have been tested at the Institut National des Mines, at Frameries, Belgium.

The motors are of the end-shield type; the frame is made of cast iron capable of withstanding the pressure that would be produced in the event of an explosion in the machine. Ventilation openings at both ends of the motor (fig. 3, A and B) are fitted with diaphragms, consisting of brass plates 0.5 mm. thick, inserted to a depth of 50 mm. and disposed one above the other 0.5 mm. apart. The cooling air has thus to pass between the diaphragms, both at the inlet and outlet of the machine. In the event of an explosion in the motor, the hot gases are cooled to such an extent in passing over these diaphragms that they are no longer able to burn when they reach the atmosphere. The machines are fitted with roller bearings in order to avoid risk, which the use of journal bearing is said to involve, of igniting gases in the event of excessive heating; the new series includes single-, two-, and three-phase as well as direct-



Figs. 4 & 5.—Mine Motors with External Slip-rings.

current machines, designed for outputs ranging between 3 and 100-h.p. Slip-ring machines can be supplied with or without brush-lifting and short-circuiting gear; they are provided with totally-enclosed slip-rings, which are outside the bearings (figs. 3, 4 and 5), and can easily be inspected by removing the cover that is bolted to the slip-ring casing by special nuts which can only be loosened by means of a special spanner intended to be retained by a responsible person so that the machine cannot be interfered with without his knowledge.

The control gear of the explosion-proof motors also affords safeguards against the ignition of gas; in the case of three-phase plant it consists of an automatic triple-pole circuit breaker combined with a starter so that the motor can be connected to the system in a simple way. All the working parts are contained in a sheet-steel tank and immersed in oil, also provided with a protective diaphragm vent. The circuit breaker is fitted with one, two, or three overload relays, time lags, and a low-voltage coil immersed in oil. The relays are outside the tank in hermetically-closed casings, and a glass window permits the adjustment of the relays to be checked at any time, but their adjustment can only be altered by loosening a nut.

For outputs below 3 h.p. the use of totally-enclosed machines is suggested as being cheaper than motors fitted with forced ventilation and protective diaphragms.

Latvian Radio Regulations.—The British Consul at Riga has forwarded a translation of regulations governing the trade in radio receiving apparatus and accessories in Latvia, together with a list of such goods the importation of which into Latvia is permitted. The regulations may be seen by persons interested at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.—*Board of Trade Journal.*

The Electrical Contractors' Association.

Annual Dinner.

THERE was a distinguished gathering at the Trocadero, W., on January 19th, on the occasion of the annual dinner of the Electrical Contractors' Association (Inc.), the N.E.C.T.A., and the National Federation Electrical Association. Mr. T. E. ALGER (the president) presided, and he was supported by representatives of all branches of the electrical industry.

After an excellent dinner and the loyal toast, Mr. W. W. Lackie, C.B.E. (one of H.M. Electricity Commissioners) proposed the toast of "The Allied Associations and Honorary Officials." He said that while contractors' schemes required no Government approval, their work was as important as the erection of central stations and the installation of distribution systems. All enlightened supply undertakings would see the wisdom of giving contractors a fair chance, for they were the best canvassers for the industry. It was necessary for contractors to have both technical and commercial ability in order to carry out their work efficiently. Electricity consumption doubled itself in every seven years; that meant a corresponding increase of work for the contractors. Although the cheap supply of energy was said to be but a small proportion of manufacturing costs, manufacturers had told him that cheap power sometimes meant all the difference between profit and loss in their business. The proper way to consider the matter was that the availability of a cheap supply of electricity would attract industries to districts where industries did not exist at present; it would give workmen better living conditions and lead to increased employment. Probably a better measure of the use of electricity than the figure of kWh per head of population was the horse-power per worker. With regard to rural development, in which installation costs would have to be reduced to a minimum, the electrical contractors could be of great assistance. It had to be remembered that these rural districts might eventually become urban, and shoddy wiring would not pay. The Association had done a great deal to improve installation work, and one day all contractors would find it necessary to become members. It was a matter for gratification that throughout the period of industrial depression which had existed practically since the war, the electrical industry had been the one bright spot, and now that there were increasing signs of a trade revival he hoped that electrical contractors would be "up and doing" to secure their share in the coming prosperity which they had done so much to deserve. In conclusion, he said that he hoped that the life line of British industry would be an electric line; contractors could ensure this.

Mr. T. E. ALGER, replying to the toast, said that Mr. Tate's absence through ill-health had been a great disappointment to them all. Referring to the Government's electricity proposals, he said that the scheme would give a great impetus to the electrical industry, and would be welcomed by all sections. There were many problems awaiting a satisfactory solution, and the current year would be a momentous one for the contractor. The latter's business was a highly competitive one; success could only be won by initiative, enterprise and energy. He had not only to train his men but he also canvassed and educated the public, and in this way did a good deal of pioneer work. Prior to the formation of the Association in 1904 several municipal authorities had obtained full trading powers, but from that time up to July last year no full trading powers were given. Then powers were given to three local authorities constituting competitors in a highly favoured position. Lord Donoughmore had suggested a joint committee of suppliers and contractors to discuss the matter. The Association had approached the I.M.E.A. with a view to drawing up a clause satisfactory to both parties, but the I.M.E.A. refused to meet them and the outlook was not satisfactory for contractors. Until recently there were few adequate municipal showrooms; it had been left to the contractors to inculcate the electrical idea. To-day there were the E.D.A., the E.L.M.A., and the municipal showrooms which the contractors welcomed. They only asked for a square deal for the contractor, who had done so much for the industry in the past. A cheap and abundant supply of electricity had been promised. If the costs of supply and service were reduced, the contractor would have a good time. There was need for a national code of wiring regulations. The Home Office had laid down rigid rules for mines and factories, and surely a code was necessary for the institutions and homes of the people. The I.E.E. rules which had been adopted by 96 fire insurance companies were a step in the right direction. With regard to the registration of contractors, Mr. Alger pointed out that 80 per cent. of those registered were members of the E.C.A. He hoped that eventually registration would be made compulsory, as it had been in some foreign countries and dominions. It was desired to put electricity on a good sound basis and to make it an economical proposition that would affect the industry and home of every inhabitant of the country. It was thus imperative that installation contractors should be efficient and capable for its introduction into the institutions and homes of the people, ensuring that that valuable and useful commodity was installed in a manner which guarded against danger. In conclusion, he mentioned that there would be a conference of contractors in Brighton in June next, at which important matters would be discussed.

Mr. WALTER RIGGS, in proposing the toast of the guests, said that many distinguished gentlemen had honoured the Association with their company that evening. He made special reference to the work of Sir Hugo Hirst, who, before the war, had courageously commenced manufacturing carbons at Witton. It was thought that this supply of carbons had played a large part in the winning of the war. Mr. Riggs mentioned that there were with them Sir Benjamin Longbottom, Mr. R. A. Chattock (president of the I.E.E.), Col. R. K. Morcom (chairman of the B.E.A.M.A.), Mr. E. T. Ruthven Murray, Mr. Ll. B. Atkinson (Cable Makers' Association), Mr. A. G. Beaver (E.W.F.), Mr. J. W. Beauchamp (E.D.A.), Messrs. Holmes and McLagan (Accumulator Manufacturers' Association), Messrs. Fletcher and Bush (E.L.M.A.), Mr. A. H. Dykes (Association of Consulting Engineers), Mr. J. N. Stephens (Chairman of the Electrical Accessories Manufacturers' Association), Mr. Leon Gaster (Illuminating Engineering Society), Mr. T. Trimnell (National Register of Electrical Installation Contractors), and Messrs. R. A. Ure and W. Finlay (Electrical Contractors' Association of Scotland).

SIR HUGO HIRST, in responding to the toast, said that Mr. Baldwin's proposals would have the effect of cheapening electricity supply, a matter which he had advocated many years ago. The margin between profit and loss was a very narrow one, and cheap power might make all the difference. Standardisation was very necessary to enable us to compete with foreign manufacturers; the existing diversity was a great handicap to mass production. British manufacturers had the men, machinery, brains and money, and with standardisation they could hold their own. Manufacturers should ask themselves if they were in a position to give adequate supply and service. If they did not organise to meet the demand which was expected, the appalling conditions which had followed the institution of broadcasting would be repeated. He had an idea that there was soon going to be room for an institution of domestic and industrial engineering, which would give an opening to hundreds of men and women trained to the work of instructing the public in the use of electrical appliances. Doctors, accountants, and other professional men had to become qualified, and because of this they were implicitly trusted by the public. It should be the same with electrical service. Such an institution as that which he had mentioned would offer enormous potentialities; it would have professors and lecturers on appliances and wiring systems and service generally. The General Electric Co., Ltd., would willingly give the first £1,000 to such an institution, and he, personally, would endow a scholarship.

Mr. R. A. CHATTOCK, who also replied, expressed the regret of the visitors at the absence of Mr. Tate, whom he said they regarded as the "father" of the Association. The Association had met with antagonism at its inception, but that was disappearing and the supply authorities and contractors were getting closer together and smoothing out difficulties by conference. Birmingham had led the way in this respect. The Corporation had instituted new showrooms which had the whole-hearted support of the Birmingham section of the Association. The registration of contractors was very valuable, and it was unfortunate that so many small contractors were not supporting it as well as they might. He did not think it possible for a municipal authority to enforce a rule that only registered contractors should be employed. In Birmingham, however, all Electricity Department work was now given to registered contractors, and it was hoped eventually to extend this to all Corporation departments. He hoped that many members of the Association would pay a visit to the British Industries Fair, which was shaping very well indeed; he assured them that the large electrical section which had been organised would be well worth seeing.

Col. R. K. MORCOM responded as well. He said that the electrical industry was wonderfully organised; it was an outstanding example of the general tendency of association which had marked this century. Association was the only way in which the competition of highly organised foreign manufacturers could be met. Associations should, however, be careful that they did not overlap or pursue false ideals. There seemed to be little doubt that the electrical industry was in for a great period of prosperity.

Mr. R. ROBSON proposed the toast of the Electrical Trades Benevolent Institution. He said that the industry paid insufficient attention to the fund; while all other sections of industry seemed to be able to raise enormous sums, the amount subscribed to the E.T.B.I. was not commensurate with the importance of the electrical industry. The fund certainly needed more publicity. It could be used as a social link between sections of the industry; for instance, in Newcastle they ran a ball in aid of the fund. This might be done in many other districts.

Mr. J. Y. FLETCHER, in responding to this toast, referred to his appointment as chairman of the E.L.M.A. He said that he would endeavour during his year of office to cement the relations between his Association and the E.C.A. It was a regrettable feature that the E.T.B.I. was not in a position to give regular pensions to those who deserved them, for the work which they had done for the industry. He appealed especially to junior members of the industry, who, if they subscribed in sufficient numbers, would be able to put the Institution on a proper basis.

The health of the chairman was proposed by Mr. R. A. PARSONS and Mr. ALGER briefly replied.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page 154.*)

Watson & Sons (Electro-Medical), Ltd.

The principal item of interest exhibited on the stand of this firm was the Sunic Potter-Bucky diaphragm, used for eliminating the scattered radiation from X-ray apparatus. Other exhibits included the Hall pattern tungsten arc lamp and a h.p. transformer of the 30-milliampere type. The latter has been designed to suit the requirements of the small cottage hospital and of the private practitioner.

Crompton & Co., Ltd.

On this company's stand there were several new productions. A novel instrument was the "iron ring" ammeter, which consists of a cast-iron case fitted with an iron pack so shaped that it can be clamped round a cable, which thus forms the primary circuit. In this way no wound former is needed and the use of a transformer becomes unnecessary, while all insulation in the instrument can be dispensed with, so reducing liability to faults.

As is shown in fig. 16, A is the pack of iron stampings, in which a circular hole is punched into which the movement fits; at this hole a cut is machined through the ring so as to form a break in the iron circuit, the movement being very similar to an ordinary moving-iron movement. Two wedge-shaped pieces of iron B (bent into the shape of a half cylinder) are mounted upon a spindle, which carries the usual pointer C and arm carrying the damping vane D; the latter swings in a dash-pot E. If now a conductor carrying a current is threaded through the ring, it becomes magnetised in accordance with the strength of the current, and magnetises the moveable pieces of iron. These are then attracted and tend to move so as to bridge the gap in the ring, which tendency is opposed by the spring F and so a scale is marked off. For low currents, owing to the smaller flux, a weak spring becomes necessary,

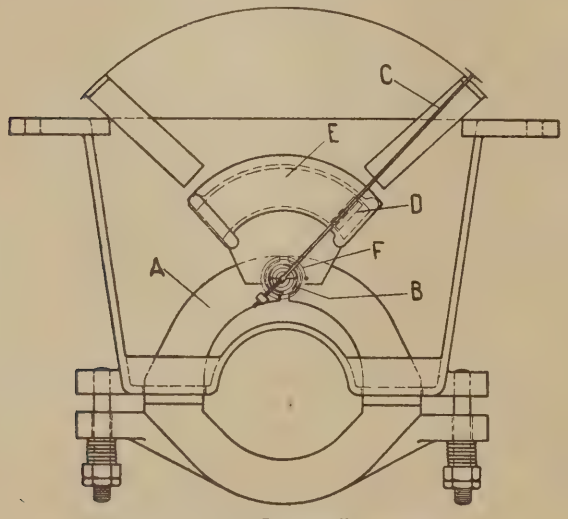


Fig. 16.—The "Iron-ring" Ammeter.

but all that is then required is to thread the conductor through two or more times and thus increase the ampere-turns. The minimum current for satisfactory working with a single conductor depends on the size of the instrument. In the case of the two exhibited, the minimum was 60 amps. for the small one and 100 amps. for the large size. The design lends itself particularly to the horizontal edgewise type of instrument, let in flush on the switchboard, the conductor running vertically at the back, or vertical edgewise when the conductor is running horizontally. In order to be able to remove the instrument without disconnecting the conductor, the ring is cut through and the back part mounted on a separate casting, which is clamped tightly against the remainder of the ring by studs as indicated in fig. 16. This part of the ring can be removed and replaced without affecting the calibration of the instrument. The design is, of course, only suitable for a.c. use, hysteresis making it unsuitable for use in direct-current circuits.

The "Alltest" set shown in fig. 17 should be very useful; it weighs only 12 ozs., and the non-hygrosconic, non-brittle, case is made of moulded insulation material. This multi-range instrument has been developed as a pocket, portable, d.c. testing outfit to be used in conjunction with shunts which are screwed under the instrument terminals, and with bobbin resistances that are screwed (any number in series) to the top or bottom terminal as desired. The attachments are plainly marked for use as separate standards for bridge work and the like, thereby making them specially valuable for research and educational purposes. The action depends on the rotation of a coil in the field of a permanent magnet, being spring controlled and dead beat. An external zero adjusting screw is provided and suitable brackets will convert the ammeter into a swivelling switchboard instrument. Somewhat similar is the "Unique" battery cell-testing voltmeter; the scale is said to be unique, the wide division at the working ranges being obtained by making the pole pieces of an unusual shape. A sample of the com-

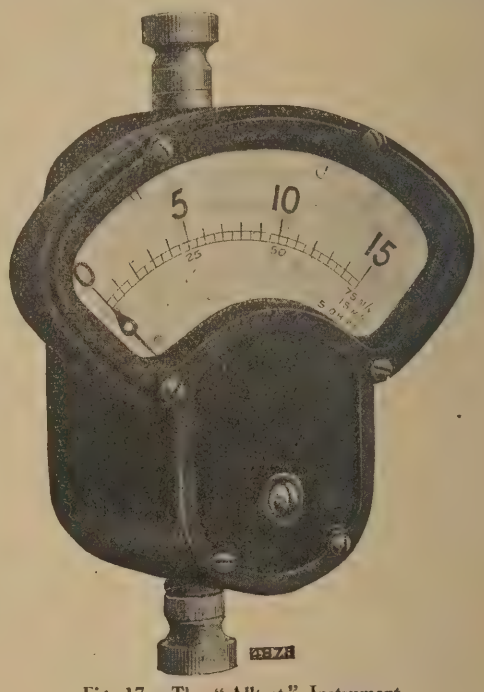


Fig. 17.—The "Alltest" Instrument.

pany's certified flame-proof instruments was exhibited, these having passed the Sheffield University's tests in a creditable manner, while a new hygrometer depends for its action on the variation in weight of a hygroscopic body operating a movement within the case of the indicator, a pointer showing the humidity of the surrounding atmosphere directly on a calibrated scale.

Igranic Electric Co., Ltd.

In addition to a large selection of radio components, the control gear side of the company's activities was represented by a demonstration model of a new design of supersensitive voltage relay. It was adjusted to make or break a circuit so as to magnetically operate circuit breakers with variations of voltage within 1 per cent. of the normal pressure, which was shown by potentiometer variation of the main supply voltage. The special form of iron core used enables such fine limits to be obtained.

The improvement of radio components during the last year is particularly noticeable in the case of the variable condenser. With the old semi-circular vanes, tuning is difficult at the lower end of the wave band, for all the shorter-wave stations are crowded together at the low-capacity end of the dial scale. The "square-law" condenser improves matters somewhat, as it is designed according to the electrical law that the capacity in a given circuit varies as the square of the wave-length to which the circuit is tuned, but the true method of adjusting the positions of stations is by frequency and not wave-length. Therefore, the desirable condenser is one that gives straight-line readings of frequency and not length of wave. The Igranic-pacent condenser is of such a pattern; its plates are similar in shape to vanes of the square-law type and it is claimed to have low-loss characteristics, a true straight-line frequency curve. The fixed and moving plates are of brass, riveted together and soldered, and the channel-shaped framework is rigid and in continuous electrical connection with the moving plates, so reducing hand capacity effects. Only two small pieces of insulating material are used and a substantial dust-proof bearing results in smooth movement. In addition to single-hole fixing, three holes are also provided for those who prefer this method of mounting. These condensers are so designed that two can be mounted together to form a dual condenser with single dial control.

M.O. Valve Co., Ltd.

This exhibit consisted of a selection from an extensive range of thermionic valves for all purposes. Amongst those of the water-cooled anode pattern were double-ended rectifiers and oscillators and single-ended modulators and oscillators. The extra-high-pressure rectifiers have molybdenum anodes almost totally enclosing the filament system, and are capable of with-

standing a maximum reverse peak of 150,000 volts; the maximum rectified current is of the order of 100 milliamps, r.m.s. Apparatus was also shown for illustrating a rapid method of measuring the amplification factor of valves.

Elliott Bros. (London), Ltd.

On the stand of this firm was shown an extensive range of miniature switchboard and portable instruments, including ammeters, milliammeters, voltmeters and testing sets for wireless, automobiles, aircraft, &c. The voltmeters, with the use of multipliers, will cover a wide range of from 15 to 600 V. A multiversal test set shown by this firm was originally designed for the mains engineer, but has been developed until it forms a universal testing set. It consists of a sensitive D'Arsonval galvanometer with shunts for varying the sensibility, together with a number of coils of from 0 to 110 ohms resistance, coupled in conjunction with two ratio arms to form a Wheatstone bridge, each arm consisting of four coils, 1,000, 100, 10 and 1 ohms. An additional external dial can be provided to extend the range of measurement. By means of a universal shunt, five sensibilities are given to the galvanometer. The whole is mounted on ebonite in a varnished teak case; a 3-ft. tripod is also provided. Other exhibits included a cylinder-pressure indicator; a Rayworth's differential cell-testing voltmeter; an averaging recorder for bulk power supplies, an instrument giving the total consumption and also the maximum demand averaged over a definite time interval. It can be calibrated as a kVA meter if so desired. A direct-reading potentiometer, a G.P.O. detector No. 2, a portable Wheatstone bridge with a self-contained galvanometer and a new pattern D'Arsonval galvanometer, were among the other exhibits. The latter instrument is of the highly-sensitive type and gives a 1-millimetre deflection at a scale distance of 1 metre with 5×10^{-10} A., with a periodic time of 10 seconds. A multiversal current transformer was also an interesting item on the stand. This apparatus is designed to give a large number of ranges with precision accuracy. The Ashdown rotoscope, manufactured for the Autocar Auxiliaries, Ltd., Letchworth, an instrument constructed on the stroboscope principle for the observation of mechanical motion, was also shown.

Foster Instrument Co.

This company displayed several interesting pieces of apparatus, including pyrometric instruments and those for purely electrical measurements. One of the most attractive exhibits was a new dial recorder, which is particularly adapted for records of temperature. The instrument operates by producing a chain of dots by means of a carbon-paper sheet under-



Fig. 18.—Indicator with Broken-Couple Alarm.

neath a translucent circular chart. A convenience resulting from this construction is that the whole of the mechanism is behind the chart and enclosed and protected in the case. The case is of convenient circular form and allows the whole record for 24 hours to be inspected without disturbing the instrument. It is entirely dust-proof and fully magnetically shielded. The moving system of this recorder has a patented spring mounting, developed by Mr. C. E. Foster and known as the "Resilia" system, by which it is claimed to be able to withstand the vibration consequent from the method of making the record by a succession of dots, which has, of course, the advantage of avoiding any frictional errors.

Another exhibit was a pyrometer indicator, fig. 18, fitted with an automatic signalling arrangement. By means of this signal lamps are lighted showing, by a white light, when the temperature is at the required figure; a red light indicates the temperature being too high and a green light corresponds to a temperature below the required figure. A valuable improvement to this instrument, a broken-couple alarm, was shown working. When the thermo-couple breaks the indicator is short-circuited across an accumulator and the pointer is carried beyond the maximum temperature reading on the scale.

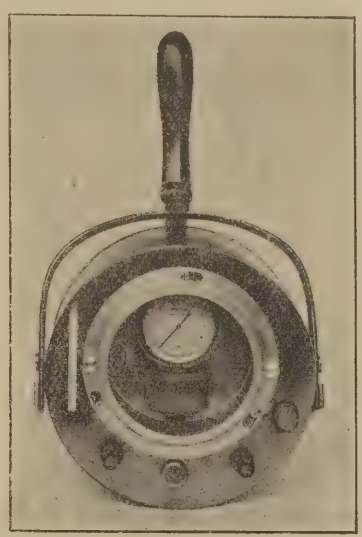


Fig 19.—Portable Surface Calorimeter.

When this happens a special alarm signal is given, calling attention to the failure of the thermo-couple so that it may be replaced before damage is done.

Another piece of apparatus of interest seen on this stand was a portable surface calorimeter, fig. 19. This instrument comprises a closed chamber having one surface blackened for presentation to or contact with the hot surface, whose heat loss is to be measured. Connected with this chamber is a small capillary tube constituting a leak, and also connected to the same chamber is a sensitive pressure gauge. When the blackened surface receives heat, as for instance from the pipe lagging, the air in the chamber expands and escapes through the leak, but in doing so a pressure is set up which is shown upon the gauge. Very quickly a steady condition is attained when the expansion of air due to the reception of heat, balances the loss of air through the leak with a corresponding steady reading on the pressure gauge, giving a measure of the heat loss.

Automatic and Electric Furnaces, Ltd.

An improved Wild-Barfield automatic steel-hardening equipment exhibited by this firm, embodies a new method of working. The heating of the furnace is effected by d.c., but the magnetic detector is operated by converted energy obtained from a commutator run by a 1/16-h.p. motor. The d.c. completely saturates the charge when approaching the critical change and the furnace is rendered non-inductive by an opposing winding. Two windings forming a quadrature transformer are arranged on the furnace casing and a second quadrature transformer having precisely the same inductance is erected on a switchboard. The two primary windings of these transformers are connected in series and are fed with a.c. The two secondary windings are connected in opposition so that the two corresponding pressures cancel out when no charge is in the furnace. As soon as a charge is introduced into the furnace an out-of-balance alternating e.m.f. is received. This is rectified by means of a second commutator on the motor and is measured by an ordinary d.c. moving-coil millivoltmeter.

It is claimed that while with the a.c. method the flux density in the steel generally shows a gradual decline during the process of heating, with the lower magnetising force found possible with d.c. the flux density in the steel shows a decided increase before it finally declines.

The Record Electrical Co., Ltd.

A change-coil volt-ampere test set was a feature of the display on this stand. It contains two moving-iron movements arranged at each end of the case. Each range has a separate scale marked on a drum, which rotates by depressing two knobs at the end of the drum, therefore overcoming the disadvantages of having many scales on the one dial. The set is complete in itself, all the coils being housed in a receptacle in the case. Other instruments showed include a complete range of "Cirscale" instruments, with a pointer deflection through an arc of approximately 300 deg.; a variety of portable measuring instruments, circuit breakers, &c.

(To be continued.)

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

A Good Crystal Detector.

One of the best crystal detectors we have seen is that illustrated in fig. 1, a product of Messrs. McLeod & McLeod. It is designed on the right lines, made with precision, and the sample sent us functioned admirably. Both the crystal and cat's-whisker (the latter is much more substantial than usual) are instantly get-at-able for adjustment without the use of threads; a slight rocking movement will remove both the end

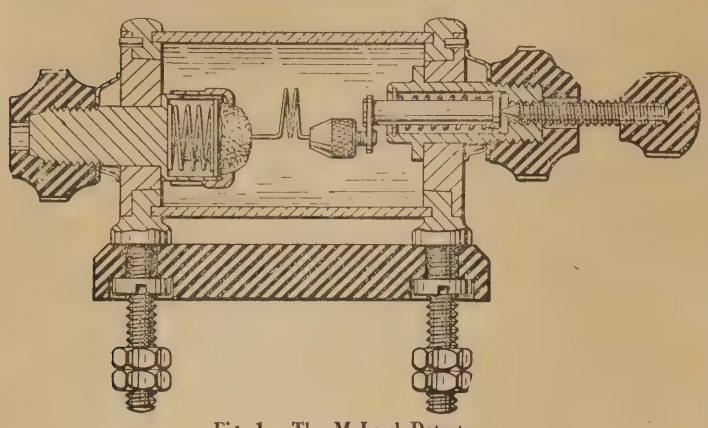


Fig. 1.—The McLeod Detector.

sections without the glass dust cover and end rings falling apart, while both sections are interchangeable, giving the advantage of right- or left-hand control, and the length of the spring plunger type of crystal cup can be adjusted. The rotary movement of the crystal and the lateral movement of the whisker are given by turning the large ebonite knobs, the projection of the whisker being made by turning the small knob. The whole face of the crystal can be explored and connection is made by the nuts below the ebonite base of the detector. All metal parts are nickelled and a chuck facilitates the whisker renewal.

Some Ediswan Components.

Should a grid leak not retain a steady resistance, it will cause crackling and parasitic noises due to the irregular discharge. Moreover, the resistance depends upon the applied voltage; thus, if the voltage is tripled, the resistance may drop to about half its orginal value. Amongst recent products of the EDISON SWAN ELECTRIC CO., LTD., is a low-capacity leak which is free from the above-mentioned defects. The resistance element is enclosed in a frosted glass tube which is evacuated, and when handling it a clean rag should be used to avoid moisture or foreign matter being left on the tube, which may establish a path along the surface of the glass between the metal end-caps. The leak is made in 0.5, 1.0, 2.0, 3.0, and 6.0 megohm sizes.

The double-value low-loss variable condenser shown in fig. 2 is actually two separate condensers united with a small knob operating either separately or jointly the two condensers in parallel. When tuning on wave-lengths below 500 metres with a large condenser stations are grouped very closely together on account of the extremely small movement required. The instrument illustrated in fig. 2 overcomes this drawback as it is possible to have only one of the condensers (300 micro-microfarads) operating in the circuit. When it is required to tune longer wave-lengths, say 1,600 metres, it is necessary to use a larger condenser, which is made possible by screwing in the small knob as far as it will go, when the condenser changes its value from 300 to 800 micro-microfarads. Both end plates are stampings of aluminium, skeletonised to minimise dielectric losses, and the vanes are of tinned hard brass.

The dual rheostat shown in fig. 3 has unusual means of changing over from high to low resistance. The wire is wound on a strip of fibre mounted in the form of a ring round the edge of the disk of insulating material with a central contact through the rotating arm with the wire on the edge of the fibre strip, a stop in the centre preventing the contact arm from accidentally slipping over on to the alternative resistance wire. When it is desired to change from high to low resistance, or *vice versa*, the central knob is pushed in, thus enabling the contact arm to clear the stop already mentioned; the control will then resume its normal course through a strong spring causing it to again make contact with the resistance wire.

The Ediswan intermediate coupler for super-heterodyne circuits has been designed to enable amateurs who wish to construct their own heterodyne receivers to employ a dependable unit. It contains the coupling transformers and a filter circuit suitably spaced and mounted on a common spindle, all connections being made to terminals on the two longest edges of the base. The whole of the parts are mounted on ebonite strips, the latter being engraved to indicate the different positions of the terminals in the circuit. The component takes its place in the super-heterodyne set between the first and second detector valves. The instrument needs no tuning and any tendency to self oscillation is overcome by the adjustment of the potentiometer used in the circuit.

New G.E.C. Components.

To its wide range of accessories the General Electric Co., Ltd., has recently added a universal filament rheostat that embodies features of an advantageous character. As shown in fig. 4, it is suitable for controlling either bright or dull-emitter valves; it consists of two coils of wire connected in series; one coil has a total resistance of 5 ohms, and the finer-wire coil a total of 25 ohms. The body of the rheostat is of brass and the wire is insulated from the casing by heat-resisting composition. The circular black dial, engraved white, is calibrated in ohms, and between the high- and low-resistance windings there is a "stop" position which acts as a safeguard against the over-running of dull-emitter valves; the tension on the contact arm is adjustable. Another addition to its components consists of two types of low-frequency transformers, which are available with ratios of 2-1 and 4-1. The former type is specially recommended for use in a circuit in which the detector valve has a relatively high impedance, while the 4-1 ratio type will give volume and clarity of tone when used in conjunction with a valve of low impedance or in the first stage of low-frequency amplification after crystal detection. Both types of transformers have real character, and the uniform standard of their performance is not the least of their commendable features.

In both patterns the primary winding is of high inductance, and the coils and trampings are hermetically sealed in the case with a special compound so as to be impervious to moisture. The drawn-metal case is of crystalline finish, as shown in fig. 5, and it acts as a shroud to prevent magnetic interaction when two transformers are mounted close together.

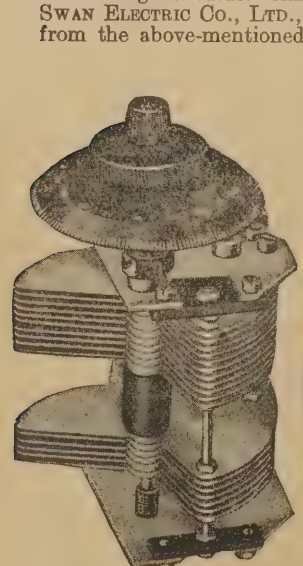


Fig. 2.—Double-Value Condenser.



Fig. 3.—A New Dual Rheostat.

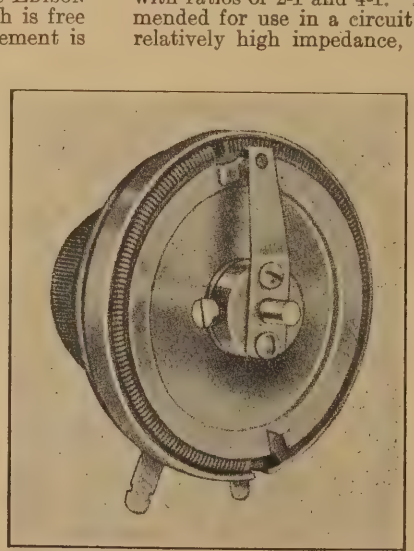


Fig. 4.—G.E.C. Dual Filament Rheostat.



Fig. 5.—"Gecophone" Low-frequenc Transformer.

"Sarbolt" Aerial Insulators.

Of British manufacture, the aerial insulator shown in fig. 6 is designed on telegraph insulator lines. It is made of vitreous porcelain throughout and does not depend on its glaze for insulation; it is provided with a ½-in. internal Cordeaux thread, a galvanised wrought-iron stem and a swivel hook. A felt washer rests on the stem shoulder to keep the screw

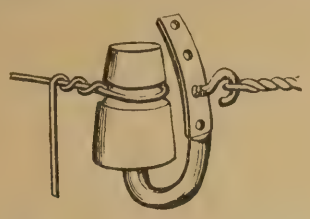


Fig. 6.—The "Sarbolt" Insulator.

free from moisture and rust and allow for expansion and contraction. It is claimed by the Hatton Supply Co. that the weight of that portion of the stem and insulator which falls below the level of the aerial wire, acting in conjunction with the free movement of the swivel hook, as indicated in fig. 6, keeps the insulator vertical in all conditions. The position of the hook can be changed to whichever hole suits best, in accordance with the slant of the aerial.

Chinese Conditions in 1925.

A Difficult Period for British Traders.

MR. H. J. BRETT, Commercial Secretary at Shanghai, has forwarded a report to the Department of Overseas Trade on the commercial, industrial and economic situation in China to June, 1925.* The report was written at the time of the general strike at Shanghai, which was paralysing foreign trade and some of the most important industries. This circumstance, combined with the continuance of civil war in China, has rendered the economic situation and the prospects for foreign trade in China in the immediate future, anything but bright. It is remarkable, however, that in spite of these disorders, the import trade of the country has continued to grow, albeit on very unsatisfactory terms, many foreign firms having sustained heavy losses. The development of new industries, although checked by the lack of security and confidence, is likewise proceeding slowly but surely, and the whole economic life of the country is gradually changing. While, therefore, business conditions are likely to grow worse rather than better for some time, there seems to be no reason to doubt that China must still remain one of the greatest potential markets in the world.

Foreign Trade.

As stated above, the import trade of China continues to increase, but the 12 months under review proved a difficult and discouraging period for all engaged in the machinery trade. The depression in this branch has affected importers of all nationalities, but British firms have also had to contend with the keen competition of low-priced Continental machinery and the readiness of their rivals to accept orders on terms which a British house could not regard as sound business. Mr. Brett says that it is nowadays practically impossible to secure any important engineering or machinery contract in China except upon terms of extended credit, and it is extremely difficult in most cases to obtain substantial guarantees of payment at stipulated dates. This is particularly true in the case of electric light works, mills, or other industrial undertakings, especially in the interior of the country. The Customs returns do not indicate the total imports into China of electrical machinery, although there is one item covering electrical material and fittings. Under this heading imports in 1924 were valued at 8,194,962 Haikwan taels (tael = 3s. 8d. approx.), being on about the same level as in 1923 (8,103,340 taels). The bulk of the electrical machinery imported into China is for lighting purposes, and as evidence of the extent to which the use of electricity in China has developed, in spite of unfavourable conditions, it may be mentioned that a list of electric light plants published last year by the Government Bureau of Economic Information contained the names of more than 220 such undertakings, with an estimated plant capacity exceeding 400,000 kW. Apart from the contract for a 4,800-kW installation in Tientsin secured by a German firm on very extended terms of credit (over 8 years) few important orders for electrical equipment were placed during 1924, and business was far from active. From the point of view of British manufacturers the year was particularly difficult owing to the practical impossibility of meeting Continental competition. It is stated that in the case, for example, of 40-kW installations, for which a fair demand exists, the difference between British and Continental prices amounted in some instances to as much as 90 per cent., and the superiority of the British plant was thus rendered a comparatively unimportant factor. In the case of electrical supplies and fittings, competition comes not only from the Continent and Japan, but also from local products which are being placed on the market in large quantities at about half the price of similar British articles.

* Stationery Office, 2s. net.

British Trade with China.

The report states that it is hardly possible to look optimistically upon the future prospects, for, apart from the general paralysis of trade and shipping caused by the strike, it must be practically certain that a determined effort will be made to direct a special boycott against British firms and goods, and though the effects of such a movement will probably be merely transitory, so long as it continues it will impose a further strain on the already over-burdened British merchant in China. Competition with other manufacturing countries grows steadily keener, and, as stated above, price is the ruling factor and the high quality of British goods is not in itself sufficient to counteract the advantage of lower production costs existing in Europe and Japan. In spite of these discouraging features, however, the future in store for British trade in China is not altogether unpromising. The anti-British campaign will have but a passing effect on the business policy of the Chinese merchant, and when this phase is over the high reputation of British goods will still retain its force, and our share in China's trade will depend mainly upon the readiness of manufacturers and merchants to adapt themselves to the altered conditions in the country. British manufacturers should therefore continue to devote the closest possible study to the requirements of the Chinese market. It is recommended that in the first instance, information regarding trade conditions in China should be sought from the Department of Overseas Trade and the fullest possible information should be provided as to prices, discounts, agency terms, &c. The manufacturer should be prepared to give all possible assistance to his local representative, especially when the goods concerned are being placed on the market for the first time. It is considered desirable to repeat the warning, frequently given in previous reports, against entering into transactions with unknown Chinese firms where any question of credit is involved. Information as to the standing of any firm of importance in China, whether native or foreign, can frequently be obtained through the London offices of the Far Eastern Banks, or in case of necessity, an inquiry through the Department of Overseas Trade may secure the required particulars. Finally, it may be said that by far the best plan for those contemplating trade with China is for them to make a thorough investigation on the spot through a competent representative. It is satisfactory to note that during recent years the tendency on the part of leading manufacturers in the United Kingdom to adopt this course has been steadily increasing.

Imports Into Dairen.

In an annexe to Mr. Brett's report, Mr. O. White, British Consul at Dairen, reports upon the trade of that territory. In the course of this it is stated that the purchases of the South Manchurian Railway Co. during 1924 were smaller than in the preceding year. The amount of electrical material bought amounted to 2,661,000 yen, of which only 29,000 yen represented British goods. As regards electrical imports generally, the value rose from £304,309 in 1923 to £412,000 in 1924, the principal item being cables and wires, £135,500.

New High-power Testing Laboratory.—During the past year the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, U.S.A., has placed in service a new laboratory that is to be used primarily for testing the interrupting capacity of oil circuit-breakers, contacts, and fuses, and the thermal capacity and mechanical strength of current-carrying parts in power houses. The power equipment of the laboratory consists of two 20,000-kVA, 600-r.p.m., synchronous generators connected in parallel and driven by a 3,300-h.p., 60-cycle motor. The generators are arranged with a number of parallel circuits so that varied current and voltage are obtainable. Provision is also made for applying 25 cycles to the motor with resulting 25 cycles at the generator terminals. Due to the large amount of power thus made available, it will be possible to make exhaustive tests; on short circuit the generators will deliver a maximum current equivalent to 700,000 kVA, 3 phase, and when testing a complete single pole of a circuit-breaker on single phase, an initial current can be produced equivalent to more than one million kVA on a 3-phase system. A group of current-limiting reactors is provided and so arranged with disconnecting switches that current obtained on short circuit may be limited to practically any value, thus making the entire power of the plant available for sustaining the voltage. Very complete measuring equipment is provided, including 3-element and 5-element oscillographs, for securing complete test information. Provision is made for the automatic operation of the tests under oscillograph control to assure proper timing of all operations. Dark-room facilities are also provided to permit the immediate development of oscillograph films.

"The Romance of Copper."—Such was the title of the address recently delivered by Mr. Ll. B. Atkinson at the Demonstration Halls of the Metropolitan Borough of Hackney Electricity Department. Mr. L. L. Robinson, borough electrical engineer, opened the meeting by introducing Col. T. F. Purves, chief engineer of the G.P.O. The lecture, which was illustrated with lantern slides, after contrasting solar and atomic dimensions, explained "the passage of electricity" in terms of the movement of electrons, and concluded with a reference to the various types of electric cable, their construction and insulation.

The Testing of Static Transformers.

The Importance of Accuracy and Some Methods of Obtaining It.

By J. LINDLEY THOMPSON, M.Sc., M.I.E.E., and H. WALMSLEY.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper describes the usual methods adopted in the commercial testing of static transformers. Emphasis is laid on the need for accuracy, and methods are suggested whereby it can be obtained. Accurate results create confidence in the mind of the customer, and also give the designer and manufacturer confidence in their product. Testing serves as a check on workmanship, materials, design and drafting, and should function as the most critical inspection of the product.

Drying and Insulation Resistance.—The drying of transformers is, in reality, a test of insulation resistance; not the actual value obtained from any Megger reading, but the characteristic with time and constant temperature. Of the ways of drying transformers, the most satisfactory is by the circulation of dry, heated, air and by the vacuum process. Drying by air should be confined, from the point of view both of efficient drying and of the necessary time taken to ensure dryness, to transformers wound for voltages not higher than

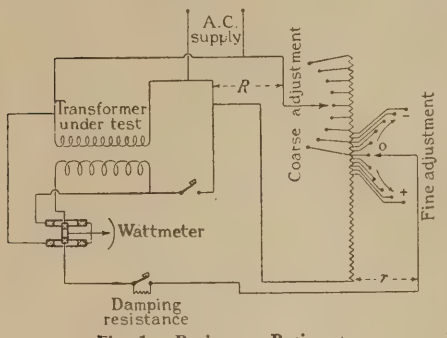


Fig. 1.—Resistance Ratiometer Arrangement.

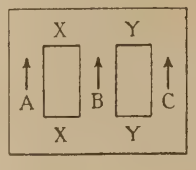


Fig. 2.—Flux Diagram; Core-type Frame.

11,000. The temperature necessary in a drying chamber is about 80 deg. C., and the time required varies with the size and construction of the unit, *i.e.*, it depends on the quantity of insulation embodied therein. The length of time can be gauged from the dielectric, characteristic, as shown by the curve of Megger readings taken during the process. In the case of transformers, especially those of high-voltage, which have a high electrostatic capacity and so require an appreciable charging current, the Megger voltage should be applied for at least 60 seconds. A high-voltage Megger is essential, *i.e.*, one wound for 1,000 or 2,000 volts. As a guide, when a transformer is dry the following empirical formula, in which f is the frequency, will be useful:—

$$\text{Megohms at approx. 75 deg. C.} = \sqrt{\frac{\text{Kilovolts} \times 20}{\frac{(\text{Kilovolt-amperes})}{f}}}$$

In general, a transformer may be said to be dry if the insulation resistance is at a high, or infinite, value when the transformer is heated to a temperature of 80 to 85 deg. C. For transformers for higher service voltages than 11,000 the vacuum process of drying is recommended as being the surest and quickest.

The container is heated to the required temperature at atmospheric pressure, and allowed to remain in this condition until the transformer becomes uniformly heated and the insulation resistance has reached a low constant value. A vacuum of approximately 28 in. accelerates the drying by rapidly liberating the moisture, which is drawn off by a pump. If oil impregnation is required it is done at this stage, dry, clean, oil at a temperature approximately that of the transformer being allowed to enter under vacuum until the transformer is fully immersed. The plant is then allowed to stand in this condition until such time as full penetration of the insulation is complete. If oil impregnation is not required, the vacuum must be released slowly through an air drier, to prevent moisture entering with the air.

Ratio Testing.—The voltmeter method leaves much to be desired. The standard-transformer method, until the last year or two, was the standard employed by most manufacturers. High-voltage transformers take an appreciable charging current, and hence, as this method is a null one, errors within limits are quite possible. Resistance-balance ratiometers are now generally employed and give reliable results in all cases. Fig. 1 shows the h.p. winding of the transformer connected across a resistance R, tapped to suitable dial switches arranged to give various resistance values. The l.p. winding is connected in opposition across a part of this resistance R, also tapped through suitable dial switches to a sensitive wattmeter to show the balance of the two circuits, the field coils of which are excited off the h.p. supply. By this arrangement any current flowing in the l.p. windings will be indicated by a wattmeter reading. The procedure is so to adjust the dial switches as to obtain a true balance and a zero reading on the meter. The ratio of the transformer is then R/r. In general, this type of ratiometer has superseded the other methods mentioned.

Polarity Testing.—This is the only means of accurately determining the connection of transformers for parallel operation, or connection in banks. Apart from a visual examination of the rotation of the windings, polarity can be readily obtained by comparison with a transformer of known polarity, and can be carried out at the same time as the ratio test if the standard-ratio transformer be suitably marked. Another method is that of employing a single-phase wattmeter, the direction of rotation of the eddy-current disk indicating the polarity. Still another method is that of using direct current.

Iron Loss and Magnetising Current.—This loss is in most cases constant and, therefore, important to the customer from the point of view of running costs; by supplying the normal voltage at the correct frequency to one winding of the transformer, with the other open circuited and the voltage and frequency adjusted to the correct values for the particular winding, a wattmeter reading will then give the iron loss and the ammeter reading the no-load current, often mistakenly termed the "magnetising current." With small transformers there is an appreciable difference. The no-load power factor varies according to the size and frequency of the transformer under test, and comes within the range of 0.2 to 0.06 approximately. This necessarily results in small readings on the wattmeter, and therefore possible errors in reading. To overcome these inaccuracies of reading it is essential that a wattmeter be used suitably designed for low-power-factor work. Such meters are available and the authors have had them in constant use for some considerable time with satisfactory results. One has its maximum capacity in volt-amperes equal to five times the maximum scale reading in watts, which means that, compared with an ordinary wattmeter for unity power factor, the error in scale readings is only one-fifth. For three-phase iron-loss measurements several instruments are necessary, unless some special change-over device is used for putting the same instruments in the different phases in turn. Two- and three-wattmeter methods give accurate results, provided suitable instruments are used.

Easy and accurate measurement of frequency is of vital importance in transformer testing, for more than 25 per cent. of inaccurate results can be traced to insufficient care in obtaining a true reading. The method recommended is a series of frequency meters of the electro-magnetic type, connected to slip-rings off the armature of the d.c. driving motor. Several advantages can be claimed for this method: By using a relay, the instrument can be easily connected to any measuring table;

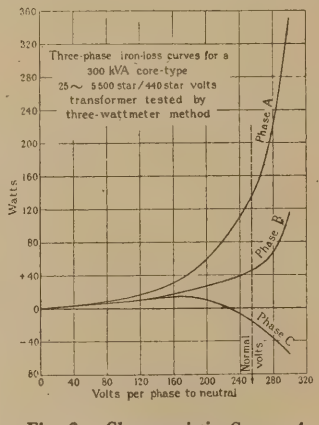


Fig. 3.—Characteristic Curve of Losses.

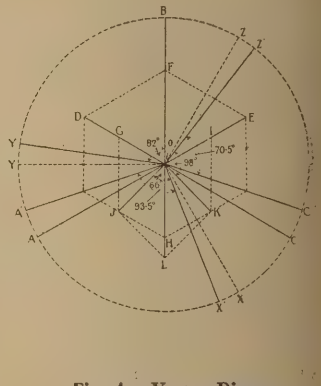


Fig. 4.—Vector Diagram.

the instruments can be used for several machines, and the range of frequencies measured can be limited, a wide scale being provided for a small variation in frequency.

Three-phase Core-type Transformers.—When measuring the iron loss of three-phase core-type transformers by the three-wattmeter method the losses measured in the three phases are never equal, and in some instances a negative reading is obtained in one of the outer phases. This apparent anomaly is puzzling to many, but it can be accounted for by the unbalancing of the magnetic flux in the core, due to its shape. If, in fig. 2, by applying a symmetrical three-phase voltage to the three phases, we excite each limb to the same flux density, half the flux in limb B returns through limb A, and half through limb C, because from the point of view of phase B the core is symmetrical. The flux in limb A returns part by limb B and part by limb C, but due to the fact that the reluctance of the return path through B is lower than that through C more flux will pass through B than through C. Similarly the flux in C will return in like manner through B and A. Supposing the reluctances of these paths are in the ratio of 60 to 40, then 60 per cent. of the flux from A will return through B and

40 per cent. through C and similarly 60 per cent. of the flux from C will return through B and 40 per cent. through A. The reason for the unequal loss measurements is the unequal distribution of the return flux.

Fig. 3 is a characteristic curve of loss measurements in each phase, plotted against the applied voltage. The extent of the negative value depends on the induction in the core at normal voltage, and also on the relation of the reluctances of the two magnetic paths for the flux in limbs A and C. This negative reading also means that the phase angle between the no-load current and voltage in phase C must be greater than 90 deg. Fig. 4 shows this relation graphically, drawn from test figures, with certain assumptions. The no-load currents have been taken as a measure of the reluctance, though this is not strictly true owing to their watt components.

Iron Loss and Form Factor.—The iron loss may be directly measured by the method already described, but unless the wave-form of the applied voltage be a sine wave the results will be greater or less than the estimated or correct loss. In general the wave-form will be peaked, due to the nature of the load on the machine, and the measured losses will be of a low order. Since the form factor of the wave does not affect the eddy loss in the same manner as the hysteresis loss it is necessary, if a correction is to be made, to separate the loss into its two components and correct the hysteresis loss in line with the form factor. Table I shows the effect of form factor on hysteresis loss :—

TABLE I.

Form factor.	Relative hysteresis loss. Per cent.
1.0	118
1.05	119
1.11	100
1.15	94.5
1.2	88.2
1.3	77.6
1.4	69.3

Hysteresis loss forms by far the greater proportion of the total loss, so that any increase in form factor will appreciably reduce the measured loss and so give erroneous results. The correction for form factor may be accomplished by (1) obtaining the form factor of the applied voltage and correcting the hysteresis loss in line with the form factor, and (2) applying an equivalent voltage to compensate for the form factor by means of an iron-loss voltmeter.

To correct by method (1), it is essential to obtain the correct wave-form of the applied voltage, or its form factor. This can be done by means of the oscillograph, thus obtaining a true picture of the wave and then analysing it for the form factor. The form factor can also be obtained by fixing a commutator to the machine giving the a.c. supply, which method is not recommended, or by the authors' arrangement of rectification of the complete a.c. voltage wave by means of either two or four three-electrode thermionic valves, as shown in figs. 5 and 6.

To obtain satisfactory results, a straight-line characteristic had to be aimed at for valve impedance plotted against circuit voltage. By maintaining the filaments at a constant normal temperature and the external resistance at a high value relative to the internal resistance of the valves, the working part of the characteristic was approximately a straight line. The most suitable valves are of low impedance, and to reduce this still further their grids were connected to the plates. Using an external resistance of 104,310 ohms, as the voltage across the valve outers was increased, the valve impedance decreased rapidly and became constant or asymptotical at 160 volts, or approximately 5.6 volts (d.c.) across the valves. With four-valve rectification, two valves were used in series for each half-wave rectification, and their impedance became constant at 4,000 ohms. With two-valve full-wave rectification the mid-point of the transformer was used as the bridge point, and the results obtained were more accurate than those obtained by the four-valve method. The former is therefore recommended as the most suitable. The authors claim the tests to be accurate within 0.5 per cent. by the method described.

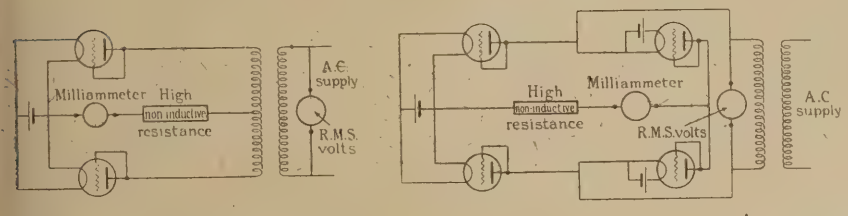
Separation of Losses.—In addition to obtaining the form factor, the losses measured must be separated into the two components (hysteresis and eddy loss) because, since the form factor affects only the hysteresis loss, that component must be obtained : (*a*) Measure the loss at constant induction and varying frequency and plot loss/frequency against frequency; this should be a straight line, and the ratio of the ordinate at the vertical axis to the ordinate at normal frequency gives the ratio of hysteresis loss to total measured loss : (*b*) Measure the loss at constant voltage and varying frequency and plot it against $1/f^{0.6}$; this should be a straight line, and the point where it cuts the vertical axis gives the eddy-current loss in watts. Method (*a*) is the simpler and quicker, which is a great asset to test-bed work. Having obtained the hysteresis component and the form factor, the hysteresis loss should be multiplied by :—

$$\frac{(\text{Form factor})^{1.6}}{(1.11)^{1.6}}$$

Results obtained by the above loss-separation methods, from a commercial-test point of view, show little variation. The method of correction for wave-form by applying a compensated voltage value in line with the form factor, is simple and easy in operation, but depends entirely on the calibration of an iron-loss voltmeter (used by the American Westinghouse Co. and the General Electric Co., of America), which indicates an equivalent voltage for a sine wave-form of applied voltage. The similarity, or almost equality, in the results obtained by the two methods is worthy of attention.

Copper or Load Loss and Impedance Tests.—The measurement of copper loss is usually carried out by an arrangement of instruments similar to that used for iron-loss measurements, except that one winding of the transformer (usually the l.p. winding) is short-circuited, and a supply capable of circulating the full-load current at the correct frequency is connected to the other winding. The ratio of the ohmic loss to the eddy loss varies for different transformers. The separation of the losses can be carried out by (*a*) calculating the ohmic loss from the measured resistances of the transformer windings and subtracting this loss from the measured loss, which gives as a result the eddy-current or stray losses, and (*b*) by separation of the losses, and by taking several readings of watts lost and frequency, keeping the load constant; the watts loss plotted against the square of the frequency is a straight line, and the loss at zero frequency is the true ohmic loss.

When taking copper-loss measurements on three-phase transformers it is advisable to apply three-phase currents, especially for transformers having a high internal reactance, as the eddy currents tend to become unbalanced and excessive when measured single-phase. Single-phase measurements with all three phases connected in series, either in open delta or Z connection, are liable to excessive errors and should not be used except for three single-phase transformers to make up a three-phase group. With transformers having magnetic shunts between the h.p. and l.p. windings to increase the reactance, it is necessary that a curve of impedance should be taken up to a high value of overload to prove that the shunt does not become saturated within the loading limits and that the impedance at the higher values does not deviate from the straight line beyond the permitted tolerance. The copper loss of a transformer is usually guaranteed at a specific temperature, but it is rarely possible to obtain the actual reference temperature on test, so that corrections have to be made to arrive at the copper loss for comparison with the guarantee. The losses in the magnetic shunts due to the leakage flux which they carry are inseparable from the total parasitic losses by any known test methods. In corrections they are assumed to vary as the eddy-current loss for copper. Any error due to this assumption is small owing to the low value of these losses, which can be approximately calculated.



Figs. 5 & 6.—Two- and four-valve Full-wave Rectification.

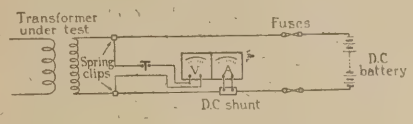


Fig. 7.—D.C. Resistance Measurement Diagram.

Resistance.—For cold measurements the direct methods are not recommended, for they are generally influenced by thermal and capacity effects. The method recommended is the indirect one, using an ammeter, voltmeter and a d.c. battery as shown in fig. 7. A precision meter should be used, preferably of the combined type, with various ranges of shunts and resistances for the instrument; the whole apparatus should be set aside for resistance measurements only and it is very necessary to take care that all electrical circuits linked up by the same magnetic circuits are open-circuited before any readings are taken.

Full-load Temperature.—The load-runs for single-phase transformers can be divided into unearthed and earthed windings. The former are most common and are connected back to back, or virtually in parallel. The core losses are supplied by exciting the two transformers in parallel, and the copper or load losses by injecting in the parallel link of either the h.p. or l.p. winding a current equal to the full-load current. The most accurate method is to excite on one side and inject on the other side. If for reasons of voltage or supply considerations the excitation and boosting have to be supplied to the same winding, then one transformer will be slightly out of balance with the other for excitation, owing to the drop of voltage across the booster. To obviate this, the excitation supply should be connected to the middle point of the booster if this point is available. For earthed transformers, which are usually for high-voltage service, the excitation and loading must necessarily be carried out on the l.p. side due to the high voltage

that would be present across the booster if loading were done on the l.p. side, for this voltage would be twice the impedance voltage of one transformer and would bring the earth point of at least one transformer to a possible unsafe voltage above earth.

The loading of three-phase transformers is carried out in a similar manner, but due to the numerous methods of phase connection possible it presents a more difficult problem. With some forms of phase connection three-phase injection of load currents is the only means possible.

Insulation Tests.—These should be taken with the insulation in its weakest condition (at the full-load temperature) so that these tests should follow immediately after the hot resistance measurements. In general, for pressure tests up to 41,000 volts, and over-potential tests up to 40,000 volts, *i.e.*, for transformers rated up to 20,000 volts, the h.p. test pressure can with safety be taken from the transformer ratio of the testing transformer and the transformer under test respectively. For higher voltages the h.p. pressure must be measured by other means due to the increase of voltage brought about by the

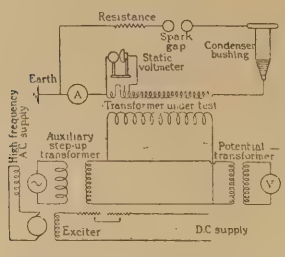


Fig. 8.—Over-potential Test Layout.

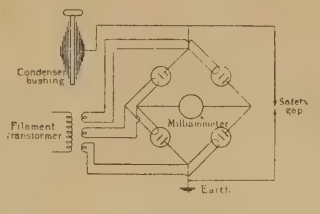


Fig. 9.—Four-valve Crest Voltmeter.

capacity of the windings; pressure-rises of 35 per cent. have been measured above ratio voltages when testing transformers for 115,000 and 136,000 volts. Static voltmeters for very high voltages have not been found satisfactory due to their delicate adjustment and susceptibility to vibration and draught. For over-potential testing, the spark-gap is recommended as the most reliable means of measurement, the calibration being that given in the Standardisation Rules of the American Institute, with corrections for barometric pressure and temperature. Fig. 8 shows a scheme of connections for an over-potential test on a high-voltage transformer.

When abnormal tests are required, such as three or four times the normal voltage, a high frequency is necessary to obtain this test value. With high-voltage transformers very high frequencies are apt to bring about complicated conditions and troubles, and it is recommended that a frequency not greater than 175 be used for high-voltage testing and over-potential testing. Where abnormal tests are required necessitating a higher frequency than 175 periods, the authors have advised other means of obtaining the voltage without creating disturbing conditions. The method involves two sources of supply, one at a high frequency, say 200, and another at 50 or 66.6 periods, and the superimposition of one supply upon the other. The resultant wave is a distorted one, but the period of maximum voltage is not less than the lower frequency of supply. To obtain the best condition the higher frequency should be a multiple of the lower, thus giving a regular peak voltage.

Pressure Test.—This should be measured in a similar manner to over-potential, *i.e.*, by a spark-gap or a crest voltmeter, which functions on the principle that the average charge current of a condenser is proportional to the maximum impressed voltage. To obtain the average value of the charge current it is necessary to rectify the alternating current and measure its value on a d.c. milliammeter. In order to use the crest voltmeter the testing transformer must be fitted with a condenser bushing or a fixed standard condenser, the earth band of the bushing being insulated from the tank and the charge current passed through thermionic valves or mercury rectifiers to earth. The rectified current is measured by a d.c. moving-coil permanent-magnet milliammeter. Fig. 9 shows the full-wave rectification method which is to be preferred, as the current measured is approximately twice that of half-wave rectification, depending on the total impedance of the valves and condenser circuit. The small pointed spark-gap shown across the condenser and the earth terminals takes the main charge current when a heavy current passes through the terminal bushing condenser, which would otherwise spark across between the plate and filament of the valves and probably burn them out.

The arrangement of the test and procedure are similar to that for over-potential testing. The spark-gap is used as a measure of test voltage, and the crest voltmeter as an indication that the voltage has been reached when the gap is disconnected.

In conclusion, the authors express their thanks to the Metropolitan-Vickers Electrical Co., Ltd.

Discussion in London.

MR. S. A. STIGANT congratulated the authors on the manner in which they had written their paper. Usually papers were so long and full of detail that the practical man had to go to considerable trouble to extract just those parts which were useful to him. From this point of view the paper before them was one of the best that had ever been presented. He endorsed the authors' view that such tests should be devised as would give the most accurate results, but apparatus and means used to that end should not be elaborate. For drying purposes, when vacuum plant was available in large works, that was the best method, but transformers could be dried without a vacuum. He agreed with the remarks concerning errors introduced by commercial types of wattmeters at high frequencies. A single-phase single limb test would give the same result as a 3-phase test. If condensers were used across the power supply, the machines needed for supplying the power could be smaller, and if power was purchased a better power factor would be available.

MR. S. W. MELSOM thought the paper valuable because it put forward just what they wanted to know. The use of a Megger for insulation resistance testing was a good method, but not of the highest accuracy. The author mentioned that the Megger voltage should be applied for 60 seconds, whereas the makers suggested a very much longer application. The reading taken with the transformer in oil would be lower, but how much lower? And would the fall be immediate or after a time, as determined by the diffusion of moisture in the oil? What did the author mean when he referred to the "infinity reading"? He emphasised the need for accuracy, but adopted an almost pre-historic method for the measurement of resistance by ammeters and voltmeters. That suggested the authors had probably never used the Kelvin bridge, or if they had, they had not understood it. It would give readings in half the time, say 5 times as accurate, and only needed one man instead of two. However, he did not intend his criticism to detract in any way from the value of the authors' contribution.

MR. A. F. W. RICHARDS agreed that accuracy had a big influence on customers', confidence, and he hoped manufacturers would not lose sight of the authors' suggestions. A great deal depended on the use of proper instruments for the various tests, especially so in iron-loss tests. Resistance tests should be the easiest, but they often gave much trouble, as Mr. Melsom had indicated. He, the speaker, probably knew most of the test beds in this country; many of them lacked suitable instruments, and only one provided fixed instruments for this test. Generally, methods were haphazard and instruments were used for other purposes without due regard to the test conditions. Frequently hours are wasted due to such things as leads sparking to earth in high-pressure tests, and these occurrences suggested that test-bed methods should be improved and brought up-to-date.

MR. J. BLOOME suggested that the 2 and 3-wattmeter methods gave different results; the same result could be obtained, but only after much trouble. The form factor played a very important part in iron-loss measurements, and it was well worth the attention which the authors had given it. He congratulated the authors on their vector diagrams for a 3-phase core-type unbalanced magnetic circuit. For pressure measurements he regarded the tachometer as all that was necessary, and for resistance measurements used an

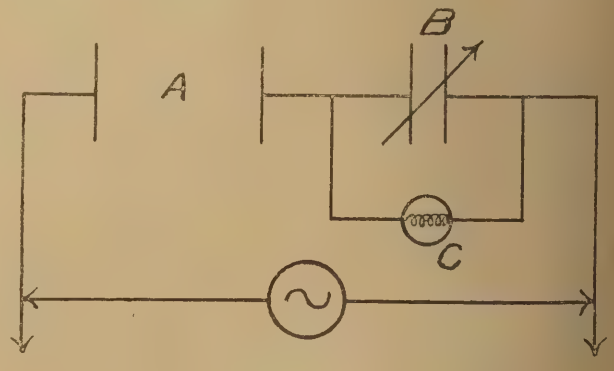


Fig. 10.—Suggested Crest Voltmeter.

ohmeter, which he found better than an ammeter and voltmeter. The instruments should not be moved between hot and cold tests, the former being obtainable in three minutes.

PROF. J. T. MACGREGOR-MORRIS referred to tests which he had helped to carry out when he was a student under Prof. Fleming; they were described in a paper that was discussed for five evenings, and in those days it was not uncommon to argue over errors of 5 per cent. in wattmeter readings. He was impressed by the advance that had been made since those days, as indicated in the valuable paper before them that night. In connection with crest voltmeters, he outlined an instrument which had been developed by a student under him, and independently elsewhere, which was independent of frequency. As shown in fig. 10 it consisted of a large capacity (A) and a smaller variable capacity (B) while (C) was a neon flash lamp; if certain precautions were taken regarding the neon lamp, its striking voltage could be relied upon to within 1 per cent., probably 0.5 per cent. The method of operation was to vary the smaller condenser (B) until the lamp flashed or, if it was alight, was extinguished. Such a simple instrument could probably be developed for pressure of 100,000 volts or over.

MR. F. S. ROBERTSON, referring to the authors' crest volt-

meter, pointed out that the illustration did not indicate to what the grid of the 3-electrode valve was connected. If it was unconnected, nothing would flow through the valve.

MR. F. E. OCKENDEN said that he could not agree with the authors' statement that the static voltmeter was not very satisfactory in connection with the measurement of iron losses.

MR. H. M. LACEY was somewhat mystified by the authors' explanation of fig. 3. He could not read quite sensibly the explanation of the effect shown.

MR. J. L. THOMPSON, replying, said that the paper was the authors' reply to remarks which had been heard concerning tests carried out in the past. The drying of transformers might easily take three weeks, but could be reduced to three days by the vacuum process, representing economy in time and money. The measurement of iron losses by tapping was simple, but might be inaccurate due to disturbance of the flux. He did not like Mr. Stigant's suggestion about condensers; their use might be very dangerous owing to values being reached which could not be calculated. Their paper was originally about 3½ times its present length, but for various reasons it had to be shortened. It must be remembered that he was dealing with shop processes and not laboratory methods. If service conditions could be met during the shop tests, so much the better, but if to do so would involve expense and loss of time, the matter would have to be considered from a different point of view. The measurement of resistance by an ammeter and voltmeter was a shop method; it was not possible to keep such instruments as had been mentioned in the discussion, in proper condition in the shops, although of course they were highly accurate in the laboratory. Regarding hot-spot temperature measurement by thermo couples, the difficulty was to find the hot spot. He did not favour the use of couples, because they must be so placed that they would involve a great risk of life to the test man who took the readings. Drying transformers by short-circuiting was also a risky business which he would not undertake, especially when large transformers were concerned. The grid of the valve crest-voltmeter illustrated in fig. 9 was not connected to anything. They were only concerned with the high peak voltage, and therefore the accuracy at the lower end of the scale was of no consequence.

The Rand Turbo-Alternator Failure.

Some Further Interesting Details.

WITH further reference to the recent failure of one of the German-built turbo-alternators in the Vereeniging power station of the Victoria Falls and Transvaal Power Co., South Africa, more details of an interesting nature have been published in the *S.A. Mining and Engineering Journal* (from which the accompanying illustrations are reproduced). It is explained that immediately before the accident occurred, in the early hours of the morning of December 8th, 1925, No. 1 machine (which was isolated from the rest of the station and feeding

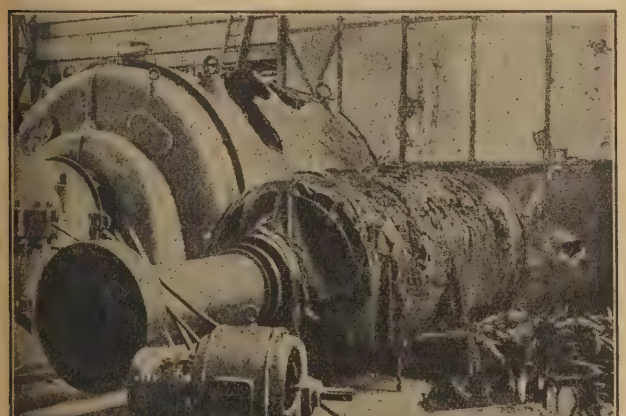


Fig. 1.—Spare Rotor and No. 3 Alternator; Part of No. 2 Rotor Embedded in Floor.

one 80,000-V line) had tripped, and that No. 3 (which was in parallel with Nos. 2 and 4, feeding the other three lines) had come off the bus-bars owing to the operation of the neutral protection gear which was set sensitively. The switchboard attendant had just noted that No. 2 machine was carrying 11,000 kW, and was on his way to the telephone to get into touch with "Control," when the smash-up took place. Most of the flying metal of the stator and rotor went, roughly, in the direction of rotation. The portions which travelled across the Vaal River, went through the roof almost vertically. One-third of the stator went through the western gable and landed within reasonable distance of the station. One-third is believed to have gone downwards through the bedplate, while part of the other third at least crossed the Vaal. The rotor did not indulge in quite so much travelling; part of it went vertically downwards, and part towards No. 3 machine through the floor (which formed the top of an access passage) and came into contact with the spare rotor seen in fig. 1, lying between Nos. 2 and 3 machines. The spare rotor struck No. 3 stator, fracturing its feet and moving it sideways on its bed, but not enough to close the air-gap of the machine and damage No. 3 rotor. No. 3 stator was ruined, as the top of the carcase was smashed by flying metal which passed over the top of the spare rotor. An extraordinary feature, however, was that No. 3 machine's end-shields were not moved or damaged, all the bolts attaching them to the stator carcase shearing. The end

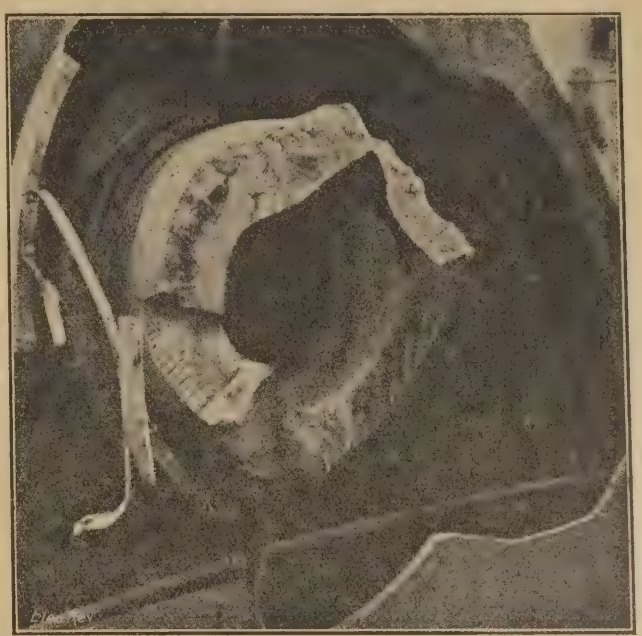


Fig. 2.—Fractured Rotor Shaft.

shields of No. 1 machine were badly damaged, but by replacing them with the undamaged ones from No. 3 generator, No. 1 set was restarted promptly. Thus the spare rotor, though destroyed itself, saved the rotor and end shields of No. 3 set. (Moral: Don't place a spare part in a position where it will be destroyed by the very event it is intended to guard against.) The rotors of the machines in this station are in two parts: one consists of the barrel with plates and windings, together with a drawn-down end, forming the centre bearing and carrying the half-coupling. The exciter end of the barrel fits on the second part, the exciter end spindle, by means of a spigot joint kept up by a number of axial bolts. The male spigot end with the full ring of fractured bolts showed that the first-mentioned portion of the rotor failed, and that, as seen from fig. 2, the barrel only got loose; this picture also indicates that the barrel and spindle, which are one forging, are hollow, and that the break took place just where the change in the diameter of the shaft began. Moreover, on approximately the horizontal diameter, to the left, will be seen what looks like an axial flaw. The fracture seems to show fine-grained crystalline metal rather than fibrous, tough, indications. The journal quoted concludes: "We do not wish to speculate on causes, preferring to await the report of the inquiry, proceeding as we write."

Movements in the Radio Industry.

Suggested Reorganisation.

CONSIDERABLE attention was given by the *Wireless Trader* in a recent issue to the movements which are taking place in the radio apparatus industry. The National Association of Radio Manufacturers and Traders includes in its policy means for controlling the discounts given by manufacturers to dealers. A number of prominent members of the Association became dissatisfied with this arrangement and as they could not secure the "decontrol" of discounts they resigned or are resigning. The advocates of the Association's policy point out that discount control places all manufacturers on the same footing where terms and trading conditions are concerned, while allowing them full freedom in fixing their selling prices. One manufacturer, when interviewed by our contemporary, averred that a new manufacturers' association existed in a provisional form and was arranging to treat with the N.A.R.M.A.T. It was stated that the new association was prepared either to absorb the N.A.R.M.A.T. or to be absorbed by it provided that in its permanent form the combined association was solely for manufacturers and that there was no attempt at discount control.

The *Broadcaster and Wireless Retailer* speaks of the "critical stage in the evolution—possibly the dissolution—of the N.A.R.M.A.T." It considers that the radio trade would be

greatly strengthened by the reorganisation of the manufacturers' section of the N.A.R.M.A.T. as a separate association or the formation of a new and "really national" association; the formation of a separate Association by the wholesalers; the joining of a reputable association by retailers—the Wireless Retailers' Association is mentioned; and the establishment of means to keep these bodies in touch with each other. The *Broadcaster* also deals with the question of price-cutting, and it is suggested that to stop this "every firm trading in this country should be attracted to membership of one or other of the three bodies, regardless of nationality."

It is stated that the radio industry has developed to a specialised and largely independent industry of enormous proportions, appealing to a world public, yet it is a child of the electrical trade, and is still so regarded by that branch. It is doubted whether any industry has such a large number of trade organisations as the electrical industry, or so much inter-weaving of interests between them. This influence of electrical manufacturers' organisations and their characteristic partiality for price control was unmistakably evident in the early activities of the N.A.R.M.A.T., but, of course, was totally unsuited for the industry which is different from all other industries. Our contemporary says: "The N.A.R.M.A.T. has done a lot of useful work for its members, and we hope that its apparent apathy with regard to general trade opinion on matters of policy is but a passing phase which will speedily be remedied."

The Association was prominent last week at one of the hearings of the Broadcasting Committee when Mr. W. W. Burnham (the chairman) gave evidence on its behalf. He said, according to *The Times*, that his Association represented the three main elements of the radio industry—the manufacturer, the wholesale distributor, and the retailer. The manufacturing section numbered 76 members, and comprised the most important British radio manufacturing concerns; the wholesalers' section had 102 members, all of whom were pledged to deal in British-made wireless goods only; and the retailers' section, now in process of formation, numbered 415, also similarly pledged. His evidence was based on members' reports, and could be regarded as expressing the considered opinion of the industry. It was estimated that some 40,000 people were directly employed in the radio industry, and the turnover last year was from 10 to 12½ million pounds. In addition ancillary or subsidiary trades had been greatly benefited by the advent of the radio industry. British radio manufacturers had been able to launch out in the world's markets owing to the excellence and reasonable prices of their apparatus. They considered, therefore, that in any matters affecting the broadcasting system in this country, the welfare of the radio industry should be studied. They thought that the time had arrived when some simple form of receiving set should be available at a reasonable price, which would provide the entertainment required, on the lines of the domestic gramophone. It would be a simple matter for manufacturers to supply such apparatus if the broadcasting authorities would provide sufficient power and suitable alternative programmes. The Association believed the present system of low-power main stations and relay stations to be absolutely wrong. It was considered that competent radio engineers could divide the country up into six or seven zones, in each of which a high-power station—say, 25 kW—could be erected. The Association also recommended the erection of a super-power transmitting apparatus for national and long-distance broadcasting. The bulk of the Association's members were in favour of broadcasting remaining in the hands of one independent authority and not passing under Government control. They considered that the capital needed by such an authority could be easily found by the issue of guaranteed 7½ per cent. debentures or bonds, and the income for running the service obtained from licences, as at present. All interests concerned should be represented on the Board of Control. They considered that the manufacturers' interest in the management should be in a greater proportion, as their highly-trained technical research people had been connected with the development of wireless transmission from its infancy, and as they also controlled all the patent rights.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from January 20th :—

Unic. No. 459,471. Class 6. Dynamos, starter motors, magnetos, &c., all being parts of motor-car machinery.—Unic Motors, Ltd., 18, Brewer Street, S.W.1.

Oco. No. 464,627. Class 6. Electric vacuum cleaning, sweeping, and hair-drying machines.—Oco Electrical Appliances, Ltd., 128-132, Shaftesbury Avenue, W.1.

Brandes, Ltd., experts in radio acoustics (lettering and design). No. 463,744. Class 8. Radio-telephonic apparatus and component parts thereof.—Brandes, Ltd.

Sidar, No. 464,207, Class 8, electron discharge tubes for radio and wired telegraphy and telephony, X-ray tubes (not for medical or surgical purposes), and rectifying tubes; and P.M.4 (lettering and design), No. 464,923, class 8, thermionic valves.—Mullard Radio Valve Co., Ltd.

Lowforma. No. 464,732. All goods in Class 8.—A. H. Clackson, Ltd., 119, Fleet Street, E.C.4.

Artoid. No. 464,972. Class 8. Scientific and philosophical instruments and apparatus for useful purposes.—E. A. Graham, trading as Alfred Graham and Co.

Galloy. No. 464,976. Class 8. Radio-telephonic apparatus and parts thereof.—Climax Radio Electric, Ltd., Quill Lane, Putney, S.W.15.

Beech Tree (lettering and design). No. 462,601. Class 13. Electrical contacts and terminals, fittings, accessories, &c.—Birmingham Specialities, 80-81, Bath Street, Birmingham.

Phonor. No. 463,177. Class 13. Electric horns and alarms for use with motor vehicles.—Pierre Robin, 295, Avenue Jean Jaurez, Lyons. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2).

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

15,148. "Telegraph typewriters." Kleinschmidt Electric Co., Inc. July 5th, 1923. (218,643.)

15,692. "Electrolytic process for the removal of rust and scale from metals." Seal Co. (London), Ltd., I. Jascourt, H. D. Pattinson, and J. Rose. March 30th, 1925. (245,170.)

15,711. "Wireless telephony." W. Dubilier. June 30th, 1924. (245,171.)

16,118. "Sound-producer, comprising a vibratory system coupled with a resonator." Signal Ges. August 8th, 1923. (220,281.)

16,121. "Method of, and apparatus for converting electric power." Hazeltine Research Corporation. July 5th, 1923. (218,675.)

18,176. "Synchronous telegraph systems." E. C. R. Marks (Morkrum Co.). July 30th, 1924. (245,175.)

18,352. "Calling-up devices for wireless communication." G. C. Beddington. July 31st, 1924. (245,176.)

20,819. "Telegraphic and telephonic receiving circuits." A. Carpmael and A. J. Ransford (legal representatives of R. B. Ransford (deceased)) (C. K. Chandler). September 3rd, 1924. (Cognate application 2,326/25.) (245,183.)

22,675. "Thermo-magnetic therapeutic appliances." W. E. Holder. September 25th, 1924. (245,189.)

22,700. "Telegraph recording instruments." A. A. Clokey. January 19th, 1924. (227,793.)

23,396. "Protection devices for electrical rectifiers." Igranic Electric Co., Ltd., and J. H. A. Spaink. October 3rd, 1924. (245,204.)

23,401. "Electric terminals, connectors, or the like." D. E. Barnett. October 3rd, 1924. (245,205.)

23,494. "Operating means for electric signalling devices." J. W. Clark. October 4th, 1924. (245,207.)

23,581. "Electrical switches." A. C. Shore, A. P. Witchell, and W. P. Brooks. October 6th, 1924. (245,213.)

24,112. "Leading-in insulators in combination with lightning protectors for telegraphic purposes." W. E. Tremain. October 11th, 1924. (245,221.)

24,439. "Electrical contact clips." W. Barker and C. E. Clarkson. October 15th, 1924. (245,225.)

25,232. "Contact blocks for electrical resistance boxes or the like." A. D. Elliott. October 23rd, 1924. (245,227.)

25,592. "Expanding carrier for electric accumulators, petrol cans, and the like." H. C. Lawdham. October 27th, 1924. (245,230.)

26,484. "Thermionic valves." Radions, Ltd., and H. J. Osborn. November 6th, 1924. (245,239.)

26,620. "Variable electric condensers." Sterling Telephone & Electric Co., Ltd., and R. C. Jones. November 7th, 1924. (245,240.)

29,961. "Automatically oscillating electric fans." J. F. Lister and H. W. Smallwood. December 13th, 1924. (Cognate applications, 8,208/25 and 19,542/25.) (245,264.)

31,017. "Electric circuit testing and like apparatus." F. O. Helliwell. December 24th, 1924. (245,270.)

31,315. "Electrical controllers." R. Amberton and J. R. Walton. December 31st, 1924. (245,272.)

1925.

7,483. "Manufacture of translucent or coloured bulbs, more especially for electric incandescent lamps." General Electric Co., Ltd. November 13th, 1924. (242,937.)

7,582. "Withdrawal of vapours and gases from electrolytic tanks." W. A. F. Pfanhauser and Lang-Bein-Pfanhauser-Werke Akt.-Ges. March 20th, 1925. (245,314.)

7,908. "Voltage regulation of exciters." British Thomson-Houston Co., Ltd. March 26th, 1924. (231,490.)

8,627. "Telephonic receivers." E. A. Graham. March 31st, 1925. (245,319.)

9,723. "Electric machine with rotating magnets." Soc. d'Applications et de Fabrications Industrielles Safi. June 7th, 1924. (235,150.)

9,864. "Systems for transmitting electric oscillations over power circuits." Soc. Lerolle et Cie. April 16th, 1924. (232,608.)

11,377. "Electric cooking and heating apparatus." C. R. Belling. May 1st, 1925. (245,330.)

15,116. "Motor-control arrangements for type-printing telegraph systems." Kleinschmidt Electric Co., Inc. July 5th, 1923. (Divided application on 218,643.) (235,575.)

16,779. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. January 28th, 1925. (245,016.)

17,060. "Timing device for operations controlled by electric switches." H. W. Spooner. March 2nd, 1925. (Divided application on 244,958.) (245,018.)

18,093. "Electric dust precipitating installations." Siemens-Schuckertwerke Ges. July 16th, 1924. (237,262.)

18,296. "Electrical switch mechanism." C. G. Koppitz. July 18th, 1924. (237,600.)

18,466. "Electroscopic testing devices." Hacklander & Co. July 18th, 1924. (237,284.)

18,505. "Electrically-driven ceiling fans." Akt.-Ges. Brown, Boveri et Cie. August 18th, 1924. (238,528.)

19,844. "Electric flashlights." National Carbon Co., Inc. December 1st, 1924. (243,672.)

21,077. "Dynamo-electric machines." International General Electric Co., Inc. August 23rd, 1924. (238,897.)

22,330. "Alternating-current mercury-vapour lamps." Dr. R. Matouch and Silectra Ges. October 3rd, 1924. (240,806.)

22,444. "Electric measuring instruments." International General Electric Co., Inc. September 8th, 1924. (239,546.)

23,803. "Device for indicating sparking and other disturbances in, and for automatically cutting-out transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Addition to 198,936. Divided application on 7,933/25.) (245,388.)

24,877. "Transformers." British Thomson-Houston Co., Ltd. October 6th, 1924. (240,877.)

25,122. "Alternating-current rectifying installations." International General Electric Co., Inc. October 8th, 1924. (241,209.)

29,446. "Electrically-maintained vibrating forks." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). September 17th, 1924. (Divided application on 244,814.) (245,051.)

31,679. "Control systems for electric synchronous motors." E. C. R. Marks (Morkrum Co.). July 30th, 1924. (Divided application on 245,175.) (245,404.)

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Auxiliary Machines on Steamships.

WHILE the use of electricity for the propulsion of ships does not appear to meet with any great degree of favour in this country, it is gradually becoming recognised that for driving the auxiliary machinery, the electric motor offers one of the most economical and reliable forms of drive available. We recently drew attention to the rapid development in the use of electricity for driving the auxiliaries on motorships (ELECTRICAL REVIEW, January 8th, p. 47), and by a strange coincidence, in a paper entitled "High Efficiency Steam Installations for Ship Propulsion, with Special Reference to the Question of Auxiliary Machinery," read on Tuesday last before the Institute of Marine Engineers, the author, Mr. Stanley S. Cook, dealt with the advantages of using electricity on ships propelled by steam engines. The motorship is, of course, in a different category to the steamship as regards the driving of its auxiliaries, as it would be obviously impossible to use a small oil engine for driving each of the auxiliary machines. The steam engine, on the other hand, can be built for very small powers, and on many steamships the bulk of the auxiliaries are driven by separate small steam engines. Indeed, in comparing the economy of the different forms of auxiliary drive available on board a steam-engine-driven vessel, Mr. Cook considered first of all the steam drive, for which, as a result of actual measurements made under service conditions, it may be said that the fuel consumption of the auxiliaries represents about 15 per cent. of the total consumption of the vessel.

Three alternative systems are, however, available, and in this paper a comparative estimate is drawn up for each of these for a cargo vessel of average dimensions propelled by steam turbines of 5,000 shaft horse-power. In the first of these a turbo-generator is employed, the turbine receiving high-pressure steam, and thus working under the most economical conditions, while the auxiliary machines are driven by electric motors. In the second alternative a Diesel engine is used to drive the generator, the arrangement being otherwise as before; and in the third, the auxiliaries are mechanically driven by the main engines. The last-named system need not be seriously considered despite its economy, as it is not favoured by marine engineers owing to the

vibration which it causes in the turbines and the gears. The steam-electric and the Diesel-electric drives effect a considerable saving in fuel as compared with the steam drive, the figures given by Mr. Cook showing that after all possible allowances and corrections have been made with the steam-electric drive, the total fuel consumption for the vessel, *i.e.*, main engines and auxiliaries, is reduced by 2.85 per cent., and for the Diesel-electric drive by 7.6 per cent., with the same main engines in each case. Thus, taking 15 per cent. of the total consumption as representing the consumption of the steam-driven auxiliaries, it will be seen that the use of the electrically-driven auxiliaries reduces the fuel consumption of the auxiliaries by 19 per cent. in the case of the turbo-electric drive and nearly 51 per cent. in the case of the Diesel-electric drive. It is apparent, therefore, that the use of electricity for driving the auxiliaries on a steamship yields a very considerable economy in fuel consumption, and at the same time there are the considerable advantages which are inseparable from the use of small, high-speed rotary machines instead of the slower and therefore larger and heavier reciprocating machines. There is thus considerable scope for the production of electrical machinery specially suited for the conditions met with on cargo steamers.

Battery-charging Stations.

The rapid development of broadcast radio-telephony has reacted on the electric accumulator-charging business, and battery-charging stations have consequently been established in somewhat large numbers all over the country. We notice that one of the motoring journals considers that many of the new stations are of mushroom growth and are run by men with very little electrical experience; its complaint that numbers of accumulators are daily being ill-treated, or permanently injured, confirms our own opinion on the subject.

On the principle that there is no smoke without fire, it may be assumed that there is some justification for the criticisms above quoted. In view of the fact that practically all motor vehicles are nowadays fitted with accumulators for lighting and engine-starting purposes, there is no doubt that there are plenty of excellent opportunities for profitable business in battery-charging and maintenance; not only is there a considerable demand for similar service from hundreds of thousands of users of radio-telephone apparatus, but also an increase in the number of the conveniently-located depôts which cater for the needs of battery-propelled vehicle owners would influence electric vehicle progress considerably.

However, for such a business to be a success, it is imperative that it be conducted on the right lines, from the point of view of both equipment and expert supervision. This fact has been realised by some of the principal battery-making concerns, which in recent years have organised excellent "service" and hire-maintenance systems, selecting for such work only establishments that may be relied upon to give satisfaction to customers and so assist in building up the makers' business and goodwill. It would appear that neither all battery-charging concerns nor all electricity supply authorities quite appreciate the mutual benefits that will accrue from arrangements that permit of accumulators being charged at such times as will not coincide with the generating station's peak load, and the adoption of other measures which will assist battery users to obtain charging energy at a reasonable cost. The price demanded for re-charging batteries, in the case of "wireless" accumulators at any rate, is far too often out of all proportion to the "service" rendered and the electrical energy utilised in the process.

It behoves all whom "the cap fits" to see to it that any grounds for complaint are removed forthwith, otherwise they will realise when it is too late that the future of their individual businesses has been seriously affected by the more satisfactory service rendered by the really efficient establishments.

Wireless Trade Organisation.

A good deal of interesting matter has been appearing in the wireless papers for several months past regarding the chaotic position of the radio-apparatus trade. We quoted some notes on the matter in our last issue, and further references are reproduced in our "Business Notices" to-day. A significant comment appears in the current number of the *Wireless Trader* under the heading "The Locarno Spirit." Our contemporary's considered policy has been the establishment of "one strong representative association for the regulation of the wireless industry," but though it has received views from many quarters on the policy of the N.A.R.M.A.T. and the efforts to evolve "a satisfactory trade government," it has decided to postpone their publication at present, in the interests of peace. It has been led to adopt this course because it understands that substantial progress "is being made toward the reconciliation of the views of all parties to the controversy" and in the hope that the time "may have arrived" when "the least said, the soonest mended." The electrical industry having passed through many similar periods of trial in the course of its progress toward efficiency of organisation, views with sympathetic interest and optimism the efforts of this lusty member of its family to establish itself upon a satisfactory and lasting foundation.

Co-operative Protection Against Fraud.

The way of the trader is beset with many difficulties, and not the least of these is the existence of a large number of dishonest people who obtain goods and resort to numerous tricks to avoid paying for them. Certain branches of the electrical industry are particularly affected by these practices, and there have been many cases in which dozens of firms have been swindled of thousands of pounds by these parasites of trade. Some of them operate in a most astonishingly brazen manner, and their nefarious actions can be recognised for months before they can be brought to justice. It is then too late: the imposition of a term of imprisonment may act as a warning to others dishonestly disposed, but it brings only poor consolation to a trader who has been defrauded of hundreds of pounds' worth of goods. In these circumstances the F.B.I.'s scheme of co-operative protection against this kind of fraud should be of inestimable benefit to those who take the trouble to participate in it. It is extremely difficult for the Press to secure the necessary detailed information to enable it to expose offenders so as to cut short their practices. We have had some experience ourselves in trying to do so, and know only too well how definite must be the reported offence before the police can take the initiative; therefore full use should be made of the confidential exchange of information arranged by the F.B.I. system, as this appears to be both safe and efficacious. Elsewhere in this issue we publish a note on the methods adopted by defaulters. While these will be familiar to most of our trade readers, they may be put on their guard against very plausible scoundrels of undoubted, if misapplied, ingenuity, and be persuaded to take part in the endeavour to purge industry of these undesirable elements.

The Origin of the Electricity Scheme.

Whenever any great scheme of national importance is adopted, there must necessarily be a large number of persons to whom credit is due for bringing it to pass; and this applies to the Government's new proposals for electricity supply. We have seen many claims regarding this in the daily Press since Mr. Stanley Baldwin made his announcement, but not a single reference to the real author. It is rarely that the true and undisputed origin of any far-reaching scheme is so clear as in this instance. We need only refer our readers to the *Journal* of the Institution of Electrical Engineers, dated June, 1916, which contains a record of the paper on "The Electricity Supply of Great Britain," read by Mr. Ernest T. Williams, O.B.E., M.I.E.E., on April 13th, 1916, before the Institution in London, and discussed in London and

Manchester.* Many leading electrical engineers took part in the discussion, which would doubtless have been taken up by the lay Press had not war news overshadowed everything else.

The Institution appointed a Committee to consider the subject in the light of Mr. Williams's paper, which made recommendations to the Board of Trade Committee on Electrical Trades; and later the Committee presided over by Sir Archibald Williamson was set up, whose report brought the matter into the forefront. The Electricity (Supply) Act of 1919, which, *inter alia*, set up the Electricity Commission, was the first step in carrying out Mr. Williams's scheme. Regarding this, the chairman of the North-Western Centre of the I.E.E., in 1919, Mr. J. A. Robertson, stated that "the first actual step in this direction was taken by the reading of Mr. Williams's paper before the Institution early in 1916. This paper put forward bold comprehensive proposals for national electricity supply under a Board of Commissioners in London. The scheme included the erection of super-stations, transmission lines, and supplies in bulk to local authorities over districts to be set up by the Commissioners." About the same date the Chairman of the Western Centre, Mr. Arthur Ellis, said: "You will no doubt remember that very instructive and interesting paper which was read before the Institution by Mr. E. T. Williams in 1916. . . . Mr. Williams has undoubtedly done a great and lasting service to the country." In reviewing the question we find that the Government's present proposals are in fact the completion of Mr. Williams's original scheme, which dealt with the electricity supply of the country as a whole, and aimed to encourage its development not by nationalisation but by the encouragement of private enterprise under an Electricity Board, working on commercial lines without a subsidy and without dispossessing existing undertakers. Indeed, we may say in brief that the only real difference between the Government's proposals and those put forward by Mr. Williams in 1916 is that, whereas Mr. Williams proposed one Board to deal with the whole problem on both its administrative and executive sides, the Government apparently intends to leave the administrative work in the hands of the present Electricity Commission constituted under the Act of 1919, and to set up a new Electricity Board with executive powers for dealing with generation and transmission, to be responsible to the Electricity Commissioners.

Whatever views may be held as to details of the scheme, there can be no question that Mr. Williams was the author of all its essential features, and we trust that he will receive that recognition to which he is entitled.

The German Steel-Electrical Combination.

We have already referred to the big scheme for the constitution of a German coal and iron and steel trust that will combine most of the collieries and iron and steel works at present owned separately by the Thyssen group, the Rhine-Elbe Union (represented by the Deutsch-Luxemburg Company, the Gelsenkirchen Company and the Bochum Verein), the Phœnix Steel Works Company and the Rhenish Steel Works Company. The proposed amalgamation has taken provisional form by the establishment of the Ver. Stahlwerke A.G. (United Steel Works Company) so as to prepare the way for the definite creation of the combination under this title with an ordinary share capital of £35,000,000, and a controllable production of, say, 6,000,000 tons of steel per annum, and a still larger output of coal and coke. As there is every prospect of the constitution of this trust being realised—for such realisation now depends upon the question of the settlement of the taxes payable on the formation of the company and upon the successful financing of the undertaking—the change will naturally be accompanied by an alteration in the relations which have existed for some years past between the Rhine-Elbe group, the Siemens and Halske Company, and the Schuckert Electricity Company directly, and the Siemens-Schuckert Company indirectly. Having regard to these circumstances, the Siemens and Halske Company has issued a communication stating that the constitution of the trust will affect in important points the community agreements which were concluded between this Berlin company, the Deutsch-Luxemburg Company, the Gelsenkirchen Company, and the Schuckert Company. On all sides, the Company states, the wish is expressed for the future maintenance in some form of the close and friendly relations which have developed between the interested firms and their managers during the years of co-operation, in order in the first place that no interruption may occur in the work carried on in common for the promotion of technical development. From this point of view negotiations as to the future relations between the interested parties will shortly be begun.

At present a method of pooling the profits exists under the community agreements, but having regard to the transfer of the coal and iron and steel properties to the new trust, this system will come to an end with the actual formation of the trust. This then is one of the important problems which will be subject to revision, while a second relates to the directorships held by representatives of the Rhine-Elbe Union on the boards of the electrical manufacturing companies. Under these circumstances the latter will secure greater freedom of activity than has prevailed during the past few years. In this connection it is stated that the idea has arisen for constituting a European (?) electrical trust in which the Siemens-Schuckert works would participate in a manner similar to the participation of the Rhine-Elbe Union in the steel trust, but for the moment no information is available on this particular point.

The Cost of Electrical Energy.

In our issue of January 1st we published an article, based on the Electricity Commissioners' Statistical Returns for the last year available (1923), showing how the quantity of fuel consumed per kilowatt-hour generated varied with the output of a large number of generating stations. Whilst full allowance must be made for the lack of completeness of the data, the results recorded were extremely interesting, and in some respects surprising.

We now print in this issue a second article by the same competent hand, and based upon data from the same inexhaustible source, in which a comparison is instituted between the cost of electricity to the consumer, as represented by the average price obtained for it, and the output of the undertaking by which it is supplied. Here, again, some allowance must be made for varying conditions which do not appear in the statistics; but in this case the comparison is less open to criticism, and the results are equally noteworthy and significant. Whatever differences may obtain in respect of the load factor, the date of purchase of the plant, the situation of the undertaking, the nature of the district, and similar considerations, they are likely to affect both small and large stations in the mass in much the same way; and at any rate, the best results obtained can reasonably be compared as indicative of the relative performances of the undertakings. Coal varies over a wide range of quality, and some of the largest stations use very low-grade fuel, which on a weight basis makes a bad showing, but there is no such variation in the value of pence; the cost of the energy supplied is, in journalistic jargon, the "acid test," which appeals even to Cabinet Ministers. If a station cannot supply cheap energy, it will fail to satisfy the examiners who are to sit on the Executive Board. On the other hand, if a station can and does supply cheap energy, on what grounds can it be condemned? Merely because it happens to be a small one?—Some of our smaller stations are in this sense amongst the most efficient.

We do not advocate the cause of the small station *versus* the big one; we merely appeal for common sense in dealing with the question of electricity supply. Large industrial communities must necessarily be served by large power stations, but it does not follow that small ones cannot as economically, efficiently, and expediently be served by smaller stations; that is a proposition which remains to be proved.

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* ELECTRICAL REVIEW, April 21st, May 19th, and May 26th, 1916.

The Relationship between Cost and Output.

A Comparison of some Electricity Supply Undertakings.

(Communicated.)

It has been shown in a previous article* that, as the size of power stations increases beyond an output of about 10 million kWh per annum, there is, generally speaking, no particular decrease in the coal consumption per kWh generated. Whether this is as it should be is another matter, which need not be discussed now. The circumstance, however, prompts a further inquiry, namely, whether the larger undertakings are able to sell electricity at prices much, if any, lower than the smaller ones, and if so, whether there is any limit of size beyond which any further increase in magnitude has no advantage to the consumer. For the latter, provided always that his supply is reliable, has no interest in anything but price. He does not care what the coal consumption may be, nor what the capital charges or running expenses may amount to. His only concern is to get his electricity at the cheapest price, and he wants neither explanations nor excuses.

The duty of an electricity undertaking is to give the consumer cheap electricity, and it is granted a monopoly on the understanding that it will do so. "Cheapness," of course, is a relative term, but so is "reliability," and so are a good many other words, the meaning of which is well understood. Again, electricity for lighting may be cheap and electricity for power may be dear in one and the same area. Rates may be varied as between different classes of consumers, either on the principle of "what the traffic will bear," or in accordance with a deliberate policy of encouraging the use of electricity for particular purposes. Rates, however important, are a matter of detail. The real test of the service of an undertaking to the community is the average price demanded per kWh for all purposes. The community as a whole is made up of individual consumers, and the less the aggregate amount of money extracted from their pockets in return for the electricity they consume, the better, on the average, are they served.

From this point of view it is interesting to see what are the average prices charged by undertakings of different sizes. Although some may be more fortunately situated for cheap supply than others, it is possible by taking a sufficiently comprehensive survey to arrive at some idea of how the cost varies with output. Stations of any particular size are not confined to any one locality, so that the good fortune of one will be offset by the bad fortune of another, if a fair number of undertakings are considered together. Graphical methods afford by far the best means of demonstrating relationships such as those we are considering. The whole of the facts correlated are brought under review simultaneously, and the eye can strike an average, or observe the trend of events, far more surely from a diagram than from numerical tables. Hence data bearing on the relationship of selling price to output of electricity abstracted from the "Return of Engineering and Financial Statistics" of the Electricity Commissioners are presented graphically in fig. 1. The points in this diagram refer to 153 electricity undertakings having outputs of less than 20 million kWh per annum. Undertakings of larger size will be considered separately.

* ELEC. REV., January 1st, 1926; p. 5.

For the purpose of the diagram, the whole of the local authority undertakings in England have been brought under review. Company undertakings, which are listed separately in the Commissioners' Return, are left out of consideration merely to keep the number to be dealt with within reasonable limits. There is, however, no reason to suppose that the relationship between price and output would be substantially different were the company undertakings included. Another class of undertakings which has been omitted from the diagram is that in which the whole, or the greater part, of the electricity supplied is purchased from some other undertaking. There are altogether 42 of these, mainly, of course, quite small in size, but since many of them are able to purchase energy from large power companies at very favourable rates, it would have been misleading to have brought them into comparison with local authorities of equal size which have to generate their own supplies. The only other undertakings omitted are a very few for which information was not available, and three little ones whose average selling price was more than 8d. per unit.

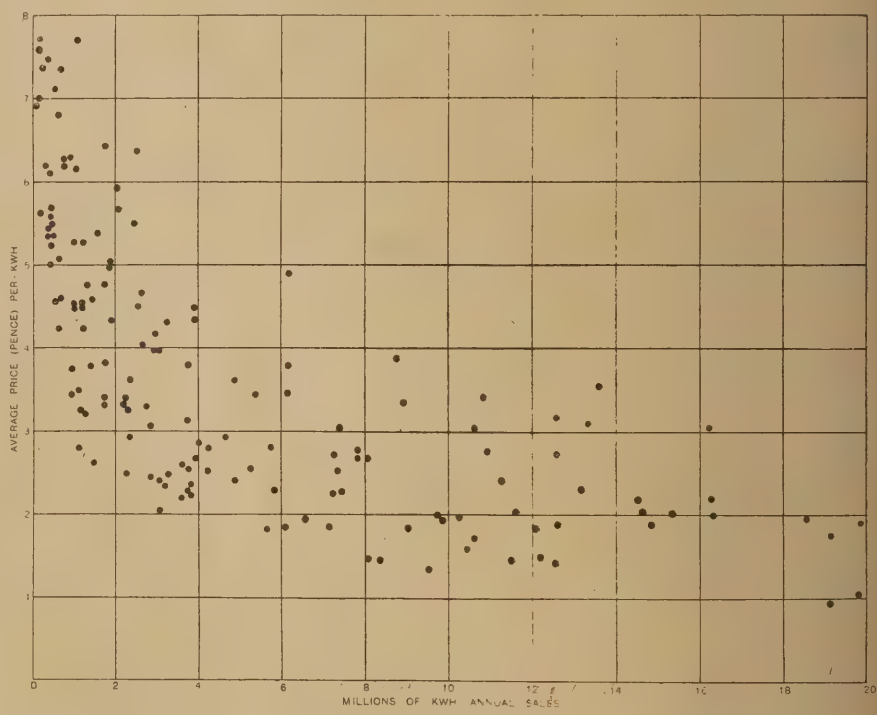


Fig. 1.—Price and Output of Electricity Generating Stations, under 20 million kWh per year.

Every undertaking is represented by a point corresponding to the total number of kWh sold during the year ending March, 1923, and also to the average selling price per unit. Circumstances will have altered slightly since the date of the return, but it is unlikely that the general conclusions would be much altered were the comparison to be made to-day. A glance at the diagram is sufficient to show how widely the price varies as between different undertakings. With a few exceptions, both above and below, the average price charged by undertakings with outputs of less than a million lies between 4d. and 8d. The next group, with outputs of from one to two millions, charges on an average between 2.5d. and 5.5d. Prices continue to get better till an output of 4 millions is reached, and after that, although there are some good undertakings between 8 and 13 millions, what improvement there is is slight and erratic.

Had the undertakings purchasing all or the greater part of their electricity been included, the advantages of this course in the case of small systems would have been strikingly manifest. There are, for example, nine

local authorities selling less than five million kWh each annually which can afford to retail the energy at an average price of less than 2d., a feat which is not possible in any case where these small outputs have to be separately generated. Four of these authorities indeed can charge less than 1.5d., and two actually less than 1d. Of the local authorities with sales of less than five million units, the Stafford Corporation easily leads with an average price of only 2.04d. for a sale of only 3.078 million units. Stafford generates the whole of its electricity itself, and with a coal consumption of 4.02 lb. per kWh and a load factor of only 19 per cent., it undoubtedly is selling cheaply. Worcester is another fortunate city. Like Stafford, it produces the whole of its power, and manages to retail it at an average of 1.82d. per unit, with total sales of only 5.670 millions. It certainly has two little water turbines aggregating 320 kW capacity at Powick, but these only amount to about 6½ per cent. of its total plant, the rest being steam. Gravesend is to be congratulated also on selling 6.081 millions, all generated by the Corporation, at an average price of 1.85d. The fuel consumption of 2.61 lb. per kWh is also very good for so small an undertaking, and this, together with the sale of 130 B.th.u. per head of population at a load factor of 34.4 per cent., also indicate sefficiency of management.

The smallest local authority undertaking able to sell energy at an average price of less than 1.5d. is West Hartlepool, which charges only 1.48d. for its 8.078

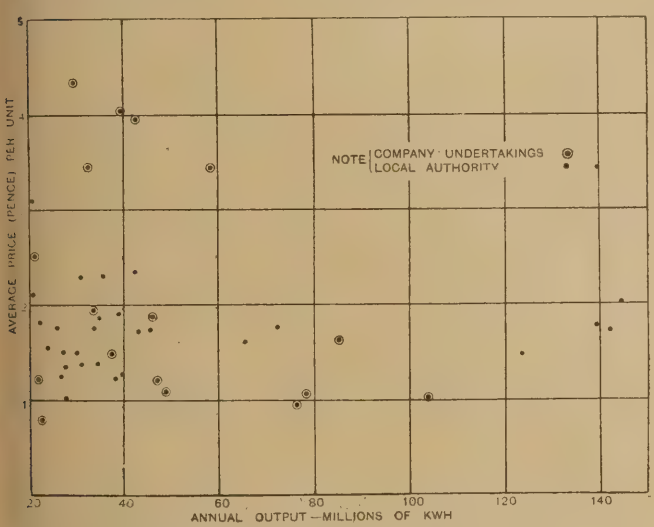


Fig. 2.—Price and Output of Stations, from 20 to 150 million kWh. per year.

million units, but nearly 2.4 million of these are bought wholesale from a power company. West Hartlepool, moreover, rejoices in a load-factor of 39.9 per cent., so that its capital charges are proportionally reduced. The Rawtenstall Corporation has neither of these advantages, and so its price of 1.46d. for 8.370 million units is extremely creditable. It generates the whole of its electricity itself, with a coal consumption of only 2.30 lb. per kWh, and shows what can be done with good management in a little station with five generating sets averaging only 1,900 kW each. The Darlington results are also rather remarkable. Here we find 9.527 million units, all generated by the Corporation, sold at a price as low as 1.35d. The load-factor is not good, being only 22.5 per cent., and the coal consumption of 3.44 lb. per kWh is by no means very good either. The only other authorities to sell below 1.5d. are Lincoln, with 11.513 millions at 1.46d.; Luton, with 12.197 millions at 1.49d.; York, with 12.547 millions at 1.43d.; St. Helens, with 19.136 millions at 0.96d.; and Bury, with 19.823 millions at 1.05d. The fuel consumptions of these five undertakings are respectively 2.31, 2.84, 2.78, 2.52 and 2.44 lb. per kilowatt-hour.

We will now turn to the consideration of undertakings with annual sales of from 20 million kWh to 150 million kWh. As these are less in number than the smaller ones, all that there are in Great Britain, whether owned by companies or local authorities, will be taken together. The prices charged by these undertakings are plotted in fig. 2 over their respective annual outputs; the local authorities being designated by plain dots and the companies by dots surrounded by circles. As will be seen from the diagram, both the dearest and the cheapest prices are charged by company undertakings, the extreme limits being an average charge of 4.34d. on an output of 29.624 million units by the Metropolitan Electric Supply Co. and an average of 0.79d. on an output of 22.170 millions by the Mersey Power Co. The latter company has a load factor of 45.1 per cent. against 23.8 per cent. for the Metropolitan Co., but even this seems hardly adequate to account for the difference.

Besides the Metropolitan Co., there are four other companies and one local authority which charge more than 3d. as an average price for their energy. The local authority is Nottingham, where 3.10d. is charged on an output of 20.402 millions. At the date of the return, the Nottingham coal consumption, however, amounted to the frightful figure of 6.15 lb. per kWh, and matters should be very different now that the new station is in operation. The four companies which come into the same class as regards price are all, like the Metropolitan Company, concerned with the supply of London. One of these, the Westminster Electric Supply Corporation, purchases nearly five-sixths of the energy it sells, but since the company it buys it from only receives an average price of 1.19d. for its product, the purchase price hardly seems to account for the selling price of 3.45d. per unit. Even so, however, this is a lower price than that charged by any of the four other companies mentioned.

After the Mersey Company, in point of cheapness comes the excellently-managed Lancashire Power Co., with an average price of 0.95d. for an output of 76.156 million. This company has the extraordinarily low fuel consumption of 1.80 lb. per kWh. The cheapness of electricity in many small towns in Lancashire is primarily due to the operations of this company, which supplies in bulk at a very low price for distribution by the local authorities. Lancashire is indeed generally fortunate in its electricity supply, no other area, except the North-East coast, being better served. Within the range we are considering, the Stalybridge Electricity Board comes next after the Lancashire Power Co. in respect of price, as it charges only 1.01d. on an output of 27.727 millions. The undertaking having the largest output dealt with on the diagram is that of Liverpool with 144.444 millions. The price of 2.01d., it may be noted, is also high, exceeding that of any other undertaking with a sale of over 60 millions.* It would appear from the diagram that any price exceeding 2d. per kWh on an average may be considered high for undertakings ranging from 20 to 150 million kWh annual output. The smaller plants, also, seem to be able to sell as cheaply as the larger ones, especially if we omit certain London undertakings whose charges rise to such ignoble eminences.

The only two undertakings with outputs exceeding 150 millions are those of Manchester Corporation and the Newcastle-on-Tyne and associated companies. The Manchester output is 185.639 million kWh, which is sold at an average rate of 1.77d. per kWh. The Newcastle undertaking sells 442.873 million kWh at an average price of 0.76d.

Throughout this article the present tense has been used, although the figures are not now quite up to date. They are, however, the latest that are available, at any rate in a form convenient for reference. Even did they completely reflect the circumstances of the moment, they must in all cases be interpreted with reference to local conditions. The instructed reader will be able to draw his own conclusions from them, especially if they are examined in conjunction with the vast amount of other data contained in the Return from which they have been taken.

* The Liverpool figures cover a period of fifteen months, and include those for the undertakings of Bootle Corporation and the Liverpool District Lighting Co., which were acquired in 1922.—Eds.

Some Troubles of a Lighting-Set Maker.

By "SARCASTICUS."

There is an attraction in the manufacture of house-lighting sets from which few of the engineering industry are exempt. The engine maker, the electrical contractor, the agricultural engineer, the ironmonger, the factor, all at times fall victims to its lure, and embark lightheartedly upon the manufacture of yet another "Brown-Light" or "Jones-Light," as such plants are usually named. In the attempt to analyse the fascination which this trade exercises over the imagination of the hard-headed man of business, let us peep through the morning mail of a typical maker, and see what the day brings him in the way of opportunities of service to the public, help to the trade, and possibly a little profit for himself.

Inquiries.

If our maker has only lately entered the field, he will be agreeably surprised by the number of inquiries which have followed his *début*. Apparently the new plant fills a want hitherto unsupplied by the well-known and long-established makers, whether of English or foreign origin. A little later on he will perhaps also be surprised (this time disagreeably) at the proportion of such inquiries which his various sales experts are able to turn into orders. The reason for the initial flood of inquiries is not that there are several hundred people who are wanting to purchase electric-lighting plants, but have purposely refrained from doing so until the appearance of the new set overcame their hesitancy; it merely indicates that there are this number of people interested either in the manufacture or the marketing of competing sets who naturally wish to find out for themselves whether the new make is going to mean any serious competition for them either on the score of price or efficiency. The new maker will also as time goes on be able to remark how curious it is that the moment the largest maker periodically drops his list prices yet another £5 all round, agents for both this and other sets send out wholesale prices to every known manufacturer for prices of lighting sets, many of them so cunningly worded that the optimistic might almost be led to believe that there were numbers of orders ripe for placing.

Extent of the Market.

The total turnover which is being done in lighting sets throughout the country is apt to strike the newcomer as truly terrific considering the general state of trade in other directions. It would be indeed difficult to find the contractor who would be so modest (or so truthful) as to confess to installing anything less than two or three dozen of these per annum, and when we multiply this number by the total number of electrical contractors throughout the country handling such business, we shall see what a truly vast field there is for exploitation by the pushful maker or the energetic salesman in this line. The resulting roseate figure is confirmed (to a certain extent) by the details which we hear from time to time of the total number of sets which certain manufacturers and certain importers sell during a normal year. A "normal" year, I may explain, is, in the average maker's opinion, the turnover for the year 1919-1920 multiplied by a certain factor which varies from 2 to 6.

Sales Resistance.

Nor does the "sales resistance"—to quote a much-used American salesmanship term—appear to be so high as might be expected. Not only does every contractor and dealer seem to do a large and regular business in installing such plants, but in addition the morning's mail will show that a large number are prepared to back up their claims by taking a set upon "sale or return" terms, and exhibiting it in the showroom free of all charge whether for rent or attendance. There is perhaps observable a certain reluctance to discussing the question of ultimate payment and certain other details of the loan, but this is of course due entirely to the fact that the maker's set is unknown in that particular district. "Clear-Light" and "Glow-Light" sets have been selling there in huge numbers, and the inquirer has no doubt that the new set will sell at sight—if it is really as good as the maker's catalogue states! Of sales resistance in the case of actual business I will not now speak, excepting to say that it is slightly more difficult to overcome.

Service not Profit.

If our glimpse through the mail bag of such a maker is made anywhere about the tenth of the month, we may be excused for wondering whether the standard of engineering knowledge in this country is quite so high as we had supposed, to judge from some of the curious complaints which are received. This feeling of pessimism, however, will be corrected if we draw upon our commercial experience and remember that this is a time of the month formerly dedicated to the payment of accounts and the signing of cheques, but now devoted chiefly to the penning of complaints. In the majority of cases, a complaint of any kind is good for another month's credit at the least, and if it is addressed to a maker who is thoroughly imbued with the spirit of free service, it will also bring such assistance as is truly surprising.

Our first letter of this kind, which causes a gloom to settle over the establishment, is to complain that the semi-automatic plant tested so carefully before despatch and upon installation will not start, and unless it is put right that same day it will be thrown out into the street, &c. A little journey of some hundred miles on the part of a mechanic shows that the battery has been discharged to such an extent that there is not sufficient current to motor the generating set round and start the engine firing; and the mild suggestion that in such a case the starting handle is really the cheapest and easiest method of getting the engine under way, provokes the stern rebuke that the plant was supposed to be fool-proof, and that such an occurrence should not be possible.

The next letter which (following hard upon the last) seems likely to provoke a sudden heart attack, is to say that another engine cannot be induced to start, that the whole countryside is watching the trouble which is being experienced, and that it is likely to spoil all chances of future business in that neighbourhood for another twenty years. This time it is a journey of a couple of hundred miles, and upon arrival the mechanic is mystified for a full couple of minutes until he turns his attention to the "petrol" which is used for starting purposes, and finds that a lighted match fails to ignite it! A walk over to the nearest garage, the purchase of a tin of real petrol, and another troublesome complaint is satisfactorily settled. Upon other "serious complaints" which involve the changing of a sparking plug, or the timely replenishment of lubricators, space and still bitter recent experience will not permit me to dilate.

The Electrical v. The Agricultural Market.

But whatever may be the occasional shortcomings of an interesting trade, there is little doubt that to the maker of small oil engines it has opened out a market which is vastly more satisfactory than the agricultural trade, upon which (prior to the advent of the house-lighting set) he had to rely for the majority of his home sales. Only those who have had to deal with the agricultural trade for a few years, and consequently are acquainted at first hand with its slow and uncertain methods, who know the number of years which it takes a farmer to make up his mind that he requires a 6-h.p. engine, and then the number of years over which he thinks payment should be spread, and the vastness of

the allowance which he requires upon the chaff-cutter (date *circa* 1850) tendered in part payment, only those will realise with due thankfulness that the electrical market, in spite of its occasional shortcomings, offers a greatly more lucrative, a more business-like, and a more satisfactory field than the old. On a bad day, a maker may be tempted to abuse the electrical contractor, but honesty will compel us to admit that, compared with some others, he is almost free from fault.

A little time spent in perusing the daily post of an average maker will quickly show that at the present time the manufacture of house-lighting sets offers more opportunities for service than for profit, but with the coming of better trade and the circulation of more money, it is probable that many of the difficulties which confront such a maker will be banished, giving place to a state of things more nearly resembling the idealistic picture which an outsider is accustomed to regard as a true presentment of a manufacturer's position and emoluments.

Electrical Traders' Accounts.

The Special Features of Practical Book-keeping for Electrical Traders.

By S. HOWARD WITHEY, F.C.I., &c.*

HAVING regard to the quantity and the variety of equipment, appliances, &c., in which the electrical trader now deals, it is very necessary that a good and appropriate system of internal check should be instituted, and it is in close relation to internal check that the trader's accounting and book-keeping should be based.

Commencing with the orders received, which are the real foundation for all the subsequent entries in the books of account, it will be found convenient to record these in a manifold order book, one form being used for each order. The original sheet will, in each case, be passed on to the person or department immediately concerned in the execution of the particular order, the copy being retained in the manifold book. As soon as an order is fulfilled, the original sheet should be cancelled, and the price extended into the cash column in the manifold book, which will then constitute a kind of rough sales book and order book combined. All unfulfilled orders of unduly long standing should be immediately investigated to prevent any being only partially fulfilled, or overlooked altogether. All orders, without exception, should be recorded in this manifold book, whether they have come to hand through the post, from agents, travellers, salesmen, &c., or have been received verbally.

The credit sales transactions should either be passed through a printed day book, or sales book, or a duplicate invoice book should be kept. Both these methods have their peculiar advantages. If the printed day book method is adopted, the book should be ruled with additional money columns to enable the various transactions to be systematically classified under their appropriate headings, such as "Cables," "Fuse Cases," "Dynamos," "Tubing," "Bends," &c. Duplicate invoice books are best kept on the pen carbon-copy principle, the original forms being the actual invoices sent to the customers and trade debtors, the copies constituting the book of original entry from which the personal accounts will be debited in the sales or customers' ledger. Care is necessary to ensure that any alteration made on an invoice after it has been torn from the duplicate book is effected, also, on the copy; otherwise the sum charged against the customer in the traders' books will most probably be incorrect.

Instead of having a separate sales account for each different class of sale, such as "Dynamos Account," "Cables Account," &c., it is much better to rule extra columns on the credit side of the general sales account, these columns being headed to correspond with those under which the sales transactions have been dissected.

If the number of returns inwards transactions is at all considerable, a separate sales returns and allowances book should be kept, consisting of copies of all the credit notes actually sent out by the trader. The entries made in this book will be analysed in the same manner as the sales book entries, and the monthly totals should be deducted from the corresponding monthly totals of the sales book, and before the latter are posted to the credit side of the sales account. In those cases where the number of returns inwards transactions is really few, they could be recorded in the end section of the sales book.

The amounts recorded in the purchase book, or bought journal, should be in accordance with the details shown on the invoices received in respect of equipment, appliances, materials, stores, &c., purchased. Separate analytical columns should be ruled for the classification of the purchases under the particular headings, and also for the various expenses as these become payable, in order that the totals may be readily available for posting purposes. The entries shown in the purchases returns and allowances book should be numbered in consecutive order with the credit notes actually received by the trader and filed, the monthly totals being deducted from the monthly totals of the purchase book.

If irregularities in the matter of cash are to be prevented, the trader should personally open all letters, &c., received, and should, at the same time, make a note in a private diary of all cash received. The system should provide for all cash received, whether in the form of cheques, bills, drafts, notes, coin, or postal orders, being paid into the bank intact, and by ensuring that all amounts entered in the diary have been actually deposited, the possibility of irregularities will be reduced to a minimum. An alternative method of controlling the cash received may be adopted by the trader, consisting of entering each item on the counterfoil of the paying-in book, the detachable portion being filled in later by the person actually paying the money to bank.

When all the cash received, without exception, is paid into the bank, all payments (except, of course, petty cash payments, for which a separate petty cash book should be kept) will be made by cheques, and consequently it will be sufficient to have two columns on the credit or payments side of the cash book, for "discount" and "bank" respectively. It will, however, be necessary to have an extra "cash" column on the debit or receipts side of the cash book, in which will be detailed all the amounts of cash received, the total of these amounts being simply extended into the "bank" column upon paying the cash into the bank. Subject to any unpresented cheques, and any cash paid to bank but not yet credited in the bank pass book, the balance of the "bank" columns of the cash book should exactly correspond with that shown in the pass book, providing all items representing interest, bank charges, &c., have been duly entered in the cash book.

*Mr. Howard Withey is the author of "The Book-keeper's Vade-Mecum," "Converting into a Limited Company," "Banking," &c.

It is very important that proper distinction should be drawn between capital items and revenue items. In this connection some of the principles which govern a discrimination are illustrated below:—

Goodwill.

The original payment for goodwill is a capital charge, but being an intangible asset, the method favoured by the writer, in the case of the electrical trader, consists of showing the item on the assets side of the balance-sheet at cost, and deducting therefrom any reserves earmarked for writing it off. The position is then very clearly defined.

Repairs and Renewals.

Amounts expended in the maintenance of any asset are charges against the periodical profits. If, however, the real value of the asset is increased by reason of the expenditure, the amount involved should be debited to the account of the particular asset, and an adequate sum written off each year to cover depreciation through wear and tear, obsolescence, or lapse of time.

Leasehold Property.

The cost of buying leasehold property should be debited to the leasehold property account in the trader's private ledger, as also should, for the time being at any rate, all legal expenses incurred in connection therewith. The annual profit and loss account will be debited with all repairs, ground rent, and depreciation to provide for lapse of time, and also with the legal expenses as soon as possible. The cost of extensions to buildings is a capital charge, including any wages paid to the trader's own employés who may have been employed in the extension operations. The amount expended in the repair and maintenance of the extensions should be written off against the profits, as well as annual depreciation.

Plant and Machinery.

The plant and machinery account should be debited with the cost of purchasing new or additional plant or machinery, and also with the cost of carriage paid on it. If any repairs are necessary to make second-hand plant or machinery immediately efficient, the expenditure involved should also be debited to the asset account. Other repairs will be charged against the profits, and also the amount necessary to write off the old asset displaced, and depreciation of the additional plant or machinery.

Fixtures and Fittings.

The cost of installing electric light, telephones, fixtures, &c., is capital expenditure, but all expenses incurred in their maintenance should be charged against the profits.

In the matter of stocktaking, particular care is necessary to ensure that none of the following are included in the stock sheets:—

(1) Any asset, such as plant, machinery, transport, &c., the value of which is shown in a separate ledger account.

(2) Any equipment, appliances, goods, &c., received by the trader for sale on behalf of the consignor, but which have not been included in the periodical purchases.

(3) Any equipment, appliances, goods, &c., which have been sold and included in the periodical sales, but have not yet actually left the trader's premises.

Provision for bad debts may be made by calculating a certain percentage of the total book debts, but the better method consists of carefully examining each item in the list of debtors, making at the same time a sufficient allowance for sums uncertain of collection, or known to be definitely bad. The total of these allowances should be charged against the profits and credited to a bad debts reserve account, the final balance of which will be deducted from the "sundry debtors" on the assets side of the balance-sheet.

After depreciation and all losses and liabilities have been provided for, a reserve may be created, consisting of sums set aside out of the profits, either for the specific purpose of equalising the profits, or in order to strengthen the financial position of the business. A reserve may, however, be undisclosed as the result of an actual appreciation in the value of such assets as investments, land, buildings, &c., or by the omission of such items as goodwill, patents, &c. Secret reserves may consist, also, of excessive amounts charged against the profits to provide for future liabilities, or for depreciation of any asset, or the value of business premises, stock, &c., could be shown at a lower figure than actual value.

In cases where a general reserve has been built up, and patents are a large item, the value of the patents could remain in the trader's books at cost, but much will depend upon whether or not the intrinsic value of the monopoly will really diminish. Renewal fees should, however, be debited to the annual profit and loss account.

Fuel Economy and the All-Electric House.

By E. W. DICKINSON.

The admirable paper by Prof. S. P. Smith, D.Sc., on the "All-Electric House," read before the Institution of Electrical Engineers on December 3rd last, raised an interesting discussion that evening, and is likely to form the nucleus for lively controversy for some little time to come.

An "All-Electric House" is, of course, a proper ideal for every electrical engineer to have, and to keep well in remembrance of his neighbours, but it is inclined to wilt when looked at from the point of view of the conservation of the nation's fuel supply.

Dr. S. Z. de Ferranti, whose house is out of reach of a distributing main, informed the meeting how he had decided that his own domestic requirements, involving heat, lighting, and power, were best served by converting to useful purpose 60 per cent. of the calorific value of fuel in the shape of oil. This he did, so far as could be gathered, by obtaining light and power in the form of electricity through conversion in an internal-combustion engine generator set, the hot water being obtained from the engine cylinder cooling system. Had the oil been burnt in a super-power station at the present day, probably not more than 17 per cent. of the heat value of the oil would have found its way into the home. One wonders whether Dr. Ferranti, confronted now with an opportunity of obtaining a supply of electricity from the mains for a new home, would jump at it.

Electrical engineers are not yet in a position to drive home with successful argument a statement that electricity is cheaper than coal or gas for domestic heating purposes, nor that its sole use, to the exclusion of gas, results in fuel economy in the widest sense.

It is necessary to take a wide view of this question if we are to do our duty to our neighbour as to our profession. Professor De Baufre, speaking recently at the University of Nebraska, concludes that "civilisation as it is organised to-day, and with it the possibility of leisure from the immediate struggles for existence to be devoted to research and philosophy, to the

arts and pleasures of life, depends more on mechanical power than on any other factor."*

In this country mechanical power is mainly dependent on the energy released by the combustion of our coals. The greater the caution and skill exercised in converting this energy to our needs, the more surely will our reserves of energy be conserved, and the more definitely shall we be able to meet successfully all foreign competition.

For cleanliness and convenience in lighting, and for power purposes in the home, electricity reigns, or will reign, supreme, but for domestic heating the case is not so convincing. Whilst admitting the convenience of the electric radiator, which can be taken to any part of a room, or from room to room, with the greatest ease, and admitting the ready sale of such apparatus, even with electricity at the present price, the case for using electricity for continuous heating should be advanced with caution. The best thermal efficiencies obtained from the conversion of heat in the coal to electricity delivered at the terminals of our super-power stations is from 18 to 20 per cent., with an average, say, of 15 per cent. A further 10 per cent. to 15 per cent. of the electrical energy so converted is lost in distribution. Little objection can be raised to an assumption of 100 per cent. efficiency in the use of electricity as a heating agent in the house; but at the very best only between 16 and 18 per cent. of the original heat value in the fuel burnt under the boilers of a super-power station is available as heat in the home.

In the case of the destructive distillation of coal in an up-to-date gas works, gas and coke are produced containing respectively 25 per cent. and 50 per cent. of the original heat value of the fuel. The remaining 25 per cent. represents the loss in manufacture, and includes the energy used to disintegrate the raw coal as well as the power used for charging the gas holders. It therefore includes the distribution losses of the gas between the works and user.

The loss in heat when gas is burnt by a mixture of air by means of gas ring, oven, and gas fire may be taken, on an average, to be about 50 per cent. in a normal household. The loss is due to the escape of hot unwelcome products which must be carried away and do pollute, it is true, the outer air; but they perhaps help to ventilate the house, and in any case do not produce smoke.

In the case of coke, one may say that, used in an open fire, it delivers 25 per cent. of its heat into the room; and when used in a closed stove, 50 per cent.—say 35 per cent. on the average.

From these reasonable premises we come to the conclusion that, using electricity in the home for heating, cooking, and washing, about 17 per cent. of the original heat of the coal fired in the power station is available; whereas by the destructive distillation of coal, forming gas and coke, about 30 per cent. is retained for similar domestic purposes:—

Original c.v. of coal at gas works.	On leaving gas works Per cent. of original c.v. of coal.		Efficiency in use	Available as useful heat in the house.
100%	Gas	25%	50%	12½%
	Coke	50%	35%	17½%
	Total			30 %

If we burnt the coke in the power station under boilers on, say, the sandwich system, instead of 30 per cent., we would have available 21 per cent. of the original c.v. of the coal:—

Gas, 12.5% + coke (17.5% of 50%)
= 12.5% + 8.75.
= 21.25.

and at the same time we would have avoided the necessity of using raw coal at the electric power station to the extent, roughly, of the weight of coke used. There and at the same time we would have avoided the necess- would be a gain here through diminished emission of smoke from the power-house chimney.

When confronted with hard facts of this character it behoves electrical engineers to advance with caution, and in this attitude of mind it might be well that they should admit the superior position held by gas where it is superior, and see in what directions advance can economically be made, little by little, with real hope of success.

One of these directions may be indicated by asking why the electrical industry should not consider marketing a gas-electric cooker, the top (or "hot plate") of which would be fitted with a gas grill and rings, and the oven heated with electricity? A pudding in a pan, or a stew in a pot, is unaffected by the gas fumes from the hot plate, but what an unwholesome idea it is to surround "bakes" and "roasts" with the heated and noxious products of gas combustion! Those who know the difference between the taste of a joint roasted in an electric oven, or by the wasteful wood- or coal-fired kitchener, and one roasted by gas will appreciate this suggestion.

Another direction in which the day use of electricity for domestic purposes might be promoted with advantage and profit to all concerned, lies in easing and facilitating the labour of the weekly wash. Dr. Margaret Fishenden has pointed out the substantial economy of the coke-fired domestic hot-water supply boiler, and the gas-heated electric washing machine also tends materially in this direction by eliminating the need for a separate coal-fired wash copper.

Electrical enthusiasts (and the author is one) who still describe gas as a "dangerous explosive" may regard these suggestions as an attempt at an unholy alliance with the enemy; but meanwhile, the only economically available means must of necessity be related to desirable ends.

Advances will, without doubt, continue to be made in the use of electricity; but the *all*-electric house does not appear to be within the bounds of economic possibility in this country at present.

* *The Times*, January 11th, 1926.

National Electricity Supply.

Conferences and Consultations.

ACCORDING to the daily Press, the series of meetings arranged by the Minister of Transport with representatives of the interests likely to be affected by the Government's electricity scheme (including the electrical manufacturing industry, the Joint Council representing power undertakings, and the gas industry) have indicated that the proposed Bill is destined to have an easier passage through Parliament than was at first anticipated by the Government.

It is understood that the subject is to be discussed at a meeting arranged in Birmingham by the South-Midland Centre of the Institution of Electrical Engineers and the Institution of Mechanical Engineers.

Birmingham Chamber of Commerce.

The Council of the Birmingham Chamber of Commerce, at a meeting on January 25th, decided to address a communication to the Board of Trade urging that before any definite proposals for the reorganisation of the electricity supplies of the country are placed before Parliament the opinions of the manufacturing and industrial interests of the country should be consulted.

Mr. GILBERT C. VYLE, in moving a resolution embodying this decision, said the Prime Minister had brought forward an electrical proposition, from which they could only gather some faint comfort. He had suggested that such areas as Birmingham, the Clyde, and part of the North-East Coast, which were on the 25-periodicity standard, should have some special arrangement made for them. What that special arrangement was the Prime Minister did not say. He said there would be considerable expenditure in standardising electrical supplies, but that it would not fall upon the State. The only thing they could deduce from that was that it would fall upon those who might be outside the standard chosen. In that case it would seem that a heavy expenditure would fall upon Birmingham manufacturers. Therefore, they suggested that when the Government came to consider the details of the scheme, the manufacturing and industrial interests concerned should be consulted.

The President (Councillor H. E. PARKES), in seconding the resolution, described the matter as of very grave importance to the manufacturing interests of the district. They were told that an important committee had gone very carefully into the facts and figures of this enormous electrical scheme. He had no doubt it had, but he felt that before a scheme of that magnitude was definitely decided upon, all parties interested should be placed in a position to judge as to its

chance of success by being given the basis upon which the scheme was grounded. They had had an example of high hopes of economies in the recent railway amalgamations. In 1921 Sir Eric Geddes stated in the House of Commons that by the amalgamation of the railways they expected to save 25 million pounds a year, and mention was made that there would be a possible saving of 45 million pounds in six or seven years. They were now five years from the time the statement was made, and recently the railway companies had the opportunity of claiming one-third of the savings under the amalgamation scheme; all they could claim was £1,770,000—an enormous difference. He felt that the business community ought to be in a position to examine the basis of this immensely important electrical scheme before it was placed before Parliament.—*Birmingham Post.*

Municipal Undertakings' Committee.

A meeting of the Association of Municipal Corporations to consider the Government's electricity scheme was held in London on January 29th, presided over by Sir Lewis Beard (Town Clerk of Blackburn), and, on the motion of Sir John Utting (chairman of the Finance Committee of the Liverpool Corporation), it was decided to elect three representatives of the largest municipal electricity undertakings, three representing those of medium size, and three representing the small municipal undertakings, to meet nine representatives of the Electrical Engineers' Association to consider the advice which the municipalities could tender to the Government in relation to the framing of its electricity scheme.

A further meeting of the Municipal Corporations' Association will be held to consider the report of the Committee and to decide on the advice to be given to the Government.—*Birmingham Post.*

Mr. Stanley Baldwin on Electricity Supply.

At Sunderland, last week, the Premier addressed a large meeting on various features of the Government's policy. With regard to electricity supply he said :—" I want to repeat this—that while cheaper and more abundant supplies of electricity are admirable in themselves, and indeed necessary, they will not alone restore good trade or give us industrial peace. Don't be led away by excitable people who seem to think that electricity in two or three years is going to transform the face of the country and make coal of no further use. The truth is, of course, electricity can be put to many uses, but it is a striking thing that with the growth of electricity in other countries where it has been developed more than here, it has led, or if you like been accompanied by, a growth all along the front of industry, with a growth in the use of gas and in the use of coal, and a development of industry generally.

" Expressions of doubt and fear have been heard from those who are interested in gas. There is assuredly room, not only for electricity and gas in this country, but for an enormous development of both.

The Views of Mr. Geo. Wilkinson, M.I.E.E.

" No national supply of electricity, even if supplied free of charge, can revive trade or recreate general prosperity without ' the will to work ' on the part of labour and the creation of a more amicable relationship between employers and employed. That is the first essential. At the present moment it seems to be taken for granted as an accepted gospel that the establishment of a number of super-stations supplying extra-high-pressure three-phase energy, and linked together by trunk mains embracing the whole country, is the certain way to provide cheap electricity everywhere. Unfortunately such high-pressure trunk mains involve enormous capital outlay and considerable permanent charges in maintenance, while transmission through them of much power for long distances can only be achieved by a heavy waste of energy.

" Well-designed electric generating stations of from 6,000 to 10,000 kW capacity located within the area where the supply is required are, in comparatively isolated towns and residential areas, nearly as efficient as the super-station and certainly more efficient than the super-station plus the long and costly extra-high-pressure trunk transmission cables.

" To supply with efficiency and economy the electrical requirements of a whole town to the saturation point through two or three trunk mains from super-stations 25 or 30 miles away is a proposition which has found no solution yet. For many such areas—which are found in all parts of the country—a modern local generating station in combination with that cheapest of all power feeders, a coal train on a good railway line, need fear no competition in efficiency from the super-power stations. Again, there are large areas that can be more cheaply, simply, and effectively supplied by means of the single-phase system. Success or non-success is often contingent on the cost of distribution, and for simplicity, reliability, and good pressure regulation there is nothing better or more effective for non-industrial areas than the single-phase system, and it is worthy of greater attention than it is apparently receiving at present. . . . It is to be hoped that legislation will not be introduced that will lay a cast-iron system down for the whole country; what is particularly applicable to one part of the country may be distinctly retrograde in another. The futility of such methods is shown to-day in the coal industry, where uniformity of method and practice can never give general satisfaction, or restore the industry to its former prosperity. This is possible in one way only, and that is by adopting such methods and practice in each locality as are best fitted to meet the local conditions. The same truths hold good in the electricity supply industry."—*Manchester Guardian.*

Mr. W. B. Woodhouse, M.I.E.E., on the Scheme.

" Mr. Baldwin says that in Chicago the consumption per head is 1,000 units per annum, whereas the average in England is 100. It is interesting to note that in Manchester, where consumption reaches 200 units per head, the price of electricity for domestic purposes is lower than it is in Chicago. The explanation is that we have cheap alternatives to electricity. We have cheap coal and all that that means, so that it is unwise to assume that the amount of use depends entirely on the price.

" A good deal has been said about rural supply, and as to what has been done in other countries. It has been found in all countries that the cost of generation is a negligible proportion of the total cost for providing a supply of electricity in rural districts, and to expend very large sums of money on transmission mains to supply farmers may not prove so economical as, for example, the use of individual oil engines on the various farms. But as public supply is developed for other uses, it becomes possible economically to supply the rural districts. No gain seems likely to arise by forcing this development.

" The Premier's remarks on frequency are of interest, as in Birmingham a frequency of 25 cycles is in use, whereas the standard for the country has been fixed at 50 cycles. It is understood that the Birmingham Corporation has investigated this question, and has decided that no gain is likely to accrue by a change of frequency. In New York two frequencies are in use, and quite recently a very large power station has been laid down to supply a still further amount of electricity at 25 cycles. It will be seen, therefore, that even in America a case has not been made out for a single standard.

" The amount of interchange of power between one coalfield and another is not likely to be great, and so, if different frequencies are in use in different coalfields the disadvantages may not be great enough to justify the change. It is, therefore, entirely a matter of balancing the costs against the savings; and it should be possible to ascertain in each area what is in the best interest of the public. If frequencies are to be changed without delay to one standard, a very large expenditure will be involved; who is to bear it?

" What the industry most wants in the public interest is a continuation on the present lines of development with an assurance to all connected with the industry of freedom from disturbance if their duties are carried out efficiently. The frequent alteration of legislation affecting the electricity supply industry has caused much delay, and in many parts of the country distribution schemes which would find a considerable amount of employment, and which existing undertakers are prepared to carry out, are being held up pending the publication of the Government's proposals.

" The same thing happened before the passing of the last two Acts in 1919 and 1922, and but for this I think the development of electricity supply in this country would have been substantially more advanced than it is at present."

" Without any further legislation the progress of concentration of generation in large stations is already proceeding rapidly, but there must be many parts of the country where a cheaper supply could be given to the consumer by putting down a small local station than by erecting costly transmission mains. Inter-connection of generating stations presents advantages within limits decided by the balance of the savings made and the extra costs incurred, and, generally speaking, there does not appear to be any advantage in inter-connected power stations in different coalfields. Each case must be judged on its merits."—*Yorkshire Post.*

Sir Felix Pole and Railway Electrification.

" A committee of Great Western experts has for about three years been engaged in surveying sections of railway which appeared to offer possibilities for electrification. While many of these sections appeared on the surface to be suitable for the introduction of electric traction, it was in every instance found, on going more closely into details, that no case could be made out that would, under existing conditions, justify the capital expenditure involved.

" But we have not left the matter at that. Just under a year ago the board deputed Sir Philip Dawson to prepare a scheme for electrifying a section of main line, to be not less than about 120 miles in length. He has not, however, yet produced a scheme."

Sir Felix desired to make it clear that the root of the matter was economic. The governing factor, he emphasised, was the cost of electrical power, irrespective of the ownership, of the source of supply. " If," he said, " the railways could obtain their power at a very much lower cost than at present, and if the price per unit could definitely be guaranteed over a reasonably long period, that would, of course, put an entirely different complexion on the whole matter."—*Financial News.*

Traffic Loud-speakers.—In order to assist passengers who are unaccustomed to underground travel, the Underground Railway Company is said to be contemplating the use of loud-speakers at some of the principal stations. It is believed that much of the delay caused by the inspection of sign posts might be avoided in this way, as one man could direct passengers to their proper routes on the " public address " system.

Legal.

Standard Telephones & Cables, Ltd., v. Freeman.

IN the Chancery Division on January 26th Mr. Justice Tomlin gave judgment in an action by Standard Telephones & Cables, Ltd. (formerly the Western Electric Co.) against Mrs. Freeman, of the Crown Works, Poets Road, Newington Green, for an injunction restraining infringement of its patent for improvements in self-supporting electrical coils. Defendant denied that she had infringed the patent.

It was stated in the specification that the invention had for its object the provision of an inductance coil in which the distributed capacity was minimised, thus making the coil very valuable for radio work.

His LORDSHIP, after hearing the evidence, said that he had to solve the problem of the difference, if any, between the plaintiffs' and the defendant's coils. The defendant declared that there was so much divergence between them that nobody could say that they were both made according to the plaintiffs' specification. He could not agree with that, and it was clear to him that the defendant's coil was constructed to give literal effect to the language of the plaintiffs' specification, being wound in the manner there set out. He therefore granted the plaintiffs the injunction asked for, an order for the delivery up of infringing articles, with costs, and an inquiry as to damages, the costs of this to be reserved.

The Reduction of Vickers's Capital.

IN the Chancery Division on January 26th, Mr. Justice Eve approved the reduction of the ordinary share capital of Vickers, Ltd., from £12,500,000 to £4,166,166.

Telephone Manufacturing Co., Ltd., v. Soutter & Sons, Ltd.

SIR EDWARD POLLOCK, the Official Referee, on January 25th concluded the hearing of the case of the Telephone Manufacturing Co., Ltd., against Messrs. Soutter & Sons, Ltd., Hockley, Birmingham, the case having been referred to the Official Referee by the order of a judge of the King's Bench Division (*vide* ELECTRICAL REVIEW, January 15th, p. 107).

The plaintiffs brought the action alleging that the defendants had broken their contract by which they (plaintiffs) were appointed sole agents for the sale of "Soutterware" for four years, and that they had expended large sums in advertising and in the organisation which they had set up and perfected, but owing to the delay by the defendants in carrying out orders they had had to repudiate the contract for which they claimed damages.

Defendants denied that, and counter-claimed for damages against the plaintiffs upon the ground that the latter had improperly repudiated the contract.

In the result the case was settled on the terms that the plaintiffs agreed to pay the defendants £17,000.

False Pretences Charge.

AT Old Street Police Court, on January 26th, Charles Frederick Kidby (29), gramophone dealer, of Brixton, and Alfred Sidney Taylor (42), engineer's fitter, of Stoke Newington, were charged on remand with being concerned together in knowingly obtaining a quantity of wireless goods, value £44 8s. 4d., from Mr. E. E Rooke, with intend to cheat and defraud (*vide* ELECTRICAL REVIEW, January 15th, p. 97, and January 29th, p. 174). Det.-Sergt. Edwards said that Kidby's house was searched, and there were found 152 statements of accounts from various firms from whom defendants had obtained goods valued at £4,000. Those statements had been compared with such books as the defendants had kept, and they found that 38 had been paid, leaving a balance of over £3,000. Defendants' practice had been, chiefly, to get goods to the value of between £20 and £100, and establish credit by paying amounts on account. All the orders sent out by the firm had been signed by Taylor.

The defendants pleaded guilty to seven charges. Taylor was sentenced to 12 months' imprisonment and Kidby to nine months' imprisonment.

Bingley District Council v. Barber.

AT Keighley County Court recently the Bingley District Council claimed £100 for electricity supplied to Richard Barber, a worsted spinner. Mr. H. O. HILARY, clerk of the Bingley Council, representing that authority, said that the current was supplied to Clyde Street Mills, Bingley, under agreement between the Council and defendant, but the point at dispute was whether the supply was to defendant or to the firm of R. Barber & Co., Ltd., which had taken over the defendant's business. Giving evidence, the defendant said he instructed a clerk in the Bingley Council's accountant's office to alter the name for the accounts to that of the company, and he paid the account by cheques from the firm's accounts. The company's affairs were now in the hands of a receiver. Mr. HILARY said that the clerk had been given no authority to make such alteration, and the agreement with the defendant personally had never been altered.

His Honour Judge MCCLEARY accepted the evidence of the defendant as to the interview with a clerk at the Council's offices, and said he was satisfied that what was done by the clerk was adopted by his employers. The Council had also sought to make the company liable for this bill, and from the time of the interview had looked to the company for payment. Now that the likelihood of payment from the company seemed remote it could not seek to make the defendant liable, and the claim would be dismissed, with costs.

Dublin and Lucan Electric Railway Co.

IN the High Court at Dublin, before Mr. Justice Johnston, recently, Mr. Moloney, B.L., applied on behalf of Mr. John Foxall, of Anglesea Street, Dublin, trustee for the debenture holders of the Dublin and Lucan Electric Railway Co., for an order for the winding-up of the company. A representative of the company said that the winding-up petition had been before the Court on previous occasions, and had been adjourned to see if there was any possibility of the line being taken over.

Mr. MOLONEY said that a provisional liquidator was appointed and certain negotiations had been going on for the sale of the undertaking.

Mr. JUSTICE JOHNSTON said he was satisfied and accordingly he would make an order for the winding up of the company.

Mr. MOLONEY said that his Lordship had given the provisional liquidator liberty to carry on negotiations for the sale of the undertaking as a going concern, and he would like that continued. It was probable that the negotiations would be closed at an early date.

Mr. JUSTICE JOHNSTON agreed to continue the power to the provisional liquidator to carry on the negotiations for the sale, and to give him liberty to carry on the existing contracts for the carriage of mails and newspapers, and for electric lighting. He appointed the provisional liquidator as official liquidator, and made the usual order for costs.

Beet-Sugar Company Prosecuted.

THE *Nottingham Evening Post* reports that on January 27th the Anglo-Scottish Beet Sugar Corporation, Ltd., appeared at the instance of the Director of Public Prosecutions, through the Chief Inspector of Factories, before the Nottingham magistrates. The charge against the company was that it had neglected to efficiently protect a brass collar conductor forming part of the screw-cap lamp, in consequence of which an employé, James A. Glover, was killed.

Mr. B. G. SAYWELL, for the prosecution, said that the company generated its own power and employed electricians. On October 29th last Glover and another man were fitting up an electric furnace, and were using high-power pendant lamps suspended from the roof, and in some cases secured by string to the girders. The lamps were of the screw cap pattern, and one side of the lamp filament was soldered to the cap, making it "live." Glover climbed to the roof to alter the position of one of the lamps; his mate heard him shout and saw him with the lamp in one hand and his arm over a girder. The man knocked the lamp out of Glover's hand, and Glover was brought down in an unconscious condition and died soon afterwards. If the lamp had been shrouded Glover would not have received a shock.

JOHN BETT, Glover's companion at the time of the fatal accident, corroborated these statements, and said that the current was 230 V a.c. The electricians, he said, had not been told not to touch the lamps. Medical evidence was given to the effect that Glover died from electrical shock, and a factory inspector said that the lampholders were dangerous. For the defence, Mr. Berryman contended that the electricians should have been asked to move the light. The premises were in course of construction, and therefore were not a "factory" within the meaning of the Act. Mr. Saywell contended that as manual labour was being performed there the premises were a factory.

The Court reserved its decision until advice had been taken upon the legal point raised.

Lapish v. Braithwaite.

This case came before the Lord Chancellor, and Lords Atkinson, Buckmaster, Carson and Blanesburgh in the House of Lords, on January 29th, upon the appeal of the plaintiff from a decision of the Court of Appeal reversing a judgment of Mr. Justice Bailhache. The question at issue was whether the defendant could remain a member of the Leeds City Council while firms with which he was connected had contracts with the Council. Mr. Justice Bailhache held that the defendant was liable to penalties, and awarded judgment for the plaintiff for £10.

The appeal to the House of Lords was dismissed. In giving their Lordships' reasons for this the Lord Chancellor said that under the Municipal Corporations Act, 1882, the defendant was not disqualified to sit and vote on the Council by reason of his being a shareholder in companies which had transactions with the Council. Nor was he disqualified on account of his being managing director of any of those companies. He was then a servant of the company with a fixed salary. If, however, he was remunerated by a percentage or commission on the profits of his company, different considerations would arise. In the present case the defendant was not so remunerated. According to the report of the case in *The Times*, the Lord Chancellor concluded:—"There are now many companies in which most or substantially all of the shares are held by one man, who may also be the principal or governing director of the

company, so that the business is his business in all but name; and if by reason of the exception in Section 12 (2) such a man can remain a member of a municipal body with which his company is in contractual relations, the Section will lose much of its force and value. It is not for your Lordships to suggest the manner in which this danger should be met, but it appears to me that the Legislature might well consider whether the Section should not be strengthened either by extending the disqualification to persons who hold a substantial proportion of the shares in a contracting company or in some other way."

The other members of the Court concurred.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

An Electric Vehicle Association.

Mr. Raymond J. Mitchell's reference to my letter is welcome as coming from one whose articles under "R. J. M." I have always read with interest and appreciation, therefore I pardon his inadvertent humorous allusions. His letter is welcome in another sense, in that he has recently joined the staff of one of the well-known manufacturers of electric vehicles—subsequently joining the reorganised Electric Vehicle Committee in company with the general manager of the same firm, of whose activities we have heard so much of late.

The informal meeting will have to consider among other matters:—

1. Whether the proposed new association would be redundant, or whether the several interests—particularly those of users of electrics—would be better served by such an association devoted exclusively to the one purpose.
2. Its relationship and co-operation with other bodies and committees to avoid overlapping; and its representation on the Council of the E.D.A.

It is conceivable that the influence of such an association as is proposed would be more widely beneficial than deliberations in the restricted confines of a committee, inasmuch as it would afford scope for all to ventilate their views and difficulties on a common platform, especially the users and prospective users of all types of vehicle. Probably we should then hear less of "electrics" being abandoned in favour of other means of propulsion; as contributory causes leading up to such a result would be dealt with in the initial stages, the association would investigate impartially and "nurse" the user in each instance.

The main obstacles to progress are fairly obvious, but the lack of conveniently located charging stations is one of the first that the proposed association should seriously tackle. Each of its members should be furnished with a complete list of public and private charging stations, the proposed association negotiating where necessary with those electricity supply authorities which have not yet fully appreciated the mutual benefits arising from the charging of vehicle batteries at times other than peak loads; and, failing satisfaction in that direction, to adopt other measures to assist users who are members in obtaining energy at suitable locations at a reasonably low cost.

In view of the standardising of a.c. working throughout the country we now have to consider the cost of conversion in every instance, as compared with generating d.c. by gas or oil prime movers. In cases where the electricity supply authority's charges are unreasonable, it is probable that users with private d.c. supply plant may be pleased to render assistance to their brother members. Electricity supply authorities can hardly object to this alternative if they have considered the business as unremunerative to themselves at a reasonable price; although the vehicle may be a consumer in more than one supply area!

As regards the sales of vehicles, much could be advanced by extending cordial invitations to prospective users to attend special propaganda meetings of the proposed association, where suitable papers for the occasion would be read and discussed, dealing with all trade and private uses.

Also, there are influential persons in other walks of life, who are closely studying the health and welfare of citizens and the amenities of city streets and traffic conditions. Such persons would be welcomed and would most probably support and attend the meetings of such an association, which would have a direct bearing on the purifying of the atmosphere of our towns and cities; whereas they might refrain from attending a technical committee.

Demonstrations and exhibitions could also be arranged.

As regards representation on the E.D.A., Mr. Beauchamp's admirable management of which is beyond all question, it should be remembered that several associations are already represented on its Council, and I respectfully submit that the position of electric vehicles would be strengthened by the inauguration of a definite association devoted exclusively to electric vehicles, which association would then be placed on an equal footing with the other associations represented on the Council of the E.D.A. With this in view, I had already approached Mr. Beauchamp for the support of E.D.A., but he could hardly be expected to devote any more time to the proposed association than to any other of the definite bodies and associations already represented on the Council, whose interests he has equally to study.

An electric vehicle association, I venture to suggest, would carry more weight when negotiating with electricity supply authorities direct or through E.D.A., which represents many supply stations—with a view to securing reasonably low-priced energy for electrics. The proposed association would assist the man who purchases an electric automobile to retain it, and not leave him to dispose of it owing to lack of charging facilities.

In conclusion, I welcomed Mr. Mitchell's letter as affording me the opportunity of assuring all those interested that I have not made my suggestion "on the spur of the moment," having watched the progress of electric vehicles during the whole of my 25 years' career in the hard fields of practical experience in electricity supply and its use in several aspects, in my professional capacity having had to face the difficulties of high initial cost of vehicles and lack of convenient charging stations for prospective users.

J. C. Elvy.

London, *January 23rd*, 1926.

The Cost of Living in Madras.

In your issue of December 4th, 1925, you print a statement from a gentleman in Bombay, giving the cost of living in that city. Below, I give the approximate cost of living per month in Madras, which is reputed to be cheaper than Bombay.

1.—House rent (decent bungalow)	Rs.125/-	to	Rs.200/-
2.—Living in boarding house, chummery, or as paying guest in private house	120/-		
3.—Boy (servant)	20/-		
4.—Dhoby (washerman)	8/-		
5.—Ayah	20/-		
6.—Cook	20/-		
7.—Tarmic catch (waterwoman) ...	8/-		
8.—Gardener	10/-	to	12/-
9.—Motor-cycle and side-car ...	25/-	to	30/-
10.—Motor-car (including chauffeur's wages)	150/-		

A bachelor would require 2, 3 and 4. A married man with his own establishment, 1, 3, 4, 5, 6, 7 and 8; in this case the dhoby would probably be Rs.12/- for man and wife, plus Rs.3/- for each child. If he preferred to be a paying guest, 2 (full charge each for self and wife, and probably half for each child) 3, 4 and 5. If he visits the club and goes to one or two entertainments during the month, a bachelor will want at least another Rs.150/-, a married man Rs.225/-, and to this will have to be added the cost of clothes for his wife and children. Madras is a place of distances, and it is necessary to have a conveyance of some kind. A bachelor might manage with an ordinary bicycle, but a married man will require a motor-cycle and side-car, or a motor-car. Chauffeur's wages are from Rs.35/- to Rs.60/- per month.

The Rs.150/- extra includes the cost of running a motor-cycle and side-car.

A Twenty-five-Year Resident of Madras.

Madras, *January 11th*, 1926.

[We are indebted to our correspondent for this interesting information.—Eds. Elec. Rev.]

The Indian Electricity Acts.

May I claim your indulgence, as the only practical means of reaching many electrical engineers in India, not, indeed, for a free advertisement, but for an opportunity of appearing in a white sheet!

In my book, "The Law Relating to Electrical Energy in India," Second Edition (Thacker Spink & Co., Calcutta) there are several mistakes in the text of the schedule, to which my attention has only just been drawn. Into the reasons for these errors I need not enter, but the necessary corrections will be found in your advertisement sheets on February 5th, and I would ask all possessors of the book to correct their copies.

J. W. Meares.

Guildford, *January 29th*, 1926.

Electrical Apparatus on Hire-purchase.

In your issue of January 22nd, Mr. L. L. Robinson suggests that the drawback to the development of electricity in his area is the cost of installation and apparatus, and he suggests a hiring scheme.

This is an excellent idea, but contractors should take the orders and carry them out, and the supply undertaking should provide the financial side of the hiring scheme, which would work better on a hire-purchase basis, and not on simple hire. Contractors could carry out this scheme without the help of the undertaking, but are handicapped in the event of the customer lapsing in payments; their only remedy is to take legal action, which I doubt would produce any good result.

The usual alternative in hire-purchase contracts is the removal of hired goods from premises, but I have an idea that most landlords have a clause in their agreements that fixtures attached to the premises become the property of the landlord.

If the local undertakers officially financed a hiring scheme, the obvious remedy for non-payment of instalments would be disconnection of supply, and this would have the required effect in the majority of cases.

A similar scheme has been working for some time in the motor-car trade, the financing body charging approximately 4 per cent. for the accommodation, and I see no reason why the electrical installation business cannot be run on the same line.

Hy. Freedman, N.R.E.I.C.,
Henfrey Electrical Installations.

London, *January 28th* 1926.

The Italian Electrical Industry.

I have read with great astonishment the article on the Italian electrical industry in No. 2,510, of January 1st, 1926, of your paper.

The grievous assertions contained in that article are completely groundless, and evidence in your correspondent an absolute lack of reflection and prudence. They also evidence in the direction of the paper a deplorable facility in accepting and publishing upon a great Italian industry and the whole praiseworthy body of our engineers some gratuitously offensive assertions.

We regard it as a debt of honour on the part of your correspondent to declare his name or to disavow his article. We take it as your duty to denounce to us the name of your correspondent if he rejects our demands.

I deem it necessary to address you this letter, in my quality of Chairman of the Associazione Nazionale Industrie Elettriche (National Association of Electrical Industries), which represents more than 2.5 milliards of capital stock, with a yearly output of energy of about 3.5 milliards kWh.

Giacinto Motta.

Milan, *January 22nd*, 1926.

[We have received a similar communication from Sig. Ing. Prof. Giuseppe Sartori, President-General of the Italian Electrotechnical Association, Milan, and a telegram from Sig. Prof. G. Ponti, president of the Association Operating Electrical Undertakings, Turin, to the same effect. We regret that the susceptibilities of our Italian friends and confrères have been wounded by the comments of our correspondent in his article. So far as concerns ourselves, we may say that the passages to which they take exception were carefully considered, and were passed as fair comment upon a matter of public importance; they were much milder than similar references to the failure of the Gleno dam which appeared in the *Engineer* of June 12th, 1925, and we may point out that the construction of dams is a civil engineering question, for which electrical engineers, whether in Italy or elsewhere, are not usually held responsible. We fail to see, therefore, why the Italian electrical associations should feel aggrieved by our references to hydraulic engineering.

We have communicated with our correspondent in Italy, and have ascertained that he had no intention whatever to cast any unfavourable reflection upon the ability or the general success of the large and highly-esteemed body of engineers engaged in the Italian electrical industry. Our correspondent's references were directed to the fact that, in times past, when the industry was still young, mistakes had been made in the construction of certain dams and reservoirs; and, far from reflecting upon the general conduct of the electrical industry, he pointed out that "the industry in Italy is showing signs of real progress." Attention was drawn to the unsuitable design, and eventual collapse, of the Gleno reservoir, in December, 1923, with a view to any similarly unfortunate collapse being obviated. Our correspondent particularly indicated that the Gleno accident was due to the fact that the dam had been built and put into use without the permission of the Ministry of Public Works, and, therefore, could not be regarded as an example of such constructions. In the "Memoria Tecnica—La Diga del Gleno"—drawn up and signed by the distinguished Italian engineers, Sigg. Ing. Prof. Mario Baroni; Luigi Kambo; Urbano Margoli, and Ugo Granzotto (dated April 15th, 1925), the authors clearly showed by inference that there had been marked progressive fissuring of the rock in the Gleno gorge, while, according to the reports issued by Sigg. Prof. Paolo Vinassa de Regny and Prof. Mario Felici, the type of the dam, apart from its actual form, "was ill-chosen." The object of our correspondent in Italy was to impress upon our readers the necessity of learning from experience, and in so doing he expressed the hope—and, indeed, the belief—that future hydroelectric dams built in Italy would be free from any such defects. There are other countries, including our own—as witness the disastrous accident that happened to the Dolgarrog Dam in North Carnarvonshire last November—where dams have burst; but no general condemnation of the engineering profession has either been expressed or considered in relation to such misfortunes. Nor was any such deduction to be drawn from the article by our correspondent in Italy regarding the Gleno accident.

We cherish too high an esteem for the achievements of the Italian nation, whether in art, science, or engineering, to be willing to cast upon it any aspersion, and we are glad to learn from Signor Sartori that out of 95 large reservoirs in Italy with high dams, only one (the Gleno) has failed.—EDS. ELEC. REV.]

High-pressure Cables.

In the debate on Capt. P. Dunsheath's recent I.E.E. paper, Mr. Emanueli, the engineer of the Pirelli Cable Co., of Milan, mentioned a cable working at 130,000 volts, alternating, which they have had in successful operation for some 18 months.

Questions of electrical transmission are likely to be prominent subjects for discussion during the next few months in this country, in view of the proposals which will be before Parliament. It may, therefore, be of interest to say that I have recently been in Milan, and while I was there Mr. Emanueli was good enough to spend nearly a whole day discussing dielectric principles as elucidated by work extending over many years in their fine laboratories, and in showing me how they have endeavoured to embody the principles in the design and construction of the above-mentioned cable.

Not only has a considerable experimental length of the cable been in operation as above stated, but some miles are in course of construction for two American power companies. The cable is, therefore, not merely an experimental *tour de force* for exhibition and advertising purposes—it is a serious piece of work already at the commercial stage.

Although it would be interesting, I do not feel at liberty to describe in detail what I saw and heard, but must leave that to the discretion of the Pirelli Co. itself. I may say, however, that the principles on which the design is based appear to me to be entirely in the right direction for high voltages and heavy transmission. As regards the embodiment of these principles, I would also like to express my admiration for the boldness, inventiveness, and attention to detail, which mark the construction of the cable itself, and the methods which have been worked out for its installation and operation. These have resulted in what I am confident will prove an important development in cable practice.

Cable of this type should place a new power in the hands of engineers who have to deal with distribution problems in large areas that are at all thickly settled.

G. L. Addenbrooke.

London, *February 1st*, 1926.

[An interesting paper by Mr. Emanueli is reproduced elsewhere in this issue.—EDS. ELEC. REV.]

Several letters have been received, too late for insertion in this issue.—EDS. ELEC. REV.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

"Electrical Review" Advertisement Competition.—We hope to be able to announce the result of our Advertisement Competition in the next issue of the ELECTRICAL REVIEW.

Change of Address.—MR. A. DE TURCKHEIM, the secretary, announces the removal of the following to 58, Abbey House, Victoria Street, Westminster, S.W.1, as from to-day, Friday, February 5th:—

The Tramways and Light Railways Association.
The Incorporated Association of Electric Power Companies.
The National Joint Industrial Council for the Electricity Supply Industry.

The telephone number in each case is: "Victoria 2110."

The British Industries Fair.—It is stated that there will be a special radio apparatus section at the London branch of the Fair, and that no fewer than 33 firms have booked space for their exhibits.

The Shannon Scheme Dispute Ended.—Official intimation has now been made by the Irish Labour Party of the "calling off" of the strike and boycott on the Shannon hydro-electric scheme in the Limerick area. At a recent meeting of the Athlone Urban Council, discussing the question of providing new retorts at the gasworks, the chairman remarked that the Shannon scheme would soon be completed and that there would then be no need for the retorts. A Labour member said that the Shannon scheme would not be completed for 10 years. The Council decided to incur the cost of new retorts.

An Industrial Lighting Chart.—For the use of electric lighting contractors and their customers, the Benjamin Electric, Ltd., has issued a chart indicating the correct types of fittings for use in the lighting of shops, factories, offices, &c. It is mounted on linen and measures about 18 in. by 2 ft.

British Interests in China.—A committee has been formed to study the political situation in China in the interests of British trade. Lord Southborough is the chairman, and the members are as follows:—Messrs. D. Landale and G. W. Swire (China Association); Sir H. Cunliffe-Owen and Col. O. C. Armstrong, D.S.O. (F.B.I.); Messrs. F. Anderson and S. Dodwell (London Chamber of Commerce); Mr. H. H. Holt (Chamber of Shipping); Sir N. J. Stabb (Hongkong and Shanghai Banking Corporation); Mr. L. N. Keefe and Lieut.-Gen. Sir G. Macdonogh (China Advisory Committee); Sir R. Waley Cohen (Asiatic Petroleum Co., Ltd.); and Major W. S. Nathan (Peking Syndicate). The secretary is Mr. W. V. Jenkins, of the Far Eastern section of the F.B.I. The Committee has offered its services to the Foreign Office, and Sir Austen Chamberlain states that the Government will be glad to avail itself of the offer.

Electric Water Heating in Ships.—Sir W. G. Armstrong, Whitworth & Co., Ltd., who recently placed an order with Messrs. Bastian & Allen for "Bastian" storage geysers for water-heating equipment in two ships being built at Walker Yard, Newcastle-on-Tyne, have now placed with the firm a repeat order for storage geysers for the water-heating equipment for two further ships.

A New Super-Power-Station for London.—The proposal of the North Metropolitan Electric Supply Co., to establish a power station on an existing site at Brimsdown, near Enfield, has now taken definite shape, and the contracts for the first section of the station of 40,000-kW capacity have been placed with the object of completing and operating the plant in a period of twelve months. The project first came under consideration in September last, when Capt. J. M. Donaldson, the chief engineer, invited two or three leading engineering concerns to discuss various proposals with him; this was followed by a request to draw up alternative schemes and to prepare estimates for his consideration. Regular conferences have been held, and throughout the negotiations Capt. Donaldson has personally supervised the engineering; the plant now in course of manufacture will conform to the most modern practice of power generation. As main contractor the Foundation Co., Ltd., has been selected, with International Combustion, Limited, as principal sub-contractor. The latter company has been awarded the whole of the contract covering steam generation and transmission, and the "Lopulco" system of powdered fuel firing is to be installed. Five boilers, each of 10,100 square feet heating surface, have been ordered, and are to be manufactured by Messrs. Babcock & Wilcox. Each of these boilers will be equipped with the "Lopulco" patent water screens and "Murray Usco" fin furnaces, which will increase the total heating surface of each boiler to 11,000 square feet. International Combustion, Ltd., has placed orders with Messrs. Howden's for the air preheating equipment, and for economisers and superheaters of the Foster type the contract has been placed with the Power Specialty Co. The plant will include the latest design of pulverising mills, each of fifteen tons per hour capacity, which with the rest of the equipment will be manufactured by International Combustion, Limited, at its own works at Barrow and Derby. This station when complete will be the largest in the London area operating entirely with pulverised fuel, and the results will be awaited with much interest.

Norwegian Ship Equipment.—A new undertaking for the construction of ship radio telegraph and telephone installations has been formed in Oslo by Mr. Lehmkukl, with Mr. Paul Ydalus, who was for a long time connected with the works of the French S.F.R. (Société Francaise Radio), as technical manager. The new firm has entered into an agreement with the French company for the use of its patents and types.

Social Events.—Messrs. Ferguson, Pailin, Ltd., held their annual staff party and dance at the firm's Social Institute Rooms on Saturday, January 23rd. The directors invited all the members of the staff to be present and to bring their friends. Two of the directors, Messrs. S. Ferguson and G. Pailin, presided. An original farcical comedy entitled "Broadcasting" was given by members of the staff. The cast was as follows:—Station director, and producer, Mr. George Pailin; Chief Engineer, Mr. R. Connard; Announcer, Mr. R. B. Willcock; Aunty Pon, Mr. J. Hammons; Uncle Wally, Mr. W. Grimshaw; Call Boy, Mr. J. Howarth. The News Bulletin, Children's Corner, and "Eve's Review," lent themselves admirably to burlesque, and much amusement was created as individual staff members were introduced in humorous, but good-natured terms. This item was followed by an entertainment introducing the "F.P. Follies," who sang popular choruses, accompanied by the F.P. Orchestra. Dancing occupied the remainder of the evening, in the course of which a huge Christmas cracker nearly 20 ft. long was opened, and a large number of toy balloons emerged from its interior.

The Greater London Division of the Electricity Supply Commercial Association held a successful dance at Cannon Street Hotel on January 26th. Over 400 members and friends were present and everybody gallantly danced through the evening to the last bar of the last waltz despite the mild weather. No doubt the excellence of the music provided by the orchestra was a determining factor. Innumerable novelties were distributed, and the social spirit displayed was a marked feature. The secretary, Mr. G. R. Smith, and those who assisted him in organising the event are to be congratulated for the excellent arrangements made, of which the catering was not the least appreciated.

Lead.—Messrs. James Forster & Co. state:—"According to Metal Exchange Statistics, the apparent consumption of lead in the U.K. during 1925 was 253,459 tons, an increase of about 33,000 tons over 1924, as against an increase of 30,000 tons in 1924 over 1923. Stocks of lead, however, on December 31st, 1925, are given as 5 tons, whereas various authorities estimate them at from 8,000 to 12,000 tons. Taking the average figure, this would reduce the increased consumption during 1925 to 23,000 tons over 1924, against an increased consumption of 30,000 tons in 1924 over 1923."

Local Exhibition.—Annfield Plain.—The Urban District Council is arranging to hold an exhibition in three of the houses which have been built under its auspices. These will have only one coal fire and will be equipped with an electric cooker, a calorifier for bath and kitchen use, and a wash-boiler. As the exhibition will coincide with the introduction of a special domestic tariff (6s. per month plus 1d. per kWh, provided that 4 kW of appliances, independent of lighting, are installed) good results are anticipated.

Extension of Southampton Docks.—At a recent meeting of the Southampton Harbour Board, Major Szlumper, assistant manager of the Southern Railway, said that his company proposed a radical alteration in the lay-out of the proposed new docks. Under the scheme the company would be able to increase the quayage from 10,000 to 17,000 sq. ft. A start would be made upon the work as soon as the latest proposals had been considered. A description of the electrical equipment of the docks was published in our issue of September 18th (p. 471), and it appears probable that a great deal of further plant will soon be required.

Trade Announcements.—Mr. G. Ellam has removed from 69, Corporation Street, to 37, Cannon Street, Manchester, and has been appointed selling agent for Lancashire, Yorkshire, and North Wales for the "Draka" wires and cables produced by Electric Cables, Ltd.

The telephone number of Messrs. R. O'Brien & Co., 66, Mosley Street, Manchester, has been changed to "Central 6486" (3 lines).

Mr. Alan Wright, Sentinel House, Southampton Row, W.C.1, has been appointed sole sales representative for Great Britain, Ireland, and export for Hazemeyer switchgear. He has sent us a pamphlet dealing with star-delta starters.

With reference to an announcement published in this column last week, Mr. Dryden, who has purchased the business of L. Weekes, Ltd., from the liquidator and receiver, has registered a new company under the title "L. Weekes (Luton), Ltd" (see our "New Companies" section to-day), which will be carried on with Mr. L. Weekes acting in the capacity of managing director.

We are informed that the "Ino" Guaranteed Lamp Co., Ltd., of 35, Aldermanbury, London, E.C.2, is preparing to open a factory in Southend-on-Sea for the manufacture of electric lamps and other electrical appliances.

The address of Philips Lamps, Ltd., is now 145, Charing Cross Road, W.C.2. Telephone: Regent 7731; telegrams, "Phillamps, Westcent, London."

The Electro-Mechanical Supplies, Ltd., of Coventry, is moving on February 9th to 44, Bayley Lane, Coventry.

Messrs. E. P. Allam & Co., Ltd., 107-109,, Gray's Inn Road, W.C.1, have been appointed sole agents for London and the South of England for Messrs. Wrights Motors, Ltd., of Halifax, for the sale of d.c. and a.c. electric motors and dynamos, of which they will hold a stock.

Catalogues and Lists.—The Jackson Electric Stove Co., Ltd., 143, Sloane Square, S.W.—A February calendar-blotter, illustrating the contruction of a new open-type protected boiling plate.

The British Thomson-Houston Co., Ltd., Mazda House, Newman Street, Oxford Street, W.—A folder containing illustrated details and prices of "X-ray" reflectors for shop-window lighting; also an illustrated folder dealing with the lighting of Peterborough Cathedral.

The Yorkshire Copper Works, Ltd., Leeds.—A pamphlet advertising copper tubes for hot and cold water.

Messrs. Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.—A comprehensive catalogue of electrical supplies, including switch- and fuse-gear, cables, insulators, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for January; also a mailing card advertising the company's conduit fittings and accessories.

Tok Switches, Ltd., Granville House, Arundel Street, W.C.2.—A blotter announcing the number of the company's stand at the forthcoming British Industries Fair, Birmingham.

Messrs. Ruston & Hornsby, Ltd., Lincoln.—Publication No. 4,439, containing a short history of the company and illustrations of its products.

Bankruptcy Proceedings.—W. G. Conway (trading as "Listron"), 88-90, Chancery Lane, W.C., radio component dealer.—The public examination of this debtor was held on January 27th before Mr. Registrar Coldridge, at the London Bankruptcy Court. He failed in November with liabilities £607, against assets valued at £313. In the course of his evidence the debtor stated that, having previously traded as a chemical merchant, he started a wireless business in November, 1924, and carried it on with success until March, 1925. In that month he entered into an arrangement with a firm to supply him with a bulk crystal, which he was to pack as "Listron" crystal, and re-deliver to them on agreed terms.

In order to carry through the arrangement, witness ordered a considerable quantity of boxes and increased his advertising, but the firm subsequently declined to take delivery of a quantity of the crystals. "Listron, Ltd.," was formed in June last to acquire his business as a going concern, but the company never functioned. He attributed his failure and insolvency to the slump in trade since March, 1925; to the failure of the customer to take delivery of the crystals; and to heavy advertising charges. The examination was concluded. The following are the principal creditors:—

	£		£
L. Harforth & Co.	46	Iliffe & Son	99
Midland Bank	46	Wireless Trader, Ltd.	34
H. Slade, Ltd.	34	Westminster Advertising Service	74
Warrilows, Ltd.	44	Wm. Sessions, Ltd.	24
Boxfoldia, Ltd.	36		

E. P. HIGGINS (Western Union Wireless Co.), 99, Regent Street, W.—Trustee, Mr. E. Parke, Official Receiver, Carey Street, W.C., released January 18th.

G. BONNET, electrical contractor, &c., 2A, Camden Road, N.W.—The first meeting of creditors was held on January 26th at the London Bankruptcy Court, when proofs of debt for £430 were tendered. The receiving order was made on January 12th upon a creditor's petition, and in the absence of any proposal the case was left in the hands of the Official Receiver to be wound up under an order for summary administration.

J. N. DAVENPORT and L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens and Albert Mills, Albert Street, Manchester.—First dividend of 2s. 6d. in £ payable February 12th at 21, Spring Gardens, Manchester.

G. H. DIXON, electrical contractor, 46, Market Place, Dewsbury.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released January 18th.

C. PEACOCK, electrical engineer, 51, Gillygate, York.—Trustee, Mr. D. S. Mackay, Official Receiver, Duncombe Place, York, released January 14th.

Company Liquidations.—GAS & ELECTRICAL SECURITIES, LTD., 14 & 16, Cockspur Street, W.—The statutory first meetings were held on January 26th, at Carey Street, W.C. The winding-up order was made on the petition of the Northern Exploration Co., Ltd., London Wall, E.C., returned as creditors for £16,000 in respect of calls on shares. The company was formed in February, 1923, with a nominal capital of £1,000, to invest funds in the purchase of securities of any kind and description in any part of the world. The accounts filed under the liquidation show total liabilities of £19,512 (unsecured £18,293), assets of £2,471, and a deficiency of £15,824 as regards contributories, the issued capital consisting only of three ordinary shares of £1 each. The liquidation was left in the hands of the Official Receiver.

EAGLE ELECTRICAL MANUFACTURING CO., LTD., 32, Charlotte Street, W.1, electrical and wireless manufacturers.—A meeting of creditors was held on January 27th. The liquidator of the company, Mr. E. H. Henry, said that one of the creditors obtained judgment some time ago and had sold the place up. Continuing, he said that a lot of work had been done in putting in wireless sets for different hospitals, and there were a number of orders for further contracts which, if they had been able to carry them out, would have been very profitable. As soon as the sheriff sold, namely, on December 23rd, the necessary resolution was passed for voluntary liquidation. According to an approximate statement of affairs the liabilities amounted to £1,093. The only assets were certain book debts amounting to £313, but the liquidator said that he did not think that these would realise more than £75. From that amount had to be deducted preferential creditors amounting to £68, leaving net assets of £7. The company was incorporated in July, 1924, with a nominal capital of £1,500. A resolution was passed confirming the appointment of the present liquidator.

The following are creditors:—

	£		£
Chadwick Healey	279	Lighting, Heating & Glass Co.	58
E. H. Henry	23	Mullard Radio Valve Co., Ltd.	157
Brown, S. G., Ltd.	67	Siemens Bros. & Co., Ltd. ...	60

RE-ECHO RADIO CO., LTD.—Winding up voluntarily. Liquidator, Mr. C. H. Whatley, 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C. Meeting of creditors at the liquidator's offices on February 10th. Particulars of claims to the liquidator by February 27th.

Calendar and Diary. — We have received from the HART MANUFACTURING CO., 76 and 77, Rochester Row, S.W.1, a 1926 diary, comprising monthly date slips upon a wall card illustrating "Diamond H" switches.

THE EDISON SWAN ELECTRIC CO., LTD., have sent us a pocket diary neatly bound in dark red leather, with a week to each double page.

Private Arrangements.—I. M. B. OLIPHANT, E. R. WHITFORD, and C. C. JOHNSON, trading as the Campbell Radio Store, 2, St. Catharine's Road, Southbourne, Bournemouth.—A meeting of creditors was held on January 27th, at the offices of Mr. Parkin S. Booth, Holborn Viaduct, E.C. The statement of affairs of the joint estate showed liabilities of £1,389 and net assets of £1,185, leaving a deficiency of £204. The separate estate of E. R. Whitford showed liabilities of £9, with assets of £35. The separate estate of C. C. Johnson showed liabilities of £166 and no assets, and that of I. M. B. Oliphant disclosed liabilities of £312 against assets of £977, a surplus of £665. Mr. Booth reported that the business was commenced by C. C. Johnson in September, 1924, without capital. In November of the same year Whitford joined the business, bringing in £250. The third partner joined the business in May, 1925, and introduced £250 in cash. A deed of partnership was entered into, under which each of the partners was credited with a capital of £250, and it was arranged that they should each draw equal amounts. In July last Mr. Whitford, senior, advanced £300 to the partnership, for which he was still a creditor. In August Oliphant brought in an additional £222 as a loan. Approximate accounts to October 16th last showed a net loss of £400. Efforts had been made to obtain further capital, but without success. Whitford desired to leave the partnership, and a deed of dissolution was prepared, but had not been executed. The deficiency was accounted for by the writing down of the assets and the loss on trading. Creditors had been pressing, but no proceedings had been commenced. There was no offer, and a deed had been executed to protect the assets. A resolution was passed in favour of the matter being dealt with under a deed of assignment with Mr. Booth as trustee, whilst a committee was nominated, consisting of Messrs. C. Latham (Wireless and Radio Trades Guardian Association), W. A. J. Osborne (British Traders' Association), and E. H. Hawkins (Poppleton, Appleby & Hawkins).

The following are creditors:—

	£		£
British Thomson-Houston Co., Ltd.	23	Marshall & Co.	41
C. A. C. Radio, Ltd.	22	Motor Macs, Ltd.	45
Evers, H. P., & Co.	44	Richards, G. T.	23
General Battery Co., Ltd. ...	75	Ward & Goldstone, Ltd.	45
Houghton Butcher (Gt. Britain)	352	Summit Manufacturing Co., Ltd.	146
Hewitt, H.	27	Sel-Ezi Wireless Supply Co., Ltd.	20

Dissolution of Partnership.—GLOVER BROS., electrical engineers and general machinists, Windsor Street, Coventry.—Mr. H. J. Glover and Mr. H. W. Glover have dissolved partnership. Mr. H. W. Glover will attend to debts and continue the business.

An Exhibition of Business Machines.—The International Business Machines Co., Ltd., and the International Time Recording Co., Ltd., have recently opened new showrooms and offices at 112, Strand, W.C.2. Here are displayed a number of aids to business efficiency. A large number of time-recorders for offices and factories are shown, as well as the Time Recording Co.'s system of synchronised electric clocks. One useful device of an electrical nature which is exhibited is a door recorder. This is attached to a door lock and at the same time is connected in an electric-clock circuit. A set of keys, each allotted to a particular individual, is provided, and when the door is locked or unlocked the time is recorded as well as an identification of the person concerned. It is especially applicable to strong rooms, but it has many other uses. Examples of "Dayton" food-preparing machines are on view. All of these are compactly built, having the driving motor incorporated in them. The range includes coffee grinders and sausage machines. A further useful device is the "Ticketograph" system, by means of which the costing of piece work is greatly simplified.

Book Notices.—"The Electrical Educator."—In the parts four to nine of this work, the prospectus which we referred to in our issue of October 16th last in connection with the first two parts has been continued and extended. Although the work in the main is a practical treatise on electrical engineering, it is so written as to make a pleasing departure from the usual text-book style, each part touching on several phases of the subject as part contributions or lessons, with the introduction of special articles by distinguished engineers on subjects of general electrical and industrial interest. Among the many eminent contributors are Messrs. A. P. M. Fleming, C.B.E., and John Bruce, A.M.I.E.E., Sir Charles Bright, F.R.S.E., Messrs. D. N. Dunlop, and H. Dickinson, M.Inst.C.E. The work is being published by Sir Isaac Pitman & Sons, Ltd., in 30 fortnightly parts (at 1s. 3d. each).

"Radio and High-Frequency Currents," by E. T. Larner. Second edition. Pp. vii+64; figs. 30. London: Crosby Lockwood & Son. Price 2s. 6d. net.

"Surface Water Supply of Canada: St. Lawrence and Southern Hudson Bay Drainage (Eastern Section), Quebec, Climatic Year 1922-23." Water Resources Paper No. 41. Ottawa: Director, Dominion Water Power and Reclamation Service. (London: High Commissioner for Canada.)

Technologic Papers of the U.S.A. Bureau of Standards. Vol. 19, Nos. 297 and 298, 1925.

Scientific Papers of the U.S.A. Bureau of Standards. Vol. 20, No. 515, 1925.—"Thermal Expansion of Tungsten."

Miscellaneous Publications of the U.S.A. Bureau of Standards. No. 66, 1925. Second Technical Conference of State Utility Commission Engineers.

"The Enlarged Heat Drop Tables," h.p. gauge pressures, l.p. absolute pressures, calculated by Dr. H. Moss from the formulæ and enlarged steam tables of Prof. H. L. Callender. Pp. 88. London: Edwin Arnold & Co. Price 10s. 6d. net.

"Atomicity and Quanta," by J. H. Jeans. Pp. 64. London: Cambridge University Press. Price 2s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV, No. 1. January, 1926. New York: The Institute. Price $1.

Revised Indian Import Duties.—The *Board of Trade Journal*, dated January 28th, contains schedules of the revised import and export duties instituted by the Government of India as from January 1st. Among the articles affected by the revision are electrical control gear and transmission gear (15 per cent. *ad valorem*); telegraphic instruments, apparatus and parts imported for or by a railway company (10 per cent. *ad valorem*); tramcars (15 per cent.); tramway track material (10 per cent.); certain prime movers and other machinery (2½ per cent.); and electrical wires and cables and transmission system fittings and parts (2½ per cent.).

Guarding Against Fraud.—Although but recently instituted, the scheme of the Federation of British Industries for the exchange of credit information has already achieved a large measure of success. Over 1,500 firms are participating, and the service covers every important trade in the country. The number of names of undesirable traders which have been notified to participants has reached over 800, and the total is increasing at the rate of 80 per week; 40 per cent. of the defaulters are of foreign origin. The working of the scheme has disclosed a number of methods adopted by these fraudulent traders. The commonest type of fraud is a declaration of inability to pay, all assets having previously been made over to the defaulter's wife or other near relative. The next most prevalent type is the long firm fraud, in which goods are sold to untraceable persons, and a number of aliases are employed. Another common method of fraud is a refusal to accept delivery after goods have been sent to a foreign market; they are afterwards bought at "knock-down" prices at public auction. Sometimes expensive samples are obtained from firms and sold. A common trick is to give two or three small orders, which are paid for promptly, followed by a large order for which the money cannot be obtained; and sometimes the disappearance of the defaulter is involved. A method of fraud commonly met with among foreign firms is the obtaining of a large order for goods by a trick; there are a number of ways in which this can be done. Some purchasers will, months, or years, after payment is due, question the quality of goods sent to them. Finally, it sometimes happens that an agent will double an order for a client, and when he finds that he is unable to dispose of the extra goods, he will repudiate the transaction and default.

E.D.A. Activities.—The British Electrical Development Association has sent us a copy of its sixth instalment of publicity matter which is appearing in the national Press. These advertisements are specially designed for the class of paper in which they are to appear; they are excellent examples of their kind, and should be productive of good results.

Siamese Electrical Imports.—A report upon the commercial situation in Siam during the year ended March 31st, 1925, by Mr. E. G. Sebastian, lately Acting Consul-General at Bangkok, states that the value of imported electrical goods and apparatus declined from 1,150,507 ticals to 796,294 ticals (£1=10.89 ticals). The value of the United Kingdom's share, however, rose to 350,000 ticals, and this country thus recovered the first place from Germany, whose contribution was 130,000 ticals, as compared with 328,343 ticals in 1923-24. It is stated that Denmark has almost dropped out of the market.

The Position of the Wireless Trade.—In the course of an article appearing in the *Wireless Trader* under the title, "The Year—What Will it Become?" the writer says:—"Then, again, we have a complete unheaval of the leading manufacturers and trade association. The trader does not know exactly what this is going to mean to him, but in a half-hope that it will mean better discounts, he holds off buying at a time of the year when he should put forth all his energies.

"Surely, Mr. Trader, the veriest novice in economics can work out the problem for himself? The manufacturer is not so foolish as to increase the price of his goods to the public, and, with a few exceptions, his profit is already so small that to give away any more of it would be running a serious risk of disaster; while, with the increases in the prices of various raw materials, such as ebonite, he is not likely to be saving much in production costs.

"How, then, is he going to find you that extra large lump of discount which you hope is going to appear as a result of a temporary break in his ranks? Obviously, the only way in which you can possibly hope to increase your discount is to send the manufacturer more orders, and thus lower his overhead charges through increased production. Therefore, if you are looking for an increase in discounts, you should be pushing sales for all you are worth, so that you may increase your orders."

Russian Orders for Germany.—It is reported from Dusseldorf that a further contract has been entered into between the Donugol (South Russian Coal Trust) and various German firms for the establishment of power stations at an expenditure of £750,000. The participating firms are the A.E.G., Siemens & Halske, Felten & Guilleaume, and two mechanical engineering works. Further negotiations with the same group are said to be still pending for other works of a similar kind.

Coal, not Electricity, the Panacea.—Addressing the Glasgow Chamber of Commerce on January 26th, Sir Adam Nimmo said that the only sound and stable policy for the industries of this country was the production of increasing quantities of coal. Unification, electrification, carbonisation, and nationalisation of royalties were no remedies for our troubles.

Australian Companies.—Installation and Equipment, Ltd., is the name of a company recently formed in Sydney, with a capital of £10,000, to carry on business as electrical engineers and contractors, &c.

The name of the Western Electric Co. (Australia), Ltd., has been changed to Standard Telephones and Cables (Australia), Ltd.

The British Electric Transformer Co. (Australia) Pty., Ltd., has been formed in Melbourne with a capital of £10,000 to carry on business as electrical engineers, ironfounders, &c.

The P. & B. Battery Co., Ltd. (capital £5,000), has been formed in Melbourne for dealing in and manufacturing electrical machinery, &c.

South African Electrical Imports.—According to the *Board of Trade Journal*, the imports of electric cable and wire into South Africa during the first seven months of 1925 were valued at £368,119.

New All-Electric House and Showroom.—The Rotherham Corporation has approved a proposal by the electrical engineer (Mr. E. Cross) to convert premises in Rawmarsh Road, now utilised by the department as a stores, into an all-electric home for demonstration purposes. Mr. Cross states that the cost of the conversion will be inconsiderable, and that the work can be carried out by his staff. He proposes to furnish the premises for demonstration purposes as a living room, sitting room, scullery, bedroom, and bathroom, and to utilise a large room adjoining as a showroom for domestic electrical appliances.

The Building Trades Exhibition.—It is announced that the Lord Mayor of London will open the Building Trades Exhibition at Olympia on April 14th.

United States Radio Exports.—Department of Commerce statistics show that radio goods valued at $8,936,565 were exported during the first 11 months of 1925, as compared with $4,950,746 during the same period of 1924. Radio exports now constitute 12 per cent. of the total foreign electrical trade of the United States.—*Reuter's Trade Service* (Washington).

Unemployment.—There was a fall of 5,503 in the number of registered unemployed persons during the week ended January 18th, the total at that date being 1,215,900. The number at the equivalent date last year was 1,269,733.

Engineering Employés' Wages.—A joint conference of representatives of employers and trade unions connected with the engineering industry, held on January 28th, broke up without reaching any agreement. The negotiations were commenced in June, 1924, upon an application from the men for a general increase in wages of 20s. per week. The employers offered an increase of 2s. per week in the bonus if the men would agree to an extension of the working week from 47 to 50 hours and other modifications, but this was not accepted. At the conclusion of the conference Mr. J. T. Brownlie, of the Amalgamated Engineering Union, said that the unions considered themselves free to take what action they thought fit. The employers replied, through Sir Allan Smith, that they thought insufficient consideration had been given to the condition of the industry as outlined in their statement. It is thought that the unions may now resort to negotiation by districts having failed to secure a national increase. Part of the proceedings of the conference consisted of the presentation of a report relating to the possibility of bringing conditions in the Continental engineering industries to the same level as our own. Italy, Germany and Belgium, in response to letters from the Minister of Labour, have signified their willingness to confer on the matter, but no reply has yet been received from France.

According to the *Financial Times*, trade union leaders in the Newcastle engineering industry state that the deadlock was due to the interpretation of the position by the employers—namely, that so long as the national negotiations were pending, no other question affecting wages could be considered by them. It is claimed on the men's side that the engineering trade is in a moderately good condition and that the state of it in certain branches is such as to warrant an immediate advance in wages. The executive representatives therefore decided in the interests of their members that where an advance in wages was warranted it was necessary to terminate the negotiations in order to allow claims from members in their respective districts to be considered without reference to the national procedure as interpreted by the employers.

New Italian Companies.—Among the electricity supply undertakings recently formed in Italy are La Società Cadorina di Elettricita, organised in Genoa with a capital of one million lire; La Società "La Luce," of Trebisacce (Castrovillari), 80,000 lire; La Società Imprese di Elettricità U. Sampietro, Trento, 1,500,000 lire; and La Società Elettrica Carnica, Udine, 1,600,000 lire.

Electrical Trades Commercial Travellers' Association.—A well-attended social evening was held on January 22nd, at the E.L.M.A. Rooms, by the Association, when a lecture was given by Mr. W. E. Bush. Refreshments were provided during the evening, and these were followed by a demonstration of "Lighting in the Home" by Miss Florence Hodge. By means of a revolving stage, the different lighting which should be used for each room throughout the house was shown in its natural surroundings, and was, in each case, contrasted with the unsuitable types of lighting which are so often seen. Mr. E. A. Joyce proposed a vote of thanks to Mr. W. E. Bush and Miss Florence Hodge, and Mr. Bush replied.

Building Exhibition at Edinburgh.—A Housing and Building Exhibition is to be held in Edinburgh from February 10th to 20th. Among the exhibitors is the Yorkshire Copper Works, Ltd., which is displaying examples of its light-gauge copper tubes.

A Scottish Protection Association.—The annual meeting of the Scottish Electrical Manufacturers' and Factors' Association was held in Glasgow last month. The secretary reported an increase in the membership. A resolution was passed permitting the admission of all manufacturers, factors, and wholesalers, trading in or with Scotland, to an extent deemed sufficient by the Association. Mr. A. B. Ames (British Electrical & Manufacturing Co., Ltd.), was elected chairman, and Mr. J. F. Stevenson (Macintosh Cable Co., Ltd.), vice-chairman. The secretary is Mr. H. C. McMillan, 13, Dundas Street, Glasgow.

German Electrical Supplies for Uruguay.—The firm of Siemens-Schuckert has received permission to erect a large branch house and works at Montevideo under the name of Compañia Platense de Electricidad Siemens-Schückert. There is a scarcity of certain electrical supplies, the requirements of the State being unsatisfied. All purchases of electrical apparatus for the Government and private stations will continue to be effected by means of public tenders.—*Reuter's Trade Service* (Montevideo).

For Sale.—Mr. H. J. Shaw will sell by auction on February 18th, at 13, High Holborn, the stock of a wireless goods factor; Messrs. Fuller, Horsey, Sons & Cassell will offer by auction on March 2nd and following days, at the Cubitt Engineering Works, Aylesbury, Bucks., the entire contents of the works, comprising engineers' machine tools, motor-body building plant, electric power plant, stores, and material, &c.; the Secretary of the North of Scotland College of Agriculture, Aberdeen, invites offers for one 20-b.h.p. and one 15-b.h.p. electric motors. (See our advertisement pages to-day.)

Lighting and Power Notes.

Australia.—TASMANIA.—According to *Tenders*, a sum of £81,000 has been appropriated by the Tasmanian Parliament for extensions to the State hydro-electric system. Of this amount £50,000 will be expended on extending the supply to north and north-west coast towns, the completion of the purchase of the Davenport power station, £1,500; mains extensions, transformers, house service meters, &c., in connection with country retail services, £4,500; mains, transformers, house services, meters, and general extensions retail services, Hobart district, £25,000.

Barnstaple.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £1,920 for mains and services, and £600 for meters.

Barry (Glam.).—ELECTRICITY SCHEME.—Specifications have been prepared for the cables and sub-station in connection with the Urban District Council's electricity scheme. A contract has been entered into between the Council and the South Wales Electrical Power Distribution Co., for a supply in bulk.

Bristol.—INQUIRY.—An inquiry was held at the Council House on January 26th by Col. T. C. Ekin, of the Electricity Commission, into the proposal of the Corporation to erect a new power station at Portishead. The Town Clerk, for the Corporation, stated that the plant at the Feeder Road works would shortly become insufficient, and it was necessary that additional plant should be available before the winter of 1927. Extension at Feeder Road was impracticable owing to water shortage, and in any case the extension would only postpone, at serious expense, the ultimate construction of a new station within a very short time. The scheme provided, as a first instalment, for plant with a capacity of 40,000 kW, and the estimated cost was £980,704, which included £246,204 for underground cables. Mr. Faraday Proctor, chief electrical engineer to the Corporation, stated that, except near Gloucester, there was no site other than that at Portishead. It was mentioned that the full scheme, if developed to 240,000 kW, would cost three millions. Mr. J. C. Peck (representative of the provisional contractors) said that there would be no question of nuisance from noise or vibration, and Mr. J. W. Gibson stated that the mechanical draught plant would obviate any risk of nuisance from dust or smoke. Mr. J. C. Glyde, clerk to the Portishead Council, said that every precaution should be taken with regard to noise, smoke, and dust, and that there should be as little depreciation of property as possible. The principal objection of Portishead with regard to boundaries was being negotiated. Objections were also raised by the National Citizens' Union and the Bristol Ratepayers' Association. The Commissioners will give their decision in due course.

China.—ELECTRICAL DEVELOPMENT.—In a recent issue of the Siemens *Zeitschrift*, Herr K. Mosig gives some particulars of the first high-pressure transmission installation in China. The power station is located on the Suchan River and near the Shanghai-Nanking railway. The initial plant comprises two 3,200-kW Zoelly-type turbo-generators running at 3,000 r.p.m., but it is intended later to install two 10,000-kW sets. The current is stepped up from 6,600 V to 33,000 V for transmission purposes to the towns of Shangschau and Wusie, a distance of 6¼ and 20 miles respectively, and is reduced at sub-stations first to 2,300 V and then to 380/220 V.

Chester.—LOANS.—The Town Council has approved of application being made for sanction to borrow £3,000 for the purpose of wiring small houses on the hire-purchase system, £3,970 for the purchase of transformers, £17,870 for the purpose of carrying out various works, and £12,000 for the purpose of replating the storage battery at New Crane Street.

Chesterfield.—NEW CONVERTER.—The Council proposes to borrow £5,500 for the erection of a 1,000-kW rotary converter at the electricity works in order to meet the estimated additional demand for electricity in the next three years.

Continental.—POLAND.—On the initiative of the Minister of Public Works, the National Economic Bank is discussing with the American and European Utilities Corporation the partial realisation of the electrification programme drawn up by the Minister of Public Works. A committee is at present studying the economic condition of the country to be electrified.—*Reuter* (Warsaw).

FRANCE.—The Compagnie d'Energie Electrique du Littoral Mediterranean has drawn up a scheme for the electrification of the villages and agricultural districts in the Vesubie valley of the Alpes Maritimes Department. The scheme includes the establishment of a 20,000-V transmission line between Saint Martin and Vesubie.

The Compagnie Electrique de la Loire et du Centre is replacing a 1,500-h.p. steam turbine which has been in use at its power station at Montlucon since 1907, with a modern one of 4,400 h.p. A new hydro-electric station of 14,000 h.p. capacity is also in course of construction at Monistrol d'Allier, and is expected to be completed by the end of the current year.

SPAIN.—The Sociedad Productores de Fuerzas Motrices, which is erecting a large hydro-electric station to utilise the Clede Falls at Pobla de Segur in the Pyrenees, is preparing plans for the transmission of the electricity generated to Barcelona. In order to ensure an uninterrupted supply, arrangements have been concluded with the Sociedad de Carbones de Berga which operates certain lignite mines near Barcelona, to establish a reserve steam-operated power plant in connection with its mines.

GERMANY.—A Berlin message states that the Swiss Government has approved the contract of the Swiss Power Transmission Co. and the Baden electrical undertakings for the mutual exchange of electrical energy.

Crowborough. — ELECTRICITY EXTENSIONS. — The Crowborough District Gas and Electricity Co. recently instructed its engineers, Messrs. A. Hugh Seabrook & Partners, to extend the plant at the generating station, and orders have been placed for a four-cycle oil engine and alternator, which it is expected will be available for service this month.

Croydon.—ELECTRICITY EXTENSIONS.—The electrical engineer has prepared a scheme for the development of the electricity undertaking at a total cost of £59,000.

LOANS SANCTIONED.—The Electricity Committee has received sanction to loans of £1,300 for buildings, £13,000 for mains, and £4,600 for plant and alterations to buildings.

MAINS EXTENSIONS.—The Committee has decided to extend mains at a cost of £3,350.

Darwen. — ELECTRICITY SUPPLY. — The Corporation has applied for sanction to extend its generating plant, but at the request of the Mid-Lancashire Electricity Advisory Board, has agreed to an interview with the Blackburn Corporation to ascertain whether an arrangement can be arrived at. The Electricity Commissioners have authorised the Council to borrow £40,000 for extensions to mains, services, &c.

Edinburgh.—DEPUTATION TO VISIT PARIS.—In connection with the extension of Portobello power station the Corporation Electricity Committee has recommended that a deputation of five members should be appointed to visit the Gennevilliers power station in Paris.

Gainsborough.—ELECTRICITY SCHEME.—Tenders for an electricity scheme are now before the Urban District Council, and it is hoped that a supply will be available by the winter of 1926.

Irish Free State.—WATERFORD SCHEME.—Opposition was made by the Chamber of Commerce and certain ratepayers at an inquiry held in the town, before an inspector of the Irish Free State Local Government Board, into the Corporation's application for a loan of £30,000 for an electricity scheme. The inspector declined to take evidence as to whether the scheme should or should not be adopted, holding that that had been decided by the granting of a Provisional Order. It appeared that a referendum of city householders gave a majority against the scheme, only four voting in favour. Alderman Keane, mayor, gave evidence in support of the scheme, pointing out that a considerable area of the city was not at present lighted. Testimony on behalf of the opposition was to the effect that the Corporation's proposals were uncommercial, and that the scheme would cost up to £50,000 to complete. The inspector's report will be presented to the Government in due course.

Japan.—ELECTRICAL DEVELOPMENT.—The Toho Denryoku's Nagoya steam power station of 25,000 kW has recently been completed, and good progress is being made with the construction of the Tsurumi station of 70,000 kW. The Tokyo Dento K.K. is to erect a power station of 150,000 kW imme-

diately on completion of one of 50,000 kW at Lenju. Concessions have now been issued for nearly all the important sites for hydro-electric development in the neighbourhood of the large cities, and future development may only be expected on the Shinano River, the Oi River, and Fuji River. On these rivers the power stations projected are all on a large scale, varying from 150,000 to 100,000 kW.

Lancaster.—EXTENSION OF SUPPLY.—The Corporation has decided to spend an additional £6,000 on a cable to supply the new garden city of Bowerham where over 100 houses are in course of erection.

Leeds.—EQUIPMENT OF SMALL HOUSES.—At a recent joint meeting of representatives of the Electricity, Gas and Improvements Committees of the City Council, authority was given for 34 houses on certain new Corporation estates to be equipped as all-electric and 34 to be equipped as all-gas.

Long Sutton.—ELECTRICITY SUPPLY.—The Urban District Council is to ask the Boston and District Electricity Supply Co., Ltd., whether it would be prepared to provide a supply of electricity for the town, and as an alternative endeavours are to be made to obtain a supply from King's Lynn and Wisbech.

Ludlow.—TRANSFER OF UNDERTAKING.—The Town Council has completed an agreement with the Ludlow Electric Light Co., under which the electricity undertaking is to be transferred to the Corporation on June 30th.

Luton.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £25,000 for mains and services, and £7,500 for sub-station equipment.

Maghull.—ELECTRICITY SCHEME.—At a recent meeting of the local Council it was decided to adopt a scheme of electric lighting. Mr. James Scott, of Bootle, electrical engineer to the West Lancashire Rural District Council, estimated the total expenditure at £12,000, and that electricity could be supplied for lighting at 9d. per kWh.

Marlborough.—STREET LIGHTING.—The Town Council has instructed Mr. G. W. Molle, of Messrs. A. Hugh Seabrook and Partners, to arrange for the changing over of the street lighting from gas to electricity.

Morecambe.—ELECTRICITY SUPPLY.—The borough electrical engineer, reporting to the Town Council on the progress of the scheme for a second cable from the source of supply at Lancaster, said that the situation was altered by the L.M. & S. Railway Co.'s negotiations with the Lancaster Corporation for a supply to its railway, Heysham Harbour and other works. He therefore submitted an amended scheme and estimate of £17,000, in which the Lancaster and Morecambe Corporations and the railway company are jointly interested. The scheme has been approved by the Electricity Committee, and the Corporation has been requested to give its sanction.

Price Reductions.—Reduction in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*Westminster Electric Supply Corporation, Ltd.*—Lighting: For the first 4,000 kWh per annum, 5d. per kWh; all consumption in excess of this amount, 4d. per kWh. Heating, cooking, and motors: If taken through a separate meter, 1d. per kWh.

COVENTRY.—H.p. or bulk supply: The increase in the basic rate from 15 to 10 per cent. Power (l.p. supply) and heating: Flat rate from 1¼d. to 1½d. per kWh. Lighting: Maximum demand rate from 8d. to 7d. per kWh for the first hour per day, the second hour remaining at 3½d. per kWh, and thereafter from 1¼d. to 1½d. per kWh; flat rate from 4d. to 3¾d. per kWh.

CHISLEHURST.—*The Chislehurst Electric Supply Co., Ltd.*—The charge for electricity reduced by 1d. per kWh.

RUGBY.—Power: 1¾d. per kWh, with a minimum charge of 10s. per h.p. installed. The charge for h.p. supply has also been reduced.

New Zealand.—ELECTRICITY SCHEME.—The New Zealand Sounds Nitrates Syndicate has been granted a 60 years' licence by the Government to generate at Smith's Sound a force of 300,000 continuous h.p., 50,000 h.p. of which is to be developed within seven years, while the construction of works to generate the balance must be begun within 10 years. The Government retains the right to resume possession with compensation at the end of 30 years. The power produced is to be used for electrochemical, metallurgical, and other purposes. The rental payable to the Government is 1s. per annum per kW.—*Reuter's Trade Service* (Wellington).

Peak District.—ELECTRICITY SCHEME.—Although the matter of providing an electricity supply to a number of districts in the Peak District has been considered by various local authorities at the request of the South-East Lancashire Electricity Advisory Board, no definite steps have been taken by those bodies, and intimation has now been made by a private company that it intends to prepare a scheme for a supply which will link up Chapel-en-le-Frith, Whaley Bridge, Hayfield, and Chinley.

Peterborough.—LOAN.—The Town Council is applying for sanction to a loan of £10,420 for the following purposes:—H.p. and l.p. switchgear, £8,666; and a fifty-ton crane, £1,754.

Plymouth.—LOAN SANCTIONED.—The Corporation has received sanction to the borrowing of £12,017 in connection with electricity supply in the Lipson Vale and Laira districts.

MAINS EXTENSIONS.—The Electricity Committee has approved mains extensions involving an expenditure of £1,643.

Preston.—STREET LIGHTING.—The Corporation Electricity Committee has had under consideration alternative side-pole and central-suspension schemes of lighting for certain thoroughfares, and has recommended the Corporation to approve of the side-pole scheme at a cost of £1,080, with an annual running cost of £360 for 36 lamps.

NEW PLANT.—The Committee has received sanction to extend the power station by the installation of a third 12,500-kW turbo-generator and auxiliary plant.

LOAN.—Sanction has also been received to the borrowing of £20,000 for changing over in the Avenham and Deepdale districts, and for laying new feeder mains in other districts.

Rawtenstall.—CORRECTION.—In our last issue (p. 179) we stated that the Corporation had received permission to increase the plant at its electricity works to reach 6,000 kW. The plant capacity is already nearly 15,000 kW (which is the largest capacity per inhabitant of any town in the United Kingdom); the proposal is to increase the capacity *by* a 6,000/7,500-kW set.

Shoeburyness.—ELECTRICITY SUPPLY.—The Urban District Council has instructed its Parliamentary agents and engineers to prepare an electricity scheme and draft Order for submission to the Electricity Commissioners. Negotiations are in progress with the War Department for a supply in bulk to the Council.

Special Orders.—Application has been made to the Electricity Commissioners for Special Orders by the following authorities:—The Urban District Council of Seaham Harbour for the supply of electricity in the urban district and in the parish of Seaham; the Borden and District Gas Co., to supply in certain parishes in the rural districts of Alton, Petersfield, and Midhurst; and the Llandilofawr Rural District Council in the parish of Llandybie.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising Messrs. Crompton & Co., Ltd., to supply electricity in the urban district of Wellington.

Stoke.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £5,500 for mains in connection with the supply of electricity in the Hanley area.

The Fylde.—ELECTRICITY SUPPLY.—A meeting of local authorities, on January 21st, considered a proposed electricity scheme for the Fylde district. The meeting decided to obtain the advice of an electrical engineer as to whether a scheme could be formulated for the joint townships to supply electricity directly without vesting the Preston Corporation with full control.

Tynemouth.—LOAN.—The Electricity Committee is applying for sanction to a loan of £16,000 for the electricity undertaking.

Walton-on-Thames.—PURCHASE OF UNDERTAKING.—The Urban District Council, on January 18th, decided to give notice of its intention to purchase the local electricity undertaking of the Urban Electric Supply Co., Ltd., at a cost estimated at £90,000.

Wrexham.—ELECTRICITY SUPPLY.—The Town Council has adopted a scheme for laying new a.c. underground distributors at an estimated cost of £12,000.

Tramway and Railway Notes.

Bradford.—TRAMWAY IMPROVEMENTS.—The Estimates Sub-Committee has approved the Tramways Committee's scheme for the reconstruction of tramway track as follows:—Manningham Lane, North Parade to Oak Lane, £27,715; Barkerend Road, Otley Road to Byron Street, £14,740; Rushton Road to Leeds Road, £8,262; and also for the purchase of ten motor 'buses (£11,834) and six railless cars (£8,925).

Continental.—POLAND.—The tramway workers in Warsaw struck work on January 28th. According to *The Times*, the dispute was the result of the men's demand for increased wages.

East Ham.—RAILLESS-CAR SCHEME REJECTED.—In connection with the Borough Council's proposal to promote a Parliamentary Bill for the substitution of railless cars on one of the routes of its present tramway system, and to extend the railless-car service in other directions, a poll of ratepayers taken on January 26th resulted in a large majority against the proposal. The cost of the scheme was estimated at more than £150,000.

Huddersfield.—TRACK RENEWALS.—The Tramways Committee has considered a report from the borough engineer on the condition of the tramway track, and has decided to reconstruct the following sections in the order named:—Apsley section, from Shore Head to Somerset Road; Newsome section, from Chapel Hill to Bridge Street (with an additional loop); Northumberland Street, Northgate to John William Street, outward track; Birkby section, from John William Street to Wheathouse Road; Manchester Road, from Longroyd Bridge (River Bridge) to Griffin Inn.

(*Continued on page 223*)

An Electrical-Instrument Works.

A Visit to the Works of Messrs. Nalder Bros. & Thompson, Ltd.

The firm of Nalder Bros. & Thompson, Ltd., whose works are now established at Dalston, was commenced in 1884 by Messrs. F. H. Nalder and H. Nalder,

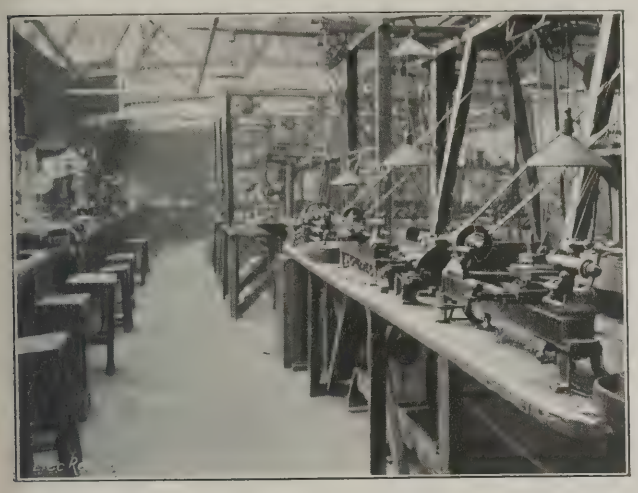


Fig. 1.—Major-Assembly Shop

under the style of Nalder Bros., with its headquarters at Westminster and a small works at Brentford. It soon became necessary to seek larger works, and in early 1887 the factory was moved from Brentford to Westminster, about which time a partnership was taken in the concern by Mr. C. W. S. Crawley, and business was carried on under the name of Nalder Bros. & Co. Soon afterwards the firm was joined by Mr. Alfred Soames, and in 1890 its continued progress necessitated another move, new works being established at Clerkenwell. In 1896 it was decided to split the business, due primarily to the ammeter and voltmeter business having increased to such an extent that it had become advisable to departmentalise the production. Mr. F. H. Nalder purchased the goodwill and plant of the ammeter, voltmeter, and switchboard department, remaining a partner in the parent firm until 1897, and was joined in the fresh enterprise by Mr. E. Thompson. The new firm was established under the name of Nalder Bros. and Thompson, with its works at Queen Street. The undertaking was converted into a private limited company in 1899 with Mr. F. H. Nalder as chairman and managing director, which position he has continued to hold to the present day. Additional works were taken over at Kingsland Green, Dalston, and in 1914 the concern moved entirely to Dalston, other premises at the present headquarters, Dalston Lane, being equipped as a modern factory. The two last-mentioned premises in which, by the courtesy of the management and staff of the firm, we recently spent a particularly interesting day, accommodate the undertaking entirely. The products of the firm now include practically every kind of instrument and apparatus required for use in connection with the modern operating switchboard.



Fig. 2.—New Assembling Wing.

The Dalston-Lane works is devoted to the winding of the instrument coils, the assembling of all instruments and the smaller relays, the manufacture of small instrument parts, such as pivots, pointers, &c., and the testing and general finishing processes such as enamelling. The top or third floor is where practically all the instrument assembling is carried out by mechanics specialised in particular operations. A new wing to this floor, fig. 2, serves as a well-lit modernly-constructed instrument shop. It is of long and narrow construction, with the benches arranged so as to receive a maximum of natural light. The various movements, coils, coil supports, magnets, and the many other delicate parts are built up in this portion of the works. Some of the most interesting operations are the assembling of pivots, pointers, and control springs. Of outstanding interest in the work here is the assembly of the dynamometer instruments, in which a special construction of movement support is used, affording, it is claimed, a high resistance against eddy currents, &c. The work is arranged sectionally, so that each type of instrument receives entirely separate and individual attention. In the large adjoining room, fig. 1, the major parts are assembled in the cases before the movements are fitted. It is interesting to note that all sizes of instruments, varying from those with 22-in. scales down to small pocket instruments, are dealt with in the same shop. One of the most interesting

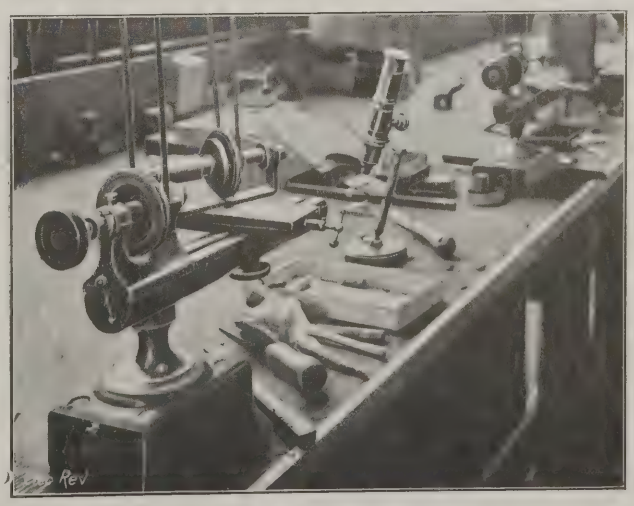


Fig. 3.—Special Pivot Grinders.

operations here is the grinding of the very small hardened-steel pivots required for many of the movements. This is done on special grinding machines,

fig. 3, designed by Messrs. Nalder Bros. & Thompson. Both the grinding wheel and the spindle are revolved in separate containers at a convenient angle of relation, the necessary observation of the point of operation being made under a microscope. These machines are



Fig. 4.—Coil-Winding Machines.

belt driven from overhead shafting. A stamped flange, which is screwed on a special lathe and receives the pivot, is clamped to the movement.

The central floor of these premises accommodates the winding, enamelling, and junior assembling de-

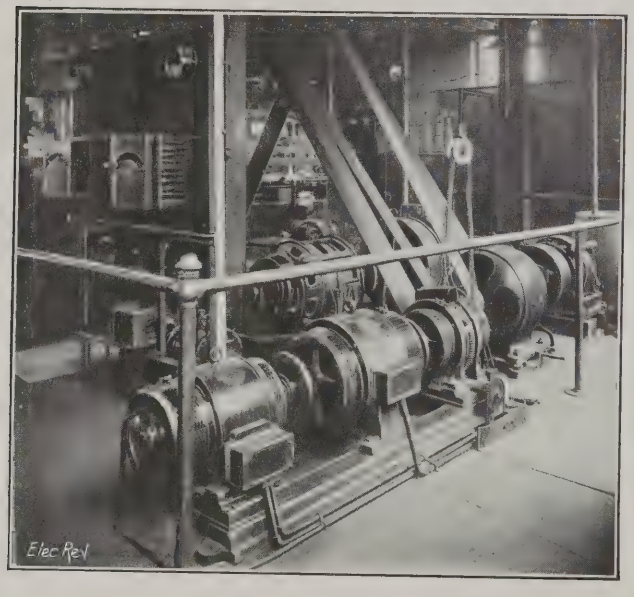


Fig. 5.—Testing Machines.

partments. Small coil-winding machines, fig. 4, driven by fractional-h.p. motors, deal with the fine-wire coils; counting gears are coupled to the spindles on which the coils are revolved. A machine for winding precision transformers with jointless-iron ring cores is a somewhat novel installation in this section. The transformer core and the "winding-off" bobbin are so revolved that one side of the continuous frame core only is wound. A compound-forcing plant is another feature: This treats coils intended for tropical countries, forcing compound between the layers and individual coils to increase the insulation and give protection against the entrance of ants. Two tanks, one vacuum and one compound, are provided; the coil, after being dried, is subjected to the hot compound under a pressure of 80 lb. per sq. in. A small winding room in which formerless coils are wound on special winding tools forms an additional portion of this department.

In any electrical instrument works the outstanding feature is undoubtedly the testing department, at any rate from the point of view of outside interest. The ground floor at the Dalton-Lane works accommodates the plant and apparatus required in this direction. It is here that the shaped tungsten-steel pieces from Kingsland Green are magnetised in coils carrying up to 1,000 A, according to the size and intensity of the magnet required. The magnets are aged by a similar method employing a.c. Sample magnets are periodically selected and kept for years under observation and test. The testing racks, which are arranged down each side of the test house, are equipped with standard cells and instruments, potentiometers and the usual testing apparatus for the calibration and standardisation of electrical instruments. A number of Kelvin balances, Siemens dynamometers, and Nalder potentiometers are used as standards, while a Crompton potentiometer provided with varying shunts of capacities up to 600 A is employed as a master standard. Tudor batteries are installed under the testing benches to provide the necessary supply for the d.c. work. The largest of these consists of six cells, each of 1,000-Ah capacity at 2 V. For the a.c. work a number of machines convert a 3-wire d.c. supply from the Hackney Electricity Department. A single-phase, 13-kW alternator supplies any frequency from 25 to 100 cycles per second to each rack by means of a series-parallel control of its field. Two small generator sets, 300 A, 15 V, are used for charging the batteries, and a 150-V generator is used for charging the special batteries for the voltmeter testing racks. A most interesting feature of the testing plant is a tandem combination, fig. 5, used to supply 3-phase energy for the calibration, &c., of power factor meters. It consists of a d.c. motor direct coupled to two alternators, one supplying current and the other creating

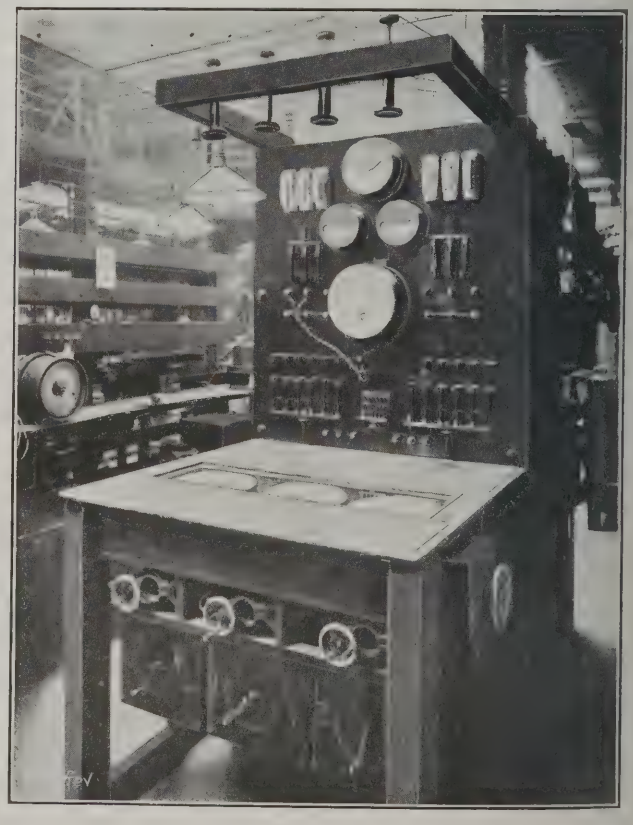


Fig. 6.—Three-Phase Testing Board.

the necessary potential difference. Both the rotors are fed from the same d.c. supply. The pressure machine has a movable stator, by means of which any phase relationship up to a total displacement of 360 deg. can be obtained. By regulating the speed of the

d.c. machine any frequency from 18 to 60 cycles per second can be obtained on the a.c. units. Each phase on the current alternator is wound with two coils, the ends of which are brought out separately to a special switchboard, fig. 6, equipped with 6-pole, 2-way switches arranged so as to give either series or parallel connections between the coils for either a star- or delta-connected 3-phase supply. The load on the machine is adjusted by means of a water resistance, which may be connected in star if desired. The stator of the pressure machine is revolved by a chain gear operated from the control board. Another machine used for the same purpose consists of a similar combination arranged vertically. A particularly interesting operation is the calibration of frequency meters. The supply frequency is calculated from the speed and design data of the machine supplying the apparatus under test; the machine speed is ascertained to a fine degree of accuracy by means of a stroboscope, the revolving disk being attached to the shaft of the supply machine. Rotary synchroscopes of the "Nalder-Lipman" pattern are tested under working conditions in conjunction with two alternators.

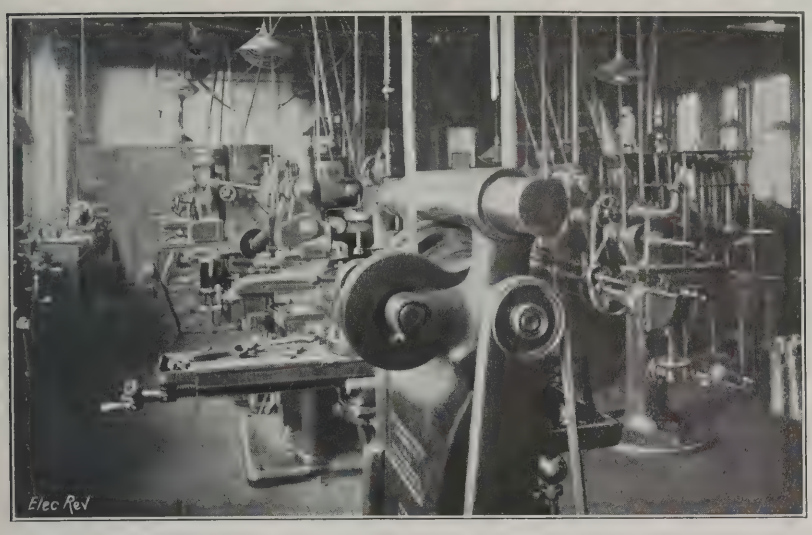


Fig. 7.—General Machine Shop.

An important and interesting section of the test room is the high-pressure section, where there is a number of "step-up" transformers of various ratings. The largest of these is a single-phase transformer of Messrs. Nalder Bros. and Thompson's own design and construction, having a maximum ratio of 110/160,000 volts, and its l.p. and h.p. windings arranged in sections, which may be readily connected in series or parallel according to the range desired, the pressure being adjusted by means of a choking coil in the l.p. circuit.

The Kingsland Green factory deals with the heavier operations necessary in the manufacture of electrical instruments and the complete manufacture of circuit breakers and heavy-current relays. On the ground floor are received the rough castings for the instrument cases and covers, which are dealt with on grinding and polishing machines. An interesting feature of this section is the shaping and hardening of the permanent magnets required for the various instruments, prior to their magnetisation in the other works. The first floor at Kingsland Green accommodates the machine shop. Here are capstan and automatic lathes, and turning, boring and milling machines of varying descriptions. Some of the automatic machines are engaged in making the very small screws, bolts, and nuts required for the instrument connections. Electric furnaces are installed for the softening of small cast-steel bars. Of particular interest in this department is the preparation of small aluminium formers required for some of the fine-wire coils for instruments and relays, &c. From stamped disks are punched cylindrical cups, reducing them to the required size in a series of operations. On a small hand-driven roller machine of the firm's own design is cut a collar of given width, and the edges of this are turned out to form small containing lips. The product is then mounted on a small expanding-core machine to receive its final shape. Shaping machines on which the metal chambers and plungers for instrument-damping apparatus are prepared, constitute another feature.

A part of the second floor is devoted to tool making; a large number of special shaping, cutting and stamping tools, used in making the ever-varying designs of instrument parts, are continually being manufactured. Some special automatic gear-cutting machines are engaged in cutting the teeth for the clock wheels required for recording instruments and time relays, &c., and also for clutches used in the generator-turning gears of testing apparatus, &c.

Fig. 7 shows a part of the general machine shop on this floor, and fig. 8 is a view of the assembly shop for the sensitive and delicate control coils for a variety of relays for definite- and inverse-time operations. The relay department is fully equipped for the manufacture and assembly of the necessary time pieces. Of particular interest in this direction is the construction of minute governors used for the speed control of the time-regulation apparatus on some of the time relays. These perfectly-constructed devices are provided with balls and straps and are hand assembled.

A third floor is equipped with some miscellaneous machinery not without interest. An engraving machine deals with the scale plates, &c., of instruments intended for use in tropical countries. The engraving is filled in with wax, after which the scales are treated in the plating department on the next or top floor, which is equipped with apparatus for nickel, copper, silver and gold finishing. The latter treatment is given to the "tropical" instruments, and the silver process is used for the fine contacts of relays, &c. It was encouraging to note at the time of our visit that the departments were fully employed, and that optimism prevailed among the staff and workpeople.

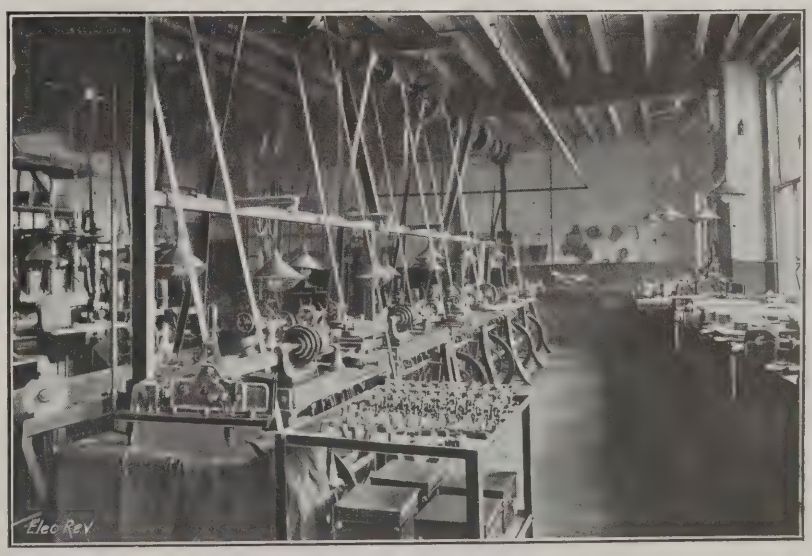


Fig. 8.—Relay-Assembly Shop.

The Birmingham Broadcasting Station.

The New Studio and Relay Automatic Telephones.

The new studio which the British Broadcasting Co., Ltd., has provided at its Birmingham radio-telephone broadcasting station, besides being the largest in this country, is of interest on account of the improvement that has been adopted for controlling echo effects. In contrast to the old method of completely draping the room so as to eliminate all echo, fig. 1 shows that one of the chief features of 5IT's new studio is ample window space, which should incidentally facilitate natural lighting and ventilation. A certain amount of echo, regulated to suit the kind of music being played, enhances the quality of transmission, and accordingly the draping has been hung on pulleys so that it may be varied at will. The area of the main studio is some 2,000 sq. ft., and since the opening of the new studio on January 20th the new control arrangements have effected quite an appreciable improvement in the quality of transmission. This is true especially of what may be termed the heavier types of transmission, in which the microphone has to deal with a volume of sound made up of many widely differing parts. The exceptionally wide floor space in the main studio has enabled a more effective distribution of the parts of a band, or choir, to be made; but as was to be expected, the large studio has been found not so suitable for speech and solo musical items as the smaller studio, from which most of the talks and some of the lighter music will be transmitted.

It is also of interest to note that the new studio and



Fig. 1.—A Corner of the Main Studio at Birmingham.



Fig. 2.—Relay Automatic Telephone Exchange at "5 I T".

office accommodation has been equipped with a Relay automatic telephone branch exchange of the latest type, as shown in fig. 2. The installation, which is initially one of 30 lines, is constructed on the expanding bookcase principle, so that additional units can be added as required. The exchange not only interconnects every department of the building, but it also establishes communication with the manual switchboard for outgoing and incoming public exchange calls. With this Relay combination service, only one telephone is used to get the automatic internal calls as well as the ordinary Post Office calls, and gives a continuous day and night automatic service throughout the Birmingham station. The Relay Co. has also received a requisition for a similar installation at the B.B. Co.'s Cardiff station.



Fig. 3.—Part of the Broadcasting Control Room.

Tramway and Railway Notes.

(*Continued from page 218.*)

Irish Free State.—DUBLIN.—According to the *Daily Telegraph*, the Dublin Borough Commissioners have sanctioned an agreement under which, in consideration of the Corporation undertaking not to exercise for 42 years its right to purchase the city portion of the Dublin United Tramways, the latter company will take over and work the Dublin and Lucan Electric Railway.

London.—MORDEN TUBE EXTENSION.—The Underground Company has placed contracts for the construction of South Wimbledon station and Collier's Wood station on the new Morden Tube extension. Of the seven stations on the line, six are now in course of erection, and it is anticipated that the line will be ready for traffic in the summer. Work has also commenced in the construction of the Tooting Broadway, Balham and Trinity Road stations, and they are scheduled to be completed in five months' time. Good progress is being made with the rest of the work. About 25 per cent. of the permanent way has been laid and the installation of signals, &c., is now in hand.

LOTS ROAD STATION.—Work is in hand to enable the Central London Tube, now dependent upon the Wood Lane power station for most of its supply of energy, to be fed entirely from the power house at Lots Road, Chelsea. The existing steam plant at Wood Lane is now obsolete and inefficient. Cables from the Lots Road station have been laid already, and in view of the different voltage of the h.p. supply on the Central London Railway, a transforming station is being installed in the Wood Lane power house, which will thus become a distributing centre for the railway. Additional plant also is being installed at Lots Road to provide for the further demand which will be made upon its output by the Central London Railway and other increased services and extensions.

TOTTENHAM COURT ROAD STATION.—The merging of the Central London and Hampstead line stations at Tottenham Court Road is approaching completion. The escalator equipment, part of which was put into service a month or so ago, has been completed, and was put in operation on February 1st. The work of demolishing the eight lifts which have hitherto served the station and the construction of the new entrance and subway leading from the site of the Central London station will not be completed until April 1st. The concourse at the foot of the main escalator, which includes the whole of the space formerly occupied by the four lifts, will, when completed, be the largest in London, providing ample accommodation for the traffic to be dealt with. The number of trains to be operated through the four platforms at Tottenham Court Road will be 1,804 per day. The cost of the improvements will exceed £100,000.

Lytham-St. Annes.—SERVICE TO BE DISCONTINUED.—The Corporation Tramways Committee has recommended the Town Council to discontinue the tramway service between Lytham Square and the hospital, and substitute motor coaches.

Newcastle-on-Tyne.—PURCHASE SCHEME REJECTED.—In connection with the Corporation's decision to purchase the Tyneside Tramways and Tramroads Co.'s undertaking for £118,000, this and other proposals were submitted to a town's meeting, and the result being unsatisfactory, a poll of the citizens was taken, which resulted in the rejection of the proposed purchase.

Telegraph and Telephone Notes.

Argentina.—TELEPHONE SERVICE.—Direct telephone communication between Bahia Blanca and Buenos Aires has lately been established. The service is a source of great satisfaction to all commercial houses, and has already proved a great saver in time.

Japan.—AUTOMATIC TELEPHONY.—The restoration of the Tokio telephone service, which was destroyed by the earthquake and fire of 1923, should be completed at the close of the financial year 1926, by which time Tokio should possess nine automatic exchanges accommodating some 36,000 lines, in addition to manual exchanges with a further 46,000 lines. The automatic equipment is being made in this country by the Automatic Telephone Manufacturing Co., of Liverpool, and will be installed by it. The associated manual equipment is being made by the Standard Telephones and Cables, Ltd., of London. Japan has followed England's lead and has adopted the Strowger director system.

Marine Radio Operators.—STRIKE SETTLEMENT TERMS.—The Ministry of Labour stated on January 28th that it had obtained from the employers proposed terms of settlement of the strike of seagoing wireless operators, and had submitted them to the Association of Wireless and Cable Telegraphists, which was considering them.

Poland.—STRIKE.—The State telegraph and telephone operators at Warsaw struck work on January 26th, demanding the reinstatement of an employé. According to *The Times*, the telephone administration declares that the non-resumption of work will be treated as a dissolution of the working contract, and that no member of the staff will be re-engaged. A *Reuter* message, dated January 28th, stated that the efforts of the Minister of Labour to mediate between the strikers and the Administration had been unsuccessful.

STATE TELEPHONE SERVICE.—Owing to the prolonged dispute between the employés and the Warsaw Telephone Co., the Government has decided to enforce the law enabling the State to take over the administration of public utility services. The Minister of the Interior has, therefore, appointed M. Urbanowicz, a lawyer, administrator for the Telephone Co., in order to assure a normal service and safeguard the interests of the shareholders and the workers. The Government has also decided to appoint a commission composed of representatives of the Ministries of Justice, Industry, and Labour, to apportion responsibility for the dislocation of the service and to settle all differences. The telephone service will be restored at once. —*Reuter* (Warsaw).

Rugby Radio Station.—PUBLIC SERVICE.—It is announced by the Post Office that on and from January 30th radiotelegrams will be accepted at any postal telegraph office for transmission to ships *via* the new wireless station at Rugby, which will enable a direct service to be offered to ocean liners and other ships fitted with continuous-wave receiving apparatus at any point on the high seas, however remote. Rugby will send daily to ships out of range of the British stations by which the regular ship and shore service is conducted, a list of the ships for which messages are in hand, indicating the order in which they will be sent. The rate will be 1s. 6d. per word.

Ship-Shore Radio Telephony.—G.W.R. TESTS.—Mr. D. B. S. Shannon recently tested what he claims to be improved apparatus for communicating by radio-telephony between a ship at sea and the shore without the use of either aerial or earth connection. The experiments were made on board one of the Great Western Railway Co.'s Channel Islands steamers; an ordinary telephone instrument was used in connection with a portable radio transmitter, and conversation is stated to have been clear over distances of from 10 to 70 miles. The ship's radio operator was able to transmit two messages with the ship's apparatus simultaneously without interference. This duplex outfit is said to consist of a 3-valve receiver and 2-valve transmitter, which can be combined in one case. The device is claimed to be specially suitable for aircraft.

Radio Notes.

Austria.—NEW STATION.—The President of the Austrian Republic, M. Hainische, inaugurated the new broadcasting station at Rosen Huegel, near Vienna, on January 30th; it is said to be one of the most powerful in Europe, and is operating on a wave-length of 500 metres.

According to *The Times*, a wave-length has been apportioned to the new station for the time being only, and is liable to be altered when the International Union at Geneva is ready to allocate new wave-lengths. In any event Vienna may possibly broadcast for some weeks to come simultaneously on two wave-lengths.

Broadcasting Committee.—FINAL PUBLIC SESSION.—The Government's Select Committee on Broadcasting held its final public session for the hearing of evidence this week in London.

Ceylon.—NEW STATION.—New transmitting plant designed for both ship to shore commercial work on i.c.w. and c.w. and broadcasting was inaugurated in December by the Governor of the island. The plant was designed by the chief engineer of the Post Office (Mr. E. Harper, M.I.E.E.) and erected by the Department. The power in the oscillatory circuit for broadcasting is 1 kW, which can be increased later as required. Excellent reports regarding the transmission have been received from places as far distant as Calcutta, India, approximately 1,000 miles distant. The broadcasting service in Ceylon is conducted by the Post and Telegraph Department.

Chile.—TWO NEW STATIONS.—The Chilean Government has granted a concession to the Compania Radio Chilena, of 30 years' duration, in conformity with the stipulations of the electric service law, and the company is therefore obliged to install two retransmitting stations in the zones which the Department of Electric Services indicates. One will be located in Concepcion, about 220 miles in a direct line south of Santiago. The entire system must be in operation by June, 1926, says *Commerce Reports*. The station at Santiago, which is to be rated at 1,500 watts, will broadcast on a 480-metre wave-length and will have the call letters CMAB. It will be permitted to broadcast four hours daily. It has been estimated that there are now 25,000 receiving sets in use throughout the Republic.

Holland. — WIRE RELAYS. — The Hague Town Council accepted on February 1st, says *The Times*, the proposal to use the ordinary telephone service as a means of broadcasting, as outlined in this column last week.

International Long-distance Tests.—TRANSATLANTIC EXPERIMENTS.—The week of international radio-telephone tests which have been conducted between England and the European Continent, on the one hand, and North and South America, on the other, do not seem to have been as successful as was expected. The pre-arranged schedule of transmission announced by the International Radiophony Bureau at Geneva was an indication of the international co-operation that has been reached, and amateur reception was relied upon to a large extent. Unfortunately, however, S.O.S. calls from ships

at sea silenced American Atlantic coast stations on two nights, while atmospherics, the Aurora Borealis (seen in France and Norway, which interfered with telegraph communication in Scandinavia) and sun spots have all been blamed. Reports from the U.S.A. indicate that experimenters seem to think that European broadcasting stations are not sufficiently powerful for more than fragmentary reception across the Atlantic Ocean. Although useful in their way, the tests serve to emphasise the fact that long-distance broadcasting is as yet unattainable as a means of entertainment.

Japan.—Stations.—According to a report by the Director of the Japanese Bureau of Telegraphs in Tokio, there are now three broadcasting stations in operation in Japan, *viz.*, at Tokio (call signal JOAK, wave-length 375 metres), Osaka (JOBK, 385 metres), and at Nagoya (JOCK, 360 metres). An experimental broadcasting station (JQOK) has also lately been established at Dairen, in Corea.

Paraguay.—Broadcasting Station Site.—A site has been awarded in the centre of Asuncion on which it is proposed to construct a large broadcasting station. The construction will be under the control of the Ministry of War and Marine, which will purchase equipment by means of public tenders. The opportunity will be taken to organise a broadcasting company under the management of the Municipality of Asuncion.—*Reuter's Trade Service* (Asuncion).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia. — Melbourne. — March 8th. City Council. Totally-enclosed armoured-type switchgear. April 27th. 2,000-kW rotary converter, and switchgear with accessories, and a.c. control gear. Specifications from City Electrical Engineer's Office.

Sydney.—February 10th. New South Wales Government Railways. 100 40-h.p. traction motors; March 3rd, 101 electric car equipments, consisting of motors, control equipments, air compressors, pantographs, &c.; April 14th, one 5-ton fixed electric crane. Forms of tender from Chief Mechanical Engineer, Wilson Street, Redfern, Sydney.

February 17th. 1,500-V, d.c. switchgear for St. Leonards and Hornsby sub-stations; March 3rd, 11,000-V ironclad switchgear for St. Leonards sub-station; March 10th, stokers or pulverised fuel equipment for three water-tube boilers for White Bay power house. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

Municipal Council. February 15th. Twenty transformer tanks. February 8th. L.p. cables. Specifications from the Construction Engineer, Electricity Department, Town Hall, Sydney.

March 2nd. Australian Gas Light Co. One 750-kW turbo-generating set. Specifications from the Engineer, Parker Street, Haymarket, Sydney.

Aylesbury.—February 16th. Electricity Department. Overhead 11,000-V transmission lines and cables. (January 22nd.)

Bedwas.—February 11th. Bedwas and Machen U.D.C. Electricity Department. H.p. transmission line, l.p. distribution. h.p. and l.p. switchgear and static transformers. (January 29th.)

Belfast. — February 20th. Electricity Department. Twelve months' supply of stores, &c., including electrical accessories, lamps, carbon brushes, electricity meters, &c. (January 29th.)

Cardiff. — February 22nd. Electricity Department. Twelve months' supply of paper-insulated cables, one 1,500-kW rotary converter, and one 2,000-kW ditto.

March 8th. One 10,000-kW turbo-alternator and condensing plant. (See this issue.)

Chesterfield.—February 13th. Electricity Department. One 1,000-kW rotary converter equipment. (January 29th.)

Clitheroe.—February 23rd. Corporation. Transformers, switchgear, and cable connections for sub-station; e.h.p. and l.p. cables, boxes, &c. (January 15th.)

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or, alternatively, one 20,000-kW turbo-alternator with condensing plant. (See this issue.)

Faversham.—February 12th. Electricity Department. Cables. (January 29th.)

Halifax.—February 20th. Markets and Parks Committee. Electrical engineering work in connection with the erection of the public abattoirs. Particulars from Borough Engineer, Crossley Street.

Hull.—February 15th. Tramways Committee. Stores required during year ending March 31st, 1927, including car-lighting fittings, lamps, cable, and switches. Form of tender, &c., from General Manager, Tramways Offices, Albion Street, Hull.

Kilmarnock. — Ayrshire Electricity Board. Supply, delivery, and laying of h.p. cables and ducts in the Burghs of Ayr and Prestwick, also transformer kiosks and section pillars. (January 22nd.)

London.—Hammersmith.—February 10th. Electricity Department. Stores for 12 months, including electric light sundries, insulated wire, joint boxes, meters, l.p. cables, &c. (January 22nd.)

Islington.—February 8th. Electricity Department. One 10,000-kW, 3-phase turbo-alternator, condensing plant, condensate, circulating, exhaust, steam and water pipes, &c. (January 22nd.)

Metropolitan Water Board.—February 8th. 12 months' supply of electric lamps. Forms of tender from the Chief Engineer, 173, Rosebery Avenue, E.C.1.

London County Council.—February 22nd. H.p. switchgear for Lewisham tramway sub-station. (January 22nd.)

St. Pancras.—March 2nd. Electricity Department. E.h.p. switchgear at the Grafton Road sub-station. (See this issue.)

Manchester.—February 16th. Tramways Committee. Permanent-way points, tongues and crossings and general stores. Schedules from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

Newark-upon-Trent.—February 10th. Electricity Department. E.h.p., medium, and l.p. mains and distribution network, with street-lighting mains and accessories, single- and three-phase house-service pattern meters, two 250-kVA transformers, e.h.p., 11,000-V switchgear. (January 22nd.)

March 1st. Corporation. Two electrically-driven centrifugal pumps. (See this issue.)

New Zealand.—Wellington.—Public Works Department. April 6th. Storage battery, motor generator, and switchboard for the Penrose sub-station.*

March 23rd. Five oil filters, 5 oil-testing equipments, and 5 filter-paper drying ovens.* 22,000-V switchgear and equipment for Penrose sub-station.*

Northern Ireland.—Belfast.—February 8th. London, Midland & Scottish Railway Co. (Northern Counties Committee, Ireland). Stores required during 12 months. Particulars from Mr. F. J. Martin, Stores Superintendent, York Road station, Belfast.

Perth.—February 17th. Corporation. Electric lighting installation at 84 houses. Plans from Burgh Surveyor.

Plymouth. — February 17th. Electricity Department. Twelve months' supply of electricity meters, cables and transformers. (January 29th.)

Retford.—February 19th. East Retford Gas, Water and Electricity Department. Electricity generating plant, mains, transformers, and meters. (January 22nd.)

Salford.—February 18th. Electricity Department. Coal supplies required during six months commencing March 1st, 1926. Particulars from Borough Electrical Engineer, Frederick Road, Salford.

South Africa.—Johannesburg.—February 25th. Municipal Council. Four d.c. switchgear panels and 3-phase, truck-type ironclad switchgear panels.*

February 25th. S.A. Railways and Harbours. Two 4-ton electrically-driven fixed wharf cranes for Luderitz jetty.*

One 7-ton and five 4-ton electrically-driven portal cranes, complete.*

Pretoria.—February 25th. Postmaster-General's Department. Supply of a manual telephone exchange for Hatfield, Pretoria. Controller of P.O. Stores, Pretoria.

February 25th. Union Tender Board. Miscellaneous telegraph and telephone materials (C×1880).*

Spain.—Ministro de Fomento. Four electric cranes for the port of Gijon Musel. Particulars from Ilmo. Señor Presidente de la Junta de Obras del Puerto de Gijon.—*Reuter's Trade Service* (Madrid).

Stockton-on-Tees and Thornaby.—February 6th. Joint Tramways Committee. Pinions, axle boxes, &c. Particulars from General Manager, Bridge Road offices, Stockton-on-Tees.

Sutton Coldfield.—February 17th. Electricity Department. E.h.p. underground main, rotary converting plant and switchgear and automatic rotary converting plant and switchgear, or mercury-arc rectifiers. (See this issue.)

Watford.—February 23rd. Board of Guardians. Electric lighting installation, consisting of wiring old buildings, new power mains, motors, main switchboard, &c. Specifications from the Master's office, 60, Vicarage Road, Watford, or from the consulting engineer, Mr. W. M. Benny, 39, Carlton Road, Putney, S.W.15.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Admiralty.—
Gasfilled and vacuum lamps.—Edison Swan Electric Co., Ltd.; and Metro-Vick Supplies, Ltd.

Barking Town.—Electricity Committee. Accepted:—
Crane at transformer house (£117).—Herbert Morriss, Ltd.

Brighton.—Lighting Committee. Accepted:—
Cast-iron tubes and specials for condensing system at Southwick (£790).—Stanton Ironworks, Ltd.
Cable (£4,695).—Macintosh Cable Co., Ltd.
Steel bar work for coal plant (£566).—Indented Bar & Concrete Engineering Co., Ltd.
80-h.p. motor (£340).—Metropolitan-Vickers Electrical Co., Ltd.
Circulating pump (£288).—W. H. Allen, Sons & Co., Ltd.
Switchgear (£74).—Brookhirst Switchgear, Ltd.
Reconditioning battery (£222).—Tudor Accumulator Co., Ltd.

Chile.—The City of Santiago having accepted the specification for "Holophane" refractors for street lighting, the contractors for the installation (the International General Electric Co.) have placed an order for 10,000 refractors with Holophane, Ltd., of London.

Eastbourne.—Electricity Committee. Accepted:—
Cable (£6,290).—Craigpark Electric Cable Co., Ltd.

Hebden Bridge.—Education Committee. Accepted:—
Installation of electric lighting in board room and offices, Pitt Street.—G. A. Cotton.

Kidderminster.—Committee of Management, Kidderminster and District General Hospital. Accepted:—
Installing electric light in the new building.—B. French.

London.—LONDON COUNTY COUNCIL.—Accepted:—
2,000-kW rotary converter for the Elephant sub-station (£7,134).—British Thomson-Houston Co., Ltd.
Wiring and fitting houses at East Hill housing estate (£1,083).—Smethurst and Co. (London), Ltd.

Sheffield.—Electricity Supply Committee. Accepted:—
10,000-kW turbo-alternator (£30,051).—C. A. Parsons & Co., Ltd.
26 h.p. switchgear panels and 6 h.p. sub-station panels (£5,600).—A. Reyrolle & Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—
Spare rotor (£2,752).—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear (£3,870).—A. Reyrolle & Co., Ltd.
Control gear, &c. (£3,801).—South African General Electric Co., Ltd.
300-amp. Edison battery (£420).; 375-amp. ditto (£533).—Associated Engineers Co., Ltd.
Two 3-phase regulators (£470).—South African General Electric Co., Ltd.
Motor pump and tank (£188).—Drysdale & Co., Ltd.
Three sets single-phase regulators (£377 per set).—South African General Electric Co., Ltd.

Worthing.—Electricity Committee. Accepted:—
H. and l.p. cables (£10,266).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, February 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Question and discussion evening.
Friday, February 12th. Lecture on "A Visit to Some Power Stations in the U.S.A. in 1925," by Mr. W. H. Patchell.
Saturday, February 13th. At Holborn Hall. From 7.30 to 11 p.m. Annual dance.

Association of Engineering and Shipbuilding Draughtsmen (Birmingham Section).—Wednesday, February 10th. At the Chamber of Commerce, Birmingham. At 7.30 p.m. Lecture on "E.h.p. Switchgear," by Mr. G. L. E. Metz.

Institution of Heating and Ventilating Engineers.—Wednesday, February 10th. At the Holborn Restaurant. At 2.30 p.m. Annual general meeting. Paper on "Engineering Services in Hospitals and Asylums," by Mr. H. G. Cathcart. 7 p.m. Annual dinner.

Institution of Electrical Engineers.—Thursday, February 11th. At the Hotel Cecil, Strand, W.C.2. At 7 for 7.30 p.m. Annual dinner.
Monday, February 8th. At 7 p.m. Informal meeting. Discussion on "Modern Applications of Ball and Roller Bearings," to be opened by Mr. R. J. Mitchell.
(North-Eastern Centre).—Monday, February 8th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "An All-Electric House," by Prof. S. P. Smith.
(North-Midland Centre).—Tuesday, February 9th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Informal discussion on "How Can the Cost of Electrical Distribution be Cheapened?"
(Scottish Centre).—Tuesday, February 9th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "An All-Electric House," by Dr. S. P. Smith.
(South-Midland Centre).—Friday, February 12th. At the City Council Chamber, Birmingham. At 7 p.m. Joint meeting with the Civil and Mechanical Engineers. Address on "Road Transport and its Possible Developments." Speaker for I.E.E., Mr. C. O. Silvers.
(Dundee Sub-Centre).—Thursday, February 11th. At the University College, Dundee. At 7.30 p.m. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.
(East-Midland Sub-Centre).—Tuesday, February 9th. At the College, Loughborough. At 6.45 p.m. Paper on "The Constants of an Electric Circuit," by Mr. R. C. Clinker.
(North-Western Centre, Students' Section).—Tuesday, February 9th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Joint debate with the N.W. Graduate Centre of the Institution of Mechanical Engineers.

Institution of Engineering Inspection.—Friday, February 12th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Application of Special Cast Irons in the Engineering Industry," by Mr. S. E. Dawson.

Electrical Engineers' Ball.—Friday, February 12th. At the Hotel Cecil, Strand, W.C.

British Electrical and Allied Industries Electrical Research Association.—Friday, February 12th. At the Savoy Hotel, Strand, W.C. At 1 p.m. Annual meeting.

Electrical Trades Commercial Travellers' Association.—Saturday, February 13th. At the Manchester Hotel, E.C. 6.30 for 7 p.m. First annual dinner.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

MAGNOLLIUM sheets (a magnesium alloy).

A recently-patented British ironing machine for laundries.

TUNGSTEN arc lamp.

Notes.

The Electrical Arrangements at the British Industries Fair, Birmingham.—We have received, at the moment of going to press, a full programme of the events which will take place during the run of the Fair at Birmingham from February 15th to 26th. We shall publish this in our next issue, but we may state now that everything points to the Electrical Section being a great success. Some seventy electrical firms are preparing exhibits. One of the principal items in the programme is the visit on Wednesday, February 17th, of members of the Incorporated Municipal Electrical Association and other representative associations connected with the electrical industry. An official inspection of the Fair will take place, and the company will lunch together. The Electrical Contractors will pay an official visit on February 22nd, the Electrical Association for Women on February 23rd, and the Electrical Wholesalers' Federation on February 24th.

The Electrical Association for Women.—A course of six evening lectures of a practical and informative nature has been arranged specially for women working in the electrical industry as saleswomen, demonstrators, &c., and for domestic science mistresses and lecturers. The lectures are to be held at the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, W.C.2, at 7 o'clock on the following evenings:—February 9th, 15th and 22nd, and March 1st, 8th and 15th. The lecturers will include Mr. J. W. Beauchamp, director of the E.D.A., Mr. W. E. Bush, manager of the Lighting Service Bureau, and Miss Hodge. The course is free to members of the E.A.W., and for non-members the fee is 7s. 6d. for the course and 2s. for single lectures.

The Electro-Harmonic Society.—PRESENTATION TO MR. W. E. LANE.—On Wednesday last week, a meeting of the subscribers to a testimonial to Mr. W. E. Lane was held at the Institution of Electrical Engineers under the chairmanship of Sir George Sutton, Bart. Opening the proceedings, Sir George read letters of apology from a number of distinguished members of the Society who were prevented from attending. The hon. treasurer of the Testimonial Fund, Mr. J. E. Kingsbury, said that subscriptions ranging from five guineas to five shillings had been received, making a total of £87 18s.; many of the members also wrote letters expressing their pleasure in subscribing. Delay in holding the meeting had arisen from the illness of Mr. Lane last year, and also from his own illness. Mr. Lane had chosen that the testimonial should take the form of a cabinet and a wireless receiving set.

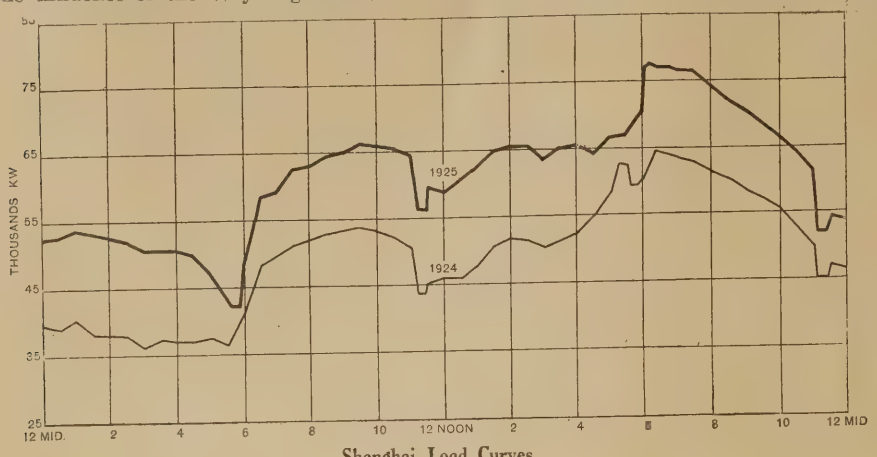
Sir George Sutton then addressed the meeting, expressing high appreciation of the services rendered by Mr. Lane to the Electro-Harmonic Society, and of the sterling qualities which he had displayed. Founded in 1886, the Society had filled a not unimportant place in the electrical industry. As one of the oldest members, he recalled some of the early days of the Society, when the meetings were held in the banqueting room of St. James's Hall in Regent Street; everybody knew everybody else then, for the industry was small compared with what it was to-day. They delighted in their own members' contributions—those of Alfred Izard and T. E. Gatehouse. Mr. Kingsbury was also a practical musician, and the other member of the "big four" was Mr. Henry Alabaster, who took charge of the business side. After twenty years had passed in the life of the Society a meeting was held, when Colonel Crompton made presentations to Messrs. Alabaster, Gatehouse, and Izard; now another twenty years had passed, and they were writing "finis" to its record. He thought it should not be beyond the ability of the younger generation to form a new society to look after the social side of the industry as the Electro-Harmonic Society had done. In 1901, twenty-five years ago, Mr. Lane became the honorary secretary; on behalf of the Society Sir George expressed the warmest appreciation of his long services, and he hoped the happiness which he had reaped was measured by the happiness of the members in being in contact with him. He was specially glad that a wireless set formed part of the presentation; Mr. Lane would sit and smoke and listen, and his thoughts would go back to the old days—to the violin of Gatehouse, the piano of Izard, and the companionship of his other old friends.

Mr. W. E. Lane said he could not believe that he deserved such a recognition; he had considered it an honour and privilege to serve the electrical community by carrying on the work which was begun by much abler men. Such success as had attended his efforts was due largely to the assistance and advice which he received from the committee and the executive committee, in which so many men of the highest eminence in the profession were enrolled. He was proud to feel that after nearly twenty-five years of continuous work he had gained their approval and esteem. To Messrs. Alabaster and Gatehouse he owed an immense debt of gratitude; they were his guides, philosophers and friends. Mr. Alabaster's great ability had made his work an easy task, and he was like a father to him: long might he live to enjoy the evening of his days. Mr. Gatehouse, unfortunately, had passed on; he was a man of high principles, brave, generous and genial, and keenly alive to the humorous. He was now in the Elysian Fields, and he hoped he was turning a benignant and approving eye on this gathering of his old friends and comrades. The mahogany cabinet was specially designed and built as part of his new house; and the wireless set was giving Mrs. Lane and himself infinite pleasure. Nothing could be more appropriate, and he

was deeply grateful for them. The Society was in a state of suspended animation, but its roots were alive, and the organisation was still available in London.

Mr. Sillar moved a vote of thanks to the Chairman, which Sir George briefly acknowledged.

Shanghai Electricity Undertaking Development.—We have received from the engineer-in-chief and manager of the Shanghai Electricity Department the load curves of the Riverside power station for December 29th, 1924, and the same day in 1925, which are reproduced herewith. Some idea of the influence of the very large industrial load on the station



Shanghai Load Curves.

can be gained from the curves. In addition to the lighting supply there is a very substantial heating load estimated at about 4,000 kW, but these two loads superimposed on the power load do not create a peak of any serious dimensions. It is interesting to note that the total kWh generated on the day of the 1925 curve amounted to 1,525,060, against 1,197,210 for the day of the curve for the previous year.

Old Liverpool University Students in London.—The second annual dinner of the Liverpool University London Society was held at the Florence Restaurant on Saturday, January 23rd, Prof. Reilly (Roscoe Professor of Architecture) presiding. Representatives of the University of Birmingham Guild of Graduates (London Branch) were present, and expressed a desire to run social events in co-operation with the L.U.L.S. The secretary, Mr. Harold Lloyd, 16, Blackheath Park, S.E.3, would be glad to hear from old Liverpool University students with a view to enlisting their co-operation.

Appointments Vacant.—Shift charge engineer for the Stafford Corporation Electricity Works. Electrical foreman (400 Rs. per month) for the South Indian Railway Co., Ltd. Two charge shift engineers (£376 and £292) for the Yorkshire Electric Power Co. Charge engineer for the North Met. Electric Power Supply Co. (See our advertisement pages to-day.)

Educational.—East London College.—Dr. R. L. Smith-Rose is delivering a course of six lectures (on Mondays at 6 p.m., commencing February 1st), on "Wireless Direction-finding in Theory and Practice" in the Electrical Engineering Department of the East London College (University of London). The fee for the course is 10s. 6d., but students of the engineering faculties of the colleges and institutions of the University of London can obtain free admission tickets on application. The lectures will be illustrated with lantern slides and will include experimental demonstrations.

Edinburgh.—The Edinburgh University Court has approved of a recommendation by the Senatus that an honours half course in the mathematical theory of electricity should be instituted.

The Opening of Parliament.—The King opened Parliament on Tuesday last, and in the course of his speech touched on a number of matters with which Parliament will deal during the new session. Among these was a statement that invitations were being issued to the Governments of France, Belgium, Germany, and Italy to take part in a conference upon hours of labour in industry; a mention of the industrial revival which was being threatened by industrial troubles was made; the Government's electricity proposals received a passing mention; and among the other new measures forecast were those dealing with rating and the valuation of machinery in Scotland, national health and unemployment insurance, and the control of road vehicles.

Fatality.—An employé of the Leicester Corporation Electricity Department, Andrew Minto, 21, was killed at the Aylestone generating station on January 27th, another man narrowly escaping death. Minto and his companion both received shocks which rendered them unconscious. Minto was conveyed to the Royal Infirmary, but on arrival there was found to be dead. Artificial respiration was resorted to, with successful results, in the case of his workmate. The two men were engaged in working an electric drill at the Corporation power station.

An inquest was held at Hampstead on February 1st on Mrs. M. Kleeman, who was found dead in a bath. When Mrs. Kleeman was discovered a pair of slippers were alight beside the electric radiator in the bathroom. Mr. J. Leadbeater, electrical engineer to the Borough Council, said the stove showed signs of overheating and was fused. He was of opinion that the slippers burned off some of the insulation from the wire and allowed the metal frame to become electrified.

Television.—Mr. J. L. Baird claims, according to the daily Press, to have invented apparatus which makes both wire and "wireless" television possible. He is reported to have said: "I do not transmit photographs, or want to; that has been done long ago. I transmit whatever comes before the transmitting end of my apparatus, its movement and form, with full detail. Television stands in the same relation to movement as broadcasting does to sound." Application is said to have been lodged with the Postmaster-General for permission to establish "television broadcasting stations in different parts of the country," and it is stated that a company has been formed to market the receiving devices, or "televisors." Such claims must be treated with caution, but it seems that the inventor's theory is to project an image of the object to be transmitted in a piecemeal fashion upon a light-sensitive appliance by means of a multitude of lenses which rotate in such a manner as to focus each momentarily on one part only of the object to be transmitted; owing to the retentivity of vision the successive "area" images appear simultaneously to the eye when thrown on to a ground-glass screen. The light-sensitive device must respond instantaneously to very small quantities of light, and it is declared that the face can be "clearly transmitted, not as a mere black and white effect, but with graduations of light and shade, and the detailed features are readily recognisable at the receiver; all movement is faithfully portrayed."

The Batti-Wallahs' Society.—On Wednesday last week Sir Hugo Hirst was the guest of the Batti-Wallahs' Society, at a luncheon held at the Hotel Cecil. Invited to address the gathering by the President, Mr. Pooley, Sir Hugo said much publicity had been given to his views regarding the conception of the scheme outlined by the Prime Minister, but he reserved the right to criticise it when the actual scheme was put forward. The idea of developing electricity on a more suitable basis than had obtained during the past 30 years was very welcome; in future it would be national rather than parochial, but they must use all their experience and judgment in formulating helpful criticism, so that they would go right this time. Soon after the War he had stated that the damage done by the War could only be finally repaired if this country adopted a policy of cheap electricity supply; he was not thinking of 60 super-stations, but that they had endless sources of waste power which they ought to utilise. The coal situation should be cleared up first; there was plenty of material available to satisfy both owners and miners, and in his opinion it was not likely that there would be a strike. With the assistance of a great mine owner, a working miner, and a financial authority, he had made a very careful study of the position, and he thought that the subsidy could not be stopped in the case of pits where it was otherwise impossible to pay the miners' minimum wage; the hours of work here differed but little from those worked abroad, but some miners took 40 minutes walking to their work, and by the adoption of electric haulage underground they could save 20 minutes each way and thus obtain a greater output. The State should acquire the royalties and pay for them by annuities; afterwards the royalties should be regulated in accordance with the thickness of the seams. The demand for payment for way-leaves underground was mere blackmail. The immobility of labour should be remedied; at present in some places miners were unemployed, whilst in other districts they were unobtainable, though work was available for them. There was no system of storing coal except in private ownership, and this should be put right. He believed that the coal industry could be reorganised on a paying basis, and that no one need give up anything, nor need there be any charge on the State. The fundamental mistake was that they had not made half enough use of electricity in their mines. Sir Hugo held that the mines should be organised in groups; a central power station should be erected for each group, and electrical haulage, coal-cutters, and other electrical equipment should be used in the mines. The coal should be properly cleaned before distribution, and the rubbish that was discarded should be burnt in the boiler furnaces. It was estimated that from this waste material every group could send 25,000 kW at least into the national network. They should extract all the by-products, and produce electricity at less than ¼d a unit as a surplus product. In addition to this waste fuel they should use blast-furnace gases and all other sources of waste heat. Unless they made use of their advantages in this respect they could not get cheap power—certainly it could not be done by erecting big super-stations all over the country. Cheap electricity would give them the all-electric age; they must all work with one common aim, but they must see that they had the right kind of electricity scheme.

Coal and electricity must be combined, but he hoped it would never be done under a scheme of nationalisation.

Proposing a vote of thanks to the speaker, Mr. G. W. Partridge commended the broadminded way in which Sir Hugo had approached the question, and said he hoped that those in authority would be equally broadminded and business-like. He entirely agreed with Sir Hugo as to the recovery of by-products and the grouping of mines, provided that it did not mean nationalisation. He agreed also that the desired cheap supply was not obtainable by erecting power stations all over the country. Sir Hugo had shown extreme knowledge of the subject and had adopted a common-sense view.

A 3,280-h.p. Electric Locomotive.—The Brown-Boveri Co., of Baden, Switzerland, has recently delivered the first of two powerful electric locomotives to the Paris-Orleans Railway Co. for use on the electrified section of its line between Paris and Brive, a distance of 330 miles. It is claimed that the engines, which have a rating of 3,800 h.p. and can attain a maximum speed of 87½ m.p.h., are the most powerful so far built in Europe. The following are the chief characteristics of the engines, which are designed to utilise d.c. at 1,500 volts:—Maximum tractive capacity at wheel rims, 21 tons 12 cwt.; normal ditto, 14 tons; weight of mechanical portion, 75 tons; weight of electrical equipment, 43.6 tons; number of electric motors, four; hourly capacity per motor at 1,350 volts, 950 h.p. at 510 r.p.m.=41 m.p.h.; hourly capacity per motor at 1,500 volts, 1,050 h.p. at 565 r.p.m.=45 m.p.h.; continuous output per motor at 1,350 V, 790 h.p. at 555 r.p.m.=44.7 m.p.h.; continuous output per motor at 1,500 V, 875 h.p. at 615 r.p.m.=49 m.p.h.; driving wheel diameter, 5 ft. 9 in.; gear ratio of drive, 1—2.55; overall length between buffers, 58 ft. 2 in. The machine, which is slightly conical in outline, has four pairs of centrally located driving wheels and a four-wheel bogie at the front and rear. Each pair of driven wheels is separately driven on the Buchli system, while the bogie design is that of the Swiss Locomotive and Engineering Works, of Winterthur, which was responsible for the mechanical portion of the engines. Each of the motors is provided with a fan for cooling purposes, and centrally located in the motor compartment is a main grouping switch by means of which the motors can be grouped either in series, partly series-parallel, or in parallel. The starting resistances are mounted on the roof of the engine. The engines are arranged to be driven from either end, and as they are intended to be used on both overhead and third-rail sections of the Paris-Orleans railway, they are provided both with two pantograph-type trolley arms and sliding shoes, the latter being mounted on wooden carriers supported on the front and rear bogies.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETING.—At the informal meeting on January 25th Mr. C. Lipman was in the chair, when Mr. H. W. Clothier opened a discussion on "Impressions of my Visit to America, mainly about Switchgear." He used a number of lantern slides to show large power stations, machines, control gear, distribution lines, &c., and said:—

"My salient impression of Canada and the United States is the largeness of the demand and consequent development of large plant. The degree of comfort in living seems to be gauged by the quantity of electrical appliances to be found in the homes. There is no scarcity of information about the public service: each undertaking issues a plentiful supply of literature. This progressive spirit creates plant which appears very large when compared with our own. Thirty or forty thousand kW turbines, which are exceptional to us, are common to them; fifty to sixty thousand kW sets are numerous; a seventy-five thousand kW steam set is on order, and a 100,000-kW design is contemplated. At Chippawa, the Hydro-Electric Commission of Ontario, the largest power station I saw, had eight 50,000-kW sets, and there is room for another, making altogether 450,000 kW in one building. Steam power stations of 250,000 kW are common, and future schemes include stations of 600,000 kW.

"On one system there are about 100 stations operating in a densely loaded area, and 30 to 40 men were engaged solely on routine examination and cleaning. In the regular quarterly round every important circuit breaker is disconnected, overhauled, cleaned, lubricated, checked, and put into service.

"How many of our undertakings have gangs of experienced fitters regularly going round to overhaul the switchgear? Supposing they were introduced, would they not in time tend to become mechanical time servers, making jobs, possibly creating accidents? My own view is that switchgear should be made sound in the first instance, with all vital parts covered up, with bolts, cotters, &c., that will not loosen, bearings that cannot rust up or jam, and then it is best left alone, just as a cable and underground joints are left.

"As a further precaution against insulation failure, users install apparatus with a greater safety factor; in important situations, at least, the installed switchgear voltage rating is higher than the normal working voltages, for instance, one finds 25,000-volt switchgear in use in power stations working at 13,500 volts. Motor-operated induction regulators are used on the 2,300/4,000-volt radial feeders, and automatic re-close circuit breakers restore the circuit automatically. A special relay is used to prevent re-closing on a bad short circuit, but otherwise the breaker would close twice and then lock out; 50 per cent. of the faults are cleared at the first shot, 25 per cent. at the second, and the remainder locked out, the time interval increasing successively; for example, 5 seconds, 20 seconds, and 40 seconds.

"It is apparent that circuit breaker design is not yet stabilised, but most breakers of from 750,000 to 1,500,000 kVA breaking capacity are enclosed in steel tanks which are grounded. Sundry features indicate an endeavour to increase the breaking capacity of circuit breakers. We think of the diversity of designs in use at home, but of 10 large stations no two were exactly alike in respect to circuit breaker construction.

"Coming from the Tyneside, where the lighting is reasonably steady, where there are practically no reactances, and where the network is all solid, one cannot help speculating to what extent American engineers have been forced to the extensive use of regulators and their accompanying complication of switching and regulating, by the greater use of reactances and the system of radial feeders. It was said at one place that without the regulators they could not guarantee the voltage at consumers' terminals within 12½ per cent."

Mr. H. Trencham, Mr. A. F. Harmer, Mr. Ferguson, and Messrs. R. C. Anderson, G. M. Davies, M. D. Hart, D. Kingsbury, and C. Lipman and Lt.-Col. K. Edgcumbe also spoke.

Junior Institution of Engineers.—Mr. F. Forrest, assistant city electrical engineer of Birmingham, speaking on Friday last at the annual dinner of the Midland Section of the Junior Institution, observed that the members would be particularly interested in the Government's electricity scheme, because the Birmingham supply was of a non-standard frequency. If, as they anticipated, 50 cycles was to be the standard, the whole of their plant had to be scrapped, a matter of enormous expense for the city. It was undoubtedly a great pity that the subject had become a political one.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The marriage took place at Accrington, recently, of Miss GLADYS HORROCKS, elder daughter of Mr. T. Horrocks, of Accrington, and M. ALBERT L. J. JOLY, who is employed at the Paris City Council electrical power station.

Mr. J. B. WOODYATT has been appointed president of the Southern Canada Power Co., in succession to the late Mr. W. C. Hawkins. He will continue to act as general manager of the company.

We regret to learn that Mr. J. V. MOINET, burgh electrical engineer, Hamilton, is seriously ill.

Mr. S. O. ALLEN, telephone traffic superintendent, of the Southampton district, who is leaving to become district manager of the Mid-Lancashire district, has been presented by the staff with a wireless set, and his wife with some plate.

After a service of almost 21 years with Newcastle-on-Tyne Corporation, Mr. ERNEST HATTON, engineer and general manager of the city tramway system, has tendered his notice to the Corporation Transport and Electricity Committee. He has been in poor health for nearly a year.

Mr. A. EBBINGTON, assistant works manager to Marconi's Wireless Telegraph Co., Ltd., of Chelmsford, who is leaving after 19 years' service, has been presented by the staff with a silver salver and a silver cigarette box.

Last week the staff of the District Manager's Office, N.W. Telephone District, entertained Mr. WHITELAW, district manager, to dinner, prior to his transfer to the district managership at Manchester. He was presented by the staff with a gold wristlet watch; and Mrs. Whitelaw with a case of fish eaters.

Mr. G. C. DEELEY, of the Southport electricity station, has resigned. His successor will be Mr. ALFRED E. KNIGHT, of Great Yarmouth.

Mr. G. F. HARE has relinquished his connection with Messrs. David Shanks & Co., Ltd., and has joined Messrs. Smith and Ansell, Ltd., of Birmingham.

Sheffield Electricity Committee has appointed Mr. S. R. BAINBRIDGE as assistant mains engineer at a salary of £319 per annum.

The Macintosh Cable Co., Ltd., announce that Mr. C. H. HAMPSON has just been appointed their sales manager.

Mr. W. J. COTTERELL, M.I.Mech.E., was to sail for South Africa on January 29th, by the *Walmer Castle*, in connection with the important contract recently awarded to International Combustion, Ltd., by the South African Electricity Commissioners for the power station at Congella, Durban. Communications may be addressed to him, c/o Dowson and Dobson, Johannesburg.

Mr. WILLIAM BLOGG, lately sales manager of the Sterling Telephone & Electric Co., Ltd., has now joined Messrs. Alfred Graham & Co., and shortly will be leaving this country for a business tour in the East and Australasia. Any communications addressed to St. Andrew's Works, Crofton Park, London, S.E.4, will be forwarded to Mr. Blogg.

The marriage of Major G. C. MILNES, M.C., M.I.E.E., borough electrical engineer of Lancaster, to Rosie, second daughter of Mr. and Mrs. W. French, of Windsor, was the occasion of an interesting ceremony on January 26th, when Major Milnes was presented with an oak revolving bookcase and rose bowl, subscribed to by the whole of the employés of the Corporation Electricity Department.

Obituary.—MR. D. MCCOLL.—The death occurred at Seaford, Sussex, on January 20th, of Mr. Donald McColl, formerly manager of the Shanghai Tramways. He was 52 years of age.

MR. G. H. PEARSON.—The death occurred recently of Mr. G. H. Pearson, traffic manager of the Canadian Marconi Co., Ltd., Montreal.

MR. W. H. DORMAN.—We regret to record the death of Mr. W. H. Dorman, founder of the firm of W. H. Dorman & Co., Ltd., engineers, Stafford. He was 93 years of age. After practising for some time as a consulting engineer in London, he spent some years in Sweden. He commenced business in Stafford half a century ago in partnership with Mr. W. Walker. Later the business was converted into a limited company.

MR. E. B. TURNER.—We regret to record that Mr. E. B. Turner, principal of the firm of Turner Bros., 134, Upper Thames Street, London, E.C., has passed away.

MR. JOHN STEPHENS.—We regret to learn that Mr. John Stephens, director and founder of the firm of Stephens, Smith and Co., Ltd., electrical engineers, Millwall, passed away on February 2nd at 47, Grosvenor Road, Ilford, at the age of 81 years.

MR. J. D. BAILIE.—We regret to learn that Mr. J. D. Bailie, the honorary secretary of the North Midland Centre of the Institution of Electrical Engineers, passed away on January 6th. Colonel H. C. Fraser, 36, Park Place, Leeds, has been appointed secretary in his place.

New Companies Registered.

Essex Radio (Ilford), Ltd. (211,225).—Private company. Registered January 21st. Capital, £50 in £1 shares. Objects: To acquire the wireless and any allied business now carried on by H. C. Cooksey and C. N. Godwin at 123, Ley Street, Ilford, as the "Essex Radio." The first directors are:—H. C. Cooksey, 14, Glencoe Avenue, Seven Kings, Essex; C. N. Godwin, 14, Glencoe Avenue, Seven Kings, Essex. Qualification, 1 share. Secretary: H. C. Cooksey. Solicitor: J. Elborne, 1 and 3, Cranbrook Road, Ilford, Essex. Registered office: 123, Ley Street, Ilford, Essex.

Bower Electric (1926), Ltd. (211,303).—Private company. Registered January 25th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical engineers, manufacturers of, and dealers in electrical, wireless, scientific and other apparatus, &c. The subscribers (each with 1 share) are:—J. R. Hudson, 2 and 3, Philpot Lane, E.C.3, solicitor; A. W. I. Mock, 2 and 3, Philpot Lane, E.C.3, clerk. The subscribers are to appoint the first directors. Secretary: D. H. Pisano. Solicitors: Abbott & Hudson, 2 and 3, Philpot Lane, E.C.3. Registered office: 15, Grape Street, Shaftesbury Avenue, W.C.2.

L. Weekes (Luton), Ltd. (211,327).—Private company. Registered January 26th. Capital, £6,000 in £1 shares. Objects:—To acquire the business of electric fuse manufacturers, electric switch manufacturers and general engineers carried on as "L. Weekes, Ltd.," at Langley Street, Luton. The subscribers (each with one share) are:—T. H. Dryden, Craven House, Kingsway, W.C.2, engineer; C. F. Butler, 331, Lordship Lane, East Dulwich, S.E.22, clerk. The directors are:—T. H. Dryden (permanent governing director) and A. L. Weekes. Qualification, 100 shares. Remuneration as fixed by the company. Solicitors: Neve, Beck, Son & Co., 21, Lime Street, E.C.

Thor Lamps and Supplies, Ltd. (211,409).—Private company. Registered January 29th. Capital, £4,000 in £1 shares. Objects:—To adopt an agreement with Haslam & Stretton, Ltd., and to carry on the business and assets comprised therein, including the registered mark of the Thor Electric Safety Lamp, and to carry on the business of manufacturers of and dealers in electric, oil and other lamps, miners' lamps, electric batteries, &c. The directors are:—L. J. Bielski ((chairman), Treleaven, Penarth, coal exporter; C. W. Jones, 56, Victoria Road, Penarth, gentleman; T. Stretton, "Silbrook," Heoldon, Whitchurch, Cardiff, engineer. Qualification, £250 shares. Remuneration, £50 each per annum (chairman, £75). Solicitor: J. H. Davis, Boston Buildings, James Street, Cardiff.

Gregson Manufacturing Co., Ltd. (211,322).—Private company. Registered January 26th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of gas, electrical and general engineers, gas, electrical and wireless instrument manufacturers, manufacturers in wood and metal furniture, novelties, patterns, packing, materials, illuminated and other signs, &c. The directors are:—A. B. Gregson, 291, Hagley Road, Edgbaston, Birmingham, electrical engineer and commercial traveller (managing and life director); W. E. S. Salt, "The Royd," Handsworth Wood, Birmingham, C.A. (chairman); H. A. Taylor, 4, Brunswick Road, Handsworth, Birmingham, works manager. Qualification, £100. Secretary: J. S. Rogers, 41, Temple Row, Birmingham. Registered office: 37-38, Sun Street West, Birmingham.

Official Returns of Electrical Companies.

Reed, Evans & Co., Ltd. (72,015).—Capital, £100,000 in £1 shares. Return dated December 31st, 1925. 92,292 shares taken up. £6,576 paid (being £1 per share on 657 and 4s. per share on 29,595 shares). £85,716 considered as paid ((being £1 per share on 62,040 and 16s. per share on 29,595 shares). Mortgages and charges, nil.

Pickvance, Ltd. (183,595).—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated January 4th, 1926. 1,002 ordinary and 600 preference shares taken up. £650 paid on 200 ordinary and 450 preference shares. £952 considered as paid on the remainder. Mortgages and charges, £1,650.

Stanley Cooper & Co., Ltd.—Mortgage on 4, Albert Road, Bournemouth, with plant, &c., dated January 16th, 1926, to secure all moneys due or to become due from the company to the National Provincial Bank, Ltd.

Brookhirst Switchgear, Ltd. (175,995).—Capital, £550,000 in £1 shares. Return dated December 29th, 1925. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Pressland Electric Supplies, Ltd.—F. W. Stephens, of Salisbury House, London Wall, E.C.2, was appointed receiver and manager on January 15th, 1926, under powers contained in debentures dated June 30th and July 2nd, 1924, and August 10th, 1925.

L. Jacobs (London), Ltd.—W. S. Warren, of 8 and 9, Martin Lane, Cannon Street, E.C.4, was appointed receiver and manager on January 14th, 1926, under powers contained in first mortgage debenture dated May 22nd, 1925.

Woodhall Wireless Manufacturing Co., Ltd.—F. W. Stephens, of Salisbury House, London Wall, E.C.3, was appointed receiver and manager on January 18th, 1926, under powers contained in debentures dated April 28th, 1925.

British Automatic Telephone Installation Co., Ltd. (176,608).—Capital, £10,000 in £1 shares. Return dated December 22nd, 1925. 4,500 shares taken up. £4,418 15s. paid (being £1 per share on 4,175 and 15s. per share on 325 shares). Mortgages and charges, nil.

W. S. Laycock, Ltd. (in liquidation).—Satisfaction in full on June 20th, 1919, of charge dated April 4th, 1918, securing all moneys due or to become due from the company to the London Provincial and South-Western Bank, Ltd. (Notice filed January 20th, 1926.)

Sherlock Engineering Co., Ltd.—W. Hand, of Corfield and Cripwell, 12, Cherry Street, Birmingham, ceased to act as receiver or manager on January 15th, 1926.

Re-Echo Radio Co., Ltd.—C. H. Whatley, of 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C.2, was appointed receiver on January 25th, under powers contained in debenture dated January 4th, 1926.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £6,800 on December 17th, 1925, of charges dated March 24th, 1911, November 13th, 1912, and March 11th, 1925, securing £250,000.

D. Halett & Co., Ltd. (169,979).—Capital, £5,000 in £1 shares. Return dated December 10th, 1925. 4,420 shares taken up. £320 paid. £4,100 considered as paid. Mortgages and charges, nil.

Davies, Kent & Stewart, Ltd. (81,627).—Capital, £3,500 in 2,500 preference and 1,000 ordinary shares of £1 each. Return dated December 28th, 1925. 1,974 preference and 1,000 ordinary shares taken up. £2,974 considered as paid. Mortgages and charges, £1,050.

W. G. Cannon & Sons, Ltd. (87,796).—Capital, £3,000 in £1 shares. Return dated December 10th, 1925. All shares taken up. £9 paid. £2,991 considered as paid. Mortgages and charges, nil.

Venezuela Telephone & Electrical Appliances Co., Ltd. (31,305).—Capital, £280,000 in 140,000 ordinary and 140,000 preference shares of £1 each. Return dated December 29th, 1925. 70,000 ordinary and 70,000 preference shares taken up. £83,494 paid on 13,494 ordinary and 70,000 preference shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £140,300.

Burwood (Concessionaires), Ltd.—Debenture dated January 15th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. H. Wood, 20, Lesbia Road, Clapton.

G. S. Hawker, Ltd.—Mortgage dated December 31st, 1925, to secure £900, charged on 1 and 2, Purley Downs Road, Croydon. Holder: Mrs. E. Brockley, 110, Church Street, Croydon.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Siemens Bros. and Co., Ltd.

"The future of the electrical industry is encouraging, and it is believed that the company will obtain its full share of the work in the future." These words appear in the course of a circular issued by the secretary in which is announced the board's proposal to take steps to meet future capital requirements "in view of the expansion of the company's business and having regard to the Government's policy of electrical development as recently outlined by the Prime Minister." An extraordinary general meeting is called for to-day (Central Hall, Westminster) to pass the necessary resolution. Shareholders have already authorised an issue of 1,000,000 10 per cent. cumulative preference shares of £1 each, but of these only 550,000 shares have been issued and are fully paid, leaving 450,000 of such shares unissued. The board recommends that no further issue of these preference shares should be made and that the 450,000 unissued preference shares should be converted into ordinary shares. In addition, it is proposed that the total share capital, which is now £2,500,000, should be increased to £3,000,000 by the creation of a further 500,000 ordinary shares.

The recommended resolution reads:—

"That the 10 per cent. cumulative preference shares of £1 each be limited to the 550,000 of such shares now issued and fully paid, and that the 450,000 10 per cent. cumulative preference shares of £1 each now remaining unissued shall be and become part of the ordinary share capital, and that the share capital of the company be increased to £3,000,000 by the creation of 500,000 ordinary shares of £1 each, so that thereafter the capital of the company will be £3,000,000 divided into 550,000 10 per cent. cumulative preference shares of £1 each, all of which have been issued and are fully paid, and 2,450,000 ordinary shares of £1 each, of which 1,500,000 ordinary shares have been issued and are fully paid, and the remaining 950,000 ordinary shares are unissued."

German Companies.

The *Telephone Works Company* (formerly Berliner), of Hanover and Berlin, reports a net profit of 265,000 marks for 1924-25, which is to be carried forward.

The directors of the *Allgemeine Elektricitäts Gesellschaft* state that the turnover in 1924-25 was 50 per cent. greater than in the previous year. After writing off 3,058,000 marks for depreciation, as against 2,426,000 marks in 1923-24, the net profits for the year ended September 30th last amount to 8,363,000 marks (7,223,000 marks in 1923-24), and a dividend at the rate of 6 per cent. is proposed on the ordinary shares, this comparing with 5 per cent. in the previous year.

Fife Tramway, Light and Power Co.

The report for the year ended December 31st, 1925, states that the trading profits of the concerns owned and operated by the company amounted to £114,098. Of this, £21,089 was retained by the subsidiaries and the balance paid over. After meeting administrative expenses, taxation, &c., and adding £3,480 brought forward, there remains a balance of £85,542. Loan and debenture interest absorbs £13,973; the preference dividend requires £23,801; £4,268 is transferred to stock redemption account; and £10,000 to reserve account; a dividend of 6 per cent. for the year on the ordinary shares is recommended; and there remains a balance of £9,694 to be carried forward. The report says that the company's revenue has been adversely affected by the abnormal trade depression in its area, but this has been countered by continued extension. The meeting is to be held at Edinburgh to-day (Friday).

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted :—

Shanghai Electric Construction Co., Ltd.—100,000 shares of £1 each, fully paid, Nos. 400,001 to 500,000.

Traction and Power Securities Co., Ltd.—£65,036 4½ per cent. debenture stock.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Adelaide Electric Supply Co., Ltd.—£250,000 new 5½ per cent. redeemable consolidated debenture stock.

Traction and Power Securities Co., Ltd.—£65,036 4½ per cent. debenture stock.

Joseph Lucas, Ltd.—A meeting was to be held yesterday (Thursday) for the purpose of considering a resolution to increase the company's authorised capital from £800,000 to £1,100,000 by the creation of 300,000 shares of £1 each. It was explained in a circular that the new capital was required to finance the recent acquisition of controlling interests in C. A. Vandervell & Co., Ltd., and Rotax (Motor Accessories), Ltd.

Adelaide Electric Supply Co., Ltd.—The company has recently issued and sold at the rate of £96½ per cent. to the Electric and General Investment Co., Ltd., £250,000 5½ per cent. redeemable consolidated debenture stock. The stock is redeemable at par in the event of the purchase of the company's undertaking or at any time at the company's option after March 1st, 1939, on six months' notice.

Havana Electric Railway, Light and Power Co.—The *Electrical World* reports that the control of this company has been acquired by the Electric Bond and Share Co. The company operates the city railway and supplies electricity from a 50,000-kVA undertaking. The gross earnings exceed $15,000,000 per year.

Westminster Electric Supply Corporation, Ltd.—A final dividend of 2s. per share is recommended, making 15 per cent. for the past year. The directors have also instituted reduced charges, particulars of which are given in our "Lighting and Power Notes." The previous year's dividend was also 15 per cent., including a 3 per cent. bonus.

Metropolitan Railway Co.—A final dividend of 3 per cent. actual has been declared on the ordinary stock, making 5 per cent. for the year, as in 1924. The final dividend on the Surplus Lands stock is 2 per cent., actual, making 3½ per cent. for the year, as against 3⅜ per cent. in 1924.

Westinghouse Brake and Saxby Signal Co., Ltd.—The report for the year ended September 30th shows a net profit of £90,612, as compared with £17,192 in 1923-24. The dividend of 6 per cent. compares with 1½ per cent. in the preceding year. £17,503 is put to reserve and £7,866 is carried forward.

Company Struck Off the Register.—The name of the undermentioned company has been struck off the register, and it is thereby dissolved :—

Witchell's Electrical Accessories, Ltd.

City of Buenos Aires Tramways (1904), Ltd.—A final dividend of 1s. 3d. per share is recommended, making 5 per cent. for the year. It is also proposed to transfer £5,604 to the general amortisation fund and to carry forward £13,234.

Bournemouth and Poole Electricity Supply Co., Ltd.—The final dividends have been declared on the 4½ per cent. and 6 per cent. preference shares for the year ended December 31st last.

Smithfield Markets Electric Supply Co., Ltd.—A final dividend of 5 per cent. has been declared, making 8 per cent. for the year, as in the preceding year.

Enfield Cable Works, Ltd.—An interim dividend of 5 per cent. has been declared on the ordinary shares.

Dorman, Long & Co., Ltd.—An issue of £500,000 of 5½ per cent. first debenture stock, at 93½ per cent., was to be made this week.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have been cheered by a slight recovery in the price of raw rubber, which found reflection in the values quoted by the share market. From being plunged into despondency and depression, the rubber market turned cheerful again upon the very moderate rally in the price of the produce. This had an indirect effect in most departments of the Stock Exchange. The gilt-edged markets are firm, although there remains a lurking doubt as to the possible movements during February in the money market. In the electrical world, the boomlet in cable and equipment shares received something of a check, prices remaining good on the whole.

The hint as to probable forthcoming new issues, thrown out in last week's ELECTRICAL REVIEW (page 188), happened to appear on the same date as the announcement from Siemens Brothers that the company intends to take steps to meet further capital requirements. The board recommends that 450,000 unissued 10 per cent. preference shares shall be converted into ordinary and that the total share capital shall be increased from the 2½ millions sterling to three million pounds by the creation of a further half-million ordinary shares. The meeting to carry the necessary resolutions will be held on Friday in this week. Siemens fell back from 35s. to 33s. 9d. on the proposals.

The Metropolitan Railway fulfilled general expectation by announcing a dividend at the rate of 6 per cent. for the past half-year, making 5 per cent. for the year. This is satisfactory to the shareholders, who felt qualms about the maintenance of the dividend in view of the falling off of £246,000 in the gross revenue. The shrinkage is due to the fact that last year's Wembley Exhibition proved so much less popular than its predecessor. The price of the stock has risen 10s. and Surplus Lands are 2 up, at 71. Districts are better at 48. There has been a general rise in the issues of the Underground Electric Railways of London, the Income Bonds improving to a point below par.

The electricity supply market continues to be a little uncertain in regard to the issue of the Government's plans as this is likely to affect the older undertakings. In the new session of Parliament which has just opened, the Government's plans will no doubt be unfolded in sufficiently full detail to enable a better judgment to be reached than has been possible up to the present. We have already sketched some of the arguments that prevail in regard to the likelihood of the new plans interfering in no way with the existing London supply companies, and have suggested that, conceivably, the latter may be benefited rather than disadvantaged by the proposed legislation. It is natural enough, however, that proprietors of electricity supply shares, who can now see in most cases quite substantial increases in capital value over the original cost of their investments, should feel inclined to sell part for prudence sake. The idea has got abroad also that dividends on electricity shares are going to be limited to 7 per cent., an idea which conveys, of course, a totally wrong impression, because the companies are to distribute their reserves, and this distribution will, in the majority of cases, have the effect of bringing up the dividends to, roughly speaking, the rates that have been paid of late.

Charing Cross ordinary are down a shilling, Metropolitans are similarly lower and Kensingtons, after their burst of strength last week, have reacted to the extent of 5s. City of Londons are 2s. 6d. down, Westminsters a florin, and the only improvement in the London list is a gain of 1s. 3d. in South Metropolitan preference, which has lifted the price to 1 5/16. Whitehall Electric preference are better at £1. The provincial shares are unchanged in price on the week.

The outstanding feature in our share list this week is a rise of 6 in Brazilian Tractions, the price having risen to 92. No fresh reasons are advanced to account for this rise other than those already mentioned on several previous occasions in this column, namely, the buying from Canada and New York on the recently-increased dividend, and the report that the shares are being accumulated on behalf of a Canadian-American syndicate bent upon securing control. The 6 per cent. preferred have strengthened to 101. Beyond this, and a point rise in British Columbia deferred, the prices in the traction and tramway list show no changes.

A general drop in prices of shares in the manufacturing group is a sequel to the rather overdone character of the previous boomlet. British Electric Transformer preference are better at 1. Telegraph Constructions rose 10s. to 28. These are about the only upward movements. The falls are fairly extensive. General Electrics escaped from the reaction that included British Aluminium, British Insulated, India Rubber, Henleys, Johnson & Phillips, and several others. Babcocks participated with a drop to 52s. 6d. The reason that prompted the selling is that holders of such shares recognise the high levels which many of the quotations have reached, in relationship to the dividends that are being paid. That the companies are doing extremely well is generally known, but the recent advance in share-values has gone some way towards discounting the immediate future. It should be mentioned, however, that the market is by no means flooded with orders to sell. What the Stock Exchange calls—without being able to define—the undercurrent, is sufficiently strong to warrant the expectation of a further rise when the present sellers are "out."

Marconis are a dull market. Nor does the probability of a settlement being reached in the wireless strike serve to arouse interest in Marconi shares. The price has receded to 25s. Oriental Telephones are harder at 2 3/16. Automatics remain at 53s. 9d. The Eastern group of cable stocks and shares is placed. Rubber shares show a general recovery, but hesitation is felt as to the outlook for the raw produce market, and the public are playing for safety rather than for profits-by-purchase.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1923	Dividend. 1924.	Price Feb. 1, 1926.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1⅝	—	*5 14 3
Charing Cross Ordinary	1	14½	15	47/-	−1/0	6 7 8
do. do. 4½ Pref.	1	4	4½	17/6	—	5 2 10
Chelsea	1	12	12	2 5/16	—	5 9 9
City of London	1	15	15	47/-	−⅛	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/6	—	5 4 11
County of London	1	15	15	58/3	—	5 3 1
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-xd	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14¼	−¼	5 5 3
Lancs. Light and Power	1	7½	7½	26/6	—	5 13 2
London Electric	1	10	10	32/-	−1/-	6 5 0
do. do. 6% Pref.	5	6	6	5 5/16	—	5 7 10
Metropolitan	1	10	11	39/6	−1/-	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅜	—	5 8 3
South London	1	15	15	2 5/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 5/16	+1/16	5 6 8
Urban Ordinary	1	4	4	1	—	4 0 0
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	46/3	−2/-	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	+2d.	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 0

Home Rails.

Central London Ord. Assented	Stock	4	4	69	—	5 16 0
Metropolitan	,,	4	5	69	+½	7 4 11
do. District	,,	3½	3½	48	+½	7 5 10
Underground Electric Ordinary	10	Nil	Nil	2⅜	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	7/6	+6d.	Nil
do. do. Income	Bonds	6	6	99	—	*6 1 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	3	6	53/9	—	2 4 10
Chili Telephone	5	6	5	6⅜xd	—	*3 18 5
Cuba Sub. Ord.	10	5	5	6½	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	176½	—	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1¼	—1/16	8 0 0
Marconi Marine	1	10	7½	7/8	—	8 11 6
Oriental Telephone Ord.	1	12	12	42 5/16	+1/16	*5 9 9
United R. Plate Tel.	5	8	8	7 13/16	—	5 2 7
Western Telegraph	10	10	10	18	—	*5 11 1

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	—	8 3 0
do. do. 2nd Pref.	5	6	6	3 5/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	105	—	5 14 3
Brazil Traction	100	4	4	92	+6	5 8 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	83½	—	5 19 9
do. do. Preferred	,,	96/-	96/-	102½	—	*4 12 8
do. do. Deferred	,,	129/5	129/5	128	+1	*5 1 8
do. do. Deb.	,,	4¼	4¼	77	—	5 10 5
London & Sub. Trac. 5% Pref.	1	2½	Nil	3/6	—	Nil
London United Tram. Deb.	Stock	4	4	40½	—	9 17 6
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	61½	—	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	18/9	—	5 6 8

Manufacturing Companies.

Babcock & Wilcox	1	12	12	2⅝	—1/16	*4 11 5
British Aluminium Ord.	1	5	10	37/6	—f.d.	5 6 8
British Elec. Transformer Pref.	1	Nil	7	20/9	+9d.	6 14 11
British Insulated Ord.	1	15	15	3 1/16	—⅛	4 17 11
Brush Ord.	1	10	10	1 7/16	—1/9	6 19 2
Callenders	1	15	15	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	34/6	—6d.	5 16 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	15	16	3 1/16	—⅛	4 6 10
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1 5/16	—1/16	*4 4 3
Johnson & Phillips	1	10	10	2 1/16	—1/16	3 8 3
Met.-Vickers, Ord.	1	8	8	29/3	—	5 9 6
do. Pref.	2	8	8	2⅝	—	6 14 9
Siemens Ord.	1	—	7½	33/9	—1/3	4 8 11
Telegraph Construction	12	20	10	28	+½	*4 5 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price February 2nd.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	20/- inc.
a ,, Roll	,,	£9 10s.	20/- inc.
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£250	£1 dec.
Grade II	,, ,,	£177	£1 dec.
Grade III	,, ,,	£98	£3 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£65 10s.	...
d ,, ,, Sheets	,,	£143 10s.	...
d ,, ,, Wire Rods	,,	£75 10s.	...
d ,, ,, H.C. Wire	per lb.	9½d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/9	5d. dec.
i Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£12	...
g Lead, English pig	,,	£35 15s.	...
g Mercury	per bot.	£15 to £15 5s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	7¾d.	...
n Tin, Block (English)	per ton.	£277 10s. to £278 10s.	10/- inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
o C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

B.E.S.A. Publication.—The British Engineering Standards Association has just issued a specification for industrial reflector fittings for electric lighting (No. 1). It covers seven sizes of British industrial circular types, which are designated according to the nominal consumption of the lamps for which each is suitable, and the distribution of light contemplated is suitable for use in installations in which the spacing of the lamps is 1½ times the height.

A comprehensive table gives the nominal diameter, the minimum effective interior diameter, the minimum thickness of steel used for making the reflector fitting and particulars of suitable lamps complying with B.E.S.A. Specification No. 161, 1924, for each size of reflector fitting. The angle of cut-off specified complies with the recommendation contained in the second report of the Departmental Committee on Lighting in Factories and Workshops, 1921; but attention is drawn to the fact that this figure may be altered at a later date when the results of certain experiments which are being carried out are available. The total luminous output is given as 60 per cent., but it is pointed out that an efficiency of about 70 per cent. was obtained with this type of reflector under the conditions which were usual formerly: the conditions have been altered as mentioned above in order to reduce the amount of glare and so comply with the recommendations of the departmental committee. Methods of selection for testing and of efficiency measurement are also given in the specification.

Copies of the new publication (No. 232, 1926) may be obtained from the B.E.S.A. Publications Dept., 28, Victoria Street, London, S.W.1, price 1s. 2d. post free.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Continued from page 193.*)

Everett, Edgcumbe & Co., Ltd.

This firm's exhibits covered a wide range, from a 2½-in. dwarf-pattern milliammeter up to a 300,000-V voltmeter, and from protective relays to integrating photometers. The latter each comprise a 3-ft. cubical enclosure, to which are attached the comparison and balancing arrangements necessary to enable the total flux of light in lumens to be determined at a single measurement. An outstanding feature of the exhibits was the Relay Graphic Recorder, fig. 20, designed for installation on electric trains, &c., where the conditions of vibration and acceleration are very severe. Three charts give simultaneous records of current, voltage, and train speed. They are driven over revolving drums in perfect synchronism by a small motor running at constant speed. The motor also provides the necessary power for moving each recording pen across

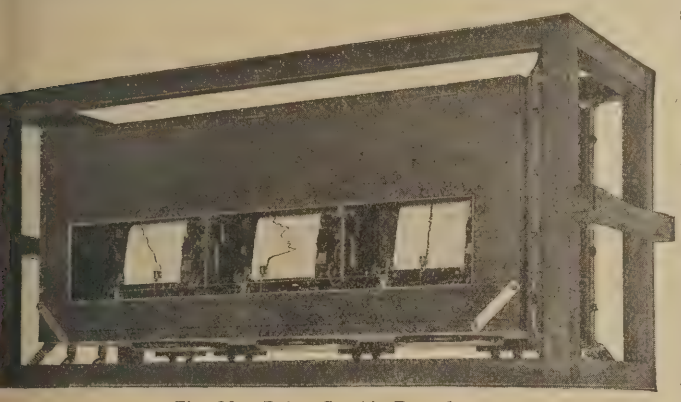


Fig. 20.—Relay Graphic Recorder.

the respective chart, in response to the deflection of an electrical movement, designed to measure the quantity in question. The correct timing of the charts is ensured by a sensitive centrifugal speed governor, which varies the field strength of the motor as may be necessary to make it run at constant speed, whether on a.c. or d.c. The measuring element proper consists of a short arm, provided with a substantial contact, which moves between two fixed contacts, serving to energise one or the other of two electro-magnets, which, in their turn, operate a simple two-way friction clutch. This clutch causes the driving motor to carry the pen across the chart in one direction or the other, according to the dictates of the measuring unit. The whole action is claimed to be perfectly dead-beat and "snappy." It is also claimed that all friction between the inking mechanism and the paper is eliminated, so that, if desired, a delicate electrical movement may be employed. The absence of the clock with its attendant troubles is another advantage. The instrument is rendered immune from the ordinary disturbances of vibration by the provision of a special spring suspension in a cradle. Any number of recording mechanisms can be operated simultaneously from the single driving motor, with the certainty that the charts are running in perfect synchronism. There are also a number of attachments for indicating different conditions. It is understood that a number of these instruments have been supplied to railway authorities, both in this country and abroad, and are giving every satisfaction.

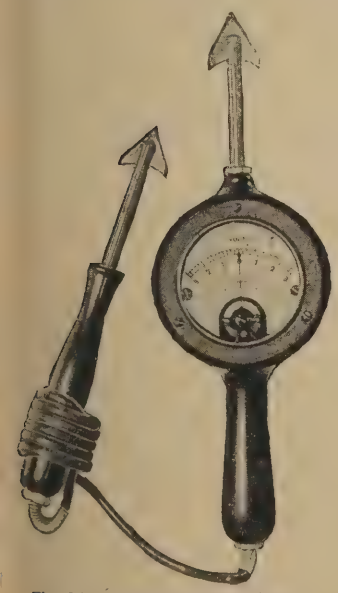


Fig. 21.—Large-Scale Cell Tester.

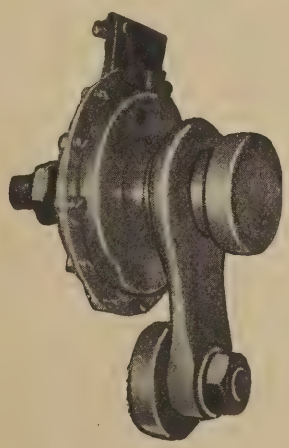


Fig. 22.—Radio-Frequency Current Transformer.

Another interesting exhibit took the form of a new cell-testing voltmeter, fig. 21. The feature of this instrument is the "super-scale," rendering the indications particularly easy to read. It is suited for testing high-pressure batteries, the case and handle being made of insulating material, moulded in one piece.

A 1,000-A current transformer, fig. 22, designed for radio frequency measurements, was another item of interest on this stand. This device, which is of the patented construction due to Mr. F. Ockenden, is believed to provide the only satisfactory solution of the problem of designing a current transformer which will stand up to frequencies of 100,000 cycles or more, and which, at the same time, is thoroughly shielded from stray radio-frequency fields. The design is based upon the fact that for satisfactory operation, the magnetic linkage between the primary and secondary circuits must be perfect, and this result is obtained by completely surrounding the iron core and its secondary winding by the primary winding, which consists of a complete copper sheath. We understand that these transformers have been supplied for frequencies up to 5,000,000 cycles (corresponding to a wave-length of about 60 metres) and, in fact, have been adopted exclusively for the new Post Office transmitting station at Rugby.

A high-pressure electrostatic voltmeter, claimed to be the smallest of its kind yet produced, was also seen. It can be scaled up to 3,000 V for a.c. or d.c., and measures only 2½ in. across the dial. It is designed to meet the requirements of radio engineers, especially for use on aircraft, where both space and weight are of fundamental importance, but where, at the same time, the working conditions are most severe. The whole of the high-pressure movement is mounted on a solid base of insulating material, a cavity in which serves as the damping chamber.

Siemens Bros. & Co., Ltd.

This firm showed some new water-tight indicator and selector switch combinations for use with thermo-electric pyrometers and distance thermometers, which are designed particularly for use on board ship but are suitable for use in any place where protection from damp and moisture is necessary. The indicators are of the pivoted moving-coil type and are of robust construction. The scales are calibrated in Centigrade or Fahrenheit degrees, as desired, and the movements, &c., are enclosed in strong water-tight gunmetal cases. The selector switches are of the press-button type, the buttons being arranged in a circle. Any thermometer may be instantly connected to the indicator by pressing the corresponding button and will remain connected until a second button is depressed, when the first one is automatically released. The last-pressed button may also be released by turning a central knob. Either packed glands or conduit nipples are provided for the cable inlets. Fig. 23 shows a 10-way selector switch and indicator combination. A four-colour temperature recorder, an optical

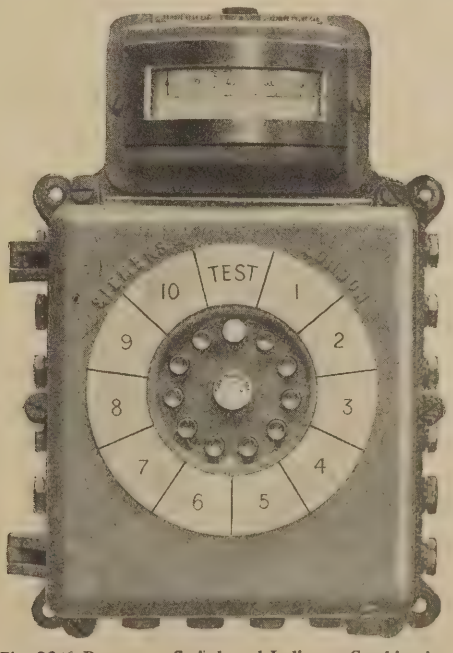


Fig. 23.—Pyrometer Switch and Indicator Combination.

pyrometer for measuring temperatures up to 2,400 deg. C. and a thermo-electric potentiometer for the measurement of thermo-couple e.m.f.'s were among the other exhibits of this firm.

The Zenith Manufacturing Co.

Among the items of interest exhibited by this firm was a neon-tube rectifier, fig. 24, designed for charging small high-pressure accumulators of the kind now in fairly common use for radio reception, being suitable for a charging current of 0.19 A. It is equipped with a regulating resistance in the primary circuit so as to give a very wide control of the charging pressure and current, rendering it capable, it is claimed, of covering all ordinary conditions. The resistance, together with a d.p. fuse and switch, is fitted at the side of the containing cabinet in a readily accessible position.



Fig. 24.—Neon Tube Rectifier.

The rectification is effected by means of two large neon rectifier tubes fitted in the cabinet in a vertical position. Owing to the large electrodes necessary in these tubes it is essential that the latter are operated vertically, otherwise the weight of the electrodes would be likely to fracture the glass support in the event of the rectifier receiving a sharp knock or serious vibration. The overall efficiency of the device is claimed to be of the order of 30 to 38 per cent. The complete rectifier is furnished with flexible cords and lamp adaptor, and battery clips for connection to the accumulator and lamp socket during charging.

George Kent, Ltd.

The chief exhibits of interest by this firm were Avery- and Martin-type telerecorders for measuring steam or water flow. The Avery instrument is designed primarily for a.c. The transmitting instrument, fig. 25, consists of a variable transformer, the rotating portion of which is moved in proportion to the rate of flow through the main. A secondary voltage is induced in the rotating element, which varies from zero to its maximum value in accordance with the variations in the rate of flow. The energy supplied to the primary also passes through a current coil of an "inverted" watt meter,

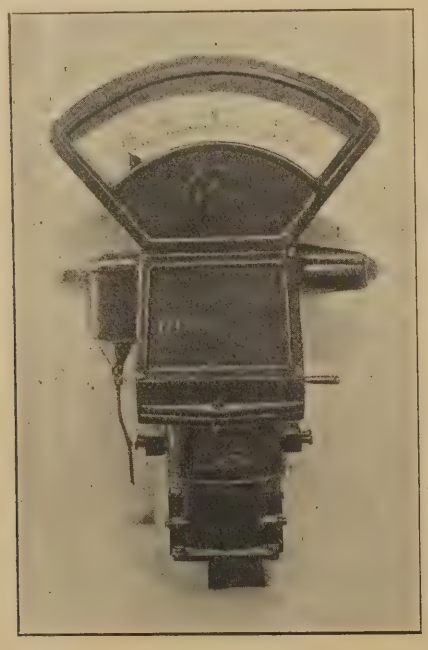


Fig. 25.—Telerecorder A.C. Transmitter.

which serves as a counter instrument for registering the total quantity of steam or water passed, and the induced energy is passed through the pressure element. By means of a solenoid connected across the instrument terminals, an artificial pressure drop is used to compensate for fluctuations in the line voltage.

The Martin-type instrument is used in connection with d.c. The transmitter consists of the usual boiler-load indicator, and the movement is effected by means of a suitable cam on a contact arm, which moves across the surface of a resistance connected across the d.c. mains. The contact arm moves in accordance with the variation in the rate of flow, and causes the ratio between the two parts of the resistance to vary, the parts referred to being divided by the point of contact with the arm.

Weston Electrical Instrument Co., Ltd.

A new portable miniature a.c. voltmeter, model 330, was seen among the exhibits of this firm; but for a deeper base it resembles the d.c. model 280. The movement is of the iron coil dynamometer type suitable only for a.c. circuits. It has a resistance of 20 ohms per volt and is claimed to be accurate to about 1 per cent. A new radiator panel voltmeter, 2 in. in diameter, and designed for use upon receiving sets, was another interesting exhibit. For ranges b low 50 volts it has a sensitivity of 125 ohms per volt and for higher ranges, 200 ohms per volt. Another new exhibit was the firm's model 440 portable pivoted moving-coil galvanometer. This instrument has a 1 mm. deflection. A.c. and d.c. dynamometer-type laboratory standard instruments were shown and also various patterns of switchboard instruments. A range of miniature instruments added to the interest of the display. Some of these are of particularly delicate construction, the movements weighing as little as 5 grains.

The Cox-Cavendish Electrical Co. (1924), Ltd.

On this stand was shown some actino-therapeutic apparatus for ultra-violet radiation and a diathermy apparatus for thermo-penetration or coagulation of the tissues.

Edison Swan Electric Co., Ltd.

This firm exhibited a range of d.c. Pointolite lamps, varying from 30 to 1,000 c.p., and a selection of 150 c.p. Pointolites for a.c. operation.

The New Oscilloscope Co., Ltd.

This firm showed the Elverson oscilloscope used for investigating the behaviour of machinery under working conditions.

Adam Hilger, Ltd.

Among several interesting items displayed on this stand was a piezo-electric resonator by which the piezo-electric effect in quartz crystals is applied to the control of radio transmitters and in the standardisation of wavemeters and kindred apparatus. When a series of potential variations is applied at varying frequencies there is a marked resonance at a frequency dependent upon the dimensions of the crystal, with a consequent alteration in the state of the associated electrical circuit. Hence by subjecting the crystal to the influence of an alternating electrical impulse supposed to be of its resonant frequency its accuracy may be verified and corrected when suitable means of indication are employed. The quartz is encased in a suitable insulating material and provided with two exterior terminals. Another exhibit was a selenium detector. This is a new apparatus designed for detecting infra-red, visible and ultra-violet radiations by noting the alterations produced in the electrical properties of selenium caused by radiations incident upon it. It was exhibited in conjunction with a Hilger ultra-violet monochromatic illuminator showing the ultra-violet spectrum of mercury vapour. The cell is of course connected to a sensitive galvanometer. The Hilger therapy spectroscope was also shown. This is a simple type of quartz train spectroscope provided with a fluorescent screen to make visible the ultra-violet portion of the spectrum under observation, designed for checking the ultra-violet emission from lamps used in ultra-violet treatment.

Newton & Wright, Ltd.

Some heavy apparatus was shown by this company; a notable feature of the exhibit was a 125,000-V unit of a three-phase transformer, to work in connection with a rectifier of new design, giving 10 milliamperes at 250,000 volts, for X-ray work, being one of a pair ordered for cancer research. The bushings were oil-filled, and the top cover was of horn fibre. The weight of these transformers is two tons each.

Amongst other items were the "Hercules" X-ray tube, and a new foot-operated switch. For the prevention of corona at the high pressures used in X-ray work, C.T.S. reel cables were shown.

Stonebridge Electrical Co., Ltd.

This company showed a wide range of instruments in a variety of styles and finishes, including flush edge-wise instruments with flat front plates, electrostatic voltmeters for ranges up to 150,000 volts, recorders, portable precision instruments covering a variety of purposes, and resistance thermometer equipments for generators and transformers.

Creed & Co., Ltd.

The Creed "Start-stop" printing telegraph system, said to be the first of its kind developed in this country, was shown, the instruments comprising a keyboard transmitter and perforator, an automatic transmitter, and a printer. The first-named may be used for direct transmission by hand from the keyboard, or in conjunction with the automatic transmitter. The printer is on the same lines as the well-known Creed standard printer. The Murray Multiplex system was also exhibited.

(To be concluded.)

The Power Factor of a Cable Dielectric.*

Its Consideration as a Function of the Applied Voltage.

By L. EMANUELI, M.I.E.E.

THE relation between the power factor and the dielectric of an impregnated-paper cable and the applied pressure is, to say the least, complicated. It has been pointed out, however, that it is a means of judging the quality of the cable and accordingly details of the study of the subject will be of interest.

The first experiment was carried out on a certain fixed quality of paper, impregnated with different qualities of oil and compound, under such conditions that bubbles, or films, of gas were eliminated. A second series of experiments was also carried out. For the first series the apparatus shown in fig. 1 was used. The paper was dried in a stove and placed in several layers between the two electrodes *a*, furnished with

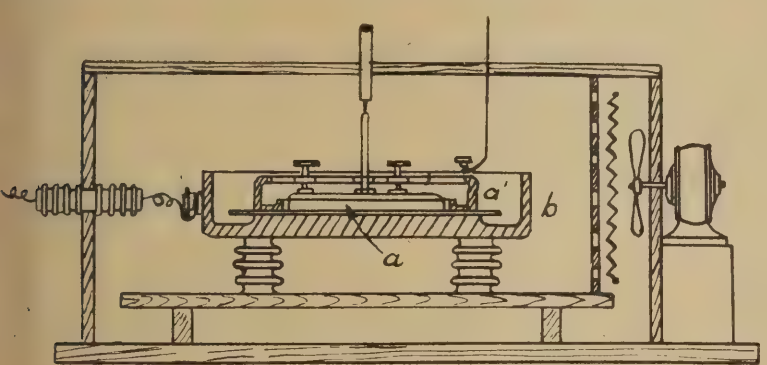


Fig. 1.

a guard ring *a'* and *b*, both suitably heated; keeping *a* raised a few centimetres above the surface of the paper sheets, a vaccum was created in the apparatus, the large opening at the top being closed with a suitable cover. The complete apparatus was placed in a stove so that, besides the vacuum, a temperature of nearly 90 deg. C. could be maintained.

After some hours in vacuum, the oil, or the compound, under examination (previously dried) was introduced into the apparatus by means of atmospheric pressure. The vacuum was maintained for at least three hours, then broken, and when the apparatus had cooled the top *a* was allowed to come into contact with the surface of the paper, this being done in order, so far as was possible, to prevent gas films forming in the dielectric. The measurements at different temperatures were generally made in steps of increasing temperature, in order to avoid the thermal contraction of volume giving rise to gas films. This precaution was subsequently found to be unnecessary.

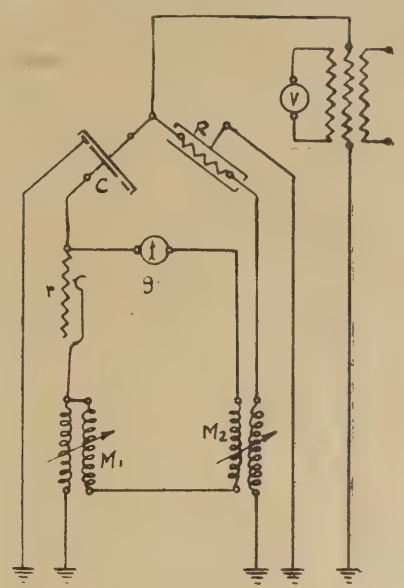


Fig. 2.

The method used to determine the power factor is shown by fig. 2, C being the condenser under test, R the ohmic resistance, M_1 and M_2 two mutual inductances (only one of which need be variable), r a resistance, and g a vibrating galvanometer. When the phase angle of the dielectric is small, then $C = M_2/rR$ and $\cot \phi \div \cos \phi = w M_1/r$. It has been supposed that R is great in comparison with the self-induction of the primary of M_2 and that the resistance of M_1 is small in comparison with the capacity of C. These conditions were satisfied in the tests, the value of C being of the order of 0.0006 microfarad (the frequency was 42); the ohmic resistance of the primary coil of M_1 was 17 ohms and the coefficient of self induction of the

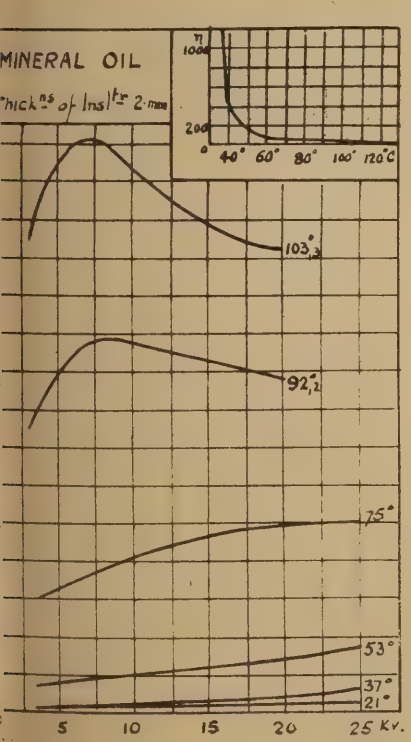


Fig. 3.

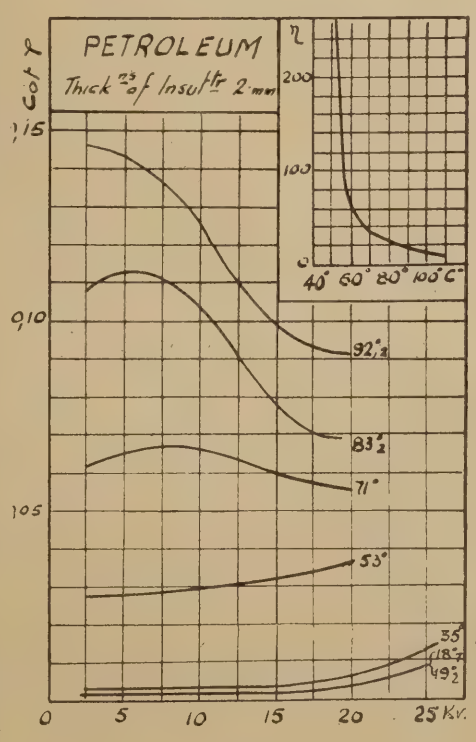


Fig. 4.

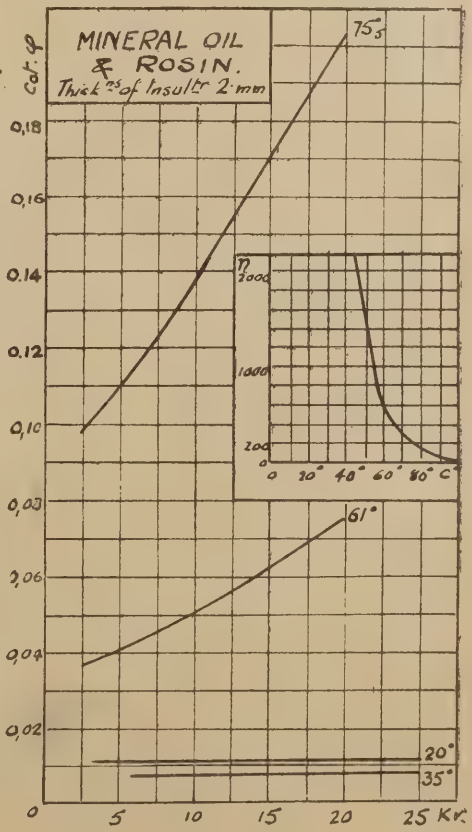


Fig. 5.

* A paper read before the third meeting of the International C.H.P. Conference, Paris, June, 1925, and reproduced by permission of the Conference.

primary coil of M, was 118 millihenrys. Owing to the fact that R is not a pure resistance and to the presence of the inductance of the primary coil of M_2 the phase error was measured once, using an air condenser instead of C, as well as comparing R with a water column resistance and calculating the effect of the inductance in series. Thus, a value was found

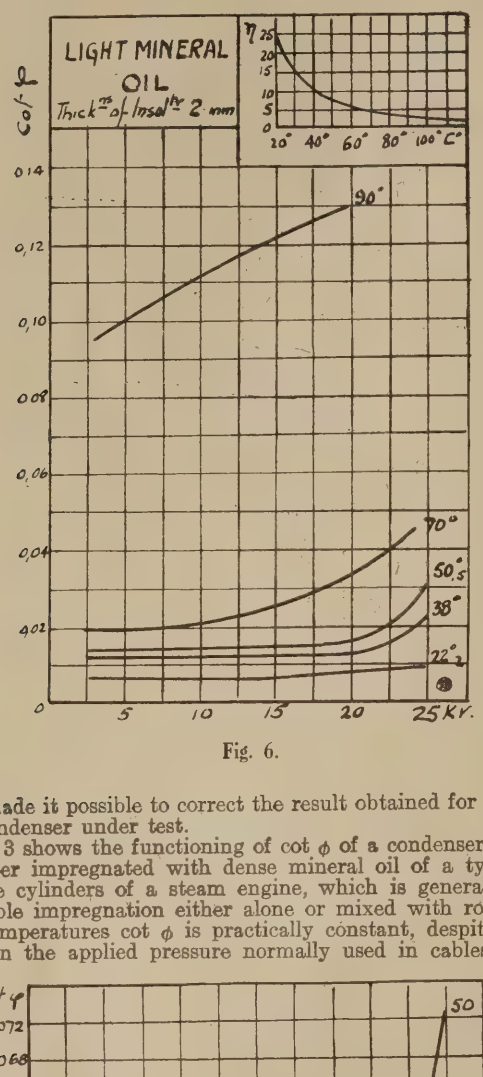


Fig. 6.

that made it possible to correct the result obtained for cot ϕ of the condenser under test.

Fig. 3 shows the functioning of cot ϕ of a condenser formed of paper impregnated with dense mineral oil of a type used for the cylinders of a steam engine, which is generally used for cable impregnation either alone or mixed with rosin. At low temperatures cot ϕ is practically constant, despite variations in the applied pressure normally used in cables. For

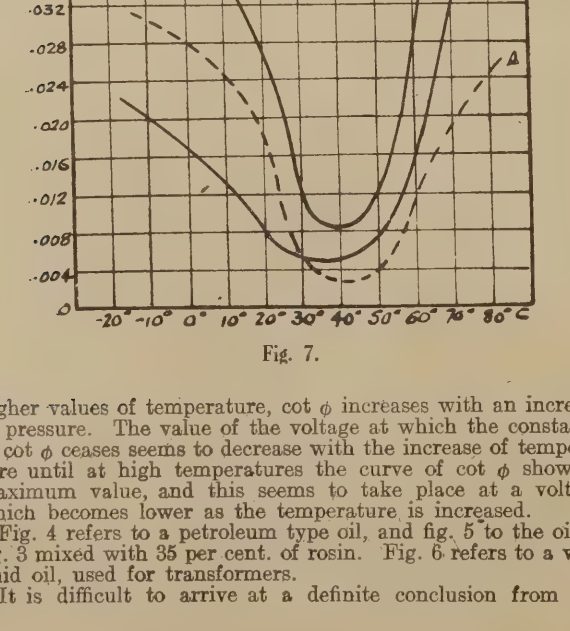


Fig. 7.

higher values of temperature, cot ϕ increases with an increase in pressure. The value of the voltage at which the constancy of cot ϕ ceases seems to decrease with the increase of temperature until at high temperatures the curve of cot ϕ shows a maximum value, and this seems to take place at a voltage which becomes lower as the temperature is increased.

Fig. 4 refers to a petroleum type oil, and fig. 5 to the oil of fig. 3 mixed with 35 per cent. of rosin. Fig. 6 refers to a very fluid oil, used for transformers.

It is difficult to arrive at a definite conclusion from the above experiments, but it is quite probable that in the range of temperature between 12 deg. and 30 deg. C. and with the gradients used in cables, the variation of cot ϕ with the voltage is very small, so that it may be considered practically constant.

In cables the matter is very different, especially because of the gas films left during the impregnation, the dimensions of which change with the temperature and with the history of the conditions which the cable has been subjected to. The amount of data obtained is voluminous; the following are some characteristic results: Fig. 7 refers to a three-phase cable of 35,000 volts working pressure, with conductors of 175 mm², and it shows the change in the relation of cot ϕ with the temperature, measured at 10,000 and 50,000 volts. In the figure there is also shown (dotted line) the curve of the difference in power factor at the two voltages; the latter curve is characteristic, and all cables show it in greater or less proportions.

The presence of a minimum may be explained by the aid of the first series of experiments in the following way: Starting from low temperatures, it may be assumed that the volume of the gas films decreases with an increase of the temperature, due to the fact that the impregnating mixture increases in volume. The pressure of the gas in those films need not necessarily increase very much, because with the increase of temperature and pressure, the gas is more soluble in the compound. Therefore, the variation of cot ϕ with the voltage decreases with the increase of temperature; on the other hand, at a certain temperature, which varies with the type of com-

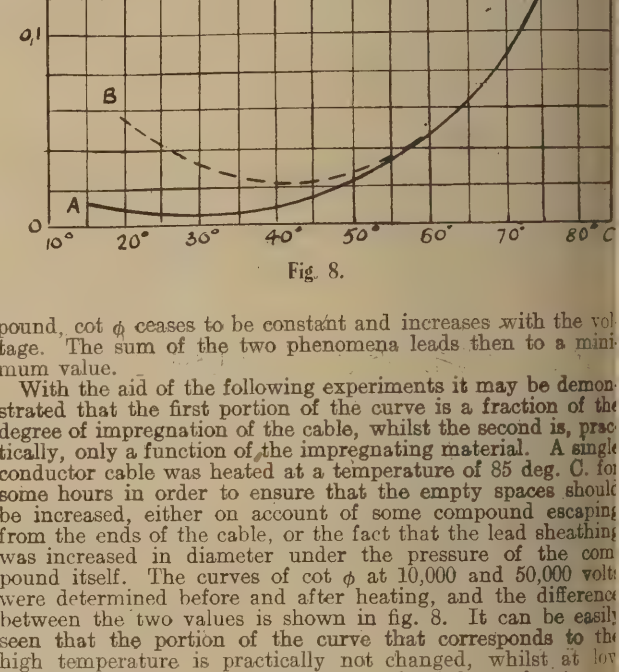


Fig. 8.

pound, cot ϕ ceases to be constant and increases with the voltage. The sum of the two phenomena leads then to a minimum value.

With the aid of the following experiments it may be demonstrated that the first portion of the curve is a fraction of the degree of impregnation of the cable, whilst the second is, practically, only a function of the impregnating material. A single conductor cable was heated at a temperature of 85 deg. C. for some hours in order to ensure that the empty spaces should be increased, either on account of some compound escaping from the ends of the cable, or the fact that the lead sheathing was increased in diameter under the pressure of the compound itself. The curves of cot ϕ at 10,000 and 50,000 volts were determined before and after heating, and the difference between the two values is shown in fig. 8. It can be easily seen that the portion of the curve that corresponds to the high temperature is practically not changed, whilst at low temperatures the difference between the values of cot ϕ at high and low pressures is considerably increased.

From what has been shown above, it follows that under certain limitations of temperature the variation of the power factor may be an index of the degree of impregnation of the cable. It is questionable, however, if it would be right to impose strict conditions on the manufacturers when the heating of the cable under working conditions may spoil the impregnation of the dielectric in a permanent and irreparable way. From this point of view the question arises whether for high-pressure cables, a limit to the working temperature can be determined, considering the possibility of spoiling the impregnation and taking into account also the periods of low temperature at which the cable may be required to work. It must be observed, however, that although it may be easy to make qualitative statements on this subject, it is not such an easy matter to arrive at exact limiting figures.

R.A.F. Vacancies.—The Air Ministry announces that five hundred aircraft apprentices, between 15 and 16½ years, are required by the Royal Air Force for entry into the School of Technical Training, Halton, Bucks. They will be enlisted by open and limited competitions held by the Civil Service Commissioners and the Air Ministry respectively. Successful candidates will be required to complete 12 years' service from the age of 18, in addition to the training period. Full information regarding the scheme can be obtained from the Royal Air Force (Apprentice Department), 4, Henrietta Street, W.C.2.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Hammer.

A recent development in the United States takes the form of a new electric hammer working on the principle of the electro-magnetic coil and its attraction for an iron core. The Syntron hammer, fig. 1, operates on ordinary 60-cycle electric circuits with 3,600 blows per min. on the shank of any tool inserted into the bit. In contrast to the usual motor-driven hammer, it has only one moving part, the piston, which is drawn back and hurled forward through a bronze barrel. The hammer is suitable, it is claimed, for drilling holes in concrete, brick or stone, for smoothing stone or concrete surfaces, for bush hammering, cutting, channeling, &c. When used with a star drill, the hammer is rated to drill concrete to a depth of three in. per min. The device is manufactured by the NATIONAL ELECTRIC MANUFACTURING COMPANY, of Pittsburgh, Pa., U.S.A., and is distributed in all countries outside the United States by the Westinghouse Electric International Company.



Fig. 1.—Electro Magnetic Hammer.



Fig. 2.—Electric Oil Hoist.

An Electric Oil Hoist.

An electric oil hoist, fig. 2, which has been marketed by the AMERICAN HOIST & DERRICK CO., St. Paul, Minn., is described in the *American Machinist*. It consists of a cylinder and piston with a load hook attached to the latter. An electric motor and an oil pump are provided at the top end of the cylinder and a system of piping and operating valves is placed between the pump and the cylinder ends. The motor, which is controlled by a snap-switch, pumps the oil from above to below the piston, thus raising the load. A valve in the piping is regulated to allow the piston to force the oil back again to the top of the cylinder, the piston and load descending under gravity. By regulating the valves the load can be raised or lowered to any point within the travel limits of the piston. A truck arrangement for suspending the equipment from an overhead track is provided.

An Improved Coal-cutter Protection.

In view of the recent Home Office recommendations to the effect that the coal-cutter machine must have a flame-proof enclosure separate from the starter enclosure, the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester, has produced a new system for the automatic protection of coal cutters, coal conveyors, and trailing cables. The essential apparatus for the new system includes a low-voltage control switch, supplied for mounting in any type of coal cutter, a special gate-end starting box, and a standard form of trailing cable with suitable standard terminal plugs.

The motor cannot be started, it is claimed, except by a simple flameproof drum switch mounted on the coal cutter, and has only three positions, *viz.*, forward, off, and reserve. The pressure of the control circuit does not exceed 20 volts, the power circuit to the motor being made and broken in the gate-end starting box. Overload and no-volt relays are re-set from the coal cutter simply by bringing the starting handle to its off position. A sensitive leakage trip device acts instantaneously with leakage to earth or between phases, and is capable of being adjusted to trip down to 5 per cent. of the full-load current of the motor, and after a leakage trip the relay remains latched out, preventing a re-start. A mechanical interlock prevents the opening of the starter box except with the contactor in the open position, and the motor cannot be started from the coal cutter until the gate starting box is properly closed. The box is fitted with an external lever by which the coal-cutter motor can be stopped under all conditions. Red and white signal lamps mounted in a flame-proof device within the gate-end box behind stout glass windows, show respectively when the gate-end box is connected to the supply, and when current is through to the coal cutter. Standard trailing cables and terminal plugs and sockets are used. Rise above earth potential of the casing of either the coal cutter or gate switch is guarded against by making it impossible for the motor either to start or to run except with an efficient earth connection between the case of the control switch on the coal cutter and the case of the gate-end starter. The apparatus is mounted within a strong flameproof boiler-plate box. Both front and back covers slide within deep machined grooves, and have handles for easy withdrawal.

The principles of operation may be seen from the diagram, fig. 3. The main power circuit passes from

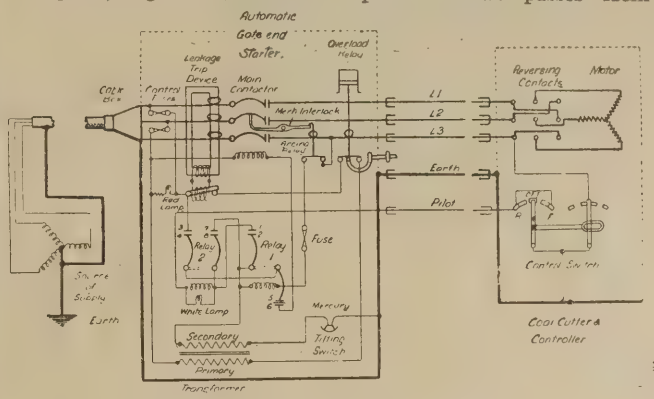


Fig. 3.—Diagram of Coal-Cutter Protection.

the incoming cable box on the gate-end starter, round the leakage trip device, to the main contactor, one lead passing round an arcing relay and an overload relay, and the three-power cores L1, L2, and L3, of the trailing cable leading *via* reversing contacts on the coal-cutter control switch to the motor. Control circuit No. 1 passes from incoming lines the L1 and L2 through control fuses shown adjacent to the cable box, through the contacts of the leakage trip device, the contacts of the overload relay, and the transformer primary. Control circuit No. 2 passes from the transformer secondary through the tilting switch to the starter-box case, through the earth core to the coal cutter case, the auxiliary contacts shown to the right in the diagram of the control switch to power cable L3, through the contacts of the arcing relay and a fuse to the operating coil of off position re-set relay No. 1, and back to the transformer secondary. Control circuit No. 3 passes from the transformer secondary, through contacts 1 and 2 of Relay 1, through the operating coil of Relay 2, through the pilot core to Contacts R or F of the controller, through the case of the coal cutter and the earth core to the case of the gate-end switch, and thence through the tilting switch back to the transformer secondary.

An Improved Hole Cutter.

Cooke's improved hole cutter, fig. 4, which is marketed by the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, London, W.C.2, should prove a very useful tool for electrical wiremen and fitters in many cases where it is required to drill large holes in metal posts, boxes, &c., in positions which do not lend themselves to the use of ordinary drillers, ratchets and clamps, &c. It consists of a small threaded centre pin, provided with a hollow head, to contain the cuttings and chips, which is inserted in a prepared pilot hole. A knurled feed nut is screwed down until the cutting edges engage with the surface of the plate and the body of the tool is revolved by means of tommy bars, pressure being gradually applied until the hole is completely made. It is claimed that burring or mis-shaping of the edge of the hole is prevented by the fact that the upstanding rim of the pressure pad holds the job in close contact with the cutter.

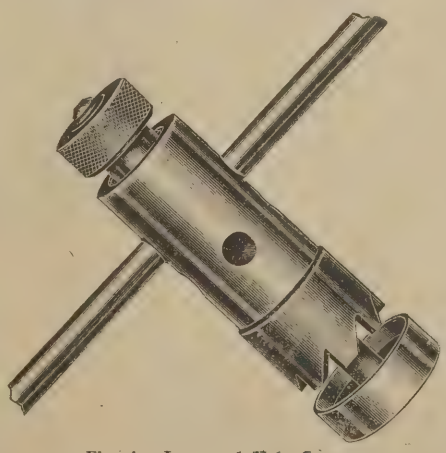


Fig. 4.—Improved Hole Cutter.

Metal-clad Switchgear for Single-phase Circuits.

New Ferguson, Pailin Single-pole Gear for Sub-circuits.

It has been said that the use of metal-clad switchgear of the draw-out or drop-down patterns for controlling high-pressure, single-phase, sub-circuits, though often desirable, has been "prevented by the prohibitive cost of that type of gear." Accordingly, in order to meet the case, Messrs. Ferguson, Pailin, Ltd., are now manufacturing a "type AV" single-pole switch with a maximum capacity of 100 amperes at 3,300 volts, which is arranged for mounting on pipe framework, isolation being accomplished by lowering the movable portion. The fixed portion, fig. 1, comprises a casting that accommodates the busbar, neutral bar (if required), cable box, isolating contacts, and downrods for supporting the removable portion. A hinged plate covers the isolating contacts when the switch portion is withdrawn, thus rendering all live gear inaccessible, while the busbar is of circular section and between units is run in iron tube; both the busbar chamber and cable box are compound filled. The cable-box is suitable for either single-core or concentric cable and provision is made for accommodating a neutral link if it is desired to isolate the neutral connection.

The removable portion of the switch, fig. 2, comprises the circuit breaker, trip coil, and isolating contacts. In order to isolate the breaker it is only necessary to undo the nuts at the bottom of the down-rods and the whole of the circuit-breaker portion as shown in fig. 2, and trip coil, which are mounted on a frame arranged to fit inside the oil tank, may be removed. The breaker contacts are of the standard Ferguson, Pailin laminated-brush pattern with arcing tips; the operating mechanism has a parallel motion and a free-handle, while overload protection may be obtained by means of a directly-connected overload coil, and an adjustable oil dashpot time lag may be fitted if desired. The complete unit has been designed to occupy the minimum space and may be mounted at 8-inch centres.

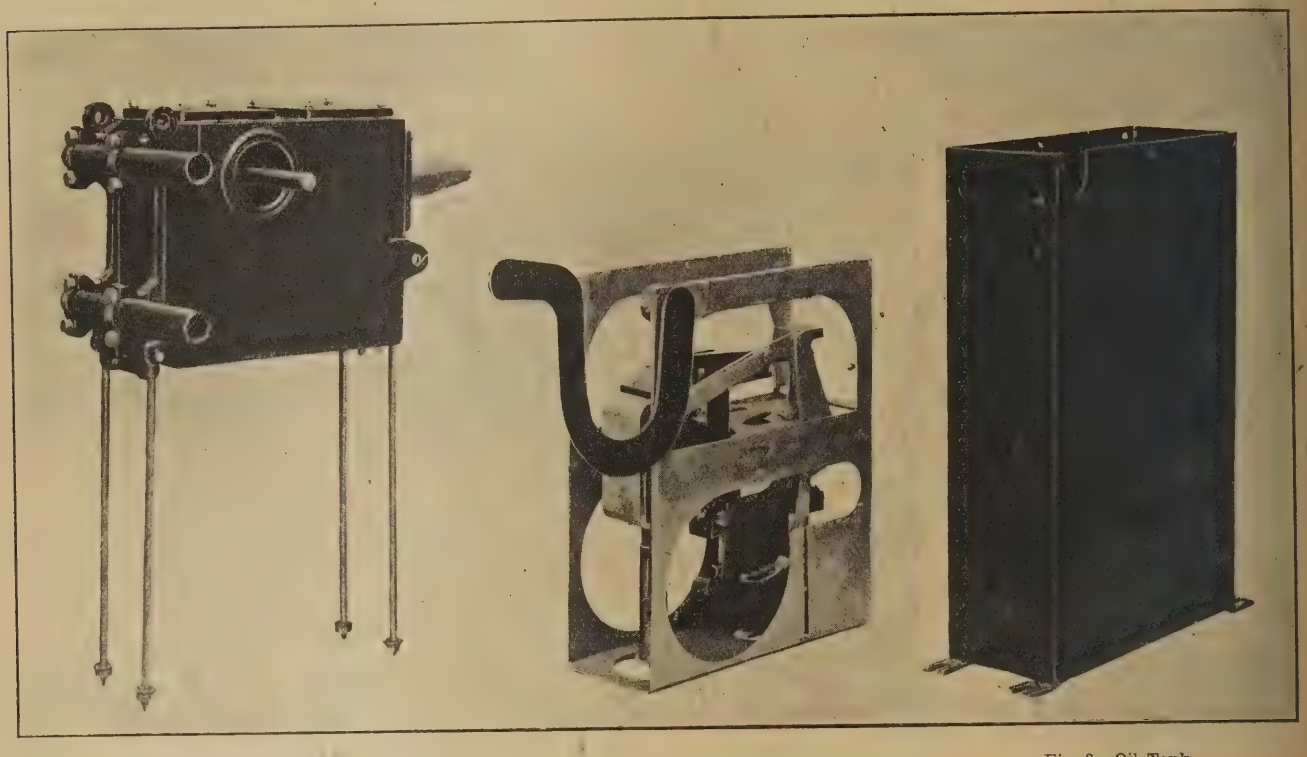


Fig. 1.—Fixed Portion. Fig. 2.—Circuit Breaker. Fig. 3.—Oil Tank.

New Ferguson, Pailin Metal-Clad, Single-Pole, Switchgear for Small Single-Phase Circuits.

British Electrical Plant for Costa Rica.—A preliminary agreement has been entered into between a British electrical company and the Compañia Nacional Hidroeléctrica de Costa Rica for the installation in the capital, San José, of a new hydro-electric plant. The whole of the equipment will be of British manufacture.—*Reuter's Trade Service* (San José).

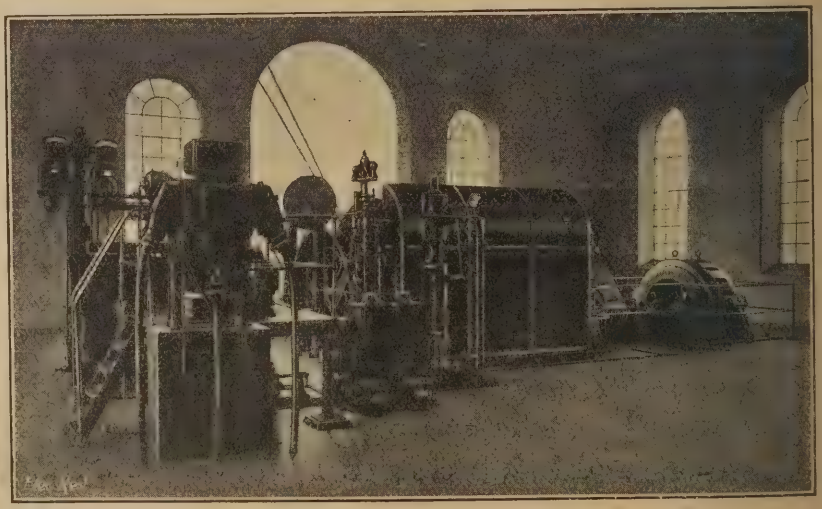
A Modern Electric Winder.

Some Particulars of the Plant at North Celynen Colliery.

An interesting example of an electrically-operated winding plant is to be found at the new house-coal pit of the Newport Abercarn Black Vein Steam Coal Co., Ltd. It is designed for an output of 270 tons per hour from a depth of 510 ft. and has a cylindro-conical drum 8 ft. to 12 ft. in diameter, single-reduction straight-tooth gearing being employed between the electric motor and the drum.

Although it was first used for sinking the pit, it is now employed for lifting coal; the drum diameters are proportioned to give lower power peaks throughout the wind.

Straight-post brakes are fitted with cast-steel bracket ends; they are housed in heavy cast-iron brackets and carry wooden blocks. The brake force is applied through a spring in conjunction with a floating lever, and while the braking effort is ordinarily derived from weights, assistance is given by introducing air to the top side of the brake piston, the combined effort being sufficient to hold the maximum pull of the motor. The brake solenoid is capable of giving a pull of 100 lb. through a 2-in. stroke. It is designed for a service of 40 operations per hour, and is supplied at 400 V from a 5-kVA transformer. It operates two single-pole, ironclad, limit, self-resetting switches. The overwind and overspeed preventer is of the "Whitmore" type. A dial-type depth indicator is installed on the machine, the pointer of which makes about ¾ of a revolution during the wind. The control platform carries all the operating gear, including the motor control lever, the brake



The North Celynen Electric Winder.

and emergency levers, and a gear for tripping in the case of current or air-pressure failure.

A 400-h.p. motor, 412 r.p.m., 2,200 V, 3-phase, 50 cycle, drives the winder. It is mounted on two pedestal bearings, and is fitted with a half-coupling forged solid with the motor shaft for connection to the gears. The switchgear consists of a draw-out circuit-breaker pedestal, controlling the main 2,200-V, 3-phase, 50-cycle supply; the pedestal carries the current and potential transformers for the ammeter and voltmeter installed on the instrument pillar, and trifurcating boxes for the incoming and outgoing mains.

The oil circuit breaker has three overload time-limit releases and a low-voltage no-close device. A suitable tank lifter is also provided for the breaker.

The motor is operated by a liquid controller of the moving-electrode type, arranged for both hand and compressed-air lever operation, and is provided with accelerating governor gear. The electrodes are so arranged that they are continually submerged in the electrolyte, thereby preventing any possible chance of open flashing between the phases.

The installation was supplied by the General Electric Co., Ltd., in conjunction with its Fraser & Chalmers Engineering Works.

The Electrical Imports of Peru.

THE following figures show the values of the imports into Peru of electrical goods and apparatus in 1924. Comparative figures for 1923 are also given, together with a note of increases or decreases. The Peruvian £ = about 20s.

	£P 1923.	£P 1924.	Inc. or dec. £P
Electrical accessories, e.g., switches, cutouts, plugs, lampholders—			
Total	21,000	37,000	+ 16,000
From Germany	9,000	16,000	+ 7,000
,, Great Britain	500	2,000	+ 1,500
,, United States	11,000	9,000	− 2,000
Accumulators and batteries—			
Total	12,000	14,000	+ 2,000
From Germany	2,000	2,400	+ 400
,, United States	7,600	10,000	+ 2,400
Insulators and tubes—			
Total	8,000	20,000	+ 12,000
From Germany	2,000	5,000	+ 3,000
,, United States	5,500	9,400	+ 3,900
,, Great Britain	700	3,000	+ 2,300
Copper wire, covered, except with silk, up to 3 mm. in diam.—			
Total	13,500	13,700	+ 200
From Germany	3,000	3,300	+ 300
,, United States	7,500	5,300	− 2,200
,, Great Britain	2,000	1,500	− 500
Ditto more than 3 mm. in diam.			
Total	32,500	16,000	− 16,500
From Germany	3,500	2,600	− 900
,, United States	12,000	11,000	− 1,000
,, Great Britain	2,000	1,500	− 500
,, Italy	15,000	700	− 14,300
Telegraph apparatus, including wireless—			
Total	3,000	10,000	+ 7,000
From United States	700	1,200	+ 500
,, Great Britain	2,500	8,800	+ 6,300
Telephone apparatus—			
Total	4,000	4,000	—
From United States	3,000	2,000	− 1,000
,, Great Britain	200	700	+ 500
Lighting fittings—			
Total	18,000	18,400	+ 400
From Germany	9,000	7,900	− 1,100
,, United States	6,000	4,500	− 1,500
Heating and cooking apparatus—			
Total	1,500	6,000	+ 4,500
From Germany	500	1,300	+ 800
,, United States	900	3,500	+ 2,600
Cables of copper wire—			
Total	86,000	84,000	− 2,000
From Germany	1,400	9,500	+ 8,100
,, United States	3,000	7,400	+ 4,400
,, Italy	79,000	24,000	− 55,000
,, Great Britain	—	31,000	+ 31,000
Electric bells—			
Total	700	700	—
Insulating tape—			
Total	1,700	1,700	—
Covered copper flex—			
Total	8,400	6,200	− 2,200
From Germany	3,200	2,600	− 600
,, United States	3,500	1,200	− 2,300
Meters and instruments—			
Total	2,800	4,100	+ 1,300
From Germany	1,600	1,400	− 200
,, United States	1,000	1,800	+ 800
Metal filament lamps—			
Total	24,000	29,400	+ 5,400
From Germany	12,800	12,400	− 400
,, United States	8,000	9,000	+ 1,000
,, Holland	2,400	6,800	+ 4,400
Magnetos—			
Total	1,300	2,500	+ 1,200
From Germany	300	400	+ 100
,, United States	700	1,700	+ 1,000
Electric light meters, domestic—			
Total	4,000	1,900	− 2,100
From Germany	3,700	800	− 2,900
Motors up to 1 h.p.—			
Total	1,400	900	− 500
Switchboards—			
Total	3,000	27,800	+ 24,800
From Germany	1,400	3,700	+ 2,300
,, United States	600	21,400	+ 20,800
,, Great Britain	500	100	− 400
Fans—			
Total	1,500	2,600	+ 1,100
From Germany	400	—	− 400
,, United States	300	400	+ 100
,, Italy	600	2,200	+ 1,600
Current transformers—			
Total	11,000	28,000	+ 17,000
From Germany	7,400	1,500	− 5,900
,, United States	2,000	15,000	+ 13,000
,, Great Britain	1,400	2,200	+ 800
Total of electrical goods and apparatus	265,000	349,000	+ 84,000
From Germany	63,000	74,000	+ 11,000
,, United States	79,000	129,000	+ 50,000
,, Great Britain	12,000	57,000	+ 45,000
,, Italy	*99,000	56,000	− 43,000

* Practically all cables.

Frequency Variations in Thermionic Generators.

By LIEUT.-COL. K. E. EDGEWORTH, D.S.O., M.C., Royal Signals, A.M.I.E.E.

(*Abstract of paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

FOLLOWING a reference to the variations of frequency which occur in the pendulum-controlled mechanical oscillating systems, the phase relationships of currents and potentials in a thermionic generator are examined, and it is shown in the paper that the frequency of the oscillations is affected by the coupling between the grid and anode circuits. Equations are obtained which give the difference between the frequency of the oscillations generated and the resonant frequency of the tuned circuits; they show that the variations of frequency connected with the method of coupling are analogous to the reversible variations existing in a pendulum-controlled clock. With normal coupling the thermionic generator goes "slow," with reversed coupling it goes "fast," and with resistance coupling the variation disappears. Three "irreversible" variations of frequency are connected with a change in the (i) effective inductance of the circuit which occurs when the oscillation is free instead of forced; (ii) the resonant frequency of a damped circuit which occurs when the oscillation is free instead of forced; and (iii) associated with the presence of harmonics in the e.m.f. generated by the valve. Certain points in the design of thermionic generators employing resistance and reversed coupling are discussed; the experimental results obtained with various types of circuit are explained in terms of the theoretical variations previously discussed, and the characteristics of different types of constant-frequency generators are then compared. The practical applications of the results fall into two main classes, namely, wave-meters and transmitters (including master oscillators). In the case of power-driven generators, the high- and low-voltage current will usually be obtained from the same machine, and changes of voltage will presumably be of the same character. It is possible, therefore, to balance changes in anode voltage against changes in filament voltage, and a very close regulation should be obtainable in this way. Assuming a 10 per cent. variation in the voltage of supply, it seems quite possible to reduce the frequency variations to something of the order of 1 in 50,000, or 200 cycles per second at a frequency of 10,000,000.

In the case of the heterodyne wave-meter, a lower order of accuracy is likely to prove sufficient. The instrument would be adjusted so as to make it independent of variations in filament voltage, leaving only the residual frequency variations

associated with changes of anode voltage. These are considerably reduced by the adjustments made in connection with the filament voltage, and are of the order of 1 in 20,000 for a change of 10 per cent. in the voltage of supply. If necessary, they may be still further reduced by using a high anode voltage (nearly high enough to stop the oscillations altogether).

Three solutions of the problem of constructing a constant-frequency generator are referred to as: (i) The rheodyne generator; (ii) the orthodyne generator with grid bias, and untuned grid circuit; and (iii) the antidyne generator with grid bias. These three methods have not yet received sufficient trial to enable one to speak very decisively as to their merits, but their probable advantages and disadvantages may be indicated.

The *rheodyne generator* is more complicated than most types of orthodyne generator, as it involves the use of two tuned circuits and an arrangement for neutralising the stray capacity coupling. It does not, however, impose any restriction on the amplitude of the oscillations, and appears to be specially applicable to small transmitters in which it is not desired to incorporate a master oscillator.

The *orthodyne generator*, in conjunction with grid bias and an untuned grid circuit, appears to involve a considerable reduction in the amplitude of the oscillations generated, which would render it unsuitable for use in actual transmitters, although it would be suitable for wave-meters and master oscillators. It has the advantage of simplicity and employs only one tuned circuit.

The position of the *antidyne generator* with grid bias is rather difficult to define. The Colpitts circuit with suitable grid bias seems to have considerable possibilities, but the author is unable to say whether a sufficiently constant frequency is obtainable without some sacrifice of amplitude. The antidyne generator with an untuned anode appears to be less advantageous than the orthodyne generator with an untuned grid.

Regarding future possibilities, the employment of the thermionic generator which will keep its wave-length constant within 1 part in 50,000 will make heterodyne reception possible on wave-lengths of 30 m. or less, and the production of such a generator now appears to be a practical possibility. Variations in wave-length due to changes in aerial capacity have already been reduced to a low figure by the use of master oscillators, and the employment of a constant-frequency circuit for the master oscillator would appear to remove any troubles connected with the voltage of supply.

The development of heterodyne wave-meters which will give an accuracy of 1 part in 10,000 is another interesting possibility. There are a number of details in the design of such an instrument which require further study, but now that variations connected with the voltage of supply have been removed, there is no reason to suppose that any of the outstanding difficulties are insuperable.

For proper modulation radio-telephony requires a band of 10,000 or 20,000 cycles, but a very much narrower band is theoretically sufficient for wireless telegraphy, and the number of channels of communication which is theoretically available on the shorter wave-lengths is very great. The number of channels actually available at the present time does not approach these theoretical limits, but is determined by the unavoidable variations in the wave-length of transmitters. Any method which will reduce the variations in wave-length of short-wave transmitters will automatically increase the number of channels of communication available for practical use.

Radio on Aircraft.—Another daring seaplane flight was begun on January 22nd by Major Franco, of the Spanish Royal Air Service, accompanied by Captain Ruiz de Alda, a specialist in wireless telegraphy and aerial navigation, and a mechanic, who set out from Spain for the Argentine. The total distance covered was 1,800 miles, and the flight took about eight days. The machine was specially equipped for the trip with a Marconi AD6 aircraft telephone transmitter and receiver of the type which has been adopted as the standard fitting for British civil aircraft. A Marconi type 14 direction finder was also fitted for navigational purposes, and the Marconi Co. arranged with its affiliated wireless companies in South America to keep in touch with the seaplane when it approached South America. The King of Spain issued a royal order in which he conveyed thanks to the Compañia Nacionel de Telegrafia sin Hilos, Madrid, for the assistance which it gave to Major Franco, and for the arrangements which it and Marconi's Wireless Telegraph Co. made with other associated wireless companies in Brazil, the Argentine, Canada, and the United States for co-operation.

A New Peril.—According to *Science Service*, amongst the items of scientific progress in 1925 was the following:—Professor Gilbert N. Lewis announced a new theory of radiation based on the Einstein view of time, which makes a distant star and the eye-ball of an observer come into virtual contact.

Exide Service.

A New Depôt at Acton.

The Chloride Electrical Storage Co., Ltd., in the furtherance of the excellent service facilities which it is providing all over the country, as well as abroad, has recently opened a new depôt at Lexden Road, Acton, to serve the South of England. The premises were formerly a garage belonging to the London General Omnibus Co., Ltd., and have a floor area of 25,000 sq. ft., all on the same level. The new premises serve a four-fold purpose; they are at once a stores, a repair depôt, a charging depôt, and assembly shops. The stores section is in efficient communication with the company's works at Clifton Junction, and a fleet of petrol and electric vehicles is available to provide stocks for Exide service depôts at short notice. The repair organisation deals not only with the company's batteries, but also those of any other make. An extensive room is provided for battery charging; it has a floor area of 8,000 sq. ft., and motor-generator equipment capable of dealing with a very large number of accumulators. Arrangements are made for the speedy replacement of exhausted vehicle batteries by others fully charged, and there is a spacious covered yard in which waiting vehicles can be parked. The accompanying illustration conveys an idea of the extent of the battery-charging room and its equipment. It was noticed during a recent inspection that the leads are either clipped to the accumulator terminals, or where lead terminals are fitted connection is made by fixing a bare copper wire with a tap from a hammer—very simple but quite efficient. An ample stock of plates of all types is maintained, as well as containers, crates, &c. The new depôt is well staffed to ensure quick attention, and is already doing an extensive business in each of its departments.



The New Acton Exide Depot—Battery-charging Room.

Water Power in Italy.—In *Annali de utilizzazioni delle Acque*, Vol. 2, No. 2, 1925, Mr. C. Bonomi supplies the following table, which shows the progress that has been made in the development of water power in Italy from the end of 1920 to the end of 1924:—

Province.	End 1920.	End 1922.	End 1924.
North Italy.			
Piedmont	365,530	452,885	532,882
Liguria	14,660	15,348	22,060
Lombardy	326,309	387,804	424,810
Venice	76,046	84,394	134,281
New provinces	81,699	81,699	84,623
Middle Italy.			
Emilia	17,813	25,679	29,379
Tuscany	20,527	22,887	27,489
Marche	29,892	38,526	42,310
Umbria	168,363	200,501	200,501
Latium	39,031	40,031	45,035
South Italy.			
Abruzzi and Molise	92,248	100,426	104,029
Campania	20,268	57,148	57,148
Apulia	—	4,400	4,400
Basilicata	—	1,000	2,153
Calabria	710	4,082	6,592
Sicily	11,400	14,832	14,832
Sardinia	—	—	10,380
Totals	1,273,496	1,513,642	1,742,904

While these developments embrace the whole of Italy, it will be noted that the greatest progress has taken place in the north. Whether or not the whole of this water power is applied to hydro-electric purposes is not stated, but certainly the greater proportion is thus used. It will be noted that, while there is nothing sensational in the progress of water-power utilisation in the period covered by the above figures, approximately half a million horse-power has been added to the water power harnessed in Italy since the end of 1920.

The Institution of Electrical Engineers.

Annual Dinner of the North-Western Centre.

The semi-jubilee dinner of the North-Western Centre of the Institution of Electrical Engineers took place at the Midland Hotel, Manchester, on January 26th, the chairman of the centre, Mr. A. G. Ellis, presiding. There were about 250 present.

The toast of "The City of Manchester and the Royal Borough of Salford" was proposed by Sir Holberry Mensforth, K.C.B., C.B.E., Director General of Factories, and was responded to by Alderman Delves, the Mayor of Salford. Councillor Mitchell, the Lord Mayor of Manchester, was unable to be present.

Lieut.-Col. Sir Joseph Nall, T.D., D.S.O., M.P., proposed the toast of "The Institution of Electrical Engineers." He said in the future development of electricity in this country care must be taken not to embark upon schemes which involved enormous calls upon the public purse, and not to hamper by legislation the ordinary development brought about by private business. There was a wide field for investigation and legislation in the matter of standardisation, but whilst they could achieve much by standardisation and encourage and guide enterprise by legislative action, they might also do a great deal of harm unless care was taken. Whatever advantages might ultimately accrue from the system of railway grouping, the immediate effect had been to hold up schemes of electrification which would have been carried out by this time if the railway companies had continued their separate existence. Some schemes had apparently been abandoned owing to the indirect influence of coercive legislation. He hoped and believed the Government's electricity proposals would not be unduly coercive nor restrictive, but would remove many difficulties and pettifogging restrictions, and that the results, in the next few years, and also in the years to come, would be of inestimable benefit to the people concerned.

Mr. R. A. Chattock, President of the I.E.E., who was received with musical honours, replied to the toast. He said there was nothing wrong with the I.E.E. One of its chief duties was to adapt itself to the needs of its members; and in that connection he reminded his audience of the Wireless Section which was now being developed. It was hoped that it would help in the development of the wireless industry by getting the general body of the members interested, and making them feel that they were being catered for by the Institution. Recently, a proposal had been made to form a separate Institute of Wireless Engineers; he could not speak too strongly against it. Sectional institutions would fritter away the strength of the parent Institution.

He thought the industry would be helped along very considerably by the British Industries Fair. An Electrical Trades Section was being started; it was going to be very representative, and those who went to see it would find it very advantageous. Considering the number of visitors who were coming from abroad, it should have a very good effect upon the electrical trade of this country.

Generally speaking, the Government's electricity scheme had met with approval, though certain sections would undoubtedly create opposition. The scheme was explained in greater detail at a conference he recently attended at the Ministry of Transport, but the explanation was confidential. That was very unfortunate, because he felt that the greater the publicity given to the scheme, and the more it was thrashed out by those interested in it, the better it would be for the country. They did not want these schemes to be carried out in a hole-and-corner fashion. If there was something which they felt was not good for the country, they ought to be allowed to say so publicly, to criticise it, and to try to get it put right. The President of the Birmingham Chamber of Commerce had said manufacturers were very dubious about the scheme, and they felt it was useless to try to discuss it unless they had before them the basic figures on which the scheme was built. It was all very well for a Government Department to say: "We have investigated this matter, we have gone into the figures, and we are satisfied"; but, as intelligent citizens, they ought to have the figures.

On several occasions this country had been accused of being backward in electrical development; comparisons with America and the Continent were made. He could not see why that attitude should be taken up, because the British electrical industry was as efficient as any in the world. Development was going on at an increasing rate. Birmingham was providing for 700 to 1,000 new customers per month. That did not look like falling behind; they were going ahead, and at this rate would soon catch up to America. No warnings or stimulants were needed; he really did not see that there was any need for the criticism and pessimism of which so much was now heard.

With regard to the development of rural areas, they were being treated unfairly. The big industrial centres were anxious to get back into the country and to open it up, but the delays and obstructions were disheartening. Even after an Order had been obtained, it took months to get wayleaves. He was sure the Ministry of Transport could help in those matters. He wished every success to the scheme—subject to reservations. Before agreeing with it, they wished to be satisfied that the dislocation of their business was justified.

The toast of "Our Guests" was proposed by the chairman in an admirable speech. In responding, Sir PHILIP NASH, K.C.M.G., C.B., referred to the electricity proposal; he said that in his opinion it was a non-party measure, and it had three great advantages—it was conceived on big and broad lines; it was constructive—not obstructive nor destructive; and in the main it was not impracticable.

Mr. S. L. PEARCE, C.B.E., M.Sc., who also replied to the toast, said the work which confronted the Electricity Commissioners was extremely complex, and the difficulties were perhaps made greater at the present time because they had to take care that their actions to-day would not hamper the carrying-out of the Government proposals. For full details of the proposals they must necessarily wait till the presentation of the Bill. It had been questioned whether a new body such as the proposed Electricity Board was needed; it was the definite conclusion of Lord Weir's Committee that it was necessary, to give full effect to the scheme, and there was no statutory body in existence which could possibly fill the same rôle. It might be regarded as a kind of Super-Joint Electricity Authority for the whole country. There was no intention to abolish the existing regional authorities, which had done excellent work, and would continue to perform most useful duties; certain powers of the Board might be delegated to them as its agents. The consumption of electricity per head could be greatly increased by the use of cheaper energy and cheaper apparatus, and both these advantages should result from the scheme. In the next 15 years they hoped to advance from 2,400,000 kW installed to 8,000,000 kW, and from an output of 5,500 million kWh sold to 21,000 millions a year. It was essential that they should take a long view. Those who would be affected by the proposals were entitled to be satisfied that the scheme was sound. It had been urged that the economies effected would be offset by the cost of the transmission lines, of standardisation, and of administration; they might be sure that these matters had been most carefully investigated, and a mass of figures had been compiled and confirmed by eminent advisers. The various undertakings, obviously, could not all share the benefits equally, but if it could be shown that any interest were prejudicially affected by the scheme, he was sure that sympathetic consideration would be given to representations to that effect. It was not sought to set up fettering Government control, but to work through and assist the existing agencies as far as possible. The Commissioners had no axe to grind and no sectional interests to serve; their one aim was to develop the electricity supply industry in this country.

Mersey and North Wales Centre Dinner.

The Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers held its annual dinner on Friday last at the University Club, Liverpool, when a large number of members and visitors were present, and Mr. A. E. Malpas, Wh.Sc., M.I.E.E., chairman of the centre, presided.

"The Institution of Electrical Engineers" was submitted by Mr. J. SANDEMAN ALLEN, M.P., who expressed admiration of the work of the Institution. The work that was done by electrical engineers was so great and important, that it could only be adequately conceived by viewing it in the national and international sense. It was only by industry adapting itself to modern needs and requirements that the country's trade would be maintained and developed. Electrical engineers were not straggling individuals, but were organised into a great national Institution, with 50 years' experience behind it, and a total strength of 11,740 members.

Mr. R. A. CHATTOCK, president of the Institution of Electrical Engineers, responded, and commented on the fashion of establishing new institutions. Referring to the training of engineers, he said he had received communications from students who said they had had no opportunities of getting on. They expressed the feeling that they were being sidetracked. If that spirit was interpreted into words it would militate against the Institution. If there was no room in this country for engineering students, there was plenty of room in the Empire, and they could not do better than get out into the world. The establishment of lighting development bureaux in various towns would have very far-reaching effects in the electricity supply industry. He hoped the idea would be extended to the cooking and heating part of the business. Supply engineers alone knew what an excellent load factor would be provided, and a high load factor meant cheap production. As to the Government scheme, he hoped it would not be made a political stunt. He felt that the politicians were trying to go a little too fast, as developments of that kind could only come about gradually. The efficiency of power stations had trebled during the last 15 years, and the last word had by no means been said. He was of the opinion that the Electricity Commissioners should consult the engineers in the industry and thrash out with them all the details of a scheme. He could say, however, that a more or less concrete scheme had been evolved, but the details had not yet been made public. He was glad that the Minister of Transport had been called in to discuss the matter. Such

conferences would be a great benefit to the industry and the country. He was sure that all would be glad that the Government did not intend to subsidise the industry. Subsidies were not only disheartening, but disintegrating, undermining energy and enthusiasm that otherwise would be put into the work.

Mr. A. G. ELLIS, chairman of the North-Western Centre, proposed "The City of Liverpool," and took the opportunity of commenting on the friendly relations and the good fellowship between the local Centre and the North-Western Centre. In the electrical engineering manufacturing business, exports amounted to 30 per cent. of the total production, most of which was shipped from Liverpool. The export trade in British electrical manufactures was practically one-third of the total electrical export business of the world, the other main portion being shared by Germany and America. The Liverpool electricity supply system was laid down on such lines that it would be able to link up with other concerns when standardisation was introduced.

The LORD MAYOR OF LIVERPOOL responded, and spoke of the enormous developments of the Liverpool tramway undertaking and the electric power and lighting department.

Mr. B. WELBOURN proposed "The Guests." The electrical engineering industry in this country, he said, was not so far behind as it was often represented to be. There was one area, the North-East Coast, where the consumption was 800 kWh per head of the population per annum. At St. Helens the figure was over 1,000, and in the smaller town of Prescot it was 500. Industrial Lancashire was a big consumer, but the chief backwardness was in the non-industrial and agricultural areas of the country. In those places there was very little demand.

Mr. T. R. WILTON, M.Inst.C.E., President of the Liverpool Engineering Society, complimented electrical engineers on solving one of the greatest problems of town life—doing away with the great curse of smoke.

The final toast, that of "The Chairman," was proposed by Mr. H. H. HARRISON, and acknowledged by Mr. A. E. MALPAS.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 27th:—

Honeycomb. No. 459,684. Class 8. Electrical coils for use in radio-telegraphy and telephony.—Igranic Electric Co., Ltd.

Radio XXX super sensitive crystal (lettering and design). No. 462,285. Class 8. Instruments, apparatus and accessories for use in connection with radio-telegraphy and telephony.—M. Feldman, 2a, Barrack Street, Meanwood Road, Leeds.

Reco. No. 463,073. Class 8. Radio-telephonic receiving sets and parts thereof.—H. J. Roberts, trading as the Roberts Engineering Co., 110, Old Street, E.C.1.

Zenite. No. 463,595. Class 8. Electrical resistances.—R. Lehmann and Co., Ltd., Zenith Works, Willesden Green, N.W.2.

G.K. Liquitone (lettering and design). No. 463,537. Class 8. Radio-telephonic receiving sets and parts thereof.—Gladwell & Kell, Ltd., 258, Gray's Inn Road, W.C.1.

Filtron. No. 465,534. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—E. A. Graham, trading as Alfred Graham and Co.

B. & T. (lettering and design). No. 464,651. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Baird & Tatlock (London), Ltd., 14-15, Cross Street, E.C.1.

Magnatone Aerial Encircles The World (lettering and design). No. 465,110. Class 8. Aerials for use in radio-telephony.—Sparklets, Ltd., Angel Road, Upper Edmonton, N.18.

Marconite. No. 464,994. Class 50. Electrical insulating substances of asbestos, mica, resin, oils or bitumen.—Marconi's Wireless Telegraph Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

28,453. "Diaphragms to be used in electric batteries." Dr. M. Wilderman. September 12th, 1924. (245,252.)

1924.

10,905. "Electromagnetic control arrangements for automatic punching machines." J. R. C. August and E. K. Hunter. March 3rd, 1925. (245,364.)

16,414. "Radio receiving systems." Electric Apparatus Co. July 18th, 1923. (219,305.)

21,337. "Electric switches." A. E. White (Elevator Supplies Co., Inc.). September 9th, 1924. (245,484.)

23,467. "Devices for the expansion or diminution of letters, figures, and the like for illuminated advertising or like purposes." H. M. Black. October 4th, 1924. (245,492.)

23,709. "Apparatus for the rectification of alternating current." H. G. Andre. November 13th, 1923. (224,871.)

23,710. "Apparatus for the rectification of alternating current." H. G. Andre. April 30th, 1924. (Addition to 224,871.) (233,292.)

23,714. "Auxiliary lighting circuits for electric train-lighting installations." J. Stone & Co., Ltd. (C. J. H. Bolton). October 7th, 1924. (245,502.)

23,729. "Electric switching-keys for high-frequency circuits." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and B. B. Grace. October 7th, 1924. (245,505.)

23,848. "Double-pole electrical connection." P. Tracy. October 8th, 1924. (245,512.)

23,926. "Modulating systems for electric signalling and the like." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). October 9th, 1924. (245,516.)

23,948. "Means for adjusting radio instruments or the like." Igranic Electric Co., Ltd., and G. F. Dandridge. October 9th, 1924. (245,518.)

24,004. "Electrical translating apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (Addition to 199,480.) (245,522.)

24,005. "Electric relay apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. ((245,523.)

24,017. "Electrical thermo-sensitive apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (245,524.)

24,024. "Railway traffic-controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). October 10th, 1924. (245,525.)

24,122. "Metal-clad electric switchgear." A. Reyrolle & Co., Ltd., and J. Mirrey. October 11th, 1924. (245,529.)

24,253. "High-speed telegraph systems." T. G. Thornblad. February 7th, 1924. (228,855.)

24,625. "Telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. October 16th, 1924. (245,532.)

24,639. "Construction of aerial 'wire' for wireless broadcast reception." F. F. Sharp and R. R. Stell. October 17th, 1924. (245,533.)

24,804. "Electric measuring instruments." G. Wall and Metropolitan-Vickers Electrical Co., Ltd. October 19th, 1924. (Cognate application 11,033/25.) (245,536.)

24,827. "Air-spaced coil for use in wireless telegraphy and telephony and also for use for electrical purposes." Lord Egerton of Tatton (M. Egerton). October 18th, 1924. (245,537.)

24,887. "Variable electric condensers." A. E. Alexander (U. S. Tool Co., Inc.). October 20th, 1924. (245,538.)

26,119. "Inductance-coil holders." H. Stevens and A. J. Stevens & Co. (1914), Ltd. November 3rd, 1924. (245,549.)

26,274. "Battery terminals." A. H. Sheppard and Ever Ready Co. (Great Britain), Ltd. November 4th, 1924. (245,550.)

27,027. "Process and apparatus for carrying out circuit reactions under very high pressures." J. Y. Johnson (Badische Anilin & Soda Fabrik). November 12th, 1924. (245,553.)

27,117. "Telephone repeater circuits." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). November 13th, 1924. (245,554.)

27,262. "Electrically-operated make-and-break devices for use in horns or warning devices for vehicles, or for use in electric bells, interrupters for spark coils, and the like." Fuller's United Electric Works, Ltd., and A. P. Welch. November 14th, 1924. (245,556.)

27,367. "Tuning-coil holder." H. A. Hickson. November 17th, 1924. (245,557.)

29,274. "Plug-in fittings or attachments for inductance coils for wireless receiving or transmitting apparatus or for other uses." F. H. Alston. December 6th, 1924. (245,569.)

29,592. "Electric switch plugs." J. E. S. E. Honor and C. W. H. Honor. June 19th, 1925. ((245,572.)

29,693. "Valve-holders for wireless receiving sets." C. Pressland. December 10th, 1924. (245,574.)

30,765. "Automatic excess-heat protector, especially for electric machines and apparatus." W. Hickel and O. Pletscher. December 22nd, 1924. (245,581.)

1925.

248. "Electrical terminals." E. M. Taunton. January 5th, 1925. (245,586.)

602. "Diaphragm sounders." F. Krupp Germaniawerft Akt. Ges. October 10th, 1924. (Addition to 225,569.) (241,150.)

1,253. "Grid resistances." Rheostatic Co., Ltd., and L. Satchwell. January 15th, 1925. (245,598.)

1,987. "Automatic switches for use in telephone or like systems." J. E. Pollak (Telephone Apparat Fabrik E. Zwietusch & Co., Ges. Kommanditges.). January 22nd, 1925. (245,606.)

2,594. "Protective device for limiting the supply of current to and automatically switching-off electric current-consuming apparatus." Maschinenfabrik Oerlikon. February 25th, 1924. (230,027.)

3,061. "Automatic switches for use in telephone or like systems." J. E. Pollak (Telephone Apparat Fabrik E. Zwietusch & Co., Ges. Kommanditges.). February 3rd, 1925. (245,615.)

5,239. "Method of and means for operating mechanically-driven rectifiers in connection with electric transformers." Lodge Cottrell, Ltd. (Lurgi Apparatebau Ges.). February 25th, 1925. (Convention date not granted.) (230,073.)

6,402. "Formers for use in the winding of electric inductance coils." Fuller's United Electric Works, Ltd., and A. P. Welch. March 9th, 1925. (245,634.)

6,440. "X-ray tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. March 10th, 1924. (230,497.)

6,649. "Coating of welding electrodes." Siemens-Schuckertwerke Ges. March 12th, 1924. (230,831.)

6,675. "Jacketed welding electrodes." P. C. Rushen (Siemens-Schuckertwerke Ges.). March 11th, 1925. (245,635.)

7,089. "Coil-holder for wireless and like apparatus." E. Shipton and B. Phillipson. March 16th, 1925. (245,637.)

11,048. "Automatic electrode-regulating apparatus for electric furnaces." Akt. Ges. Brown, Boveri et Cie. May 7th, 1924. (233,692.)

14,391. "Ignition devices for internal-combustion engines." M. J. B. Barbarou. July 26th, 1924. (237,566.)

14,700. "Flashlight containers." P. R. Puckett. June 5th, 1925. (245,661.)

15,073. "Electrically-operated vacuum cleaners." G. R. Bimm. June 10th, 1925. (245,662.)

17,332. "Electric luminous tubes." General Electric Co., Ltd. February 9th, 1925. (245,672.)

18,573. "Alternating-current induction meters." Dr. O. T. Blathy. August 23rd, 1924. (Addition to 201,573.) (238,863.)

18,601. "Electrical condensers." J. Bate and C. A. Vandervell & Co., Ltd. July 21st, 1925. (245,676.)

19,329. "Combined electrical condensers and resistance units, more especially for use in radio circuits." Dubilier Condenser Co. (1925), Ltd. May 2nd, 1925. (245,680.)

19,845. "Electric flashlights." National Carbon Co., Inc. December 1st, 1924. (243,673.)

20,477. "Device for regulating the pressure of mercury-vapour in the working chamber of mercury-vapour apparatus, and more particularly in mercury-vapour rectifiers." Dr. W. Dallenbach. August 15th, 1924. (238,565.)

26,704. "Diaphragms for telephone instruments." E. V. Mackintosh and C. French. October 24th, 1925. (245,704.)

29,233. "Direct-current ampere-hour meters." G. Wall and Metropolitan-Vickers Electric Co., Ltd. October 18th, 1924. (Cognate application 7,475/25.) (Divided application on 245,536.) (245,707.)

32,798. "Method of and apparatus for converting electric power." P. C. Rushen (Hazeltine Research Corporation). July 4th, 1924. (Divided application on 218,675.) (245,708.)

The

Electrical Review

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Manager and Secretary: E. S. MIDDLETON.

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The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

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The Result of our Competition.

WE have pleasure in announcing below the names of the winners of prizes in the ELECTRICAL REVIEW Advertisement Competition:—

CLASS A.

FIRST PRIZE, £100 - Awarded to Mr. J. L. Hayden (Sells, Ltd.), 168, Fleet Street, London, E.C.4, for the six full-page advertisements of the Macintosh Cable Co., Ltd., Ashbourne Road Mills, Derby.

Two SPECIAL PRIZES of £50 each—

(1) Awarded to the Wandsworth Electrical Manufacturing Co., Ltd., Imperial Works, Ludgate Hill, Birmingham, for six full-page advertisements prepared by Mr. John F. Preston (Messrs. H. P. Pope, Ltd., Advertising Agents).

(2) Awarded to Messrs. A Reyrolle & Co, Ltd., of Hebburn-on-Tyne, for six full-page advertisements.

(These two Special Prizes are additional to those originally offered. The keenness of competitors in the full-page class was so great, and the work so good, that after considering the report of the Judges, the Directors decided to award these extra prizes to the entrants named who ran neck and neck for second place right to the finish.)

CLASS B.

PRIZE, £50—Awarded to Messrs. Evershed and Vignoles, Ltd., Acton Lane Works, London, W. (Advertising Manager, Mr. A. W. Swan), for the best six half-page advertisements.

CLASS C.

PRIZE, £25 Awarded to Mr. J. E. Crawshaw, 28, Deansgate, Manchester, for the best six quarter-pages of the Lea Recorder Co., Ltd.

The number of advertisers who entered for the com-

petition was 45. The judging took place on Thursday, February 4th, at the Hotel Cecil. Messrs. J. W. Beauchamp and L. L. Robinson commenced their very difficult task at 11 a.m., and late in the afternoon on the same day the Electrical Review notified the five winners of their successes by telegram.

All of the submitted advertisements were carefully mounted on stout white cards, and arranged on tables around and in the centre of the well-lighted Pompadour Room.

We reproduce the successful advertisements in a special Art Supplement this week.

The Judges were entirely of one mind in the decisions reached, and the Directors of the Electrical Review, Ltd., desire to acknowledge the debt of deep gratitude to them for so efficiently performing their very difficult duty.

The prizes were duly posted on Friday, February 5th.

We print below the full report of the Judges, and some comments by them appear on page 244 :—

"Electrical Review" Competition.

To the Directors of the Electrical Review, Ltd.

In preparing a report upon our examination of the competing advertisements in the Electrical Review Competition, we hope that it will be recognised that we have experienced considerable difficulty in comparing advertisements of goods of very varying appeal or attractiveness; for example, note the different treatment required for plant, instruments, and accessories respectively. The existence of this difficulty has not, however, prevented us from arriving at quite definite conclusions as to the best series submitted in each of the three Classes.

The entries of the Macintosh Cable Co., Ltd., are recommended for the first prize in the full-page series (Class A). In all the four essential points: power of immediate attraction; qualities compelling continued attention; boldness of design; and artistic arrangement —these advertisements are excellent. They are conspicuous for the way in which they have produced a well-told story on a difficult subject.

The full-page series entered by Messrs. A. Reyrolle and Co. and the Wandsworth Electrical Manufacturing Co., Ltd., respectively, admirably execute the same difficult task, and we select them as being of equal merit and deserving of special recognition. Other competitors produced excellent examples of the purely technical advertisement in attractive form; one was noteworthy for its determination to attain to "truth in advertising" by modestly claiming to be only "very nearly perfect"; others made good use of the readiness with which plant lends itself to effective display.

In Class B (half-pages) we recommend as the best series those submitted by Messrs. Evershed & Vignoles, Ltd. In respect of design these advertisements compel attention. They make good use of the house outline around the Megger; also of the chart behind the recorder; and of the worry of a man who kept no records. They also get home well with the argument about the security which is assured by the use of reliable instruments.

Turning now to Class C (quarter-page), we recommend the series of the Lea Recorder Co., Ltd. for the prize. In the small space at the designer's disposal there is necessarily less opportunity for him to bring the same compelling force to bear upon the reader's mind. The presence of other announcements also has a weakening effect, but the quarter-page space in this series is, in our opinion, availed of to the fullest possible extent. Note how the direct question put to the reader-buyer is one always uppermost in his mind. The interest having thus been aroused, is well maintained. We especially commend the effective use that is made of diagrams. Though in point of boldness the series may not be all that the subject deserves, the limited space is well used.

Among the other examples included in Class 3, there were some which, while they compelled attention through boldness of design and directness of appeal, lacked certain other essentials. Some compelled attention, but did not maintain interest or excite further inquiry; some had no "story" to tell, or the story told was on the dull side.

The competition has, in our opinion, given a stimulus to the desire of advertisers and designers to produce work of a high standard. As the result of our examination of the 270 examples that were submitted by 45 companies and firms we feel that we must congratulate British advertisers upon the advance that they have made, for we believe it to be perfectly true that in the normal weekly issues of trade journals, either in this country or in America, there is no better advertising matter than has been brought together in this collection of announcements published in the Electrical Review between July and December, 1925.

We have been greatly impressed with the value of the whole-page advertisement as a means of fixing the reader's attention and affording the designer full scope for the exercise of his ingenuity and skill in effectively telling his story and illustrating the goods.

J. W. Beauchamp.
February 4th, 1926. L. L. Robinson.

Go to Birmingham!

Everything in regard to the future place of electrical products at the British Industries Fair depends upon the measure of success that attends our operations at Birmingham during the twelve days commencing on Monday next. The seventy or eighty exhibits that are now being prepared should make a powerful impression on the minds of the large number of visitors who are expected from overseas; and the collection of electrical articles brought together should make an atmosphere in which trade relations between home buyers and our firms should receive an excellent stimulus. The principal electrical day will be Wednesday next, 17th inst., when we hope there will be a large gathering of electrical men who have the ordering or specifying of goods. On other days delegations from electrical contracting and wholesale trading concerns will be present. We wish all exhibitors a very busy time, and urge all our readers who can manage to do so, to spend at any rate one day at Birmingham before February 26th.

The Lighting of Coal Mines.

The discussion on the above subject before the Illuminating Engineering Society on January 21st (reported elsewhere in this issue) was opportune, and raised many interesting points. Many data have been presented at different times to show the good results that have attended the introduction of improved electric lamps. It was, therefore, diquieting to note from Dr. T. L. Llewellyn's contribution that, in spite of these and other improvements in lighting, both nystagmus and cases of disability seem to have increased during recent years. This problem, like many others, is complicated by other considerations that tend to mask the effects of better lighting. The deranged condition of the industry accounts for a good deal, but in the meantime there are circumstances which have prevented the full advantages of electric lighting from being realised. Mr. E. Farmer, in his introductory paper, drew attention to one, namely, the tendency of naked filaments to glare when seen amidst the dark surroundings of the mine. Frosting the inside of the glass cylinder would seem to be a palliative, even though it causes some diminution in light. Another fact, commented on by Mr. T. J. Sack and others, is that a life of 1,000 hours, often demanded by colliery owners, cannot be expected from a miniature 2-volt lamp of reasonable efficiency; hence, underrun lamps, often furnishing even less than the legal minimum of 1 candle-power, are in use. It would pay handsomely to adopt lamps of a shorter life, but run at a higher efficiency, and there is also good prospect that miners will ultimately consent to use a somewhat heavier lamp, enabling 4-volt batteries to be employed and a higher candle-power obtained. In this event

gasfilled lamps may ultimately be used. Finally, there is the possibility, suggested by Prof. W. Thornton's researches, that low-voltage high-frequency currents, supplied by special cables, may eventually enable ordinary systems of electric lighting to be more widely installed in mines.

Railways and Rural Electrification.

WE referred in the closing paragraph of our leader of January 22nd to the electrification of the railways as an alternative method of carrying electricity supply into the country. There is not a centre of population in the whole country which is not within reasonable distance of a railway station. Consequently, if the whole of the railways were electrified, the whole of the country could be given a supply of electricity. That is a consummation attainable only after very many years; but the same is true of the method contemplated by the Government. Now, it is known that the railway companies are interested in the problem of electrification, and we have recently been told by more than one of their leading representatives that if it could be shown that electrification would pay, then they would be ready to adopt it. The companies are at present spending very many millions a year on new steam locomotives, rolling stock, and permanent way, which might equally be expended on electric locomotives and other electrical equipment. The North-Eastern Railway went so far as to build an electric main-line locomotive, and seriously considered the conversion of a large portion of its system to electrical operation. It appears, therefore, that the margin between profit and loss due to electrification is but a narrow one. It is worth consideration whether, if a portion of the capital scheduled for the Government scheme were devoted to the elimination of that margin, the electrification of our main-line railways and the concurrent electrification of the whole country might be brought about most economically and with the most beneficial results.

The point is that there is no necessity to find the whole of the enormous capital required to convert all our railways to electrical operation; a certain outlay would be justifiable on a strictly commercial basis, and up to that point the railway companies would be prepared to go, if there is any meaning in words. The additional capital required would be the difference between that amount and the actual cost, and if it were provided on similar terms to those offered to the proposed Executive Board—that is, with a Trade Facilities guarantee, and with sinking-fund suspended for five years—it would not only be readily obtainable, but would, we think, be at least as likely to become remunerative as the capital required for the national network and the standardisation of frequency. At the same time the combination of the railway load with that of public supply for lighting and power would greatly improve the load factor and enable the cost of energy to be reduced to a figure acceptable to the railway companies.

Unusual Dangers.

THE report which appeared in our last issue of a fatal accident due to a shock from the uninsulated collar of a lamp draws attention to a danger attendant upon the use of the screw-cap type of lamp which perhaps has not received sufficient consideration. It was stated that the unfortunate victim was altering the position of a high-power pendant lamp of this type whilst the cap of the lamp was alive; apparently, he received a shock of 230 volts alternating between the lamp cap and a steel girder, which ended fatally.

Even if such circuits were always wired with the switch on the live side, the danger would not be wholly removed, as it might be possible for a break to occur on the earthed side of the circuit, leaving the lamp cap charged through the filament. But even if this were not the case, no reliance could be placed on the wiring of the lampholder so that the lamp cap was on the earthed side, because at any time alterations might be made nullifying this precaution; it is also possible for the polarity of a whole installation to be reversed when work is in progress on the public mains. In the case of private self-contained installations neither pole may be earthed, and yet a fatal shock may conceivably be received from such a fitting.

Whilst we deprecate an alarmist policy where the risk is negligible, we think it must be recognised that there is a real danger to be dealt with here, and that provision should be made to prevent the recurrence of such an accident if possible—the most obvious course being to cover the exposed metal with an insulating coating.

A fatality recorded in our last issue, presumably due to contact with a radiator which had become "alive," is another example of those accidents in the bathroom which, more than any other class of accident, have marred the use of electricity in the home. Only in the bathroom, scullery or wash-house, and cellar is it normally possible, within reason, to bring about a fatal accident in the household, and, as we have repeatedly urged, the greatest care should be taken to limit the risk in such localities to the minimum. Portable apparatus should never be used in a bathroom.

Unfortunately electrical engineers have thought fit to impose the same precautions upon the use of electricity in other parts of a house where the risk is, humanly speaking, negligible. It is impossible to eliminate every conceivable element of risk in the use of electricity, any more than that of gas, coal, coke, oil, or even water. Who would ever have imagined that putting a pair of slippers under a radiator would bring about the death of the owner?

Interconnected Power Systems.

AN interesting article recently appeared in the *Electrical World*, of which an abstract is printed elsewhere in this issue, describing the methods adopted by a large electricity supply undertaking in the United States to obtain the advantages of interconnection between four power stations, without the drawbacks consequent upon the massing of plant aggregating 500,000 kW.

If the system were solidly linked up, the occurrence of a fault on any part of it would result in the discharge of an immense amount of energy into the fault, setting up a violent disturbance throughout the system. To obviate this, the "loose-linking" method has been employed, enabling the stations to assist one another when necessary or desirable, but limiting the effects of an uncontrollable disturbance to the minimum area. This end is attained, as explained in the article, by limiting the number of points at which energy may pass from one area to another, and by providing adequate automatic switchgear at each of these points. The installation of heavy switchgear at the power stations is being avoided as far as possible.

Wholesalers and Contractors.

THE general theme of the speeches at last week's dinner of the Electrical Wholesalers' Federation, which are reported in this issue, was an apprehension of the Government's intentions so far as the wiring of premises and the sale of electrical appliances are concerned. There appears to be a feeling that the Government intends to encourage municipal authorities to apply for full trading powers, and this fear may not be entirely without reason having regard to the decision in the Barrow, Bath and Burnley Corporations' Bills last July. Through Mr. A. G. Beaver, the Electrical Wholesalers' Federation expressed its determination to support the Electrical Contractors' Association in its fight against the granting of these powers, and at the same time Mr. Beaver warned manufacturers that it was not in their interest to adopt a neutral attitude. The contractors intend to get their blow in first if they can; the first manifestation of this spirit is the publication of a pamphlet, "Electrical Freedom," which is mentioned in our Business Notes.

The "Electrical Review" Advertisement Competition.

By J. W. BEAUCHAMP and L. L. ROBINSON.

In this competition there were examples of the modern advertising method in which a particular article is illustrated and supported by some decoration or sketch illustrating the idea for which it stands or work which it accomplishes.

This method is good, but in some of the examples the supporting ideas rather overshadow the actual article being sold, that is to say, the advertising agent or designer has become too much obsessed by his advertising technique, thus losing sight of the real object—to sell a certain article.

This is often noticeable to-day in the work of some agents.

It is seen again in poster work; the advertisers get so pleased with the fineness of their poster work that they produce something more likely to be appreciated by their brother advertising agents than by the public to which it is really addressed. The object and the supporting atmosphere should carefully be kept in their respective places.

We were impressed with the very high quality of all the stuff sent in, particularly the full-page spreads. Much of the best of the American advertising work was really embodied in these advertisements without making them too blatant and noisy.

In judging, a difficulty arose in comparing advertisements for heavy plant, highly scientific instruments and ordinary accessories. It would be easier if the advertisements were divided into classes.

It requires far more imagination to make a really telling advertisement out of some simple material or accessory than out of high-grade plant which lends itself naturally to effective pictorial treatment.

Some of the advertisements were very good because they were an appeal from a manufacturer to a retailer and pointed out how the retailer could make money by handling such goods.

Advertisements from the manufacturer to the retailer must go a little further than selling to the retailer, which after all is only half a sale—they should suggest how the retailer can "re-talk" the story to the ultimate user, or at least recommend him to get from the manufacturer some further leaflet or information on this very important point. Goods sold by manufacturers to retailers are really only half sold.

Some of the advertisements were a very happy combination of popular appeal and technical information—there is room for this sort of work in our industry; it not only sells the goods but also acts as a sort of unconscious text-book towards the buyer, increasing his technical knowledge in an easy way; as the suction cleaner says "It beats as it sweeps," we should say "The advertisement teaches as it sells."

In some cases the advertiser has forgotten that the reader of the technical paper is a busy man—or at least it is the busy reader who is a buyer. As he turns over the leaves, dozens of them, some feature must be provided to arrest his attention before consideration is given to the message which he is to read but will not read unless some outstanding feature has made him pause for a moment on that page. Here is the great advantage of the full page.

A few of the advertisements had a "carrying on" feature, they left rather a feeling that one should look for the next issue from the advertisers (this is important) or that one should write immediately for fuller details—the latter feeling is very important if it can be created, because if the writer immediately writes for something the seller gets his name on his file in connection with a certain subject, and then has all the material for follow-up work.

Few manufacturers perhaps expect to get a definite order right away from a particular advertisement, but if they can extract a letter from the potential buyer and so "start a file" with him, the rest should be easy. The seller then has a definite avenue of approach for his written matter and for his travellers.

The judges were glad that there was only one prize offered in each class; there was no real difficulty after serious consideration in adjudging the one first prize in each class, but it would have been very difficult to discriminate between Nos. 2, 3, and 4 had there been more prizes than one. The whole standard of the first half dozen in each class was very high.

Generally it was encouraging to note the absence of mere "superlatives" in the advertising, and the general expression of care and thought given to combine some arresting feature or statement with definite and valuable information as against the shrieking methods with which we were at one time threatened in engineering advertising.

The most interesting were those cases where a very scientific article or simple material, rather difficult to make a story with, had been treated.

Some of these less dramatic accessories or materials are of the utmost importance in electrical advertisements, and it is worth while bearing in mind that the firm that succeeds in putting across, for example, simple systems of wiring, good fittings, and things of that kind, is in a way advertising for all the other firms, much as E.D.A. by pushing electricity generally helps to sell dynamos, measuring instruments, and so on.

The almost entire absence of very noisy or rather vulgar advertisements was most encouraging—this class of thing may make people gape, but it sells nothing and lets down the standard of the whole business; the heroic figures, and more or less nude ladies and complicated sketches can safely be left to sellers of patent foods and similar articles.

Similarly, with the wording: "clichés," rhymed lines, and devices of that kind are no good in our business.

Copy should be terse, based on knowledge of the goods and belief in their utility. This, coupled with some imagination, placing the advertiser in the buyer's mental position, is most likely to produce results, and, generally speaking, the advertisements put before us represented this rather high-class, serious advertisement treatment in a very satisfactory manner.

Electricity in Agriculture.—After an extensive tour of America and Europe, Mr. H. P. Colwell, chief electrical engineer of the Victorian Railways, on returning to Australia in December is reported by the *Sydney Morning Herald* to have said that the rapid application of electricity to railways, industry, and agriculture in Europe had surprised him. 'During the war the price of British coal advanced to a prohibitive extent, and many European countries applied electricity to industries formerly dependent upon coal. Some of the farming districts, particularly those of Sweden, were remarkably well equipped with electrically-operated machinery, and he had seen consignments of electric ploughs sent from Germany to Russia. Where it was practicable to plough huge areas of land in one locality, the country was reticulated with electric cables, and ploughs were harnessed to electric tractors.

Hydro-Electric Enterprise in Canada.—During 1925 a total of 719,000 h.p. was added to the hydro-electric generating capacity of Canadian installations, bringing the total now operative to 4,290,000 h.p. Last year's installations represent a direct capital investment of $70,000,000, without regard to the new capital required to utilise the power. A further 1,000,000 h.p. at least is expected to be added during the current year. Quebec led in 1925 with a total of 439,000 h.p. in new installations; Ontario was second with 200,000 h.p., and British Columbia third with 59,000 h.p.—*Reuter's Trade Service* (Ottawa).

The British Industries Fair—I.

Electrical Features and Meetings.

On Monday next a trade event of the first importance commences simultaneously at London and Birmingham. It is natural to place London first, but from the point of view of the electrical industry that section of the British Industries Fair will be overshadowed by Birmingham.

As our readers know, special efforts have been directed towards the building up of a really representative electrical section at the Castle Bromwich Aerodrome, in which spacious buildings the Fair is housed. These efforts have borne abundant fruit; the list of exhibitors includes between 70 and 80 firms which are wholly or mainly electrical, and among them are the names of most of the leading concerns of the industry. We think, therefore, that electrical manufacturers will be represented in a manner fitted to their importance in the economic life of the State, and it is our earnest hope that the results obtained by them will more than justify their participation in this great trade show, which, it is hoped, will one day threaten the supremacy of Leipzig.

The Fair is designed, in the first place, to show foreign buyers what this country's capabilities are, and the whole of the organisation of the Department of Overseas Trade, and the Consular and Diplomatic Services, have, for the past few months, been spreading the idea and inducing traders in all parts of the world to visit England this year. Over 200,000 invitations have been issued to buyers in the Dominions and foreign countries, and to each two letters have been sent in his own language in the case of European and Latin-American countries. It may be of interest to mention actual figures; the following is a selection from an official list giving the country and number of buyers invited:—Australia and New Zealand, 2,000; Canada and Newfoundland, 2,168; South Africa, 2,256; Argentina, 1,145; Norway, 1,081; Sweden, 1,126; Holland, 1,600; the United States, 5,000; France, 2,892; Spain, 1,600; Italy, 3,000; Switzerland, 2,264; Balkan States, 1,000; and the Middle East, 1,000. It will be seen from this that every endeavour has been made to attract visitors from all the important markets, and the Department of Overseas Trade reports that the organisation of the Fair has received a remarkable response from representative buyers throughout the world. The opening of the Fair is thus taking place in most propitious circumstances, and everything points to success.

We have so far said nothing of the London section of the Fair. While, from our own point of view, this is of considerably smaller importance, it is by no means negligible. The radio industry is putting up a good show, there being a separate section for this purpose in which 33 firms have taken space. Having regard to the progress which the industry has made in the last year or two, there is no doubt that it now constitutes a very important branch of British production, and should secure a good share in foreign markets. Apart from the radio section, however, there will be many exhibits of electrical novelties and small electrical appliances at the White City, all of which play their part in the inculcation of the "electrical idea" and lead to bigger things.

The London list includes a number of the leading firms of radio apparatus makers, including the General Electric Co., Ltd., the British Thomson-Houston Co., Ltd., Burndept Wireless, Ltd., the M.O. Valve Co., Ltd., Marconi's Wireless Telegraph Co., Ltd., the Mullard Wireless Service Co., Ltd., the Marconiphone Co., Ltd., and S. G. Brown, Ltd., apart from a number of other firms which, although not so well known, do a tremendous business in radio apparatus.

The value of the Fair is to be enhanced by the seizing of the opportunity to bring together at the exhibition a number of trade associations and groups. We have already mentioned one or two functions which have been arranged, but we think that a brief *résumé* of the programme drawn up for the Birmingham section may be of interest and use to our readers. On Monday next (February 15th) the Lord Mayor of Birmingham will officially open the Fair, and on the following day the chief magistrates of other industrial towns will pay a visit at the Lord Mayor's invitation. On the same day (February 16th) an official visit will be paid by the Birmingham Association of Building Trades Employers. Wednesday, February 17th, is an "electrical" day, when a number of associations representative of associations in all branches of the industry will attend the Fair. Among the bodies who have notified their intention of taking part are the Institution of Electrical Engineers, the Incorporated Municipal Electrical Association, the Association of Mining Electrical Engineers, the Provincial Electric Supply Committee of the United Kingdom, and the Association of Electric Power Companies (Inc.). On February 18th official visits are being made by the Midland Builders' Federation and the Ironmongers' Federated Association, while there will also be a conference of Midland Gas Departments. The Duke of York will be at the Fair on February 19th, and on the same day the Sheffield Chamber of Commerce will pay an official visit.

On February 23rd official visits are to be paid by the National Hardware Association, the Export Merchants' Section of the Chamber of Commerce, the Ironmongers' Federated Council, and the Electrical Association for Women. Wednesday, February 22nd, is another "electrical" day, when the principal officers and local branch secretaries of the Electrical Contractors' Association will inspect the exhibits. The President and Council of the Electrical Wholesalers' Federation will be there, and the Birmingham and District Master House Painters' Association will also pay an official visit. The last official visit in the programme is that of the Liverpool Chamber of Commerce on February 25th. The Fair closes on February 26th.

In London an important banquet will take place on the evening of the opening day. The Mansion House has been lent by the Lord Mayor for the occasion, the President of the Board of Trade will preside, and the Prince of Wales will be the principal guest.

From the above list of functions it will be seen that while the foreign markets have been intensively cultivated, our all-important home market is also to be fostered by the visits of a number of representative bodies of users of manufactured products, as well as exporters who are an indispensable link in the chain of foreign trade relations.

The Birmingham Corporation is also rendering active assistance in the organisation of the Fair. It will be appreciated that the power supply to such a large aggregation of exhibits and arrangements requires very special attention, and the Corporation Electric Supply Department has carried out the work well. The Corporation has also taken a large amount of space as an exhibitor. The Electric Supply Department is to have a display exemplifying the use of electricity in a number of diverse directions. The principal exhibit will be a 184-kW mercury-arc rectifier sub-station. This is of the type employed in outlying areas to convert 25-cycle a.c. at 5,000 V to d.c. at 220 and 440 V. A transformer sub-station, as installed on the premises of large consumers, is also to be shown. This type consists of a 100-kVA transformer with the necessary h. and l.p. switchgear, to step-down the pressure from 5,000 V to 440 V three-phase and 110 single phase. Other exhibits will be electric furnaces, a coal-cutter, static condensers, bench drills, &c.

Electricity Supply in Great Britain.—XI.*

Lincoln, Rutland, Norfolk, and Suffolk.

The above Counties (except such parts of Lincolnshire as are included in the North-East Midlands provisionally determined Electricity District), together with the Counties of Cambridge, Isle of Ely, Huntingdon, Soke of Peterborough, and such parts of Essex as are not included in the London and Home Counties Electricity District, form Area No. 18 of the Fuel Consumption Analyses Report of the Electricity Commissioners, published annually by H.M. Stationery Office (price 1s. 6d.).

Table 8 gives the following totals for this Area :—

Year ending 31st March.	Area No. 18. kWh generated.
1922	72,728,485
1923	90,663,814
1924	107,370,713
1925	121,939,441

These figures include the kWh generated by Peterborough Corporation, Cambridge E.S. Co., Ltd., Wisbech E.L. & P. Co., Ltd., and by the undertakers in Essex outside the London and Home Counties' Electricity District, as well as the kWh generated at the stations shown on the accompanying maps.

The County of Essex was reproduced in No. 3 of this series, and the Soke of Peterborough was included in the map which accompanied the first of the series. With regard to the Counties of Cambridge, Huntingdon, and the Isle of Ely, it is not proposed to publish the maps, as the whole area is being applied for by the promoters of the Bedfordshire, Cambridgeshire, and Huntingdonshire Electric Power Bill.

The following is the list of existing authorised



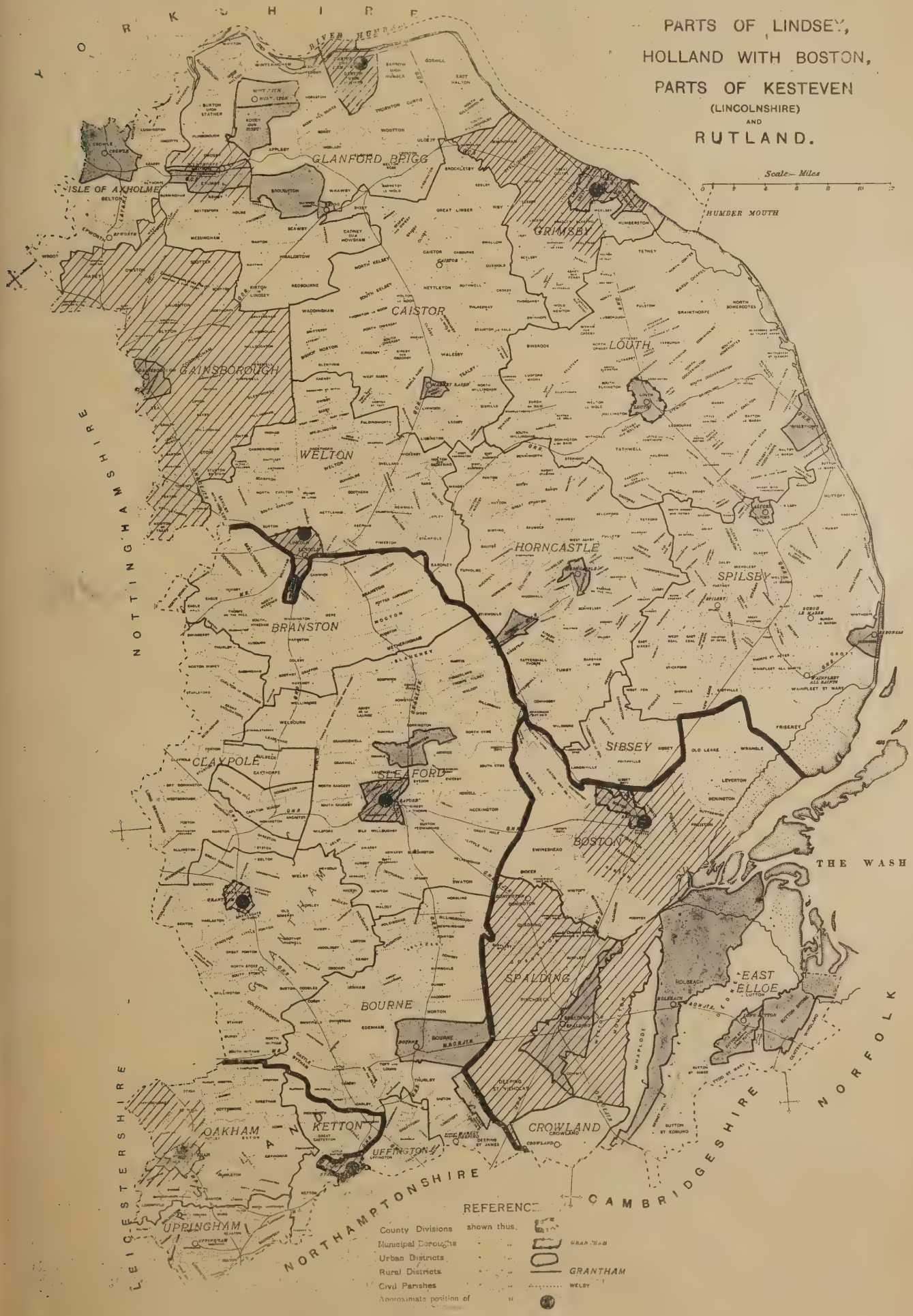
Electricity Supply in Norfolk and Suffolk.

*Parts I-X of this series appeared in the Electrical Review of October 9th, 16th, 23rd, and 30th, November 13th and 20th, December 11th and 25th, 1925, and January 15th and 29th, 1926.

undertakers, whose areas are shown hatched on the accompanying maps:—

Local Authorities.

Bury St. Edmunds Corporation.
Cleethorpes Urban District Council.
Felixstowe Urban District Council (undertaking operated by a company).
Great Yarmouth Corporation.
Grimsby Corporation.
Ipswich Corporation.
King's Lynn Corporation.
Lincoln Corporation.
Lowestoft Corporation.
Norwich Corporation.
Scunthorpe and Frodingham U.D.C.
Sleaford Urban District Council.



Electricity Supply in Lincolnshire and Rutland.

Companies.

Aldeburgh Electric Supply Co., Ltd.
Barton-on-Humber Electric Supply Co., Ltd.
Boston and District Electric Supply Co., Ltd.
Brundall and District Service Co., Ltd.
Edmundsons Electricity Corporation, Ltd.
Newmarket Electric Light Co., Ltd.
Oakham Gas and Electricity Co., Ltd.
Sheringham and District Electricity Supply Co., Ltd.
Urban Electric Supply Co., Ltd.
Woodbridge and District Electric Light Co., Ltd.

Cleethorpes Urban District Council obtains a bulk supply from the Great Grimsby Street Tramways Company, and Scunthorpe and Frodingham Urban District Council purchases its supply from a private company.

The Urban Electric Supply Co., Ltd., has separate undertakings, each with its own generating station, at Grantham and Stamford. Norwich Corporation is supplying in bulk to the Brundall and District Service Co., Ltd., and the Sheringham and District Electricity Supply Co., Ltd., is arranging to take a bulk supply from Edmundsons' generating station at Cromer.

The remaining undertakers possess their own generating stations, as indicated on the maps. It will be seen that there is no Power Company included in the above list of undertakers, and at the present time no part of the area of either map comes within any Power Company's territory, although part of north-west Lincolnshire is included in the North-East Midlands Electricity District as provisionally determined by the Electricity Commissioners. The areas applied for have also been hatched on the maps; the names of the promoters concerned are as follows:—

East Anglian Electricity, Ltd.
Orford Electric Light and Power Co., Ltd.
Spalding Urban District Council.
East Dereham Urban District Council.
Gainsborough Urban District Council.
Bungay Urban District Council.
Nottingham Corporation (Extension).

Particulars of applications are given in the Electricity Commissioners' Annual Reports and in the *London Gazette*.

The 1921 Census gives the following particulars for the districts shown on the accompanying maps:—

Administrative County with associated County Boroughs.	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Lincolnshire, Parts of—				
Holland ...	263,120	85,254	20,434	1,570
Kesteven ...	469,377	108,250	25,823	2,175
Lindsey ...	972,796	408,698	95,148	8,723
Rutland ...	97,273	18,376	4,531	369
Norfolk ...	1,315,064	504,293	121,783	8,747
Suffolk, E. ...	557,353	291,073	67,912	4,484
Suffolk, W. ...	390,916	108,985	27,570	2,053
Total ...	4,065,899	1,524,929	363,201	28,121

Similar particulars for the Administrative Counties of Cambridge, Huntingdon and the Isle of Ely give the following totals:—

Acres.	Persons.	Resident families.	Buildings not containing dwellings.
787,226	258,160	64,090	4,762

These maps are reproduced by permission of the Controller of H.M. Stationery Office. The originals were prepared by the Ordnance Survey Department for the 1917 Boundary Commission.

Since 1917 the following alterations to areas, &c., have been made:—

(1) The Urban District and Parish of Scunthorpe and Frodingham has been created by uniting parts of the Parishes of Appleby, Ashby, Crosby, and Flixborough, and parts of the Urban Districts and Parishes of Brumby and Frodingham and Scunthorpe. The remainder of the Parish of Ashby was transferred to the Parish of Burringham, the remainder of the Parish of Crosby to the Parish of Flixborough, and the remainder of the Parishes of Scunthorpe, Brumby and Frodingham were united to form the Parish of Brumby Rural.

(2) The Borough and Parish of Lowestoft has been extended so as to include the Urban District and Parish of Oulton Broad.

(3) The City and County Borough and Parish of Lincoln has been extended so as to include the Urban District and Parish of Bracebridge, the Parish of Boultham, and parts of the Parishes of Bracebridge Heath, North Hykeham, and Skellingthorpe.

(4) Parts of the Parishes of Humberston and Weelsby have been transferred to the Urban District and Parish of Cleethorpes, and a part of the latter has been transferred to the Parish of Weelsby.

(5) The Urban District of Broughton has been abolished, and the Parish of Broughton has been included in the Rural District of Glanford Brigg.

(6) The Parishes of Thetford Saint Cuthbert, Thetford Saint Mary, and Thetford Saint Peter have been united to form the new Parish of Thetford, co-extensive with the Borough.

(7) The Urban District of Mablethorpe has been extended so as to include the Parishes of Trusthorpe and Sutton-le-Marsh. The name of the extended Urban District has been altered to the Mablethorpe and Sutton Urban District.

(8) The Parishes of Saxlingham Nethergate and Saxlingham Thorpe have been united to form the new Parish of Saxlingham Nethergate.

(9) Part of the Parish of Heacham has been transferred to the Urban District and Parish of New Hunstanton.

(10) Parts of the Parish of Gosberton have been transferred to the Parishes of Surfleet and Quadring; and parts of the Parishes of Surfleet and Quadring have been transferred to the Parish of Gosberton.

Wave Power Utilisation.

Brief Particulars of a Bulgarian Experiment.

In view of the efforts that have been made for many years past to devise some practical means—both from the point of view of economy and efficiency—of utilising the power of the tides for the generation of electricity, it is interesting to learn that some trials are at present being carried out at Varna, on the Black Sea, by a Bulgarian engineer named Athanas Vodenitcharoff, with a machine which he has devised. The engineer in question has been at work on the subject for the past thirteen years, during which period tests have been made with many different forms of wave-utilisation motors. The sixth device of the kind, installed at the breakwater of the Black Sea port of Bourgas in 1924, gave such promising results that M. Vodenitcharoff was



Fig. 1.—Wave Power Plant at Varna.

at last successful in securing the interest of a group of financiers who, early in 1925, organised the Syndicat pour Utilisation des Vagues Marines par le Moteur "Ouragan," with offices in Sliven, Varna, and Sofia. With the assistance and under the auspices of the Syndicate, M. Vodenitcharoff is now putting the finishing touches to a larger and more ambitious installation at Varna, of which we are able to reproduce a couple of photographs.

Owing to the question of patents in the different countries having still to be settled, it is not possible to publish full details of the arrangement adopted. From the particulars we have been able to obtain and from

the illustrations, however, we gather that the installation comprises a staging of iron or ferro-concrete construction, a series of floating elements which the inventor terms "power centralisators," a receiver and transmitter, with counterpoise, of the horizontal movements of the waves, a corresponding receiver and transmitter of the vertical movements, mechanism for converting the horizontal and vertical movements into rotary motion, an accelerator, flywheel, and adjusting gear, together with supplementary gear such as automatic pumps, dynamos, transformers, accumulators, &c.

M. Vodenitcharoff, who in the Bourgas experiment demonstrated his ability to provide electric lighting and power from the waves by a small motor which is now to be seen in the Marine Museum at Varna, claims that the success he has achieved is due to the fact that the Ouragan motor utilises four distinct movements of one and the same wave, *viz.*, the moment of rise on the advance of the wave, (2) the moment of descent of the floating member or power centralisator on the passage of the wave, (3) the moment of the horizontal stroke of the wave irrespective of its direction, and (4) the moment of return of the floating member on the passage of the wave. The experiments at Varna are being watched with great interest by Bulgarians from the King downwards. A provisional British patent has, we understand, already been applied for.

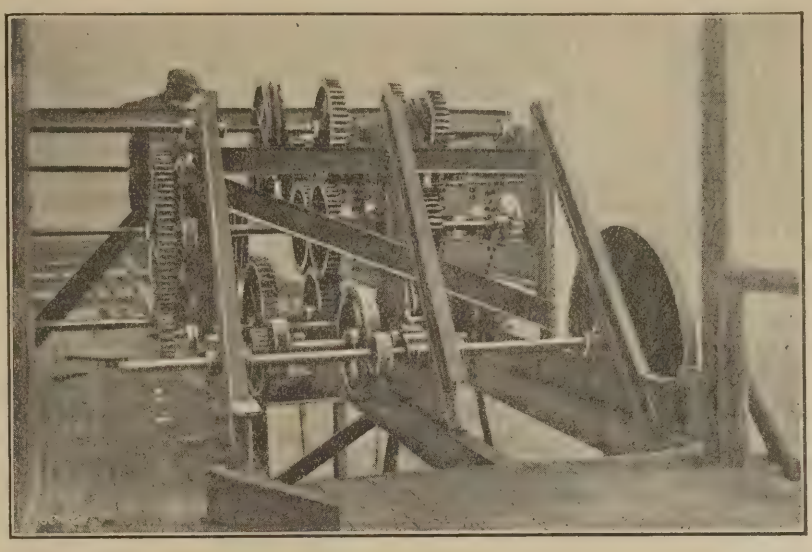


Fig. 2.—Gearing of Wave-operated Motor.

Boiler-Room Practice.

Coal Flow, Air Flow, and Steam Flow.

By JOHN BRUCE.

ONE of the most desirable features of modern boiler-house operation is the facility to readily determine, or express in such a manner as to be easily understood by all the boiler-room operatives, the instantaneous efficiency of conversion of the potential heat energy in the coal entering the boiler furnaces of any individual boiler unit.

While it is now generally recognised that a boiler plant can only be efficiently and scientifically operated from the interpretation of certain data, recorded or indicated by modern boiler-room instruments, it may be found that even with a comprehensive instrument equipment, only a trained combustion engineer can make the interpretations necessary to state the efficiency of conversion at a particular moment. An instrument panel equipped with a multiplicity of temperature indicators, draught gauges, CO_2 recorders, and steam and water flow meters, may easily prove the reverse of helpful to the average operator in the modern boiler room. Instead of facilitating the operation of coal-consuming equipment purposely installed to save coal, the complexity of instruments and the difficulty to the average operator of reconciling the various indications results in inefficient operation; the instrument equipment and the operator are condemned, and the boiler room becomes the sepulchre of possibly half a dozen different instrument makers' productions.

When deciding the equipment to be mounted on a boiler unit instrument panel, the average engineer is inclined to forget the fireman's or boiler operator's limitations, especially if the allowance for instruments permits a certain prodigality in this direction.

It is admitted that the day of muscle and brawn as recommendations for a boiler-room job are over, and that a different type of man, in whom intellect is looked for as a predominating feature, is being attracted to this section of power station work.

This new type of boiler-room operator, while certainly prepared to operate the plant in his charge to a combustion engineer's instructions or from instrument indications and the physical appearance of his fires, has still one thing in common with his predecessor, and that is the natural desire for simple, easily read, and easily understood gauges. The average fireman of ten or twenty years ago was content with the B.O.T. standard fittings for indicating steam pressure and water level, and the measure of his efficiency was very often based on the tonnage handled by his shovel and his ability to keep the needle of the pressure gauge on the "mark."

The modern type of fireman, or rather boiler attendant, asks that the modern "efficiency" instruments with which his boiler plant is equipped shall be few in number, easily read, and easily understood; and, instead of having to reconcile a dozen different indications, it should be possible for him to tell, from one or a combination of two indications, that the conditions under which the unit is being operated are consistent with maximum efficiency and economy. The ideal of one instrument or gauge as an indicator of overall boiler unit efficiency is not so Utopian as at first sight appears, and in this article it is proposed to discuss in particular the combination of measurements necessary to give this information.

In previous articles dealing with boiler-plant operation it has been pointed out that if comprehensive records of operation are to be made, the instrument equipment must necessarily be capable of providing all the data involved in the tabulation of a heat balance statement. It does not, however, follow that the plant could not be operated equally efficiently with fewer instruments, provided that such instruments give all the information necessary for the control of the variable factors influencing minute to minute operation.

The function of any steam boiler is the absorption of heat liberated from the combustion of fuel in a specially

designed furnace, the heat absorbed by the boiler being finally transmitted, by conduction and convection, to the water and steam contained therein. The performance, or efficiency, of the complete process is then the ratio of the heat units carried by the steam from the boiler (as the result of the combustion of unit weight of fuel) to that available for absorption as represented by the potential heat units contained in the same unit weight of fuel. The modern boiler unit for the generation of steam produced from the heat liberated by the combustion of coal may consist of a combination of the following components:—

(1) A furnace for the combustion of coal, designed and arranged to ensure that the heat liberated will be produced and presented to the heating surfaces of the boiler in the most efficient manner.

(2) A boiler, or water container, arranged in such a manner relative to the furnace that the heat presented by the furnace will be absorbed by the water rapidly and efficiently.

(3) A steam superheater, usually arranged as an integral part of the boiler, and designed to absorb heat by the heat-carrying medium, additional to the heat already absorbed by the water.

(4) An economiser, or in other words, feed-water heater, usually designed and arranged as part of the boiler unit total heating surface, its function being the absorption of heat from the gases of combustion after the latter have left the heating surfaces of the boiler. The heat thus absorbed is taken up by the water on its way to the boiler.

(5) An air heater designed and arranged as a component part of the combined boiler unit. The function of the air heater is the absorption of heat from the gases of combustion after these gases have left the heating surfaces of the economiser or boiler.

If the foregoing components of a boiler unit are arranged in the order stated, the air heater reduces the gases of combustion to the final temperature at which they will be discharged to the stack and atmosphere.

The heat absorbed by the air heater is taken up and carried by the air being supplied for the process of combustion of the fuel, thus reducing the endothermic work of the furnace, and diverting the commencement of the thermal cycle to a point in the path of the waste gases.

While the foregoing combination of equipment has been stated as representative of modern boiler-room practice, it should be pointed out that certain variations exist with relation to items 4 and 5.

Air heaters have not yet been widely adopted, and where they are installed it is not always in combination with a water economiser.

The operation and the resultant performance of a boiler unit consisting of the various combinations of equipment described are governed by certain factors over which the operating engineer should have perfect control. These factors have been discussed at length in previous articles, and for the present purpose we need only consider them briefly here.

On the assumption that the separate components of a boiler unit are correctly designed and so arranged in relation to each other that with the correct operating conditions the resultant performance will represent maximum attainable efficiency, and that the whole of the unit is in first-class mechanical condition, it can be shown that the overall performance is, practically, entirely dominated by the performance of the furnace.

The duty of the furnace, which term includes the combustion chamber and setting, is the liberation of heat units from the combustion of the coal and the efficient presentation of these liberated heat units for their rapid absorption by the other components of the unit.

The performance of any correctly designed and erected stoker and setting, as far as combustion efficiency is concerned, is, generally speaking, governed by two variable factors. These two factors are:—(1) rate of coal flow, (2) relative rate of air flow. These two variables result in one factor, rate of liberation of heat units.

The function of the heat absorbing components of the unit is the rapid absorption of the liberated heat units, and again assuming correct design and setting and cleanliness of internal and external heat transmitting surfaces, the resultant performance of this section of the boiler unit is influenced by two variable factors. These are (1) temperature of resultant gases of combustion, (2) velocity of resultant gases of combustion.

A high temperature gradient is necessary for efficient heat transfer, and temperature is therefore the predominating factor, since it influences all three methods of heat transmission—radiation, convection, and conduction.

Temperature is directly dependent upon furnace performance, and therefore the efficiency of the boiler unit is practically entirely influenced by the variable factors governing the operating temperature of the furnace.

Mechanical and physical properties of the materials used in the construction and setting of the modern mechanical stoker place, however, a limit to the temperature at which automatic stoker plant can be commercially operated, a compromise usually being arrived at between efficiency and maintenance.

The perfect combustion of a given fuel results in a definite maximum elevation of temperature above that of the original fuel and that of the combining weight of air supplied for combustion. This theoretically possible temperature is never attained in the furnace of an ordinary boiler unit, for the following reasons.

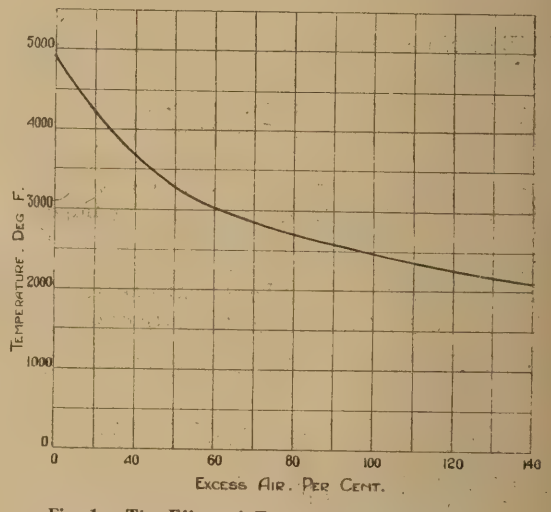


Fig. 1.—The Effect of Excess Air on Temperature.

In commercial practice it is impossible with the present types of equipment to effect complete and rapid combustion with the theoretical amount of air, and the necessity for the introduction of air quantities in excess of the theoretical, results in the dilution of the products of combustion and a consequent lowering of the temperature theoretically attainable.

In other words, the furnace temperature and the temperature of the resultant products of combustion are dependent upon the excess air quantity with which the process of combustion has been effected.

Under ordinary conditions of commercial operation necessitating the introduction of a certain excess air percentage, there will be in the gaseous products of combustion certain amounts of oxygen and nitrogen remaining uncombined. This excess oxygen and nitrogen must be heated from the initial temperature to a temperature equal to that of the gaseous products of combustion.

They thus rob the actual combustion products of a definite amount of heat, with the result that the actual mixture has a temperature lower than the theoretical. Considering in the meantime only this aspect of the question, it will be seen that furnace temperature and the temperature of the gases presented to the boiler are dependent upon the percentage of excess air utilised in the process of combustion.

The theoretical temperature attainable is also further reduced due to loss by radiation to bodies other than those of the useful heat-absorbing components of the boiler unit, and the decrease in temperature due to this

source is a function of the time taken for the complete combustion of a given mass of fuel.

Further, the restriction of the supply of air to values below that found necessary for commercial operation will produce temperatures below the theoretical, since, under these conditions, the heat generated will be less than that amount due to the carbon content burning to CO instead of CO_2.

Generally speaking, it can be stated that reducing the excess air will result in raising the furnace temperature, or in other words, if a furnace is operated at a point just below its critical point of combustion, which with modern equipment corresponds to 35 per cent. to 40 per cent. excess air (13 per cent. to 14 per cent. CO_2) it can be taken for granted that the furnace temperature and the temperature of the furnace gases are at their highest commercially attainable value. The curve in fig. 1 has been plotted from computations made for a theoretical case, and while not strictly accurate, since the effect of radiation is not included, it serves to show the approximate relation between attainable temperatures and air quantities involved in the combustion of a given coal.

To sum up what has been said, we can state that, assuming a mechanically perfect boiler unit and the complete oxidation of the combustible constituents of the fuel, the factor dominating boiler plant performance is the control of air flow in correct relation to fuel flow.

Before considering at length what relationship exists between rate of flow of air, heat generated, and useful heat absorbed, it should be pointed out that the boiler-room operating crew must fully understand the meaning of the indications given by the simple instruments used in boiler operation for the measurement of air pressure and air flow. The simple U-tube draught gauge, though not an actual air flow meter, is nevertheless an instrument of precision of equal importance to the steam flow meter and other elaborate boiler-room metering apparatus, and for the proper application of the information given by these instruments, a common-sense knowledge of the general principles of gas and air flow is necessary.

The meaning of the word "draught" is liable to be misinterpreted, in cases where a boiler unit is equipped with both "U"-tube and differential pressure gauges.

In boiler-room work, draught means an elevation or depression of pressure in relation to the pressure of the atmosphere, and does not in itself directly represent a definite relation to air flow, unless the value of such draught is considered along with fuel bed or gas pass resistance.

Differential pressure gauges are employed to indicate the drop in pressure between two points, as for example, the drop in pressure through the firebed, or the drop in pressure from the combustion chamber to the uptake.

It can be shown that if the air or gases flow through a path having a constant resistance, the pressure drop between two points in that path will be a measure of the rate of gas or air flow.

On a modern boiler unit with an efficient equipment of soot blowers, the gas passes of the unit can be considered as a path of constant resistance, and a differential pressure gauge connected to indicate the drop of pressure across this path will, therefore, be a gas flow meter, capable of giving measurements of acceptable accuracy for commercial operation.

For the control of furnace conditions, a combination of differential gauges and Pitot tube manometers can be profitably utilised.

The Pitot tubes are inserted in the forced-draught ducts carrying air to the grates, and the differential pressure gauges are connected to indicate the pressure drop through the fuel bed. Care must be taken when interpreting this pressure drop, for the instrument is not now measuring the pressure drop across a path of fixed resistance, and the indications given by the gauges will be affected by variations in the thickness of the fuel bed, due either to intentional operation or irregular combustion.

This combination of instruments for the measurement of furnace air conditions can be utilised to equal advantage even though the unit is equipped with more than one grate, necessitating two or more forced-draught ducts.

(To be continued.)

All-Electric House Developments.

Some Features of the Experiments at Woolwich and Ilford.

So much has been said on the subject of "all-electric" houses which is controversial and based on the estimates of various people interested in the subject, that any data taken from actual experiment or practice are particularly welcome. The recent developments in this direction at Woolwich and Ilford have enabled us to collect information which may prove of interest and value not only to electrical engineers, but to many connected with the building trades, and at the same time confirm the view already expressed that the all-electric house is a practical proposition.

Four such houses have been in occupation now at Woolwich for over 12 months. They have been erected on the Eltham housing estate of the Woolwich Borough Council, where there are at present over 600 six-room houses completed and occupied and others in the course of erection. It is interesting to note in passing that, although only the four houses referred to are "all-electric," all the other houses on the estate are equipped for electric lighting and cooking, the tenants being charged a flat rate of 2d. per kWh for all the electrical energy consumed.

As a safeguard the Borough Council included one chimney in the construction of each of the four experimental houses, but the bases of these have been built in, fig. 3, and coal fires have never been installed. The claim that in the "all-electric" house the saving on the cost of construction, due to the elimination of chimneys and chimney breasts, is sufficient to provide for the necessary electrical apparatus, has been substantiated in each building, although one chimney is included. The houses are semi-detached and contain six small rooms and a bathroom. Each electric installation includes nine lighting points, complete with pendants and holders; heating plugs in all bedrooms, living room and parlour; one 3-kW fire fitted with a hot receptacle for plates; one 600-watt bowl fire; one full-range cooker; one wash boiler and water-heating apparatus. The equipment in each house is similar, with the exception of the water-heating apparatus and wash boiler; these vary slightly, with a view to ascertaining the most suitable form of apparatus. The heating elements for the wash boilers are either clamped to the bottom of the boiler or fitted as immersion heaters, and are of 4-kW maximum capacity with 3-heat regulation. A hot-water tap supplies the boiler from the storage tanks.

In each of two of the houses two storage tanks are fitted, one serving the sink and wash boiler in the scullery and the other the bath and hand basin in the bathroom. In the other instances only one tank is provided in each house to serve both the scullery and the bathroom. The tanks are all fitted with low-wattage heaters, which must be connected to the supply either continuously or for 12 to 14 hours before hot water is required.

In one case the tank is provided with rather unusual heating arrangements. Two elements are included, one of 125-W loading for continuous service,

and the other, of 1,000 W, for boosting purposes. These are arranged externally to the tank in such a way that the small element heats the water in the top half and the boost provides for the lower half. This is brought about by creating a separate water circulation in each half of the tank; the element is housed in a cylinder with pipe connections to the top and bottom of the half of the tank in question, the water path being



Fig. 1.—Main Switch and Prepayment Meter.



Fig. 2.—Electric Geyser and Wash Boiler.

through the cylinder. The capacity of this tank, which serves the whole house, is 20 gallons. In one of the other houses are fixed two atmospheric tanks, each fitted with a ball cock for the cold water supply, one being placed in the scullery and the other on the first floor outside the bathroom. Each is equipped with an electric immersion heater. These tanks are different to the others in that practically the whole of the water is available for use at its inside temperature. This is due to the small inflow of cold water through the ball cock, which is purposely so adjusted. In another case the hot-water flow from the tank is regulated by the cold water tap so that the input and output are always the same.

Of the tenants occupying these houses two were nominated by the Electricity Committee and two by the Housing Committee of the Corporation. Three of these are non-technical people, and hence the consumption figures which have been obtained from the four houses may be taken as representing the normal use of electricity in the ordinary home. The ordinary flat-rate charges which are adopted by the Electricity Undertaking, per kWh, are—lighting 6d., heating and cooking 1d., and water heating 0.5d. Two systems of metering the consumption of the "all-electric" houses are being employed. In one the amounts of energy used on the various services are charged on the above-mentioned tariffs by a novel method which was originated by one of the staff, but only one meter is used. This is effected by introducing a current transformer with two tappings into the heating and cooking, and water-heating circuits with the secondaries connected to the series coil of the meter. The transformers are of 12 to 1 and 6 to 1 ratios for heating and cooking, and water heating, respectively. Thus the actual amounts which pass through the meter, charged at 6d. per kWh, are equivalent to the total amounts consumed and charged at the relative flat rates. This method results in the correct total charge being arrived at although the actual amounts of energy consumed are not given. The second system of charging is based on estimated proportionate relative consumptions on the different services for the ordinary household, by which a figure of 0.8d. per kWh for the whole supply is arrived at. The whole of the supply is controlled directly by one meter. Prepayment meters are installed in all the houses, and the following figures of consumption and revenue for the four houses (*a*, *b*, *c* and *d*) in question, covering a period of 13 months ending in December last, are of interest. (*a*) 7,327 kWh, £30 8s. 10d.; (*b*) 7,495 kWh, £31 4s. 3d.; (*c*) 5,509 kWh, £22 19s. 5d.; (*d*) 6,493 kWh, £27 1s. 3d. The above money amounts represent the revenue collected at the rate of 1d. per kWh, and were subject to a 20 per cent. rebate. This results in an average cost of £22 6s. 9d. for 13 months for lighting, heating, cooking and water heating—not, in most cases, an impossible or an uneconomical figure.

With the object of obtaining reliable and first-hand information regarding the practicability of the all-electric house, the Ilford Electricity Department has embarked upon an experimental scheme for which it is entirely responsible. Twelve all-electric houses have been provided, and these are owned by the Department, and are to be rented by its own employés. The houses are built somewhat on the lines of those of the usual Government housing schemes, with six small rooms, including a scullery and a bathroom. One coal fire is provided for in each house, although the necessary equipment for the electrical alternative is installed. A hot-



Fig. 3.—Sitting-room.

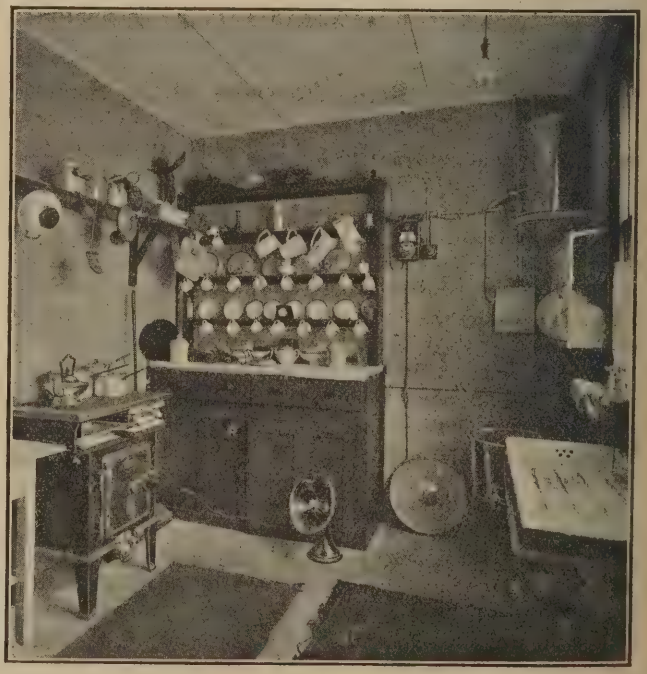


Fig. 4.—Kitchen.

All-Electric Houses at Woolwich.

water supply system is provided, and the water may be heated either electrically or by the coal fire. This is effected by the provision of two 1-kW immersion heaters in the circulation tank, with the result that the water may be heated wholly by either electricity or the coal fire, or the electric heaters may be used as a boost after the water has been brought to a certain temperature by the older method. This arrangement should prove a means of surmounting some of the objections to electric water heating met with in many places.

Each room is equipped with points for both lighting and heating, and two fires, one 2-kW bar-radiator and a small bowl fire, are provided in each house. In addition, the following apparatus completes the electrical equipment of each dwelling :—A full-range cooker (including an electric kettle), a wash boiler, and an iron. The whole of the hire and consumption charges for each consumer are covered by a fixed rate of 2s. per week, plus 0.75d. per kWh for the energy consumed. It may prove of interest to compare these figures with those of the ordinary all-in supply rates of the undertaking, *viz.*, 12.5 per cent. of the rateable value of the residence and 0.75d. per kWh. The houses have not yet been occupied for a sufficiently long time for any useful consumption data to be collected, but we look forward with interest to obtaining these at a later date. As in the case of the Woolwich houses a saving, amounting to the cost of the electrical apparatus, has been made on the construction of each house, the building cost of which amounted to £780. Special ventilation arrangements have been included in the houses, ventilating ducts connecting each room to a brick chamber and cowl mounted on the roof. For demonstration purposes one of the houses has been fully furnished, and is on view to the public for a period of three months which commenced on January 25th. It is interesting to note that during the first week of inspection about 750 persons visited the house.

The Issue of Material Supplies.

A Procedure to Minimise Delay.

By W. J. HISCOX.

Delays in production are often due to lack of material supplies, despite the fact that most sizes of material are stocked upon a maximum-minimum basis. Apart from this, there is the tendency of the modern planning department to insist upon sizes which hitherto have not been stocked, with the idea of reducing machining costs and thus increasing the capacity of the machining department.

With regard to sizes of material deemed to be in stock, failure of supplies is due chiefly to error occasioned by faulty stock records, for if orders are not booked until three or four days have elapsed since the issue of the material, it is obvious that in very many cases new supplies are not requisitioned until existing stocks are practically exhausted, and the buyer is unable to get in the new supplies before this happens. The only way to eliminate this trouble is to insist upon all issues being posted to the record cards daily.

MATERIAL REQUISITION

JOB No. ..... DATE ..... PART No. .....

Amount	PARTICULARS	C.	Qrs.	lbs.	Rate	£	s.	d.
	Issued by Recd. by							

Fig. 1.—Requisition Form.

Another factor is that in many cases the ordering point is fixed too low. It was probably fixed when the volume of work was much less than it is to-day, and no allowance has been made to meet the demands of increasing business. It is the case sometimes that the ordering figure is much less than the amount of material required for one single issue, and it is necessary, therefore, that in progressive works, the ordering figure should be revised from time to time.

Delay occasioned by the planning department insisting upon a size of material not hitherto stocked being used can be minimised by advance instructions being sent to the store, so that requisitions for supplies can be sent to the buyer before the material is actually required. For the most part, the store receives information only when the requisition is received, which means that the material is wanted at once. As the size specified is not stocked, the nearest size (larger) in stock is issued, but is returned from the machining department because the planner insists upon the correct material being used. More valuable time is wasted here, apart from the probable wastage of material, and the suggestion of advance instructions being sent to the store should be seriously considered.

Even if these safeguards are adopted, however, it does not mean that delay will be altogether obviated in connection with the issue of material supplies, although it should be considerably curtailed. Often the delay is extended because there is no intelligent procedure operating in the material store to ensure orders being promptly met when the material is received, whilst, in addition, the absence of such a procedure means that the buyer does not get information relating to the urgency of one specific class of material. The material storekeeper should at all times know exactly what orders are held up pending receipt of further supplies, so that he can give proper information to the buyer, and issue the material immediately it is received. The following procedure, put into operation by one firm of engineers, gave satisfactory results in this respect :—

All material demands were made known by means of a requisition form (fig. 1), made out in triplicate, two copies being sent to the store, and one retained by the foreman. In the event of the material being in stock, it was at once issued, one copy of the requisition being returned to the foreman (with the material) and the other (after signature for receipt was appended) retained in the store for posting to the stock card.

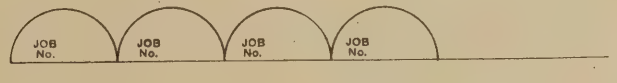


Fig. 2.—Guide Card.

If the material was not in stock, one copy of the requisition was at once returned to the foreman, endorsed "No Stock," while the other, similarly endorsed, was retained in the store, being placed behind a guide card (fig. 2) bearing the appropriate job number. Before this was done, however, a small card was made out and pinned to a board headed "Jobs awaiting material" (fig. 3), blue cards representing castings and stampings, and white cards bar and sheet materials, &c. In connection with the cards for castings and stampings, the part number or pattern number had to be given, while the cards for other materials had to give the size and

particulars of material, in addition to the part number for which the material was required.

The storekeeper ascertained from his stock card that sufficient supplies were on order to meet the demand, and twice weekly he sent to the buyer a list of all orders awaiting supplies, together with particulars of the material required. This had the effect of keeping the buyer posted with the urgency of any specific material, and influenced his actions in the matter of obtaining supplies.

It was not intended, however, that the storekeeper should confine his attention strictly to orders actually held up, for with the best intentions he could do no more than minimise delay that had already occurred.

JOBS AWAITING MATERIAL

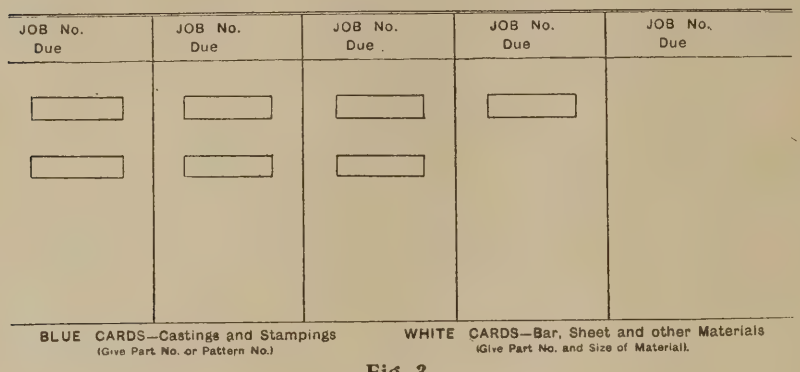


Fig. 3.

It was his business to maintain adequate supplies of material, and thus obviate delay, and he was assisted in this direction by the material shortage board (fig. 4). This board was arranged for classified materials, and under the various classifications appeared the materials, the stocks of which had reached the danger point, this information being derived from the stock card.

For example, the stock card for a specific material might give the maximum as 1,500 lb.; the ordering point as 750 lb.; and the danger point as 350 lb. Immediately the latter figure was reached, particulars were entered upon a small card, which was then pinned to the board under the correct classification, even though no jobs were held up for the material. A list of materials appearing upon this board was also sent to the buyer twice weekly, and many delays were obviated by prompt action on the part of the buyer, following information received from the material store.

It is undoubtedly true that in many works sufficient attention is not given to the material store by the management, and yet it should be apparent to all that any delay here is reflected throughout the whole course of manufacture. It may be contended that sufficient has been done by fixing the stocks to be held, and that it is the duty of the storekeeper to maintain a sufficiency of such stocks. In the modern works, however, the different phases of organisation are interdependent, and no one department can work quite independently. The storekeeper is influenced by circumstances quite outside his control, and the least that can be done is to give him the facilities which will enable him to make known to interested parties adverse circumstances, and also do his own work in the most expeditious manner possible. The method outlined in this article achieves these results.

Standardisation in Czecho-Slovakia.—The Czecho-Slovakian Government has recently adopted a number of standards for electrical work based on those in force in Great Britain, Germany, America, and France.

Legal.

Beet-Sugar Company Prosecuted.

The Nottingham magistrates, on January 30th, gave their decision in the case reported in our last issue (p. 211) in which the Anglo-Scottish Beet Sugar Corporation, Ltd., was prosecuted for failing to efficiently protect a brass collar conductor forming part of a screw-cap lamp, in consequence of which an employé was killed. During the original hearing the company claimed that the premises in question were not a "factory" within the meaning of the Act.

According to the *Nottingham Evening Post* the magistrates' decision was to the following effect:—"We are of opinion that the defendant company is guilty of the offence charged, and upon the summons in respect of neglecting to observe regulation 2, in consequence of which the workman John Albert Glover was killed, the company is fined £50."

Mr. Saywell asked that costs of 25 guineas should be allowed, but the magistrates allowed five guineas to come out of the fine.

A Dublin Electrical Dispute.

In the Dublin Circuit Court, before Judge Pigot, last week, Mr. P. J. Lawlor, electrical contractor, of Dublin, sued the New Ireland Assurance Society, Dublin, for £30, for work done in connection with the electrical installation at the Society's new premises.

Mr. Lawlor gave evidence as to his securing of the contract. When he had the work completed £35 was deducted under a clause in the specification, which stated "providing a sum of £5 for points in the schedule marked F." He contended that the proper construction of this clause was that £5 only should be deducted for all seven points. For the Assurance Society it was contended that the clause meant that £5 should be deducted for each of the seven points.

Judge Pigot held with the plaintiff, and gave him a decree for the £30 claimed.

Mullard Radio Valve Co., Ltd., and Ballantyne v. Hay and Son.

This action was mentioned before Mr. Justice Russell, in the Chancery Division, on February 5th, when Counsel for plaintiffs moved for an injunction to restrain infringement of two letters patent with respect to valves. Counsel stated that the defendants, who appeared in person, had consented to treat the motion as the trial of the action and to pay an agreed sum for costs. There would be no inquiry as to damages, defendants having disclosed the names of their suppliers. They were willing to submit to a perpetual injunction.

His Lordship made an order accordingly.

MATERIAL SHORTAGE

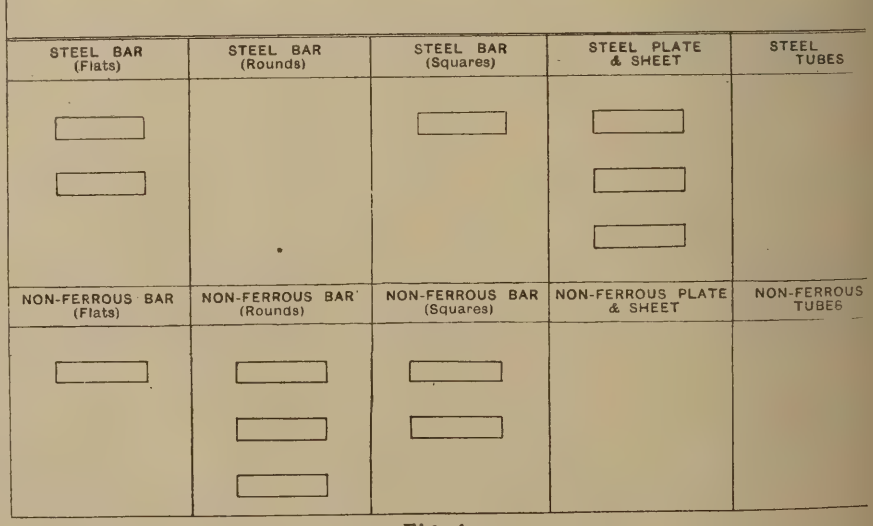


Fig. 4.

British Thomson-Houston Co., Ltd., v. London Electric Lamp Co.

In the Chancery Division, before Mr. Justice Russell, on February 5th, Counsel appearing for plaintiffs in this action moved for an injunction to restrain infringement of two letters patent. He stated that there was an *ex parte* injunction running over that day. Defendants were now willing to treat the motion as the trial of the action and to submit to an injunction. They would pay the costs, but there would be no inquiry as to damages, defendants having disclosed their suppliers. The plaintiffs waived any claim for damages.

His Lordship made an order accordingly.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Illumination at Blackpool Jubilee Celebrations.—At a recent meeting of Blackpool Jubilee Celebrations Committee, it was reported that Mr. C. Furness, electrical engineer, had considered the question of illuminations, and was of the opinion that it would involve a minimum cost of £8,500. It was proposed to have the greater part of the promenade illuminated, which would require nearly 200,000 lamps. The engineer suggested that the Committee should offer £250 to be distributed in prizes for the best illuminated features carried out by companies or ratepayers. It was proposed to charge 2d. per kWh for electricity for private schemes of illumination.

An Industrial Lighting Chart.—The dimensions of the chart issued by the BENJAMIN ELECTRIC, LTD., were given incorrectly in our last issue. It is 30 in. long and 20 in. wide.

An Inquiry from India.—An Indian firm (Bombay) desires to be put in touch with high class manufacturers of electrical apparatus of the types described below. Concerns already fully represented in India should not apply :—

(1) Switch and fuse gear, comprising fuses 15 to 200 amps., with back connections and terminals; cartridge fuses and aerial fuses. Knife switches 25 to 200 amps., unmounted, but complete with terminals. Ironclad switch and fuse boxes (D.P. and T.P.), 10 to 200 amps.

(2) Insulating materials, comprising ebonite and fibre sheets and rods, cotton tape and Empire tape and cloth.

(3) Poles for overhead transmission purposes.

(4) General electrical machinery.

All communications relating to these items should be addressed in the first instance to the ELECTRICAL REVIEW Service Department, 4, Ludgate Hill, London, E.C.4.

Our Productive Capacity.—In the course of his recent speech to the shareholders of the Midland Bank, Ltd., the chairman, Mr. R. McKenna, traced the causes of Great Britain's industrial depression. He said that this was generally attributed to one or more of the following causes: first, that much of our plant in the heavy industries was out of date and our organisation defective; secondly, that there was a superabundance in the world's supply of those commodities which we usually exported; thirdly, that wage costs were too high, more particularly in some of the sheltered industries; next, that the burden of taxation, both national and local, threw a charge upon industry which handicapped us in competition for foreign markets; and finally, that the unsettlement of Europe had gravely restricted the purchasing power of many of our customers. While these were all serious obstructions to trade, the policy of deflation had also contributed largely, but there was good reason to believe that eventually we should reap the reward due to this policy. Mr. McKenna said :—" It is not unusual for writers on the present day conditions of England to discover signs that the productive capacity of our country in competition with other nations has passed its zenith. I confess, however, that I do not share their opinion. There is always room for improvement, and I believe the years of depression have been a testing time for us and a warning to put our house in order. The exceptional depression has been largely due to temporary financial conditions, and I have strong hopes that these are now coming to an end."

A Co-operative Society's Electrical Department.—The Blackpool Co-operative Society recently opened a department for the sale and installation of electrical appliances and reports successful trading for the first half-year. The sales, direct and through other departments, amounted to £1,242 and work valued at £588 was done for members. The result was a net profit of £103.

Unemployment.—There was a decrease of 15,075 in the number of unemployed registered at the Employment Exchanges during the week ended January 25th. The total at that date was 1,200,800, as compared with about 1,241,000 twelve months earlier.

German Failures.—Official figures just published concerning the number of bankruptcies and applications for " Official supervision " (equivalent to moratorium) show that January eclipsed all previous records. There were 2,092 bankruptcies and 1,553 supervisions granted, as against 660 bankruptcies and 1,388 supervisions in December. Bankruptcies were therefore three times those of the worst previous month. Though these bankruptcies were distributed throughout all industries textile and motor branches suffered more than any other.—*Financial Times.*

Capturing Foreign Markets.—In a speech at Woking last week Mr. A. M. Samuel, Parliamentary Secretary of the Department of Overseas Trade, said that British manufacturers should endeavour to produce more decorative and up-to-date goods for foreign markets. According to the *Financial News* Mr. Samuel made special reference to telephone and radio apparatus. " We accepted," he said, " the vulcanite telephone receiver, but no one ever attempted to enclose it in a box or case to keep the instrument clean." Our equipment was second to none for wireless sets and in a few years' time every house, if not every room in a house, would possess a set.

Electric Meters for Japan.—The demand for electric meters in Japan has in recent years reached large proportions; in 1924 no fewer than 400,000 were bought. The bulk of these were of German manufacture, although appreciable quantities were supplied by the United States, Great Britain and Switzerland. Japanese manufacturers find it impossible to compete with foreigners on the score of low prices, and they propose to ask the Government to raise the import duty upon these meters.

Callender's Hospital Fund.—We have received a copy of the 23rd annual report of the Hospital and Distress Fund of Callender's Cable and Construction Co., Ltd. The receipts during 1925 amounted to £1,550 (including £95 brought forward) and the expenditure to £1,468, leaving a balance of £82 in hand. Apart from rendering aid to over 360 members, the fund made grants aggregating £934 to sixteen institutions.

The Basle Water-Power Exhibition.—It is announced that a number of the leading European countries are officially participating in the International Exhibition of Inland Navigation and the Utilisation of Hydraulic Power which is to be held at Basle from July 1st to September 12th this year. Negotiations are also proceeding with the Governments of Great Britain, Canada and other countries.

The Reorganisation of the Supply Industry.—Mr. Samuel Ferguson, managing director of Messrs. Ferguson, Pailin, Ltd., said at the company's recent annual meeting that the reorganisation of the electricity supply industry would take 15 years to complete. The London area was in such a deplorable state electrically that even if the whole of the industry's efforts were applied to its reorganisation, the task would take five years.

World Employment.—The issue of *British Industries*, dated January 30th, contains a series of curves showing the trend of employment in the eight leading industrial countries during 1923, 1924, and 1925. The United States curve shows a large decline of employment in 1924 with a partial recovery in the succeeding year. The French and Belgian curves are practically level. The trend in Italy has been upward but there have been two or three sharp lapses. The Canadian curve, while horizontal in character, has also experienced some fairly large fluctuations. There was a very serious fall of employment in Germany at the end of 1923, but since that the general tendency has been improvement and 1925 closed with employment at about the same level as at the beginning of 1923. The United Kingdom curve is flat but with a decided improvement in 1924, and a return to the 1923 level last year. Swedish employment has encountered violent fluctuations; the curve appears to be of a seasonal character—high in summer and low in winter.

Australian Customs Tariffs.—Owing to the Australian manufacturers not being in a position to meet the requirements of Australian users, the Department of Trade and Customs has deferred until April 1st the operation of duties which were to have come into operation on January 1st, 1926, upon valves for radio-telegraphy and telephony.—*Reuter's Trade Service* (Melbourne).

International Customs Tariffs.—Writing in the " Review of 1925 " issue of the *Manchester Guardian Commercial*, Prof. Gilbert Cannan says :—" It is quite impossible to believe that the present barriers against the free movement of persons and goods will be long maintained by the two dozen States between which Western Europe is now divided. A perception of common interest must soon lead to Customs unions being concluded here and there, and when the movement is once begun it will be difficult to stop, as the largest combination will offer great attractions to other units. . . Hence we should not dismiss as altogether Utopian the talk of a European, or at all events a Western European, Continental Customs Union or Zollverein, which was heard of last year in the most unlikely quarters. Sooner or later, unless the whole system of Customs duties is first abandoned, such a consummation will come about. Great Britain will then have the choice of joining the Continent or becoming a perfectly free port. It is scarcely conceivable that she could stand aside with a protection system of her own."

A Siemens-G.E.C. Combination.—It is announced that arrangements have been made to merge the railway signalling departments of Messrs. Siemens Bros. & Co., Ltd., and the General Electric Co., Ltd., under the title of " Siemens and General Electric Railway Signal Co., Ltd."

Trade Announcements.—MR. F. J. GORDON, manufacturers' representative, has moved to larger premises at 92, Charlotte Street, W.1, including a showroom and stores.

MESSRS. W. WORBY BEAUMONT & L. W. BURT have removed their offices to 20, Essex Street, Strand, W.C.2. Their telephone number and telegraphic address are unaltered.

MR. H. H. CASSE has resigned his directorship of Charles Bell, Ltd., and has commenced business in partnership with Mr. N. Walker at St. Jude's Place, Manningham Lane, Bradford.

MESSRS. JAMES GORDON & CO., LTD., inform us that Mr. J. J. Lassen has retired from the board of directors, and has no further interest in or connection with the company.

Mr. John Harris, of 113-117, Caversham Road, Reading, has opened an electrical service station in connection with his business.

Messrs. T. W. Broadbent, Ltd., of Victoria Electrical Works, Huddersfield, have arranged with Messrs. Darroch and Espie, of Dock Works, 37, Weir Street, Paisley Road, Glasgow, to act as their representatives in Scotland for the sale of a.c. and d.c. generators and motors, as successors to Mr. James Espie of the same address, who is retiring from business.

Miss E. Stringer informs us that she has resigned her position as London manager for the Concordia Electric Wire Co., Ltd., having been appointed sole selling agent for F. & E. Stanton, Ltd. She is opening a sales office at 3, Victoria Street, S.W.1. (Telephone: Victoria 1485.)

The Saxonia Electrical Wire Co., Ltd., has taken over the stocks of insulated copper and resistance wires of the Engineering Supplies, Ltd., and is supplying these instrument wires in addition to the flexible cords, &c., which they manufacture.

Catalogues and Lists.—Siemens and English Electric Lamp Co., Ltd., 38 & 39, Upper Thames Street, E.C.4.—February price sheet of electrical materials and appliances. Fully illustrated.

Higgs Motors, Witton, Birmingham.—A price list of industrial electric motors (a.c. and d.c.), d.c. generators, and motor-generator sets.

The East London Rubber Co., 29, Great Eastern Street, E.C.2.—A set of illustrated and priced sheets adding to and revising the firm's comprehensive radio apparatus catalogue.

Messrs. Young & Wildsmith, 20, Bloomsbury Street, W.C.1.—A trade price list of electrical materials and accessories.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Catalogue Section SF, illustrating and describing various types of signs and flashers produced by the company, fully priced; and a mailing card advertising "Pirelli-General" flexible cords with cotton and silk coverings of various colours.

Messrs. L. McMichael, Ltd., Wexham Road, Slough, Bucks.—Pamphlets dealing with h.f. radio transformers and their use, "Dimic" air-spaced coils, condensers, grid leaks, &c. Illustrated and priced.

Crane Packing, Ltd., Slough, Bucks.—A brochure dealing with the use of metallic packing in various spheres; also two illustrated pamphlets treating of the same subject.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A leaflet advertising the company's electric lamp service.

K.F.M. Engineering Co., Ltd., 29-31, Portugal Street, Kingsway, W.C.2.—A well-illustrated catalogue of "Internalite" day and night signs.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire.—Illustrated pamphlets dealing with the company's l.f. transformers, including amplification curves over the musical scale. Also a showcard advertising this component.

Messrs. George Green & Co., 40, Aybrook Street, W.1.—Leaflet No. M.214, bearing an illustration and prices of "Gee-Gee" electric tea urns.

Bankruptcy Proceedings.—H. L. Wood, 7, Taswell Road, Southsea, Hants, electrical engineer and radio dealer.—The public examination of this debtor was held on February 1st, at the Court House, Portsmouth. The statement of affairs showed liabilities of £4,069, against assets of £85, leaving a deficiency of £3,984. Debtor attributed his failure to judgment and costs of an action brought against him by his late partner amounting to £1,917. He commenced business as an electrical engineer in 1918, at High Street, Clapham, with about £500 capital. The business appeared to have been a success, and in August, 1920, was sold for £1,500. He came to Portsmouth and started a new business, and in March, 1921, he was joined in partnership by another, who paid £2,000 for a half share in the business. The partnership bought an additional business and traded as electrical engineers, later dealing in radio sets. The business was not successful, and in May, 1923, a deed of dissolution was executed and the business wound up. As a result a claim was made against the debtor. He then entered into partnership with his wife, and on November 17th last the business was converted into a company and he and his wife were directors. The consideration for the sale was £1,998, which was satisfied by the allotment and issue to the vendors of 498 ordinary shares and by the issue of £1,500 debenture stock to debtor's wife. The examination was adjourned.

G. W. H. Hanford (Radio Manufacturing Co. and the O.I.C. Manufacturing Co.), 37, Gold Street, Southsea.—Trustee, Mr. C. Hoult, 87, High Street, Portsmouth, released January 27th.

W. G. Bayman, electrical engineer, late of 13, Russell Street, Plymouth, now of 86, North Side, Wandsworth Common, S.W.—Last day for proofs for dividend February 17th. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C. Discharge suspended for one year, until January 11th, 1927.

P. Boswell (Boswell & Co.), electrical engineer, 132, Earl's Court Road, S.W., and 110, Ebury Street, S.W.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., released August 26th.

R. E. Hughes and R. McL. Alexander (R. E. Hughes and Hughes and Alexander), house furnishers and electrical and wireless engineers, 129, Brockley Rise, S.E., and 51, Honor Oak Park, S.E.—Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., released October 1st.

M. Kelly, radio apparatus dealer, 12, Jackson's Row, Manchester.—Receiving order made February 3rd, on creditor's petition.

Company Liquidations.—Antill, Ltd., Seymour Place, Marble Arch, W., electrical engineers, &c.—A meeting of creditors was held on February 6th, at the Institute of Chartered Accountants, E.C. Mr. C. Pittman, C.A., the liquidator of the company, submitted a statement which disclosed liabilities of £7,593 and net assets of £1,258, leaving a deficiency as regarded the unsecured creditors of £6 335. It was reported that Mr. R. A. C. Antill commenced trading in 1914. He joined the Army during the war, disposing of his business. On his demobilisation in 1919 he again started trading, and the present company was formed and took over the concern, in 1920. The issued capital of the company was £8,625. Between May and December, 1920, there was a net loss on the trading of £442, and in 1921 there was a net loss of £1,643. In the succeeding 12 months there was a net loss of £975, and in 1923 the net loss rose to £1,973. During 1924 a net profit of £490 was earned, but since that time further losses had been sustained aggregating £3,437. The company's turnover ranged from £20,000 to £33,000 per annum, and it was stated that losses had been incurred on contracts. Some little time ago creditors were approached and asked to stay their hands, it being hoped that arrangements could be made for the payment of all the liabilities in full. Creditors, however, began to press, and liquidation then took place. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Pittman and Mr. A. E. Quaife, of Messrs. Westacott, Quaife & Co., of High Holborn, as joint liquidators.

Pressland Electric Supplies, Ltd.—Winding up voluntarily. Liquidator, Mr. W. Bronson, 157, Cricklade Avenue, Streatham Hill, S.W.2. A meeting of creditors is called for February 17th at the Sun Hotel, Kingston-on-Thames.

Dissolutions of Partnership.—May & Jennings, gas, oil, electrical and mechanical engineers, 203, Kirkstall Road, Leeds.—Mr. A. C. May and Mr. W. A. Jennings have dissolved partnership. Mr. May will attend to debts.

Ernest Weston & Co., motor and wireless engineers, &c., London Road, Crowborough.—Messrs. E. Weston and L. J. Dumble have dissolved partnership.

Meeting of Creditors.—Cole, Marchent & Morley, Ltd.—An informal meeting of creditors will be held at Prospect Works, Wakefield Road, Bradford, on February 16th, when a statement of affairs prepared by the company's accountants will be presented to the meeting.

The Portuguese Electrical Market.—In a recent article upon this subject, *Commerce Reports* says that the relative cheapness of domestic labour and the high price of electrical energy in Portugal, discourage the sale and use of domestic electrical appliances. Germany satisfies the greater part of the limited demand for electric fans, offering them at low prices and giving liberal credit. The same applies to vacuum cleaners. The above-mentioned high charges for electricity preclude electric cooking, although there is a demand among the wealthier classes for small water heaters, toasters, hotplates and percolators. Both cookers and heaters would probably become popular if the charges were reduced. Electric washing machines are practically unknown. Refrigerators are used to some extent, the large hotels employing German makes. A firm securing the general agency of a manufacturer always desires the whole of Portugal as its territory and this is usually satisfactory when the concern has connections in Lisbon. Electrical appliances are sold on a strictly cash basis, but it is considered that there is scope for the introduction of a rental system by private interests.

Railway Electrification in Venezuela.—Mr. J. A. Goudge, C.B.E., chairman of the La Guaira and Caracas Railway, speaking at the company's recent annual meeting, is reported by the *Financial Times* to have said:—"We have seen the results of several schemes of electrification of railways in South America and elsewhere, which, frankly, have not increased the profit of the undertakings which have constructed the electrification. But if you ask us to-day whether we would face the responsibility of going on as we are or spending the money which we propose to spend in electrification, we unhesitatingly say we will electrify."

The Traders' Co-ordinating Committee.—This committee, which was formed five years ago by the Federation of British Industries, the Association of British Chambers of Commerce, and other organisations, to co-operate in the presentation of the traders' case before the Railway Rates Tribunal, is appealing for funds to enable it to continue the work which it has been carrying out successfully. It is claimed that the Committee has already saved the traders of the country £3,000,000 a year which would otherwise have gone to the railway companies, and an unratified agreement has been made whereby a saving of a further £3,000,000 will be effected. The offices of the Committee are at 39, St. James's Street, S.W.1.

New Australian Companies.—Williams & Shaw Pty., Ltd., is the name of a company recently formed in Melbourne with a capital of £20,000 to carry on business as electrical engineers, indentors and importers.

With a capital of £20,000, the Victor Storage Batteries Pty., Ltd., has been formed in Melbourne to engage in the manufacture of electric storage batteries, &c.

The 44-hour Week in Australia.—The Forty-Four Hour Act came into force in New South Wales on January 4th. It provides that while no more than 44 hours shall be worked in any week the hourly rates shall be increased to bring wages to the same figure as prevailed under the 48-hour week arrangement.

South American Markets.—Two recent Department of Overseas Trade publications (obtainable from the Stationery Office) deal with markets in the South American region. The first is a report on Ecuador (1s. net) by the Acting Chargé d'Affaires at Quito, Mr. W. C. Graham. It is stated that a peaceful *coup d'état* occurred in July, 1925, and a provisional government was formed. The latter's programme includes the unification of the complicated Customs duties and the revision of all municipal and public contracts. There is said to be a growing market for industrial and agricultural machinery; German and American manufacturers have established machinery stocks, which place them in a favourable position. The imports of machinery and apparatus during 1924 showed a decrease in weight from 3,277,566 kg. to 3,251,252 kg., but the value rose from £186,654 to £236,823. British traders are advised to draw up all their catalogues in Spanish and to be very careful in their choice of representatives in this market. Cases are not uncommon of British manufacturers appointing agents who also represent foreign houses dealing in a similar line of business. Appointments should not confer representation for the whole of the west coast of South America—a region far too wide for one agent to cover.

The second report deals with the Dominican Republic and Hayti (1s. 6d. net). The part relating to the former State, by Mr. J. Bowering, British Consul and Chargé d'Affaires at Santo Domingo City, states that the imports of electrical machinery, apparatus, and appliances during 1924 were valued at $118,270, the United States' share being 96.5 per cent. In 1923 the value was $117,072. The report says that the demand is principally for low-grade or second-quality goods as the purchasing power of the population is limited. Quotations should be c.i.f. Dominican ports and in American dollars. Mr. E. D. Watt, Acting Consul at Port-au-Prince, says that although Hayti is supposed to be rich in mineral resources no attempt has been made to develop them, which leads to the belief that either the quality or the quantity does not justify development. The British share of the import trade increased during the year 1924-25 and, given competitive prices, there is no reason why it should not continue to expand. The imports of machinery and apparatus during the period October 1st, 1924, to August 31st, 1925, were valued at $480,332.

British Railway Material for New Zealand.—The Premier of New Zealand announced last week that the Government would shortly invite tenders for the supply of railway material valued at £300,000 as the first instalment of the £800,000 extension scheme which is to be carried out during the next three years. It is to be stipulated that only material produced in the British Empire shall be used.

New Municipal Showrooms.—The Mayor of Lincoln (Miss M. E. Nevile) formally declared open the new showrooms of the Lincoln Electricity Department, in Corporation Street, on February 1st. A large number of officials were present, including the city electrical engineer (Mr. Stanley Clegg), the chairman of the electricity committee (Ald. W. S. White), the electrical engineer of Grimsby (Lt.-Col. Vignoles), and the vice-chairman of the Grimsby Electricity Committee (Councillor C. Fletcher). Ald. W. S. White, in the course of a speech, said that it was now realised that it paid to advertise just as much when selling electricity as any other commodity. The Lincoln Corporation electricity undertaking was inaugurated in November, 1898. In 1899 an exhibition was held, but though no doubt this gave a start to the department, the progress made for some years was very slow. Two years ago a second exhibition was held, and it could be truly said that the business of the department had expanded since that date in a manner never previously known. The appeal of that exhibition was made particularly to the householders in the city, and it was in the use of electricity in the home that great strides had been made.

Malay Hydro-Electric Scheme.—In a recent interview with the *Financial News*, Sir Montague Barlow gave some particulars of the Perak River hydro-electric scheme for which Sir W. G. Armstrong, Whitworth & Co., Ltd., have received a concession from the F.M.S. Government. It is proposed to form a public company to operate the concession. A dam and two sluices will be constructed in the river to give a gross head of 59 ft. There will be two 9,000-kW generators with provision for a third, and a steam stand-by plant with a capacity of 5,000 kW will also be provided. The bulk of the power will be supplied to the tin mines in the Kinta Valley and a number of electrically-operated dredges are being made to utilise it. The agreement (which is backed by the Government under the Trade Facilities Acts) requires that all machinery, &c., shall be of British manufacture, and the company will place orders for well over a million pounds' worth of work with British firms.

Social Event.—The annual dinner and general meeting of the A.T.M. Golf Club (Automatic Telephone Mfg. Co., Ltd.), were held at the Bear's Paw Restaurant, Liverpool, on January 30th. After dinner Mr. G. W. Moore (manager) presented trophies and medals to the successful members, Mr. C. H. Archer securing the "Tay-Mel" cup (presented by Messrs. E. Taylor and E. A. Mellinger, directors of the company). Mr. J. J. Langley was elected captain for the forthcoming season, Mr. W. A. Philips secretary, and Mr. G. C. Hague treasurer.

German Loans in America.—The *Financial Times* states that a group of towns in the Palatinate have taken up a loan of $3,800,000 at 7 per cent. against joint security from a consortium of American banks. The loan is for 20 years and will be used for the development of the municipal gas, water, and electricity works. The Berlin municipality is also seeking a short-term loan of $3,000,000, at 6½ per cent. from one of the leading New York banks. This is required to finance the completion of the big power station at Rummelsburg.

Municipal Trading at Burnley.—The Burnley Corporation has discussed with the British Electrical and Allied Manufacturers' Association the question of the terms upon which the electricity department proposes to sell domestic and other apparatus to the public, as well as the terms of hire purchase. As a result of the conversation, all existing resolutions concerning the sale or hire of electrical appliances are to be rescinded and fresh regulations drafted. Cash sales are to be at the list prices issued by the manufacturers. Thus, a difficult question affecting the interests of local electrical contractors has been amicably arranged.

The electrical exhibition organised by Burnley Corporation was brought to a close on February 6th. It has been extraordinarily well supported, and is described as one of the most successful events in the Provinces. Domestic apparatus has been freely sold, and the Department have had some difficulty in coping with the rush. The Corporation is making a feature of wiring people's houses on the deferred payment system, a four-roomed dwelling being done for £12, of which sum 36s. is the immediate deposit, leaving the balance to be paid at 12s. 9d. per quarter.

Irish Free State Electrical Imports.—The appended table shows the value of the total imports of electrical machinery and apparatus into the Irish Free State during the first nine months of the two past years, and the amount attributed to the United Kingdom as country of shipment but not necessarily of manufacture :—

	Total. Jan. to Sept.		U.K. share. Jan. to Sept.	
	1925. £	1924. £	1925. £	1924. £
Electric wires and cables	81,737	52,032	68,757	39,618
Telegraph and telephone instruments and apparatus	21,279	24,018	21,074	23,893
Electric lamps and parts	38,440	36,237	37,931	34,333
Batteries and accumulators	22,063	17,111	20,666	16,254
Radio sets and parts ...	34,964	78,615	34,023	76,997
Other electrical goods and apparatus	50,549	78,830	48,117	75,496
Electric generators ...	10,660	6,864	10,147	6 726
Electric motors	18,853	12,760	18,316	12,175
Other electrical machinery	51,887	31,838	45,719	31,020
Totals	£330,432	£338,305	£304,750	£316,512

It will be seen that while wide variations are shown in the different classes of goods, the 1925 imports show a drop of £7,873, as compared with those of the preceding year. All but £25,682 of the goods came from the United Kingdom, and of the balance £8,999 is attributed to Belgium, £7,867 to Germany, and £8,999 to "other countries."

The Swiss Electrical Engineering Industry.—A Swiss contemporary, commenting on the electrical engineering industry in Switzerland during the past year, states that while during the first six months an increased output was recorded, new orders were difficult to obtain during the second half of 1925 owing to the keenness of international competition. Moreover, as orders for new material for the Swiss Federal Railways have decreased, the outlook is not regarded as very bright. The recent fall in the value of the French franc is also regarded as detrimental to the Swiss electrical industry.

Strike at Padiham Station.—A strike has occurred among the steel constructional engineers of one of the contracting firms at the Lancashire Electric Power Co.'s station at Padiham. The men receive 1s. per hour for their labour, and are claiming 1s. 5½d. per hour, which, they allege, is the minimum for constructional work.

Swiss Industries Fair.—CORRECTION.—We regret that the date of this Fair, which is to be held at Basle, was given incorrectly in our issue of January 29th. It is to run from April 17th to 27th.

German Aid for Russia.—According to a statement published by a Berlin newspaper, the Soviet State Electrical Trust has entered into an agreement with the A.E.G. for a period of five years to secure technical assistance for the Russian works for improving the production. The trust is given the right to utilise the German company's patents, will be supplied with patterns, and will have the right of having engineers trained at all works of the German company.

"Electrical Freedom."—This is the title of a booklet which has been produced by the Electrical Contractors' Association (Inc.). It is described as a brief statement of the claims of electrical installation contractors and electrical retailers, and it is mainly directed against State and municipal electrical trading and contracting. It is contended that while electricity supply should be carried on under public control, as water supply generally is, municipalities should not engage in the wiring of premises and the sale of electrical appliances.

An Austrian Electrical Syndicate.—It is announced from Vienna that the four large manufacturing companies—the A.E.G.-Union, the Siemens-Schuckert Co., Brown, Boveri and Co., and the Elin—recently formed themselves into a syndicate for the purpose of fixing prices and conditions of delivery on a common and uniform basis, particularly in the case of contracts open to public competition. The constitution of the syndicate is now said to have evoked opposition in various quarters. Thus the city of Vienna states that in order to cope with the situation it will obtain its requirements from abroad in future, while a similar decision is credited to the Austrian Federal Railway authorities.

Threatened "Underground" Electricians' Strike.—We reported recently that members of the Electrical Trades Union employed in London electricity undertakings had been awarded an increase of 6¼ per cent. in their wages. The "Underground" railway companies have declined to apply this award to the men employed in their power stations, and in consequence the Union has decided to take a ballot upon the question of a strike among its members employed in railway power stations; the papers are returnable by February 20th. About 1,000 men are involved. The railway companies contend that they are not so favourably placed as the supply authorities in their ability to pay the increase. The Minister of Labour is said to be "watching" the situation.

Book Notices.—"Faraday House Journal." Vol. XI, No. 5; Lent Term, 1926.—Mr. L. J. Kettle, electrical engineer and manager of the Dublin, Irish Free State, electricity undertaking, is the subject of the frontispiece. He is president of the F.H. Old Students' Association. Mr. E. C. I. Macdonald deals with Brazilian railway electrification, Mr. S. Gibson writes on asbestos, and Mr. W. A. Benger describes the Parkinson "Tork" single-phase motor.

"Science Abstracts." A & B. Vol. XXIX, Part 1, No. 337, and Index 10, Vol. XXVIII (A & B). London: E. & F. N. Spon, Ltd. Price 3s. each.

"Pyrometers," by E. Griffiths. Pp. xi + 126; figs. 49. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

"The *Journal* of the South African Institution of Engineers." Vol. XXIV, No. 6. January, 1926. Price 2s.

"The *Electrician* Electrical Trades Directory and Handbook for 1926." London: Benn Bros., Ltd. Price 25s. net.

United States Electrical Exports. — According to *Commerce Reports*, the preliminary figures of exports of electrical goods from the United States during the first eleven months of last year show a total value of $80,264,527, which is only $1,800,000 below the total for the whole of 1924. It is estimated that the figure for the full year will be about $85,000,000. This is not a complete figure, however, for a great deal of electrical apparatus is incorporated in other exports, *e.g.*, automobiles, washing machines, refrigerators, &c. Generally speaking, more business was done in smaller equipment during 1925, and less in heavy equipment. This is attributed to some extent to the increasing representation of the smaller American firms in foreign markets. There were increases in a.c. generators, steam generating sets, and self-contained lighting sets, but the shipments of d.c. generators and motors were smaller. Small motors showed a substantial gain, but stationary and railway motors declined. There was a large fall in the exports of electric locomotives, but the shipments of batteries were heavy, owing to the interest in radio-telephony. The exports of telephone and telegraph apparatus remained at about the same level, but those of domestic appliances continued their rapid progress. Wiring devices, electric lamps, and ignition equipment exports all showed rises, but the greatest increase occurred in the radio apparatus section, which increased by about $4,000,000 to $8,936,565 in the first eleven months of 1925. It is estimated that radio exports constituted 11 or 12 per cent. of the whole of the United States foreign electrical trade during 1924.

As regards distribution, it is said that exports to Europe were slightly smaller, but Great Britain remained the principal customer. Exports to Australia and New Zealand and South America increased.

For Sale.—Birmingham Corporation Electric Supply Department has for disposal three d.c. and one a.c. generating sets. Messrs. Fuller, Horsey, Sons & Cassell will sell by auction on March 2nd and following days, at the Cubitt Engineering Works, Aylesbury, the entire contents of the works, including engineers' machine tools, motor-body building plant, electric power plant, &c. (See our advertisement pages to-day.)

An Arc-Welding Plant Contract.—Among the orders secured by members of the F.B.I. recently was one for three two-operator arc welding machines for the Eastern Bengal Railway, supplied by Alloy Welding Processes, Ltd.

The London Engineering Dispute.—Negotiations between the engineering employers and employés in the London district regarding the application for a 20s. per week increase remained suspended last week on account of an unofficial strike at a printing-press manufacturer's works. A meeting between the national executive of the Amalgamated Engineering Union and the London District Committee of the union was held on Saturday last to discuss the dispute.

Electric Locomotive Manufacture in Japan.—In August last an order was placed by the Nippon Denryoku K.K. for four 25-ton electric locomotives with the Kawasaki shipbuilding yards. Although the works had had no previous experience of the work, two of the locomotives were completed in four and a-half months. It is claimed that the materials used are wholly Japanese, there being no foreign work in them whatever. The yards are said to have orders for 12 more locomotives for various railway authorities.

An Anglo-Greek Electricity Scheme.—The Athens correspondent of the *Financial News* reports that under the contract signed in September last between the Greek Government and an Anglo-Hellenic group (including the Power and Traction Finance Co., Ltd.), the latter has received a 60-year concession. This gives the group the exclusive right of the production and distribution of electricity within a radius of 20 km. from the centre of Athens, and the exclusive right to install and operate tramways in this area; the right to supply electric current to bodies outside this area; and the exclusive right of the exploitation of the Athens-Kefissia Railway. The initial capital of the group will be about £4,000,000, half of which will be raised in London under the Trade Facilities Acts.

American Sales in England.—The sale of high-grade radio parts of American manufacture has increased considerably in England, and there is a growing desire among British electrical dealers to become agents for American radio manufacturers. This demand is also being felt in the household appliance line.—*Commerce Reports.*

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report February 9th:—Copper (electrolytic) bars, £67, 30s. increase; do. do. sheets, no change; do. do. wire rods, £77, 30s. increase; do. do. h.c. wire, 9¾d., ¼d. increase.

Messrs. James & Shakespeare report February 9th:—No change in the prices for copper bars (best selected), sheet and rod; English pig lead, £35 5s., 10s. decrease.

Messrs. Edward Till & Co. report February 9th:—India-rubber, Para fine, 2s. 8d., 1d. decrease.

Salvadoran Customs Decision.—The Government of Salvador has decided to admit electric signs of all types free of all import duties and other charges.

Strike at Yallourn.—Six hundred miners employed at the Victorian Electricity Commission's brown coal mine at Yallourn have gone on strike. The men allege that the Commission is delaying its decision with regard to wages and also that the living conditions in the mine township are "intolerable."—*Reuter.*

Lighting and Power Notes.

Argentina.—Buenos Aires.—According to *Power*, after an exhaustive engineering study, the Compania Hispano-Americana de Electricidad is obtaining two tandem-compound steam turbo-generators as the initial installation for the new generating station to be built at the entrance of the harbour of Buenos Aires. Each generator will be a 50,000-kW, 13,200-V, 1,500-r.p.m., machine with a 250-V, d.c. exciter, and a 2,500-kW, 2,300-V service generator with its own d.c. exciter, all mounted on the same shaft.

Barrow.—Hydro-Electric Scheme.—The proposed hydro-electric scheme, which has been under consideration for some time came before the Corporation on February 1st. It is proposed to harness the Backbarrow Falls on the River Leven, which is the outlet of Lake Windermere, and to erect a power station for the accommodation of three 500-kW turbo-alternators. The output is estimated at 4,000,000 kW per annum and the estimated cost is £78,000 for the construction of the station with headrace, pipeline, plant, &c., and £12,000 for transmission lines. A saving of from 4,000 to 5,000 tons of coal per annum is anticipated. The scheme has been held up on account of opposition to the terms of agreement with the Lancashire Ultramarine Co., and the Backbarrow Charcoal Iron Co., for the transfer of their water rights at Backbarrow. The Corporation has now approved the scheme and also the amended terms with the two companies for compensation.

Birkenhead.—Electricity Agreement.—The Electricity Committee has obtained a draft agreement for an increased supply of electricity in bulk from the Walsall Corporation.

Loan.—The Committee is applying for sanction to the borrowing of £21,319 for the erection of transformers, rotary converters, and the provision of connecting cables.

Blackburn.—Loan.—The Town Council, on February 4th, approved of an application for powers to borrow £5,000 for the provision of electric cooking apparatus to be let out on hire.

New Sub-Stations.—The Council has also approved plans for the erection of sub-stations in Cornelian Street and Cabin End Row.

Blackpool.—Loans.—The Corporation is applying for sanction to the following loans:—£22,200 for cables; £3,800 for transformer chambers and switchgear; and £9,000 for new phase and frequency changers in connection with the electricity undertaking.

Canada.—Hydro-Electric Development.—The fifth generating set of the Cameron Falls power station, Nipigon development, was put into commission on December 1st last. This set was urgently needed as the demand of the Thunder Bay system in November recorded a load at Port Arthur of 26,000 h.p., an increase of over 3,000 h.p. as compared with the corresponding period of the previous year.

Cheltenham.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £9,500 for boiler plant.

Cardiff.—ELECTRICITY EXTENSIONS.—The Electricity Committee has approved, for submission to the Finance Committee, a report submitted by the borough electrical engineer for extensions and replacements at the Roath and Hayes stations, and for mains and sub-station extensions. The report covers a period of two years, and the estimated cost of the extensions is £82,540.

Chester.—WIRING OF SMALL HOUSES.—The Electricity Committee is making application for sanction to borrow £3,000 for the wiring of small houses on the hire purchase system. The Committee has prepared a scheme whereby smaller dwellings may be wired at a cost not exceeding £10. It is proposed that the contractors should first of all have the opportunity of wiring the houses to a schedule prepared by the Committee at a profit. If the contractor does not agree, the Corporation will do the wiring. It is proposed that the occupier or owner should pay 1s. 10d. per £ of the expenditure per month, and in cases where tenants cannot repay in one year, the rates of repayment will be at 2s. 1d. in the £ spread over a period of three years.

MAINS EXTENSIONS.—New distributing mains are required in the eastern portion of the city and for that purpose it is proposed to lay a h.p. underground cable from New Crane street to a sub-station to be erected on land adjoining Hoole Lane, and to lay a further cable from the new sub-station to supply the Great Boughton district. New l.p. cables are also required and the cost of the whole work is estimated at £17,870. The Committee has recommended that application be made for sanction to borrow that sum. The recommendations have been approved by the Council.

Chesterfield.—ELECTRICITY SUPPLY.—The following matters were approved at the January meeting of the Electricity Committee:—A new e.h.p. feeder, to be laid to the Whittington Moor area, to duplicate the existing feeder; distribution mains to be extended to Handley Road, New Whittington; Hasland Green to the borough boundary; Highfield housing estate, and Hunloke Avenue, and overhead distribution in the Holymoorside rural area.

Continental.—GERMANY.—According to *The Times*, a Bill has been introduced into the Prussian Diet for appropriating the sum of 54,000,000 marks for extending the participation of the Prussian State in electrical works. The greater part of the amount has already been spent in acquiring interests in existing works. The proposal is part of a larger scheme of State control of electricity in Prussia.

SPAIN.—The Madrid correspondent of *The Times* reports that the Cabinet has approved the general lines of the new scheme of the Minister of Public Works for the better utilisation of the country's great hydro-electric resources. At present many new works are in course of construction, but owing to insufficient capital they are advancing very slowly. By lumping together the annual State payment towards these works for the next 25 years, the Minister hopes to speed up construction.

CZECHO-SLOVAKIA.—The Ceskomoravska Kolben Co. of Prague has recently completed a 20,000-kVA turbo-generator set for the power station at Seestadtl. The set, which runs at 3,000 r.p.m., is the largest of this type so far constructed in Czecho-Slovakia.

ROUMANIA.—According to a recently-issued report there were 133 central electricity stations in operation in Roumania at the end of 1924, of which 29 are operated by water power, 62 by internal-combustion engines, and the remainder by steam. The largest stations are those at Anina with an annual output of 19 million kWh; the Arad station (steam) with a capacity of 4,000 kW; and the Klausenberg station (steam, internal-combustion engine and water power) with a capacity of 3,200 kW.

AZERBAIJAN.—At a recent meeting of the Elektroplan, the question was discussed of the electrification of Azerbaijan. The plan submitted by the special commission provides for the gradual installation of hydro-electric works on the Araks, Kura, Terter and Samur rivers, the power of the individual works ranging from 30,000 to 60,000 kW.—*Reuter's Trade Service* (Moscow).

Dosthill (Staffs.).—ELECTRICITY SUPPLY.—A canvass of residents has been recently made resulting in applications for electricity supply being received from 95 per cent. of the householders. The Pooley Hall Colliery Co., Ltd., has decided to proceed immediately with the provision of a supply.

East Preston.—ELECTRICITY SUPPLY.—The Rural District Council has decided to consent to the Worthing Electricity Order on condition that the compulsory mains be extended to the villages of Angmering and Ferring, and that the price of electricity in the rural district should not exceed the price in the parish of Durrington.

Elland.—LOAN SANCTIONED.—The Urban District Council has received sanction to the borrowing of £1,000 for domestic apparatus to be let out on hire.

Epsom.—ELECTRICITY SUPPLY.—The Urban District Council has applied for sanction to a loan of £9,000 for renewing mains, and for approval to the installation of two 300-kW Diesel engines.

Gainsborough.—ELECTRICITY SCHEME.—The Council has received a report on the proposed electricity scheme. The cost of the plant is estimated at £8,561, mains and transformers, £10,105, and building, contingencies, and engineer's fees, £6,600. The report has been adopted.

Glasgow.—PROGRESS DURING DECEMBER.—The Corporation electricity manager reports that in December 103 houses were wired under the department's scheme, bringing the total to date to 1,709, while the number of applications for the hire of appliances was 529, making the total to date 9,603.

Glossop.—PURCHASE OF UNDERTAKINGS.—The Finance Committee of the Corporation has again considered the question of the purchase by the Corporation of the electricity and tramway undertakings of the Urban Electric Supply Co., Ltd., in the borough, and has received a report by the consulting engineer, Mr. R. Blackmore, on the proposal. The Committee has recommended the Council to purchase the undertakings at the price set out in the report.

Hastings.—ELECTRICITY AGREEMENT.—The Electricity Committee has entered into an agreement with the Rye Rural District Council for the supply of electricity to the rural district.

LOAN SANCTIONED.—The Committee has received sanction to the borrowing of £12,000 for mains and meters.

Hebden Bridge.—ELECTRICITY SUPPLY.—The Urban District Council is to consider at its next meeting the question of coping with the increased demand for electricity either by increased generation or by an additional bulk supply. In the meantime the Halifax Corporation is being asked to quote for an additional supply.

Irish Free State.—BLACKROCK (CO. DUBLIN).—The Free State Parliament has approved an Order under the Electricity Supply Acts in respect of a scheme for the township and district.

Lairg.—ELECTRICITY EXTENSIONS.—Extensions of the present electricity scheme are proposed and Mr. Claude Pain, in conjunction with Messrs. A. Hugh Seabrook & Partners, has been called in to advise.

Lancaster.—LOAN.—The Electricity Committee is applying for sanction to a loan of £12,500 for electricity purposes.

Leeds.—LOANS.—The Electricity Committee has received sanction to loans of £50,000 for sub-station equipment and £10,500 for sub-station buildings. Sanction is being sought for a loan of £1,600 for electricity services to 500 houses at Neaswood, Cross Gates, and Middleton.

Liverpool.—EXTENSION OF SUPPLY.—The following mains extensions have been authorised by the Corporation:—H.p. main from Smithdown Road sub-station to Lodge Lane sub-station, at an estimated cost of £12,383, and l.p. mains at an approximate cost of £8,295; extension of h.p. mains in Hawthorne Road, at an estimated cost of £1,378, and the provision of the necessary equipment in a sub-station at an approximate cost of £2,000 to supply industrial consumers.

PURCHASE OF UNDERTAKING.—Sanction has been received to the borrowing of £68,449 for the purchase of the undertaking of the Liverpool District Lighting Co., Ltd.

London.—SOUTHWARK.—The Electricity Committee has received sanction to a loan of £7,680 for mains, services, and plant.

Manchester.—PROGRESS DURING DECEMBER.—During the month of December the Corporation electricity undertaking showed an increase in connections of 2,424 kW, bringing the total to 275,836 kW; and the number of applications received for supply, including existing consumers for additional supplies, was 931, representing a total of 2,126 kW. The number of hired cookers connected increased by 108, bringing the total actually on circuit to 1,253. Applications for the hire of cookers totalled 91. One 750-kW converter was put into commission at each of the following sub-stations:—Whalley Range, Didsbury, West Didsbury, and Fallowfield. The Bowker Vale sub-station was also put into commission.

LOAN.—The Electricity Committee has recommended to the Corporation that application be made for sanction to a loan of £50,000 for equipment for distributing stations.

Nantwich.—ELECTRICITY AGREEMENT.—The Urban District Council has approved a draft agreement with the Gwynedd Trust, Ltd., for the supply of electricity to the town.

Newton Abbot.—APPLICATION FOR ORDER.—The Rural District Council having refused its formal consent to an application for an Order to supply electricity in the rural area by the Teignmouth Electric Lighting Co., Ltd., the latter has appealed to the Electricity Commissioners to dispense with the Council's consent.

Rawtenstall.—YEAR'S WORKING.—We have received from Mr. C. L. E. Stewart, borough electrical engineer, a copy of the accounts of the electricity undertaking for the year ended March 31st last. A summary of the accounts shows that there was a total income of £54,470, as compared with £54,032 in the preceding year. Working expenses were higher at £28,425, as against £27,479, and there was a gross profit of £26,045 (£26,553). After deducting capital charges there was a net surplus of £6,368, as compared with £6,339 in 1923-24. The sales of electrical energy increased from 9,140,752 to 9,577,834 kWh, and the average price per kWh obtained fell from 1.367d. to 1.30d.

Reigate.—Opposition to Bill.—The Town Council has decided to petition against the Bill of the Metropolitan Electric Supply Co., Ltd., which seeks powers to supply within the Council's area and adjacent districts, on the ground that it would be unfair for the company to be given legal powers to compete with the Corporation, which has lately spent a large sum on the development of its undertaking.

Sheffield.—Electricity Extensions.—The Electric Supply Committee has approved extensions and works at an estimated cost of £5,608, and extensions of mains for general distribution purposes at an estimated outlay of £17,831.

Linking Up.—An arrangement has been entered into for the linking-up of the electricity undertakings of the Sheffield and Rotherham Corporations with a cable for an interchange of supply of 10,000 kW, and the agreement provides for an emergency supply of electricity being given by one Corporation to the other. Rotherham Corporation has agreed to allot to the Sheffield Corporation stand-by plant of a capacity of 10,000 kW, and for this service the Sheffield Corporation will make an annual payment. Sheffield Corporation may take from Rotherham a supply of electricity in bulk not exceeding 25 million kWh per annum, with a minimum of five million kWh. The linking-up cable, with subsidiary apparatus, will cost between £40,000 and £50,000, and the cost of this work, as well as the cost of maintenance, will be equally divided between the two Corporations. The agreement is to remain in force for five years from the date of the actual linking-up. The general manager of the Sheffield electricity undertaking reports that by this agreement the extension of the generating station at Blackburn Meadows can be postponed.

Southport.—Domestic Appliances.—The Electricity Committee has received sanction to the borrowing of £5,000 for the purchase of domestic electrical appliances to be hired to the public. The Committee has authorised its electrical engineer to purchase domestic appliances for hire-purchase at a cost not exceeding £2,000 from revenue account.

Loan.—The Town Council is applying for sanction to a loan of £25,000 for strengthening the network of cables in the town and erecting distributing kiosks in different parts of the district.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Sidmouth Urban District Council for authority to supply electricity to certain parishes in the rural district of Honiton; Cement Houses, Ltd., for the supply of electricity in the boroughs of Southend-on-Sea, Chelmsford, and Maldon, the urban districts of Burnham-on-Crouch, and Shoeburyness, and the rural districts of Rochford, Chelmsford, and Maldon.

The Bynamman and District Electric Supply Co., Ltd., has applied for certain amendments to be made in the draft of the Bynamman and District Electricity Order.

United States.—Hydro-Electric Development.—According to *Power*, a station now under construction on King's River in Central California is to operate under an ultimate static head of 2,470 ft. It will be the highest-head hydro-electric plant in America. The San Joaquin Light & Power Corporation expects to have the station in operation within a year. The entire King's River project will involve the expenditure of $50,000,000. The plant will include four of the largest horizontal waterwheel generators in the country. The first of these units, rated at 33,000 kVA, 13,200 V, is being made by the American General Electric Company.

The Philadelphia Electric Co.'s petition for approval of its $52,000,000 hydro-electric scheme, at Conowingo on the Susquehanna River, was allowed on January 12th by the Pennsylvania Public Service Commission. The Public Service Commission of Maryland has already passed the project, and the permission of the Federal Power Commission will probably be forthcoming shortly.

Whitchurch.—Application for Order Approved.—The Urban District Council has decided to support the application of the Gwynedd Trust, Ltd., for powers to supply electricity in the Council's area.

Tramway and Railway Notes.

Continental.—Belgium.—Work is well in hand on the electrification of the local railway between Brussels and Ninove. The section as far as Schepdael is already in operation, and it is anticipated that the complete line will be finished by the autumn. In connection with the work the Société Nationale des Chemins de Fer Vicinaux, of Brussels, is about to invite tenders for the establishment and equipment of a transformer sub-station at Eyseringhen.

The Société d'Electricité de l'Escaut of Antwerp, has recently entered into a contract to supply the whole of the electrical energy required for the operation of the tramway of the Antwerp General Tramways Company.

Switzerland.—It is reported from Berne that the Swiss Federal Railway authorities have recently given orders for 48 additional express electric locomotives. Twenty are to be built by Brown, Boveri & Co., of Baden, 26 by the Oerlikon Maschinenfabrik, Oerlikon, and two by the Ateliers de Sécheron, of Geneva. The last-named company has also secured an order for the electrical equipment of 16 eight-wheel rail motor coaches.

Work is about to be commenced on the construction of an electrically-operated cable railway between Burglen, near Altdorf (Canton of Uri) and the summit of the Kingzig. The line will be about 1¼ miles in length.

France.—As a result of the satisfactory experiments with the block system of luminous signals on the Asnières-Argenteuil line, the French State railway authorities have decided to adopt it on the Becon-les-Bruyeres-Saint Germain-en-Laye section (10 miles) of the Paris-St. Germain railway, which is at present in course of electrification.

Croydon.—Route to be Abandoned.—The Borough Council, on February 1st, decided to abolish the Addiscombe tramway system, and to complete negotiations for an omnibus service on and beyond that route.

New Service.—A through service of L.C.C. tramcars between Victoria Embankment and Croydon and Purley was commenced on February 7th. The length of the route is 14 miles.

Farnworth.—Tramway Agreement.—The Urban District Council, on February 3rd, entered into an agreement with the South Lancashire Tramways Co. for the working, use, maintenance and management of the Council's tramway for a further 21 years as from April, 1927. The company will maintain the track, and take its electricity supply from the Council's electricity undertaking, and the Council is to receive 5 per cent. of the net profits.

India.—Calcutta.—The Government has approved the draft agreement with the Calcutta Tramways Co., Ltd., for the construction of a tramway along the main sewer road from Russia Road South to Ballygunge railway station.

Bombay.—The Bombay Electric Supply & Tramways Co. is to introduce a railless-car service on one of the tramway routes. The scheme has received the consent of the Corporation.

Keighley.—Railless Cars.—The last of the tramway track was formally removed by the Mayor on February 4th. The heavy cost of track maintenance was the chief cause of the change last year, and Keighley was the first town in the country to abolish tramways entirely and substitute railless-cars.

London.—New Subway.—The Corporation of London and the Metropolitan District Railway Co. have come to an arrangement for the construction of a subway to link up Blackfriars Station and the public ways at Blackfriars Bridge.

Southern Railway Electrification.—The Southern Railway Co. has announced that Cannon Street Station will be closed from June 5th to June 28th, in order to enable the work of reconstruction in connection with the electrification of the railway to be proceeded with night and day. From June 28th to July 10th a modified steam and electric service will be run from Cannon Street Station.

From February 28th temporary electric services will be introduced between Charing Cross and Cannon Street and Orpington, and from June 6th temporary electric services will be introduced between Charing Cross and Dartford.

Stoke.—Abolition of Tramways.—At a recent meeting of the City Council the refusal of the Ministry of Transport to support the Council's action in declining to grant additional omnibus licences to the Potteries Electric Tramways Co. was discussed, and it was decided to appoint a special committee to negotiate with the company on the matter of both tramways and omnibuses with a view to the abolition of tramways if possible.

Telegraph and Telephone Notes.

China.—New Wireless Station.—It is reported that a radio station is being constructed at Paotouchen, Suiyuan Special Administrative Area, and the work is expected to be completed shortly.

Denmark.—Telegraph Service.—According to the recently-issued report for the year ending March 31st, 1924, by the Danish Telegraph Authorities, the telegraph system in Denmark at that date comprised 5,388 miles of overhead lines, 525 miles of submarine cables, and 238 miles of underground lines—a total of 6,151 miles.

Hull.—Telephone Profits.—A report presented to the Hull Corporation Telephone Committee showed that the profit on the telephone undertaking for the current financial year would exceed £12,000, after allowing for payment of royalties to the Government amounting to £10,900. The Hull Corporation is the only municipality in the kingdom to own a telephone undertaking, and the tariffs are the lowest.

Exchange Extension.—The Municipal Telephone Committee has authorised the provision of additional switches at the Queen's Road exchange, at a cost of £580.

Pacific Cable Board.—CANADA'S THREAT TO WITHDRAW.—Mr. Charles Murphy, Postmaster-General, announces that he has notified the Pacific Cable Board that he will recommend Canada's withdrawal from partnership with Great Britain, Australia, and New Zealand, if the Board persists in the duplication of the Pacific cable between Fiji and Canada.—*Reuter* (Ottawa).

In the Canadian House of Commons, Sir George Perley asked for an assurance from the Government that no such step would be taken without at least first consulting Parliament. Mr. Lapointe, acting leader of the Government, said that correspondence was still proceeding with the Cable Board, and he hoped that an amicable settlement would be reached.—*Reuter* (Ottawa).

Poland.—TELEPHONISTS' STRIKE.—The Inter-Ministerial Commission of Arbitration, which had been summoned to settle the differences of opinion between the telephone operators and their employers at Warsaw, gave its decision on February 4th. The Commission censures the arbitrary conduct of 14 telephonists with regard to their employers, and requests them to return to work at a reduced salary for two months. The manager of the Telephone Company, who had assumed control on behalf of the State, has communicated the details of this decision to the directors of the Telephone Company.—*Reuter* (Warsaw).

Switzerland.—NEW AIRCRAFT STATION.—A wireless telegraph reception and transmission station is to be installed at the aerodrome at Dubendorf, near Zurich.

The Telephone Service.—NEW EXCHANGE AT SALFORD.—Employment for a period of 12 months will be provided for 200 men by the erection of a new telephone exchange at Salford, the largest building undertaking that Manchester has seen for many years. Involving an expenditure of £250,000 and occupying a floor space of six acres, the structure, when completed, will be fitted with apparatus of the automatic type; the building is to be steel-framed throughout, and the 4,000 tons of steelwork required is to be fabricated at the Trafford Park works of Messrs. Edward Wood & Sons.

Radio Notes.

Concerts in the Air.—AIRCRAFT RECEPTION.—Wireless concerts for air travellers were inaugurated on the Paris-London airway on February 1st, when all the passengers by the Air Union noon aeroplane from Le Bourget enjoyed a concert broadcast by the Radio-Paris station.

Daventry.—DISTORTION.—Capt. P. P. Eckersley, chief engineer of the B.B.Co., replying to a letter in *The Times* from a correspondent complaining of unpleasant distortion from the Daventry station, says: "We have had several letters to the same effect. While not wishing to shirk responsibility, it can be proved that, given certain methods of reception, no serious distortion is apparent. This condition is admittedly dependent upon a greater factor of safety in the receiving set than that necessary with short waves. We find that the overwhelming majority of complaints (numbering 150 out of the estimated 100,000 listeners to Daventry) come from users of sets other than crystal. 'Low tone' distortion is often produced by heavy receiver reaction effects, and this, coupled with the fact that we are using a microphone which brings in the 'low' tones more pronouncedly than former types, suggests that our theory of the trouble can be supported, at least, reasonably. It may be, however, that under-modulation in the transmitter caused by some spurious effect would result in the necessity of listeners using more reaction in the receiver than heretofore. Our standard tests have not revealed any defect in the circuits which would account for a lack of modulation, but in order definitely to prove whether some undiscovered effect is present, we are carrying out certain experiments to check performance and to assure ourselves that responsibility for the trouble does not lie with us. My own opinion at the present moment is that the effect is only apparent because of the introduction of a more perfect over-all frequency response in the transmitter, which 'shows up' badly in those receivers which for their sensitivity rely too much upon the use of reaction. Another type of distortion is dependent upon the interference between direct and indirect rays from the station, but this effect, bound up with fading, will only be apparent at very long ranges, upwards of 200 miles. We have no control over this type of distortion except in attempting to keep our wave-length perfectly steady. We have never, and never will, adopt a policy of over-modulating transmitters in the interests of long-distance listeners, and to the detriment of good quality."

Finance.—POST OFFICE PAYMENTS.—Details of the additional money required by Government Departments to cover expenditure which they will have incurred by the end of the financial year in excess of the amount already voted are given in a list of supplementary estimates which was issued last week. The Post Office demands another £847,000, of which sum £223,000 is needed to meet increased payment to the British Broadcasting Co., Ltd.

France.—PROPOSED "LUXURY" TAX.—Many protests have been raised against the proposed new taxes on wireless apparatus, which is classed as a luxury. The French Wireless Union has unanimously adopted a resolution pointing out that wireless is by no means a luxury, as 90 per cent. of the sets belong to modest employés and workers; that it is a powerful element in furthering social progress, and that still wider development of wireless would bring into the Treasury greater resources than the proposed tax, which would restrict such development. The resolution expresses the determination to oppose any tax on ordinary sets, the price of which does not exceed 2,000 fr.—*Reuter* (Paris).

Iceland.—NEW STATION.—The new broadcasting station at Reykjavik has begun testing operations. According to the *Evening News* it transmits at 11 p.m. on a wave-length of 430 metres. The transmitter, which is to be under official control, works on a power of 500 watts, and was installed by Standard Telephones & Cables, Ltd. (Western Electric Co.), one of whose engineers is at present in charge of the station.

Licences.—PROSECUTION.—Supporting a licence prosecution at Willesden, London, on February 4th, a Post Office representative said that defaulters, under the new Wireless Act, committed two offences, and accordingly two summonses were being issued in each case William Boyd, of Cricklewood, was summoned for installing a wireless set without a licence, and for working it without a licence. He pleaded guilty, and the magistrates fined him 10s. for each offence, and said that future offenders would be more severely dealt with.

Spain.—NEW STATION FOR BARCELONA.—The Casa del Aficionado, of Barcelona, manufacturers of wireless telephone material, is about to install a wireless station at Barcelona. This station will be the fourth in that town.—*Reuter's Trade Service* (Madrid).

The Wireless Association.—A NEW CLUB.—The above-named Association, which aims, apparently, at assuming a similar position to that of the Automobile Association in motoring circles, requires its members to sign a pledge that they will refrain from oscillating during broadcasting hours. Amongst the services it proposes to afford its members are accumulator charging at low rates, the hire of receiving sets, technical repair and advice (personal or by post), legal service, and special insurance rates.

United States.—FARMERS' WIRELESS TELEPHONY.—The Sears Roebuck Agricultural Foundation at Dallas recently sent questionaires to farmers in Texas, Oklahoma and Louisiana, asking them to name the benefits received from radio reports. Five hundred replies were recived, of which 163 listeners said that radio service saved them money each year; the average saving was 148.64 dollars per family. Market reports were considered to be the greatest financial advantage.—*Reuter's Trade Service* (Chicago).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—SYDNEY.—March 31st. New South Wales Government Railways. One air compressor for Zarra Street power house.

April 21st. Four motor-generator sets and four switch-operating batteries for Hornsby and St. Leonards sub-station. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

MELBOURNE.—April 7th. City Electrical Department. One 2,000-kW rotary converter, with transformer and accessories,* d.c. switchgear and accessories, and one a.c. control panel.*

April 7th. Victorian Government Railways. One hydraulic plate-bending press.*

Aylesbury.—February 16th. Electricity Department. Overhead 11,000-V transmission lines and cables. (January 22nd.)

Belfast. — February 20th. Electricity Department. Twelve months' supply of stores, including electrical accessories, lamps, carbon brushes, electricity meters, &c. (January 29th.)

Belgium.—February 24th. The Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. Telephone switchboard, with c.b. and luminous signals, &c., for the central regional and interurban telephone exchange at Verviers. Particulars (cahier des charges special No. 3,160) for 8¼ fr.

Bristol.—February 25th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Cardiff. — February 22nd. Electricity Department. Twelve months' supply of paper-insulated cables, one 1,500-kW rotary converter, and one 2,000-kW ditto. (February 5th.)

March 8th. One 10,000-kW turbo-alternator and condensing plant. (February 5th.)

Cheadle and Gatley.—February 15th. Electricity Department. E.h.p. and l.p. switchgear. Specification from Electrical Engineer and Manager, 37, High Street, Cheadle, Cheshire.

Clitheroe.—February 23rd. Corporation. Transformers, switchgear, and cable connections for sub-station; e.h.p. and l.p. cables, boxes, &c. (January 15th.)

Dundee.—Town Council. Electrical work in connection with 60 Corporation houses. Particulars from Mr. Geo. Baxter, Director of Housing, 91, Commercial Street, Dundee.

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or, alternatively, one 20,000-kW turbo-alternator with condensing plant. (February 5th.)

February 16th. One 750-kW motor converter for Leith Substation. (February 5th.)

Halifax.—February 20th. Markets and Parks Committee. Electrical engineering work in connection with the erection of the public abattoirs. Particulars from Borough Engineer, Crossley Street.

Hull.—February 15th. Tramways Committee. Stores required during year ending March 31st, 1927, including carlighting fittings, lamps, cable, and switches. Form of tender, &c., from General Manager, Tramway Offices, Albion Street, Hull.

Leicester.—Electricity Department. One 18,750-kW, 3-phase turbo-alternator, with condensing plant. (See this issue.)

London.—London County Council.—February 22nd. H.p. switchgear for Lewisham tramway sub-station. (January 22nd.)

St. Pancras.—March 2nd. Electricity Department. E.h.p. switchgear at the Grafton Road sub-station. (February 5th.)

Metropolitan Asylums Board.—February 24th. Installations of electric lighting at the Upper Southern Convalescent Fever Hospital and the Joyce Green Hospital, Dartford. Installation of kitchen fittings and appliances at the North-Western Fever Hospital, Lawn Road, N.W.3. (See this issue.)

Manchester.—February 16th. Tramways Committee. Permanent-way points, tongues and crossings and general stores. Schedules from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly.

February 23rd. Steelwork for permanent way and parcels depôt.

Board of Guardians. February 13th. Electric lighting at Cottages Homes, Styal, Handforth. February 19th. Electric bed lifts at new pavilions, Booth Hall Infirmary, Charlestown Road, Blackley. Particulars from Mr. F. H. Overmann, architect, 183, Oxford Road, Manchester.

Morley.—Borough Council. Electrician's work in erection of 56 houses, Middleton Road estate. Particulars from Mr. F. Turner, borough engineer, Town Hall.

Newark-upon-Trent.—March 1st. Corporation. Two electrically-driven centrifugal pumps. (February 5th.)

Perth.—February 17th. Corporation. Electric lighting installation at 84 houses. Plans from Burgh Surveyor.

Plymouth.—February 17th. Electricity Department. Twelve months' supply of electricity meters, cables and transformers. (January 29th.)

Retford.—February 19th. East Retford Gas, Water and Electricity Department. Electricity generating plant, mains, transformers, and meters. (January 22nd.)

Richmond-on-Thames.—February 22nd. Town Council. Electrically-driven centrifugal pump, with motor, switchgear, &c. Mr. Hugh P. Williamson, water engineer, Riverside.

Salford.—February 18th. Electricity Department. Coal supplies required during six months commencing March 1st, 1926. Particulars from Borough Electrical Engineer, Frederick Road, Salford.

South Africa.—Johannesburg.—February 25th. Municipal Council. Four d.c. switchgear panels and 3-phase, truck-type ironclad switchgear panels.*

February 25th. S.A. Railways and Harbours. Two 4-ton electrically-driven fixed wharf cranes for Luderitz jetty.*

One 7-ton and five 4-ton electrically-driven portal cranes, complete.*

Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (See this issue.)

Pretoria.—February 25th. Postmaster-General's Department. Supply of a manual telephone exchange for Hatfield, Pretoria. Controller of P.O. Stores, Pretoria.

February 25th. Union Tender Board. Miscellaneous telegraph and telephone materials (C×1880).*

Cape Town.—March 17th. Electricity Department. Electric cables, electric light poles, cross arms, insulators, &c.

Mooreesburg.—March 20th. Municipal Council. Engine-room equipment, including oil engines and tanks, main generators, motor booster, pumps and air compressor, travelling crane, switchboard, battery and connections, distribution system, instruments, meters, &c.; and house service connections.*

Spain.—Madrid.—La Junta de Obras del Puerto de Castellón de la Plana. A 3-ton electric crane.—*Reuter's Trade Service* (Madrid).

Sutton Coldfield.—February 17th. Electricity Department. E.h.p. underground main, rotary converting plant and switchgear, and automatic rotary converting plant and switchgear, or mercury-arc rectifiers. (February 5th.)

Watford.—February 23rd. Board of Guardians. Electric lighting installation, consisting of wiring old buildings, new power mains, motors, main switchboard, &c. Specifications from the Master's office, 60, Vicarage Road, Watford, or from the consulting engineer, Mr. W. M. Benny, 39, Carlton Road, Putney, S.W.15.

Wrexham.—February 18th. Electric lighting installation at Miners' Hall and Institute, Rhos. Specification from Mr. J. Owen and Mr. F. A. Roberts, architects, Westminster Bank Chambers, Wrexham.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Birkenhead.—Electricity Committee. Accepted:—

1,500-kW rotary converter (£5,417); and 750-kW converter (£3,272).—Metropolitan-Vickers Electrical Co., Ltd.

Cable.—Hackbridge Cable Co., Ltd. (£2,139); Macintosh Cable Co., Ltd. (£116); W. T. Henley's Telegraph Works Co., Ltd. (£1,140).

Two 200 kVA transformers (£355).—General Electric Co., Ltd.

Switchgear for Bromborough sub-station.—Ferguson, Pailin, Ltd. (£948); English Electric Co., Ltd. (£222).

Switchgear for Beaufort Road sub-station (£100).—British Thomson-Houston Co., Ltd.

Bradford.—Tramways Committee. Accepted:—

58 steel gear wheels and 60 steel pinions for tramcars (£522).—David Brown & Sons (Huddersfield), Ltd.

Three one-man electric trolley vehicles (£1,445 each).—Associated Equipment Co., Ltd.

Three ditto (£1,530 each).—Richard Garrett & Sons, Ltd.

Electricity Committee. Accepted:—

One auxiliary motor-generator for Valley Road generating station.—Crompton & Co., Ltd.

Markets and Fairs Committee. Accepted:—

Illuminated signs at Kirkgate and Rawson Place Markets.—J. Akers (10 signs, £186); wiring signs (£163).—Smith & Croft.

Great Horton Co-operative Society, Ltd. Accepted:—

Electrical installation at new branch store, Brownroyd Hill.—A. Higginbotham & Son.

Bury.—The Town Council has decided to complete agreements with the English Electric Co., Ltd., and the General Electric Co., Ltd., in connection with the conversion of eight bogie cars, and with the De Laval, Chadburn Co., Ltd., for the supply of an oil purifier to the electricity department.

Chesterfield.—Electricity Committee. Accepted:—

E.h.p. and l.p. cables (£3,164).—Macintosh Cable Co., Ltd.

E.h.p. switch cubicles (£271).—British Thomson-Houston Co., Ltd.

Cornforth.—The Parish Council has accepted the tender of Wilson Fleetham, Coxhoe, at 8s. per lamp per annum for cleaning, maintaining and repairing and providing and fixing bulbs required for 140 electric street lamps.

Derby.—Tramways Committee. Accepted:—

Six car bodies, roof covers, and trucks (£7,050).—Brush Electrical Engineering Co., Ltd.

Six electrical equipments (£3,737).—British Thomson-Houston Co., Ltd.

Durham.—County Council. Accepted:—

Telephones at premises, Old Street (£78).—Kelly & Co.

Electric lighting installation at school at Tursdale (£113).—Reid, Ferens and Co.

Eastbourne.—Electricity Committee.

2,500-kW turbo-alternator:—

Oerlikon, Ltd.	£12,021
Escher, Wyss-Boveri	12,024
English Electric Co., Ltd.	12,108
Belliss & Morcom, Ltd.	12,142
A.E.G.	12,830
Metropolitan-Vickers Electrical Co., Ltd.	12,836
C. A. Parsons & Co., Ltd.	13,759
British Thomson-Houston Co., Ltd.	14,393
Fraser & Chalmers Engineering Works	14,538
Richardsons, Westgarth & Co., Ltd.	14,560
Allen, Sons & Co., Ltd. (Recommended.)	**14,754**
Browett, Lindley & Co., Ltd.	15,385
Brush Electrical Engineering Co., Ltd.	15,785
J. Howden & Co., Ltd.	16,475

Boiler, stoker, economiser, &c.:—

Stirling Boiler Co., Ltd. (Recommended.)	**£11,038**
John Thompson Water Tube Boilers, Ltd.	11,097
Babcock & Wilcox, Ltd.	11,863
Vickers-Spearing Boiler Co., Ltd.	12 040
Clarke, Chapman & Co., Ltd.	12,219
Richardsons, Westgarth & Co., Ltd.	12,305
J. S. White & Co., Ltd.	17,937

200,000-gal. cooling tower and tank:—

Premier Cooling & Engineering Co., Ltd. (Recommended.)	**£1,897**
Visco Engineering Co., Ltd.	1,908
Clyne Engineering Co., Ltd.	2,150
Davenport Engineering Co., Ltd.	2,155
Richardsons, Westgarth & Co., Ltd.	2 160
Film Cooling Towers, Ltd.	2,170
Hudson Economiser Co.	2,298

Glasgow.—Tramways Committee. Accepted:—

Commutators.—P. R. Jackson & Co., Ltd.

Car chains (brake).—Weldless Chains, Ltd.

Hastings.—Electricity Committee. Accepted:—

H.p. switchboard at Shepherd Street sub-station (£464).—Ferguson, Pailin Ltd.

Hull.—Tramways Committee. Accepted:—

Two switches, 100 ft. radius (£94); and one switch, 130 ft. radius (£58).—Hadfields, Ltd.

Liverpool.—Water Committee. Accepted:—

Electrically-driven centrifugal pump for Dudlow Lane pumping station (£1,490).—W. H. Allen, Sons & Co., Ltd.

Irish Free State.—The following contracts were among those placed by the Controller of Stores, Department of Posts and Telegraphs, Dublin, from December 21st to January 22nd, inclusive :—

Cable.—Siemens-Schuckert (Ireland), Ltd.; and W. T. Henley's Telegraph Works Co., Ltd.
Cable switchboard.—W. F. Dennis & Co.
Dry cells.—Edison Swan Electric Co., Ltd.; and Allen Liversidge, Ltd.
Porous Leclanché cells.—Siemens Bros. & Co., Ltd.; and General Electric Co., Ltd.
Platinum contacts.—Marconi's Wireless Telegraph Co., Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Telephone keys.—Sterling Telephone & Electric Co., Ltd.
Telephone relays.—Standard Telephone & Cables Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; International Electric Co., Ltd.
Tungar battery charger and parts.—British Thomson-Houston Co., Ltd.
Fuseboards.—Standard Telephones & Cables, Ltd.
Generators.—Siemens Bros. & Co., Ltd.
Enamelled and flameproof wire.—S. G. Leach & Co., Ltd.
Switchboard wire.—Celtic Electric Co.
Zinc rods (Leclanché).—Eyre Smelting Co., Ltd.—*Irish Builder and Engineer.*

Leeds.—Tramways Committee. Accepted:—

Points, crossings, and special work.—Edgar Allen & Co., Ltd. (£2,201); Thermit, Ltd. (£247).

Electricity Committee. Accepted :—

Cable.—W. T. Henley's Telegraph Works Co., Ltd. (£3,955); Enfield Cable Works Ltd. (£1,346); Macintosh Cable Co., Ltd. (£370).

Sewage Committee. Accepted :—

Electric lighting work at Thorpe Stapleton pumping station (£202).—Wilson Hartnell Installations, Ltd.

London.—ADMIRALTY.

3,300 accumulators.—Edison Swan Electric Co., Ltd.

HACKNEY.—Electricity Committee. Recommended :—

Air compressor (£110).—Reavell & Co., Ltd.
One Weir turbine feed pump (£525).—G. & J. Weir, Ltd.

HAMMERSMITH.—Electricity Committee. Accepted :—

Two 250-kW oil-cooled transformers (£400).—Hackbridge Electric Construction Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee.—The following tenders were received for the installation of electric lighting at Darenth Training Colony :—

Read & Partners, Ltd.	£8,192
Kershaws	8,431
Brightside Foundry & Engineering Co., Ltd.	9,040
S. Dixon & Son, Ltd.	9,750
T. Clarke & Co., Ltd.	10,000
Toy & Winslow	10,285
Direct Electric Service (Bury), Ltd.	10,380
Coley & Swinnerton, Ltd.	10,425
G. N. Haden & Sons, Ltd.	10,440
A. Higginbotham	11,100
Smethurst & Co., Ltd.	11,900
Douglas Electric Lighting & Power Co.	11,977
H. B. Giles	12,185
Taylor & Allen, Ltd.	12,885
R. Hunt & Co., Ltd.	12,960
Pinching & Walton	15,000
A. Innes	15,561
Jenner Light & Power Co., Ltd.	18,880

Maidenhead.—Town Council. Accepted:—

Electric fire siren (£83).—S. G. Leach & Co., Ltd.

Manchester.—Electricity Committee. Accepted:—

Two 750-kVA static transformers.—Hackbridge Electric Construction Co., Ltd.
3-phase induction regulator.—English Electric Co., Ltd.

Tramways Committee. Accepted :—

Trial equipment of "Maley" electro-pneumatic brake on tramcar.—Electro-Mechanical Brake Co., Ltd.
Steel girder tramway rails.—Cargo Fleet Iron Co., Ltd.

Education Committee. Accepted :—

Electric lighting at Ashton Road clinic.—Harrisons, Ltd.
Rearrangement of electric lighting at Ashton school.—R. Seddon & Sons.

Navan.—County Meath Board of Health. Accepted:—

Electric lighting installation at new County Hospital (£310).—Gilbert Bros. (11 tenders were submitted.)

Plymouth.—Health Committee. Accepted:—

Dynamo at sanatorium (£60).—W. H. Heath & Co.

Salford.—Tramways Committee. Accepted:—

30 fully-enclosed top covers, including new seats and canopies, and 60 lower vestibule ends and staircases for small cars (£18,930).—Massey Bros.

Southampton.—Education Committee. Accepted:—

Installing electric lighting at the new Taunton school (£928).—Groves and Co.

Forthcoming Events.

Physical Society of London.—Friday, February 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Annual general meeting.

Institution of Engineering Inspection.—Friday, February 12th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "The Application of Special Cast Irons in the Engineering Industry," by Mr. S. E. Dawson.

Electrical Engineers' Ball.—Friday, February 12th. At the Hotel Cecil, Strand, W.C.

British Electrical and Allied Industries Research Association.—Friday, February 12th. At the Savoy Hotel, Strand, W.C. Annual general meeting and luncheon.

Junior Institution of Engineers.—Friday, February 12th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecture on "A Visit to Some Power Stations in the U.S.A. in 1925," by Mr. W. H. Patchell.
Saturday, February 13th. At Holborn Hall. From 7.30 to 11 p.m. Annual dance.

Electrical Trades Commercial Travellers' Association.—Saturday, February 13th. At the Manchester Hotel, E.C. At 6.30 for 7 p.m. First annual dinner.

British Industries Fair.—February 15th to 26th. At the White City, London, W., and the Castle Bromwich Aerodrome, Birmingham.

Association of Mining Electrical Engineers (London Branch).—Tuesday, February 16th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 6.30 p.m. Paper on "Mining Signalling Apparatus and Telephones," by Mr. O. D. Kennedy.

Royal Society of Arts.—Wednesday, February 17th. At John Street, Adelphi, W.C.2. At 8 p.m. Lecture on "The Propagation of Electric Waves," by Mr. J. E. Taylor.
Monday, February 15th. At 8 p.m. Cantor Lecture on "The Production and Measurement of High Vacua," by Dr. G. W. C. Kaye.

Edinburgh Electrical Society.—Wednesday, February 17th. At the Royal Scottish Society of Art, 117, George Street. At 8 p.m. Paper, "A Talk on Cables," by Mr. F. Stevenson.

Poplar School of Engineering, Old Boys' Society.—Wednesday, February 17th. At the School of Engineering, High Street, Poplar, E. At 7.45 p.m. Paper on "Present-day Development in the Electrical Supply Industry," by Mr. O. L. Robson.

Institution of Electrical Engineers.—Thursday, February 18th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Joint meeting with the British Section of the French Society of Civil Engineers. Paper on "The Electrification of the Paris-Orleans Railway," by M. Parodi
(Mersey and North Wales (Liverpool) Centre).—Monday, February 15th. At the University, Liverpool. At 7 p.m. Paper on "Dielectric Problems in High-Voltage Cables," by Capt. P. Dunsheath.
(North-Western Centre).—Tuesday, February 16th. At the Milton Hall, Deansgate, Manchester. At 7.30 p.m. Joint meeting with the Institution of P.O. Electrical Engineers. Lecture on "Wireless," by Mr. E. H. Shaughnessey.
(Scottish Centre).—Wednesday, February 17th. At the Grosvenor Restaurant, Glasgow. Semi-Jubilee function (Ladies' Evening), dinner, whist and dancing.
(South-Midland Centre).—Wednesday, February 17th. At the University, Birmingham. At 7 p.m. Paper on "The Electrification of the Paris-Orleans Railway," by M. Parodi.
(Tees-Side Sub-Centre).—Monday, February 15th. At the Cleveland Technical Institute, Middlesbrough. At 7.15 p.m. Paper by Mr. C. W. Blacklock.
(North-Midland Students' Centre).—Tuesday, February 16th. At the Technical College, Bradford. At 7 p.m. Paper on "Storage Batteries for Power-station Service," by Mr. C. A. Wilson.

Diesel Engine Users' Association.—Friday, February 19th. At Caxton Hall, Westminster, S.W.1. Paper on "Heavy Oil Engine Installations—Choice of Site and Lay-out of Plant," by Mr. G. Porter.

Manchester Electro-Harmonic Society.—Friday, February 19th. At the Albion Hotel, Piccadilly, Manchester. Concert.

British Electrical Development Association Conference.—Friday, February 19th. At Caxton Hall, Westminster. Lecture on "The Electrical Industry and the Architect," by Mr. G. Blair Imrie.

Institution of Mechanical Engineers.—Friday, February 19th. At the Institution, Storey's Gate, S.W. At 6 p.m. Annual general meeting. Paper on the "Measurement of Cutting Temperatures," by Mr. E. G. Herbert.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Moulded candles having imitation "tears" at the top and sides.

Lighting cables and sockets suitable for the external lighting of ships when illuminated in connection with regattas or other special occasions.

Notes.

Appointments Vacant.—The United River Plate Telephone Co. requires several engineers for its permanent staff in Buenos Aires; draughtsman (£337), for the City of Birmingham electricity department; combustion engineer (£327) and assistant power station superintendent (£360), for the Borough of St. Helens electricity department; wireman, for the Cornwall Mental Hospital, Bodmin; meter superintendent (£208), for the Nuneaton Corporation electricity department; shift charge engineer, for the Mersey Power Co., Ltd. (See our advertisement pages to-day.)

The Hastings Hum.—With regard to the "hum" which, it was alleged by the lay Press, was annoying the residents at Hastings, we have ascertained from the borough electrical engineer, Mr. Russell F. Ferguson, that it was caused through the ash pit acting like a loud speaker. The ash pit tapers down from the front, and then continues with a gentle slope to the back; the remedy was to put in concrete so as to make a gradual slope from the front to about 10 in. under the chain-grate stoker at the back. The cause of the trouble was discovered by a member of the operating staff, and by placing corrugated sheet iron underneath the stokers, the correct angles which suppressed the sound were found. The matter was very simple, once the spot where the trouble lay had been localised.

Boiler Explosion Report.—We have received a copy of the report of a preliminary inquiry on the explosion from a water tube boiler at the West Ham generating station on April 29th last. The boiler was made by the Stirling Boiler Co., Ltd., in 1920, and was first put on commercial load at West Ham in 1922. One of the front-row tubes burst, forming an aperture 13.5 in. long and 7.5 in. wide (maximum). The contents of the boiler escaped through the opening, projecting flames and vapour from under the grate to the boiler opposite. The tube immediately behind that which failed was bent backwards by the force of the explosion. The latter appears to have been the result of over-heating, the cause of which was removed when the tube failed. The tube which failed had only been in service for about ten weeks and the quantity of scale found in any part of it did not exceed 1/32 in. The tube had also bulged both in the solid and fractured parts.

Local Society.—A lecture on "The Influence of Light in Industry and Commerce" was delivered before the Edinburgh Electrical Society on February 3rd by Mr. H. E. Hughes, of the Scottish Electric Lighting Service Bureau. The developments were traced and comparisons made of artificial lighting from the carbon lamp up to the present day manufacture. Raw or glare light was condemned and the proper reflection and control of light explained. Industrial and shop lighting methods were discussed and a number of excellent lantern slides shown.

Ontario Hydro-Electric Power. — The December *Bulletin* of the Hydro-Electric Power Commission of Ontario shows that the Commission's various plants have a total capacity of 942,028 h.p. This figure is very close to the ultimate development contemplated, which is given as 1,068,728 h.p. The Niagara system possesses the bulk of the plant (788,500 h.p.), and only 10,000 h.p. remains to be developed there under present arrangements. A further 25,000 h.p. is being harnessed at the Thunder Bay system, and 10,500 h.p. at the Georgian Bay system.

French Scientific Activities.—We are informed that the fiftieth anniversary of the birth of the "Association pour l'Avancement des Sciences" will be celebrated at the 1926 Congress of the Association which is to be held at Lyons. Between July 24th and August 1st there will also be held a large international exhibition in the Fair Palace, Lyons, representing all that relates to applied science.

G.E.C. Research Laboratories' Visit.—At the invitation of the General Electric Co., Ltd., a large party of science masters attending the Annual Conference of the Science Masters' Association in London, recently visited the G.E.C. Research Laboratories at Wembley, and were conducted through the various testing and experimental rooms. Particular interest was shown by the visitors in the work in progress in the vacuum physics laboratory and the experimental tungsten wire model factory. A special party visited the Osram lamp works at Hammersmith; over 200 members accepted the invitation extended to the Association.

A Lady Demonstrator at Home.—The accompanying illustration depicts what might be a lounge in a comfortable country mansion. But it is not; it is a section of the Hackney



A Lady Demonstrator "At Home."

electrical demonstration halls, with Mrs. A. M. Pearmain, the supervisor of domestic electrical appliances, "in the chair."

The Electrical Research Association.—The report of the Council of the British Electrical and Allied Industries Research Association for the year ended September 30th, 1925, to be submitted to the annual general meeting to-day, contains a foreword by Mr. Ll. B. Atkinson, chairman of Council, pointing out that the five years' agreement between the Department of Scientific and Industrial Research and the Association ended with the period under review; he expresses gratification at the satisfactory results achieved in that time, seeing that the organisation had to be built up. In future the grants from the Department will progressively diminish, and contributions to the funds must be sought from other sources.

The report states that the Department appointed a committee of investigation, whose report expressed high appreciation of the work of the Association. Subscriptions and grants have been promised, sufficient to cover the minimum requirements of the Association for a further five years.

Researches are in progress in connection with dielectrics in general, and a comprehensive programme of fundamental research into the properties of insulating materials has been under consideration, but at present the funds are not sufficient to permit of its being put in hand. Proposed purchasing specifications have been issued for pressboard, cotton fabric, and shellac; investigations on synthetic resins and hard composite dielectrics have been completed; and researches have been carried out on insulating oils, porcelain, mica and micanite, buried cables, and poles for overhead lines. It is stated that a heavy testing set built specially for testing switchgear could be kept continuously employed, and that new results would in all probability be obtained. Researches on switchgear and fusible cut-outs, steam condensers, and steam turbines have been continued, and it is estimated that the nozzles research has enabled a saving of 3 per cent. in the steam consumption of large turbines to be made. Extended steam tables have been prepared. Confidential researches on transformer steel and phosphor-bronze springs have been put in hand, and the question of telephone interference has been studied. Many reports, some of which are confidential, have been issued.

A folding diagram illustrates the organisation of the Association and its numerous sections and sub-committees, and the personnel of the latter, as well as lists of members and associate members of the Association, is appended to the Report.

Educational.—Faraday House Scholarships.—The annual examinations for a Faraday scholarship of fifty guineas per annum (tenable for two years in college and one year in manufacturing works) and for a Maxwell scholarship of fifty guineas per annum (tenable for one year in college and one year in works) will be held at Faraday House, on April 7th, 8th, and 9th, 1926. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations, but do not obtain the necessary number of marks to qualify for a scholarship. Further particulars may be obtained from the Secretary, Faraday House, 62-70, Southampton Row, London, W.C.1.

Difficulties in Interviewing.—The following is a copy of a letter received by an electricity supply undertaking:—

"I called to-night the second time to make inquiries in reference to having electric light laid on in my flat in this house. Never in any place have I met a man less able or less willing to give the required information. He reeled off whole paragraphs about volts and units and divisions of thousands by forties, all of which is quite incomprehensible to any person knowing nothing about the measurements of electricity; and I venture to say that such people are the greatest majority by far. What I wanted to know, and still want to know is how the price of electricity compares with gas. When I asked that question, I was told most off-handedly, "he thought it would be cheaper." I then said I could not act on thought, and told him what the average cost of my gas is, hoping he might be able to make some comparison. All the reply I received was "you had better stick to your gas." However, I still tried to get information, but came away about as well informed as before I called. With me, as with most people, the question is "will electricity laid on by the company work out at about the same cost as gas, or will it be more expensive?" We do not need to be told it is cleaner and a greater comfort. We know that, but the comfort most people can have is regulated by their purses. Surely the company could make comparable tables that would be intelligible to the ordinary person. I have no doubt that had I been an attractive young lady I should have been most graciously given the information I required by the young man; but as the management of most houses is in the hands of women not quite young, it may be worth the company's while to have an attendant especially for elderly and stupid (!) women."

[If, as the writer of the letter says, the supply assistant reeled off whole paragraphs about volts, &c., it does not bear out the lady's impression that he was unwilling to impart information: but it does suggest that the use of technical terms may have irritated her. All prospective consumers cannot, of course, be treated alike, and the writer of the letter may prove to be one of those cases where the strict avoidance of technical terms and a generous supply of tact will produce the desired results.]

Ex-British Westinghouse Association.—An invitation has been "broadcast" to members of this Association to attend the dinner on Friday, March 5th, at the Holborn Restaurant, London. Tickets may be obtained from Mr. W. E. Warrilow, 40, Mildred Avenue, Watford, Herts.

Telephone Exchange Model.—A demonstration set, comprising a working model of the outgoing and incoming sections of a telephone exchange, has been completed by the London telephone authorities, and arrangements are in hand for a course of lectures to literary and other societies in London which may be interested in the subject. Applications from such societies for particulars of the lectures will be welcomed. The adoption of the correct methods of operating by subscribers is important, and arrangements have been made for many visits to exchanges, both in the case of individual subscribers and of parties, the latter including parties from engineering colleges, public schools, L.C.C. evening institutes, borough council municipal colleges, members of local Chambers of Commerce, representatives of overseas telephone corporations, City of London institutes, clubs, workers' educational associations, and students from abroad. A correct view, on the part of subscribers, of the general working of the system is very important, and there is abundant testimony as to the value of such visits of exchanges. The London Telephone Service welcomes personal examination by any subscriber of the organisation and working of the exchange which serves him, or of any other exchange he desires to see.

National Association of Supervising Electricians.—The annual meeting of members of the National Association of Supervising Electricians was held on February 2nd at the Junior Institution of Engineers, 39, Victoria Street, London, S.W.1, and was attended by a large audience. Mr. W. J. Revell, the chairman of the Association, in his address, referred to the growth of the Association financially and numerically, and emphasised the important position it now occupied in the electrical industry, which was the result of the general policy of the Association with regard to admittance of only qualified men, and its outlook on industrial matters. The educational activities for the past 12 months had increased, and included lectures, debating society meetings, works visits, the W. E. Highfield Shield, the "Economic Premium" Competition, and the N.A.S.E. Scholarship scheme. In referring to the Employment Bureau, Mr. Revell said that it was gratifying to know that positions ranging from £300 to £500 per year had been secured for a number of the members, the success in this direction being in advance of previous achievements. It was becoming recognised that membership of the Association was, generally speaking, a qualification. The chairman also made reference to the fact that the N.A.S.E. continued to be represented on the I.E.E. Wiring Rules and B.E.S.A. Committees. He referred to the regrettable resignation of Mr. Frank Gill, M.Inst.C.E., M.I.E.E., the president of the Association, owing to business abroad, and said they had been fortunate in securing Mr. A. M. Sillar, M.Inst.C.E., M.I.E.E., M.I.Mech.E., as the new president of the Association, and he appealed to the membership to give Mr. Sillar their loyal support.

The following were elected to fill the five vacancies on the Board of Control according to rule:—Messrs. C. Bull, J. Cowan, E. L. Eastell, B. C. Garman, and F. W. Smith. Messrs. F. E. Phillips and B. S. Westaway were elected auditors.

Electricity as a Public Utility.—Col. Oakley (chairman of the Basingstoke Corporation Electricity Committee) presided at a meeting held in the Town Hall on January 27th, when an address, with lantern illustrations, was given by Mr. J. W. Beauchamp, secretary of the British Electrical Development Association, on "Electricity as a Public Utility." In the course of his remarks, Mr. Beauchamp mentioned that there were about 25,000 electric ranges in use in this country.

Fatality.—On February 8th, two Post Office electrical engineers, A. W. White and W. F. G. Merritt, received fatal injuries owing to the collapse of a telephone standard on which they were working, falling from the top of a five-storey building on to the "live" line of the Metropolitan Railway at Farringdon Street Station. White was killed by electric shock, and Merritt died from his injuries in St. Bartholomew's Hospital.

International Electrotechnical Commission.—Arrangements for the meetings of the I.E.C., which are to commence in New York on April 13th next, are now completed. The technical sessions will commence on April 13th and continue until the 16th, when there will be a break of two days; they will recommence on the 19th, and, it is hoped, conclude on the 22nd. Since The Hague meeting the various National Committees have been considering the proposals that emanated from that meeting. A number of experts' papers on the important question of the rating of electrical machines are to be presented, and probably apart from that question one of the most important subjects to be discussed will be the rating of hydraulic and steam turbines for electrical plant. Other subjects include transformer oils, traction motors, &c., details of which will receive attention at New York.

At the conclusion of the technical meetings, the United States and Canadian Committees (hosts of the International Commission) are providing free transportation and sleeping-car accommodation for a tour of some 2,500 miles that will include visits to: Washington, Philadelphia, Baltimore, Pittsburgh, Chicago, Detroit, Niagara Falls (two days), Toronto, Montreal, and Schenectady. At Niagara the Canadian Committee will take over the party and visit Toronto and Montreal. The United States Committee will then take the party to Schenectady and back to New York, the tour terminating on May 8th.

The delegates from Europe are to travel in the Cunard s.s. *Andania*, sailing from Hamburg on March 31st, and Southampton and Cherbourg on April 2nd, and it is evident that this meeting in New York will be well attended. It is the first time that a plenary meeting of the I.E.C. has been held in America, although the St. Louis Exposition of 1904 was practically the birthplace of the Commission. The National Committees are adding to their working delegates a number of influential representatives to do honour to the occasion.

Institution Notes.

Institution of Electrical Engineers.—SCOTTISH CENTRE.—The Scottish Centre of the Institution, whose headquarters are in Glasgow, is to celebrate its semi-jubilee with a ladies' evening on the 17th inst. The function will take the form of a dinner, followed by whist and dancing. Prof. Magnus Maclean, chairman of the Centre, will be in the chair.

Physical Society of London.—CHANGE OF ADDRESS.—The registered office of the Society has been moved to 30, Great Russell Street, London, W.C.1.

Society of Engineers.—The report of the Council for the year 1925 shows that the membership has increased by 41 to 611, and there are 10 associated societies. The president for 1926 is Mr. G. O. Case.

Incorporated Municipal Electrical Association.—SUMMER MEETING.—In connection with the visit to Glasgow in June next of the Association for its annual conference, a request for the use of the banqueting hall at the Municipal Buildings for a reception has been granted. The Electricity Committee is to entertain the visitors.

Institute of Transport.—It is announced that the paper on "State Ownership of Waterways," to be read before the above Institute at the Institution of Electrical Engineers, on Monday, March 1st, will be delivered by Mr. H. D. Dickinson of the University, Leeds, instead of by Prof. J. H. Jones, M.A., as previously stated.

Junior Institution of Engineers.—A question and discussion evening was held on February 5th, and was very successful. Questions on the following subjects, amongst others, were raised, and in every case an answer was forthcoming:—Pressure gauges for the air supply to boilers; interference between wireless receivers in restricted areas; the testing of rotors for dynamic balance; and the prevention of rust in workshops in mild and moist weather.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Watford Urban Council has decided to award the sum of £500 to the borough electrical engineer, Mr. BARHAM, in recognition of the special technical work involved in the erection of the new power station, and the changing-over from single-phase to 3-phase. Sums of £75 each have also been granted to Messrs. GREENHALGH and WALLEY in recognition of special assistance given to the engineer.

Mr. L. G. SIMS, M.Sc., has been appointed by the Council of the University of Birmingham lecturer in electrical engineering, vice Mr. O. R. Randall, Ph.D., M.Sc., B.Sc. (Lond.), who has been appointed professor of electrotechnics at the Witwatersrand University, Johannesburg.

Mr. REDMAN, the electrical engineer of Shipley, has been seriously ill, and is still confined to his house. The Electricity Committee has expressed its best wishes for his speedy and complete recovery.

BAILIE HIGGINS, the sub-convener of the Glasgow Corporation Electricity Committee, has been elected for a further period of three years as Clyde organiser of the Electrical Trades Union, a post he has held for the last six years.

Southport Corporation is recommended to increase the salary of Mr. A. LATHOM, mains assistant, to £273 12s. per annum.

The marriage took place at St. Mary's Church, Bearwood, Birmingham, on January 23rd, of Mr. CECIL A. KERSHAW, of the London staff of Messrs. Merz & McLellan, consulting electrical engineers, and Miss DORIS ROBERTS, of Talbot Road, Bearwood.

The Bradford Corporation last week referred back to the Estimates Sub-Committee for further consideration a series of proposed salary increases, including that of Mr. THOS. ROLES, city electrical engineer, whose present salary is £1,500, and the increase recommended was £100 per annum to the maximum salary at present provided for the position.

Obituary.—ALD. E. PRIESTLEY.—The chairman of the Bradford Tramways Committee, Alderman Enoch Priestley, was killed on the L. & N.E. Railway on February 2nd. He was 71 years of age. At an inquest a verdict of "Accidental death" was returned.

MR. T. W. WARD.—We regret to record that Mr. T. W. Ward, a founder of the firm of T. W. Ward, Ltd., iron, steel, and machinery merchants, of Sheffield, passed away recently at the age of 72 years. Mr. Joseph Ward, brother, has been managing director of the company for some time past, but Mr. T. W. Ward was a director up to the time of his death.

MR. J. C. B. INGLEBY.—The death is reported of Mr. J. C. B. Ingleby, managing director of the Electric Motor and Stove Hiring Co., Leeds.

MR. A. E. GIFFEN.—Mr. Alexander Ewing Giffen, chief of the Post Office Engineering Department in the North Staffordshire and South Cheshire area, died last week at the age of 55.

MR. J. V. MOINET.—The death has taken place at Hamilton of Mr. J. V. Moinet, burgh electrical engineer and manager. Mr. Moinet, who had been Messrs. Edmundson's resident engineer and manager, accepted the invitation of the Town Council to continue as official in charge when the works were taken over at the beginning of this year. Mr. Moinet was at Scarborough before going to Hamilton.

SIR T. BROOKE-HITCHING.—Sir Thomas Henry Brooke-Hitching, who died last week, was, *inter alia*, a director of the Chiswick Electric Supply Corporation, Ltd., and the West London and Provincial Electric Supply Co., Ltd.

Wills.—The late Mr. EDWARD D. M. SCRIVENER, managing director of Taylor, Tunnicliff & Co., Ltd., left £39,529 (£28,049 net personalty).

The late Mr. L. W. SPRATT, a director of the Hart Accumulator Co., Ltd., left £151,988 gross and £147,466 net personalty.

New Companies Registered.

Daycomar, Ltd. (211,492).—Private company. Registered February 3rd. Capital, £200 in £1 shares. Objects: To carry on the business of agents and concessionaires for foreign and domestic electrical, radio and optical goods, manufacturers of and dealers in all kinds of kinematograph, phonographic, musical, electrical, mechanical and optical goods, &c. The directors are:—J. S. Martin, 33, Kensington Square, W.8; W. E. L. Day, Hollydene, 15, Cholmeley Park, Highgate, N.6. Solicitors: Kerly, Sons and Karuth, 10-11, Austin Friars, E.C.2. Registered office: 19, Lisle Street, W.C.2.

W. T. Hellaby & Co., Ltd. (211,557).—Private company. Registered February 5th. Capital, £2,000 in £1 shares. Objects: To acquire various business assets and effects from B. French and W. T. Hellaby, and to carry on the business of electricians and electrical contractors, electrical, mechanical, gas, water, heating, lighting, motor and general engineers, &c. The directors are:—B. French, Summer Bank, Bewdley Hill, Kidderminster; W. T. Hellaby, Trevine, Water Orton, Warwickshire. Qualification, 1 share. Solicitor: H. G. Ivens, High Street, Kidderminster. Registered office: 80, Dale End, Birmingham.

Economisers Engineers, Ltd. (211,393).—Private company. Registered January 29th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, boiler makers, brassfounders, ironfounders, tin and copper smiths, &c. The directors are:—G. Austin, 31, Ashton Road, Golborne, near Warrington; G. Coombes, 7, Granville Avenue, Whalley Range, Manchester; H. Ward, 7, Granville Avenue, Whalley Range, Manchester; S. A. Ward, 7, Granville Avenue, Whalley Range, Manchester. Qualification, £1. Solicitor: R. Barrow-Sicree, 86, Cross Street, Manchester. Registered office: 5, Blackfriars Street, Deansgate, Manchester.

T. B. T. Electric Co., Ltd. (211,407).—Private company. Registered January 29th. Capital, £2,000 in £5 shares. Objects: To carry on the business of electrical and mechanical engineers, suppliers, and contractors and manufacturers, exporters, importers and workers of and dealers in electrical, magnetic, galvanic and mechanical machines, &c. The subscribers (each with one share) are:—T. B. Thrige, Odense, Denmark, manufacturer; L. C. Peter, Ornberg, Odense, Denmark, director. T. B. Thrige is permanent governing director. Solicitors: Turner & McCandlish, 3, Raymond Buildings, Gray's Inn, W.C. Registered office: 171, Queen Victoria Street, E.C.4.

Frank Thornton, Ltd. (211,479).—Private company. Registered February 3rd. Capital, £6,000 in 2,250 7½ per cent. cumulative preference and 3,750 ordinary shares of £1 each. Objects: To carry on the business of manufacturers of and dealers in instruments, apparatus, accessories and all materials connected with radio, telegraphy, telephony, and television, and in particular cables, wires, ropes or other substances, accumulators, batteries, &c. The permanent directors are:—Mrs. M. Thornton, address not stated; F. H. Thornton, 167, Rosehill Road, Burnley; H. Thornton, 29, Hogarth Avenue, Burnley; W. H. Thornton, address not stated. Qualification, 150 ordinary shares.

Avalite, Ltd. (211,476).—Private company. Registered February 3rd. Capital, £6,000 in 2,250 7½ per cent. cumulative preference and 3,750 ordinary shares of £1 each. Objects, directors, and all other particulars as Frank Thornton, Ltd., above.

Electric Super Service Co., Ltd. (211,461).—Private company. Registered February 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers and contractors, &c. The permanent directors are:—Mrs. E. M. Chalmers, 6, St. John's Wood Road, N.W.8; J. W. P. Chalmers, 6, St. John's Wood Road, N.W.8, consulting engineer. Qualification, £100. Registered office: 30, College Street, Dowgate Hill, E.C.4.

Wood, Russell & Co., Ltd. (211,474).—Private company. Registered February 2nd. Capital, £7,000 in £1 shares. Objects: To acquire the business now carried on at 34 and 36, Oxford Street, W., as "Wood, Russell & Co.," and to carry on the business of mechanical, electrical, gas and motor engineers, metal workers, ironfounders, builders, tool makers, water supply engineers, &c. The directors are:—P. N. Wood, Netherheys, South Croydon, boiler manufacturer; and G. D. Russell, Upmeads, Guildford, engineer (both permanent, subject to each holding 2,000 shares). Remuneration of permanent directors, £250 each per annum; of ordinary directors as fixed by the company. Solicitors: Guscotte, Fowler & Cox, 1, York Buildings, Adelphi, W.C.2.

Angel Super Signs (1926), Ltd. (211,508).—Private company. Registered February 4th. Capital, £5,000 in 4,950 ordinary shares of £1 each and 2,000 management shares of 6d. each. Objects: To acquire the business of general sign manufacturers, &c., heretofore carried on by Angel Super Signs, Ltd., and to carry on the business of designers, inventors and manufacturers of and dealers in all kinds of signs, &c. The subscribers (each with one ordinary share) are:—S. H. Cotton, 76, Meath Road, Ilford, Essex, clerk; G. Goodwin, 94, Barry Road, East Dulwich, S.E.22, clerk. The first directors are to be appointed by the subscribers. Qualification, 100 shares of either class. Solicitors: Arthur Hunt & Money, 24, Haymarket, S.W.1.

Official Returns of Electrical Companies.

Ajax Production Engineers, Ltd.—A. G. White, C.A., 14, Old Jewry Chambers, E.C., was appointed receiver on January 28th, 1926, under powers contained in debentures dated January 11th, 1924.

B. M. A. S., Ltd.—J. Collier, I.A., King Street West, Manchester, was appointed receiver and manager on January 29th, 1926, under powers contained in debenture dated February 12th, 1925.

Pressland Electric Supplies, Ltd.—F. W. Stephens, of Salisbury House, London Wall, E.C., was appointed receiver and manager by Order of Court dated January 29th, 1926.

Simms Motor Units (1920), Ltd.—Issue on January 8th, 1926, of £5,000 debentures, part of a series already registered.

C. F. Palmer (London), Ltd.—Charge pursuant to Land Registration Act, 1925, to secure £3,000 charged on 63a, Effra Road, Brixton, S.W., and land adjoining. Holder: C. F. Palmer, 91, Holmdene Road, Herne Hill, S.E.24.

Wallingford and District Electric Supply Co., Ltd.—Debenture dated January 23rd, 1926, to secure £3,500, with further advances up to £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. J. Kirby, "Riverside," Donnington, near Newbury, Berks.

Hawk Coil Co., Ltd.—Debenture dated January 26th, 1926, to secure £343, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: R. J. Coley, 189, Richmond Road, Kingston-on-Thames.

Specialities (Liverpool), Ltd.—Satisfaction in full on October 29th, 1925, of debenture dated September 28th, 1922, securing £500. (Notice filed January 29th, 1926.)

Woking Electric Supply Co., Ltd.—Satisfaction to the extent of £500 on February 20th, 1915, of debenture stock issued under trust deed dated March 1st, 1926, securing an indefinite amount.

Hewittic Electric Co., Ltd. (89,947).—Capital, £50,000 in £1 shares. Return dated November 18th, 1925. 40,000 shares taken up. £40,000 paid. Mortgages and charges, nil.

East Lancashire Electric Co. (Accrington), Ltd. (140,029). Capital, £3,000 in £1 shares. Return dated August 19th, 1925 (filed February 2nd, 1926). 1,475 shares taken up. £1,325 paid. £150 considered as paid. Mortgages and charges, nil.

Ferryside Electric Supply Co., Ltd. (186,406).—Capital, £1,200 in £1 shares. Return dated January 14th, 1926. 1,000 shares taken up. £1,000 paid. Mortgages and charges, nil.

Western Telegraph Co., Ltd. (6,886C). — Capital, £3,500,000 in £10 shares. Return dated December 10th, 1925. 311,895 shares taken up. £2,339,650 paid. £779,300 considered as paid. Mortgages and charges, £818,675.

Delagoa Bay Development Corporation, Ltd. (76,099).—Capital, £166,300 in 267,400 ordinary shares of 10s. each and 130,400 preference shares of 5s. each. Return dated December 25th, 1925. 267,400 ordinary and 68,400 preference shares taken up. £105,800 paid. £45,000 considered as paid. Mortgages and charges, £245,550.

C. H. Hare & Son, Ltd. (110,911).—Capital, £20,000 in 9,000 ordinary and 11,000 preference shares of £1 each. Return dated December 31st, 1925. 8,600 ordinary and 11,000 preference shares taken up. £12,102 paid on 11,000 preference and 1,102 ordinary shares. £7,498 considered as paid on 7,498 ordinary shares. Mortgages and charges, nil.

Liverpool Electric Cable Co., Ltd. (71,099).—Capital, £30,000 in £1 shares. Return dated December 30th, 1925. All shares taken up. £7,833 paid. £22,167 considered as paid. Mortgages and charges £24,795.

Mawdsley's, Ltd. (91,783).—Capital, £20,000 in £1 shares. Return dated January 4th, 1926. 18,937 shares taken up. £6,937 paid. £12,000 considered as paid. Mortgages and charges, £6,300.

City of Freetown (Sierra Leone) Electricity Co., Ltd. (138,058).—Capital, £15,000 in £5 shares. Return dated December 31st, 1925. 200 shares taken up. £1,000 paid. Mortgages and charges, nil.

East India Tramways Co., Ltd. (74,457).—Capital, £125,000 in 15,000 preferred, 35,000 ordinary, and 75,000 deferred shares of £1 each. Return dated December 9th, 1925. 7,476 preference, 33,433 ordinary and 75,000 deferred shares taken up. £7,489 paid on 7,476 preference and 7 ordinary shares (including £6 paid on 24 preference shares forfeited). £108,426 considered as paid on 33,426 ordinary and 75,000 deferred shares. Mortgages and charges, nil.

Concordia Electric Wire Co., Ltd. (74,416).—Capital, £100,000 in £1 shares. Return dated November 25th, 1925. 57,319 shares taken up. £57,319 paid. Mortgages and charges, £34,500.

Trent Electric Wire Works, Ltd.—Debenture dated January 23rd, 1926, to secure £1,000, charged on the company's undertaking and property, present and future. Holder: A. M. Gourlay, 24, George Square, Glasgow.

Drake & Gorham, Ltd. (70,275).—Capital, £125,000 in £1 shares. Return dated November 12th, 1925. All shares taken up. £85,000 paid. £40,000 considered as paid. Mortgages and charges, £12,000.

Liskeard Gas and Electricity Co., Ltd.—Particulars filed of £8,000 debentures authorised October 28th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £4,400 (on January 21st, 1926).

Van Raden & Co., Ltd. (78,383).—Capital, £10,000 in £1 shares. Return dated November 30th, 1925. 6,754 shares taken up. £4,654 paid. £2,100 considered as paid. Mortgages and Charges: Mortgage, £1,800 debenture, £1,200; loan, £3,200.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Yorkshire Electric Power Co.

The accounts for 1925 show a net profit after meeting interest and debenture charges, of £205,016, as compared with £182,764 in 1924. A balance of £46,053 is brought forward, making £251,065, and it is proposed to allocate this amount as follows: Dividend of 6 per cent. (3 per cent. already paid) on the cumulative preference shares £39,529; dividend of 8 per cent. (3 per cent. already paid on the ordinary shares, £84,667; to general reserve fund £40,000; to plant renewals fund, £25,000; writing off expenses of inquiries under the Electricity (Supply) Acts, &c. £6,819; carried forward, £55,051. The report states that the revenue has been maintained in spite of the general trade depression. Substantial economies have been effected, and the prices to consumers have been reduced. The supply of electricity in bulk continues to increase, there having been a number of agreements for new and additional supplies during the year. The addition of the Shipley Urban District Council to the company's system brings the number of distributing undertakings to 57. Following upon the abandonment of the West Riding (Aire and Calder) Electricity District scheme the company has proceeded with its development in the north-western districts; extensions have been made and the existing network is being reinforced by a system of 33,000-V mains; the first section, between Thornhill and Halifax, has been completed. A second 12,500-kW turbo alternator has been installed at the Thornhill station and a portion of the generating plant has already been installed at the Ferrybridge Station. It is expected that the initial installation of 50,000 h.p. will be completed during the current year. In February last year an issue was made of 500,000 ordinary shares of £1 each. To meet the rapid growth of the company's operations the directors recommend that 765,000

six per cent. cumulative preference shares be offered to shareholders forthwith at 21s. each. An extraordinary meeting is to follow the general meeting (at Leeds, February 16th), at which a resolution will be submitted providing for the issue of a further £794,000 as ordinary or preference capital, being the balance of the £4,000,000 authorised by the company's Acts. The shareholders will also be asked in due course to consent to the promotion of a Bill to increase the authorised capital to £6,000,000. The directors propose to give £5,000 to the Leeds University Building Fund by annual payments over a period of years.

Ferguson, Pailin, Ltd. The annual meeting was held on February 4th. Sir Kenneth Crossley (chairman), who presided, said that satisfactory progress had been made during the past year. The dividend remained at the same level, but the reserve had been increased by £10,000, and the value of goodwill and patents had been written down to £1. It was difficult to make a forecast of the company's prospects. The electrical industry was undoubtedly the brightest spot in the home industrial situation, and the Government's electricity scheme (which, he thought, would not cheapen electricity) should bring benefits to the general trading community. They could confidently expect a share in the large amount of orders which would eventually be placed. The extension of the company's Buckley Street works was proceeding satisfactorily, and the factory of the Australian company (which also reported progress) had been extended too.

Siemens Bros. and Co., Ltd. At an extraordinary meeting, held on February 5th, under the chairmanship of Mr. G. Mure Ritchie, a resolution was passed limiting the number of 10 per cent. cumulative preference shares to the number already issued (550 000), and providing for the conversion of the balance (450.000) of these shares into ordinary shares, leaving 950,000 ordinary shares unissued. The chairman explained that fresh capital was needed to finance the increased amount of business which the company was securing, and hoped to secure in the near future. It was proposed to issue 500.000 ordinary shares of £1 each forthwith, and these would be offered exclusively to shareholders in the proportion of one new share to each three held. The shares would be issued at 23s.; they would not participate in the dividend for the past year.

Traction and Power Securities Co., Ltd. The annual meeting of this company was held last week, Mr. H. A. Vernet (chairman) presiding. In presenting the report and accounts, the chairman said that the issued share capital remained at £683,280, while the debenture stock had increased from £300,000 to £365,036. The value of investments at or under cost had risen from £1,062,905 to £1,307,633, and the reserve stood at £200,000 as compared with £166,259 at the end of the preceding year. After referring to the increased net revenue and the raising of the dividend from 10 to 13 per cent., the chairman said that the return to the gold standard had eliminated the baneful uncertainty from sterling exchange. The way was now clear for the remodelling of our internal currency system.

Joseph Lucas, Ltd. At an extraordinary general meeting on February 4th a resolution was approved providing for the raising of the company's capital to £1,100,000 by the creation of 300,000 new shares of £1 each. The chairman, Ald. H. J. Sayer, explained that the new capital was needed in connection with the acquisition of the control of C. A. Vandervell and Co., Ltd., and Rotax (Motor Accessories), Ltd. It was proposed to allot 130,000 of the new shares for the whole of the ordinary shares of Rotax, Ltd. Then 126,500 shares would be issued immediately to the company's own shareholders in the proportion of one new share to each five held at the rate of 65s. per share. The company's principal aim was to standardise automobile electrical equipment as far as possible and improve the "after-sale" service.

Fellows Magneto Co., Ltd. The directors state that for several reasons they are unable to submit completed accounts for the past year. It has been found that while the radio apparatus branch has been making substantial profit, the magneto branch has been working at a loss. There appears to be no prospect of improvement in the latter part of the business and it has been decided to cease manufacturing magnetos and to concentrate upon the production of radio apparatus. A scheme of reconstruction is under consideration. The directors therefore asked the shareholders to adjourn the meeting which was to be held on February 8th until the proposals were ready.

Westinghouse Brake and Saxby Signal Co., Ltd.—The annual meeting was held on February 5th. Lord Southborough, who presided, referred to the many developments which the company had made to meet requirements as they arose, and said that in spite of the depression in the coal industry, many collieries had replaced their old methods of handling coal at the pit decks by the company's electro-pneumatic system. To enable them to furnish additional capital to their Continental associated companies, it was proposed to issue £100,000 of new capital. There would be no difficulty in this as the shareholders had offered to take the whole of the shares.

Oliver Pell Control, Ltd.—A public statement was made in the financial Press last week to comply with Stock Exchange regulations. It stated that the authorised capital is £100,000 in £25,000 eight per cent. cumulative participating shares and 75,000 ordinary shares of £1 each. The former class is entitled to a further participation in profits when the ordinary shares have received 8 per cent., and after receiving 12 per cent. for not fewer than three consecutive years, may be converted into ordinary shares. A dividend of 10 per cent. was paid on both classes of shares in respect of 1924.

Uxbridge and District Electric Supply Co., Ltd.—The accounts for the year ended December 31st last, which are to be presented at the annual meeting on Wednesday next, show a profit of £39,745 and to this is added £1,590 brought forward, making £41,335. Debenture interest, &c., and depreciation absorb £19,950, and it is proposed to pay a dividend of 8 per cent. on the ordinary shares, and to carry forward a balance of £1,385.

City of Buenos Aires Tramways Co. (1904), Ltd.—The balance of net revenue for the year ended December 31st last is £80,838. A final dividend of 1s. 3d. per share (making 5s. for the year) is recommended; £5,604 is to be transferred to the amortisation and general fund, and £13,234 is to be carried forward.

Power Securities Corporation, Ltd.—The report for the past year shows a gross income of £96,412 and an available balance of £77,966. The addition of £8,556 brought forward makes a total of £86,522. It is proposed to transfer £20,000 to reserve, to pay a dividend at the rate of 6½ per cent. on the ordinary shares, and to carry forward £12,944. Meeting: February 17th.

Enfield Cable Works, Ltd.—The directors have decided to offer the balance of the unissued ordinary capital to existing ordinary shareholders in the proportion of one new share, at 45s. per share, for each five ordinary shares at present held. The new shares will rank *pari passu* with the existing ordinary shares for future dividends.

Ever-Ready Co. (Great Britain), Ltd.—At a meeting to be held on March 1st the directors will submit a scheme for the capitalisation of £49,800 of the general reserve, and the issue of £1 ordinary shares to the shareholders in the proportion of one to each five shares held.

Dorman, Long & Co., Ltd.—As briefly reported in our last issue, an offer of £500,000 of 5½ per cent. redeemable first mortgage debenture stock was made last week at the rate of 93½ per cent. The stock is redeemable at par on or before May 1st, 1963, or it may be redeemed at 102 per cent. on or before May 1st, 1943, at three months' notice.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—A meeting is to be held to-day (Friday) to consider resolutions for the issue of 50,000 existing £1 shares as 6 per cent. preference shares, and of 10,685 "A" ordinary and 42,137 "B" ordinary shares of £1 each.

Tottenham District Light, Heat, and Power Co.—The directors recommend the following dividends for the half-year ended December 31st last:—Preference stocks: at the rate of 5½ and 5 per cent. respectively; "A" stock: at the rate of 7⅜ per cent.; "B" stock: at the rate of 5⅞ per cent.

Isle of Thanet Electric Supply Co., Ltd.—The ordinary shares are to receive a dividend of 2½ per cent., the first to be paid. The company proposes to issue 72,000 six per cent. participating preference shares at par to existing shareholders in the proportion of one to five.

London Electric Supply Corporation, Ltd.—The directors have declared the balance of the dividend on the 6 per cent. preference shares for 1925, and a final dividend at the rate of 12 per cent. upon the ordinary shares (less tax) making 10 per cent. for the year.

St. James' & Pall Mall Electric Light Co., Ltd.—A balance dividend of 7s. 6d. per share and a bonus of 5s. are recommended on the ordinary shares, making a total distribution of 17½ per cent. for the year, as in 1924.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hendon Electric Supply Co., Ltd.—22,212 ordinary shares of £1 each, fully paid, Nos. 73,884 to 96,095.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—The directors recommend the payment of a final dividend of 2½ per cent. on the ordinary shares.

National Gas Engine Co., Ltd.—A dividend of 4 per cent. has been declared on the ordinary shares for the past year.

Stocks and Shares.

MONDAY EVENING.

BUSINESS in the Stock Exchange is proceeding very quietly. Members and clients are alike becoming restive under the enforced restfulness that stands in such marked contrast to the feverish activity which prevailed up to the end of last year. The rending of the rubber boom has cost many people money, and the stream of new issues tends to divert attention from older stocks and shares. The Stock Exchange is, in a word, quiescent. It demands a detached mind to acknowledge the

logic of the present position as being only what might have been expected after nine months of active and excited markets. Cable equipment issues have parted with some of their recent exuberance, though prices are well maintained, and the declines are modest as compared with the previous substantial rises in a good many prices.

The London Electric Supply Corporation announces a final dividend for 1925, making 10 per cent. for the year, the same as that of the previous twelve months. The price of the shares remains at 32s., to which it fell last week, and the return on the money invested in the shares at to-day's price is 6¼ per cent. Chelseas are dull at 2⅛. Urban ordinary went back to 19s. 6d. There is a good deal of quiet buying of Whitehall Electric Investment 7½ per cent. preference, which shares can still be obtained at their par price of 20s. The chairman of the Gas Light & Coke Company protested, at the recent meeting, that the Government is unduly favouring electricity; he referred more particularly, of course, to the electrical expansion scheme which is now proposed. No doubt the provision of fresh capital for development of the scheme would be assisted by the extension of the Trade Facilities Act to the financing part of the plan.

Underground Electric Railways of London are a good spot. The £10 shares have risen to 2½ and the income bonds are close to 100. The Underground group declares its dividends on the Thursday in this week. Districts, however, are ½ lower at 47½. Speculation is taking mild interest in some of the London tramway issues. London and Suburban preference are up 1s. to 4s. 6d. London United Tramways 4 per cent. debenture gained 4½ points at 45, and the Company's ordinary shares strengthened to 3s. The market in these has been dormant for so long a time that curiosity is expressed as to what may be the possible reason for this revival of attention. The recent report upon the results of the L.C.C. Tramways was not such as to encourage optimism, and this consideration adds to the interest attached to the rises in tramway shares.

The dispute, over wages, between the Underground Railways and the Electrical Trades Union has had no effect so far upon prices of stocks and shares in companies that might be affected if the trouble should become serious.

Metropolitan-Vickers ordinary have dropped back to 28s., but General Electrics gained a trifle, to 31s. 6d., upon the formation of the Siemens & General Electric Railway Signal Company. Both companies have carried on separate railway signalling departments, but these branches are now to be amalgamated into the new undertaking. Details of the latter are expected to be made public very shortly. The Yorkshire Electric Power Company is about to offer 765,000 6 per cent. cumulative preference shares of £1 each, the issue price of which will be a guinea. The company's profits for last year came out at £205,000, an advance of £22,000 over those of 1924, and the dividend on the ordinary shares is maintained at 8 per cent. upon the larger capital. The existing 6 per cent. preference stand at 22s. 6d. in the market, this price carrying the dividend of 7 1/5d. per share. The ordinary, at 31s., yield £5 3s. per cent. on the money.

Another company which is raising new capital is the Enfield Cable Works, in which proprietors of the existing ordinary shares are to be offered one new share at 45s. for every five shares at present held. As the latter stand about 69s. ex dividend, the new issue offers a pleasant bonus. It may be pointed out that shareholders, whether they care to take up their allotments or not, should on no account miss the opportunity of securing the benefit which this new issue affords them, for the rights will be readily saleable in the Stock Exchange. Many people throw away papers that invite them to subscribe more capital, and by so doing they present "money for nothing" to those who are only too glad of the chance to take up new shares, offered at bonus prices, which are not subscribed by the original allottees.

The Isle of Thanet Electric Supply Company proposes to issue 72,000 participating 6 per cent. preference shares at par to all shareholders; one new share being offered in respect of every five old shares held. The Company has declared its first dividend on the ordinary shares, and at the rate of 2½ per cent. actual. The price of the latter is 17s. middle. The new preference will participate with the ordinary after the latter shall have received 6 per cent. dividend.

The Brazilian Traction boom continued further, the price being run up, on American-Canadian buying, to 98. Around this figure a lot of shares came in, and reaction carried back the quotation to 94½ ex dividend, at which there was still left a rise of 3½ points on the week. Mexican Light & Power Common and preferred are better, upon some vague, and quite improbable, rumour of early dividend-resumption on the former. Yorkshire (West Riding) Trams have gone back to 17s. 6d. Cable and telephone descriptions are uninteresting. Automatic Telephones at 2⅝ have lost 1/16; so have Orientals at 2⅛. The wireless shares are neglected because of the uncertainty felt as to what may be the outcome of the conferences between the Government and the wireless operators in connection with the strike of the latter.

India Rubber shares are up to 25s. Telegraph Constructions put on a further 10s. at 28½. The other changes in this group have been already mentioned. Rubber shares have retreated well into the background of popular favour. Business in them runs on humdrum and unexciting lines, the price of the produce, at 2s. 10d. per lb., being 1s. 10d. below the highest level reached during the boom period before Christmas.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923	1924.	Price Feb. 8, 1926.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1⅝	—	*5 14 8
Charing Cross Ordinary	1	14½	15	47/-	—	6 7 8
do. do. 4½ Pref.	1	4	4½	17/- xd	—	5 5 11
Chelsea	1	12	12	2⅛	—1/16	5 12 11
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/6	—	5 4 11
County of London	1	15	15	58/3	—	5 3 1
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14½	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	+6d.	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5 1/16	—	5 7 10
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅜	—	5 8 3
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 1/16	—	5 6 8
Urban Ordinary	1	4	4	19/6	—6d.	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	46/3	—	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	31/-	—	5 3 0
Home Rails.						
Central London Ord. Assented	Stock	4	4	69	—	5 16 0
Metropolitan	,,	4	5	69	—	7 4 11
do. District	,,	3½	3½	47½	—½	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2½	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	6	6	99	—	*6 1 2
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	3	6	52/6	—1/3	2 5 8
Chili Telephone	5	6	5	6⅜	—	*3 18 5
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	+1	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1¼	—	8 0 0
Marconi Marine	1	10	7½	¼	—	8 11 6
Oriental Telephone Ord.	1	12	12	2⅛	—1/16	*5 12 11
United R. Plate Tel.	5	8	8	7 3/16	—	5 2 7
Western Telegraph	10	10	10	17⅞	—⅛	*5 11 11
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 5/16	—1/16	8 6 0
do. do. 2nd Pref.	5	6	6	3 3/16	—	9 8 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	106	+1	5 13 2
Brazil Traction	100	4	4	94½xd	+3½	4 4 8
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	84½	+1	5 18
do. do. Preferred	,,	96/-	96/-	103½	+1	*4 12 0
do. do. Deferred	,,	129/5	129/5	128	—	*5 1 7
do. do. Deb.	,,	4½	4½	79	+2	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	4/6	+1	Nil
London United Tram. Deb.	Stock	4	4	45½	+4½	8 8 4
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	32½	+1	Nil
do. Pref.	100	Nil	Nil	62½	+1	Nil
do. 1st Bonds	—	5	5	69½	—1	7 3 11
Yorkshire (West Riding)	1	5	—	17/6	—1/3	5 14 3
Manufacturing Companies.						
Babcock & Wilcox	1	12	12	2⅝	—	*4 11 5
British Aluminium Ord.	1	5	10	37/6	—	5 6 8
British Elec. Transformer Pref.	1	Nil	7½	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3 1/16	—	4 17 11
Brush Ord.	1	10	10	1 1/16	—	6 19 2
Callenders	1	15	15	3⅜	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	34/6	—	5 16 0
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/6	+6d.	4 15 3
Henley	1	15	16	3 11/16	—	4 6 10
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1½	+ 1/16	*4 0 0
Johnson & Phillips	1	10	10	21 1/16	—	3 8 3
Met.-Vickers, Ord.	1	8	8	28/-	—1/3	5 14 4
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	33/9	—	4 8 11
Telegraph Construction	12	20	10	28½	+½	*4 4 3

*Dividends paid free of Income Tax.

The Interconnection of Power Systems.

The Successful "Loose-linking" of Large Power Stations in America.

In view of the Government's proposed method of reorganising the system on which electricity is generated and transmitted to distributing centres in this country, it will be instructive to consider a method that has been successfully applied in the United States to minimise system disturbances and reduce the duty that is expected of oil switches without sacrificing flexibility and economy of operation.

"Like a radio vacuum tube on the verge of oscillation—highly efficient, but damnably unstable"—is an expression which has been used facetiously, but which, nevertheless, has a sober application to solidly interconnected concentrated sources of power. In connection with an example of what has actually been accomplished in America, Mr. Alex. Dow, president of the Detroit Edison Co., was interviewed recently by a representative of the *Electrical World* regarding what he terms the "loose-linking" of his system, which has been gradually perfected since 1920, involving a generating capacity of over 500,000 kW and a mass of 24,000-volt cables. Fig. 1 indicates the method followed.

"What is the distinctive feature of this system?" Mr. Dow was asked. "Our system is not a closely connected unity served by several power houses," he replied. "Instead, I like to think of it as several contiguous areas having their own sufficient power houses interlinked primarily for mutual assistance and secondarily for the attainment of maximum economy. 'Loose-linking' is not new; continually increasing demands and generating capacity, together with the close knitting of the transmission system, forced us into it in 1920; the whole connected capacity was ever ready to spill an immense amount of energy into a fault whenever one developed. No company can afford to allow conditions to continue that are favourable to system-wide disturbances.

"Economy is subordinate to the first purposes of interlinking — namely, mutual assistance. Therefore, the manner and extent of interlinking should be such as will permit the transfer of energy between contiguous areas when needed and to the amount required by any controllable operating disturbance affecting the area which needs assistance. Interlinking should not be so tight that disturbances of the service that are temporarily uncontrollable will extend from the area in which they originate into contiguous areas. In other words, all of the ordinary chances of trouble, such as the disablement of a turbo-generator set, or the loss of an important line, should automatically bring sufficient assistance into the disturbed area from other areas, but an uncontrolled disturbance (some vicious short circuit causing generators and synchronous machinery to break out of step) should not be aggravated by having the energy of more than one area dumped into it; nor should such a disturbance be permitted to extend into other areas than that in which it originates. The foregoing requirements can be met by limiting the number of points at which energy may pass from one area to another and by providing adequate automatic switchgear at each of these points.

"The system operator, in consultation with the production department, assigns to each power house the amount of load it is to carry from hour to hour. Each large change of assigned duty will necessitate relimitation of the areas of supply, and the number and locality of the interlinkages in use at any time must be varied in consonance with the duty assigned for the time being to each power plant. The system operator must not only prescribe the points of interlinking and the normal carrying capacity of each interlinkage, but must in the final refinement prescribe the overload at which the interlinkage will automatically disconnect.

"One important requirement is that when a power house (or power area) breaks loose from the others, it should carry with it a proportion of the total load corresponding to that proportion of the total load which was assigned to it for the time being. If it carries too much load with it, a needlessly large amount of service will be affected by the disturbance; if it carries too little load with it, the other power houses will be temporarily overloaded. It is desirable that the interlinking of an area should not be effected with more than two other areas.

"At the Connors Creek plant the ring bus is split into two main sections, with generators and lines on each, resulting in two separate buses and transmission line groups. When these lines were tied together only at the sub-stations, the maximum short-circuit current at the Connors Creek plant was cut down considerably, but the current values in the sub-stations were not, because lines emanating from both buses were joined in the sub-stations. However, lines to the nearest sub-stations are being cut over at the power source, so that all lines to the same sub-station will be on the same main bus, but on different bus sections. This method of operating has been found satisfactory and separation of the station buses may eventually be followed by separating, or loose-linking, the steam system for similar reasons of reliability.

"While it is not the case now," pointed out Mr. Dow, "we are avoiding the installation of switches within large power houses to prevent switch wrecks putting the stations out of service. Interlinkage switching stations should also be separated from distributing sub-stations and should be located and built in due sequence in advance of necessity. The switchgear should have large excess capacity, or at least provision should be made to substitute quickly switches of larger capacity when conditions change.

"The 120,000-volt double-circuit loop around the outskirts of Detroit from Marysville to Trenton Channel primarily feeds the outskirts of Detroit without running high-voltage large-capacity cables from the generating plants themselves, but it also serves as a tie between our two most economical plants on the extreme opposite sides of our system. This loop, consisting of two parallel circuits each nearly 120 miles long, can be divided into approximately three equal parts by two sectionalising stations and is also tied at certain points, designated by the system operator, with the city cable system.

"Loose-linking represents only a partial separation of the system; all generators operate in parallel on the main system and carry the allotments of load as determined by their best efficiency. Although instantaneous exchange of power between two adjacent plants is normally limited to the one tie, considerably more load can be transferred between adjacent areas by different switching combinations at the various interlinkage stations. It has been possible to maintain the system economy as high as with the customary solid interconnection between stations, but without the possibility of serious derangement of the whole system which is thereby permitted.

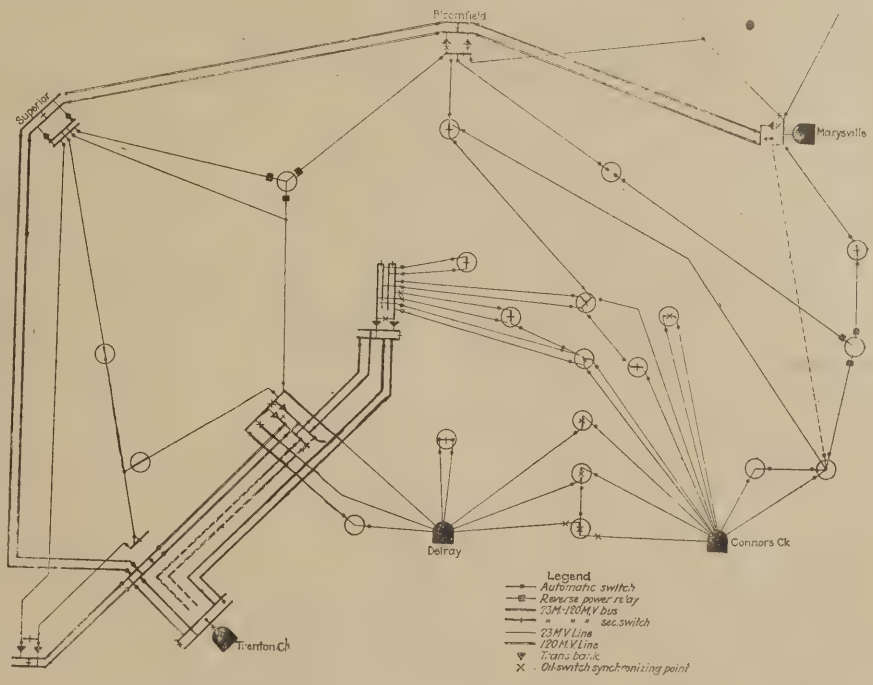


Fig. 1.—Method of "Loose-Linking" the Detroit Edison Power System.

"No more reserve capacity is required than in a system that is closely interconnected all of the time. Even if it were required, it is not so expensive to provide as many people think. The cheapest form is an oversize generator driven by a turbine with a manual-control bypass valve admitting h.p. steam to an intermediate stage, safeguarded by the governor, of course. The economy during emergency operation would be reduced, but would be more than offset by the saving in fixed charges on reserve capacity furnished in the usual way. Engineers are worrying too much over fixed charges when spending a little more than is technically economical may mean the difference between a desirable, and a merely satisfactory, or poor, service. Five per cent. increase in capital invested in a power house would hardly be noticeable in the cost of rendering service, and if spending this money produces more reliable service, it is an inexpensive way of securing better public relations.

"Advantages gained by loose-linking are greater reliability and stability of operation than we obtained five years ago, despite the fact that loads have increased in size and number and generating capacity has been augmented by two large

stations at Marysville and Trenton Channel. In addition, we have minimised circuit breaker duties and, consequently, the possibility of breaker failure, with possible equipment damage and most certain service interruption. Short-circuit currents were assuming values which no available circuit breakers could handle safely. Sustained short-circuit currents to any point of the system have been limited; in sub-stations the reductions vary from 15 to 55 per cent.; at Delray the reduction has been 38 per cent., and at Connors Creek about 29 per cent. with a closed ring bus (41 per cent. with a sectionalised bus). The reduction, even though the breakers disconnect the trouble promptly, also means lighter bumps on the system and less disturbance of the connected synchronous machinery; bumps are confined more to one generating plant and its area, and are not so keenly felt in the other areas. Isolation of trouble and prevention of promiscuous secondary disturbances enable a better diagnosis to be made and a quicker recovery to normal operation."

Mr. Dow does not contend that loose-linking supplants the necessity of reactors, or other methods that may be adopted. He recognises the desirability of greater certainty of relay action than is now obtainable. Nevertheless, he confidently believes that loose-linking can be applied to any concentrated power sources, with benefits equal to those he has obtained. The location of the plant and its size are less restricted than with solid interconnection.

Power Factor and Tariffs.

Types of Correction Plant and a New Three-part Tariff.

(*Abstracts of papers read before the* Institution of Electrical Engineers.)

At the meeting of the Institution on February 4th, two papers on the above subject were submitted, an excellent résumé of the first one (by Mr. E. V. Clark, who is in Australia) being read by Mr. E. L. Hill. The paper, which will be abstracted next week, contends that, although it has no energy content, the wattless component of electricity supplied to consumers has a real value to them, and in many cases entails a real running cost to the undertaking; that where low power factor is seriously perturbing a supply undertaking, a rational tariff should include a charge for wattless component, and that a charge based on the kVA-hours of lagging wattless component consumed, with an equal rebate for leading wattless component taken at time of load, is a reasonable basis for such charge, although not absolutely ideal; and finally, that the adoption of a three-part tariff embodying such a charge may be arranged without undue complication of metering methods, and without entailing perplexity in the minds of non-technical users of power.

The second paper, an abstract of which follows below, was written with the aim of following up the first one. It summarises the principal types of apparatus employed for the improvement of power factor, and describes the modern static condenser and also types of power-factor rectifying plant that have been developed during the past three years. The second part of the paper outlines various forms of power-factor tariff in force in Great Britain, and systems of metering employed in conjunction therewith are briefly dealt with.

Power Factor Improvement.

By E. W. Dorey, A.M.I.E.E.—*Abstract.*

Since Dr. G. Kapp's paper in 1922 there has been no addition to the types of auto-synchronous and synchronous motors therein described. The rotary condenser still finds favour in Great Britain, but it has a comparatively high loss, usually not less than 5 per cent., and may be as much as 7 per cent.; when this loss is capitalised, the rotary condenser, under the conditions ruling in Great Britain where power is mainly generated from coal, compares very unfavourably with other forms of p.f.-improving apparatus, such as static condensers. To take as an example a 1,000-kVA equipment, the difference in losses between static and rotary condensers would be of the order of at least 4 per cent. With a 12-hour working day, 300 days per annum, this would be the equivalent of 144,000 units lost, and at 1d. per unit sold this is approximately £600 per annum. If this difference be capitalised it will show the static condenser installation to be by far the more economical.

The adoption of p.f. tariffs has compelled designers to produce an induction motor with a very high inherent power factor, and the introduction of a.c. motors fitted with ball and roller bearings has assisted greatly; when the wear that is attendant upon the use of the journal bearing has not to be contended with, it is possible to use a much smaller air-gap.

Oil-immersed electrostatic condensers are manufactured in Great Britain principally by Messrs. British Insulated and Helsby Cables, Ltd., and the Telegraph Condenser Co., Ltd. They consist primarily of plates comprising a length of paper coated with tin under the Mansbridge process; the plates are separated by the requisite thicknesses of paper used as the dielectric, the number of thicknesses being dependent upon the voltage applied across the terminals of the unit. Generally speaking, each unit of the condenser has a capacity of approximately 1 microfarad, but this may be greater or less according to the special conditions obtaining on the circuit. The two principal makers assemble the units in frames, the frames being fixed into boiler-plate tanks and completely oil-filled. The modern oil-immersed static condenser is a very reliable and efficient apparatus.

A good deal has been said about the risk of resonance due to the connection of static condensers, but over many years no difficulty whatever has been experienced. It is not claimed that resonance may not occur under certain exceptional conditions, but under the ordinary industrial conditions prevailing, not only in Great Britain, but overseas, experience shows that resonance does not occur.

The static condenser, as built in Great Britain, is essentially a medium-pressure apparatus, the most economical voltage being about 600, but condensers have been, and are, built for direct connection to supplies up to 3,300 volts. Only in exceptional cases is it cheaper to supply a h.p. condenser, and the saving is not even then more than 10 to 15 per cent. of the overall cost of the equipment. The right place to put the condenser is in the l.p. circuit, as by so doing the improvement will be effected as far as possible out on the distribution network, and in practice the call for h.p. condensers is very small.

A case has been reported from overseas of a British-made 100-kVA, 3,300-volt, outdoor condenser which, for the purpose of test and experience generally, is connected direct across the h.p. overhead transmission line without any protection whatever, and is therefore subject to every kick and surge on the system. Nearly 12 months have elapsed since the condenser was first connected and it continues to give every satisfaction. This should be sufficient evidence to show that the static condenser does not in reality possess the attributes of frailty so frequently ascribed to it.

A comparatively new development is the l.p. pole-type condenser connected direct across pole-type step-down transformers, this application being particularly useful in the case of rural distribution. British-made condensers of this type have been working for some considerable time in New Zealand, and it is reported by the engineer of one Power Board that, from the point of view of improved regulation only, the installation was worth while. In this case, however, the annual saving effected is sufficient to repay about 70 per cent. of the cost of the equipment, and to this has to be added the increase in the useful output of the transformer, as the condenser being connected on the low-pressure side of the step-down transformer unloads the transformer of wattless current, and for every 2 kVA of condenser capacity under industrial conditions the load on the transformer will be reduced by approximately 1 kVA.

The efficiency of the static condenser is 99.7 per cent., so that the losses are almost negligible. A bank of directly-connected condensers having an output of 1,000 kVA would have a loss of only 3 kW. Where auto-transformers are used for stepping up the voltage from that of the supply to the most economical voltage for the condenser, the auto-transformer losses have to be added, but the overall losses of large complete equipments for the usual industrial voltages may be taken to be between 1 and 1.5 per cent. of the output in kilovolt-amperes.

With the two makes referred to, the type of unit used in either case would be the same; therefore, at 440 volts the condenser would require to be 86 per cent. larger and approximately 80 per cent. more costly than at 600 volts. To overcome this it is usual to step up the voltage by means of an auto-transformer to the most economical voltage for the condenser (in the above case, 440 to 600 volts). The auto-transformer is comparatively inexpensive and the overall reduction in price for the complete equipment is very considerable.

Where new step-down transformers are necessary, either as separate units or to bank with existing transformers, and in addition a condenser is required, it is possible to overwind the secondary of the transformer to give the most economical voltage for the condenser. By this means the auto-transformer is avoided and the whole scheme simplified, a considerable monetary saving being effected.

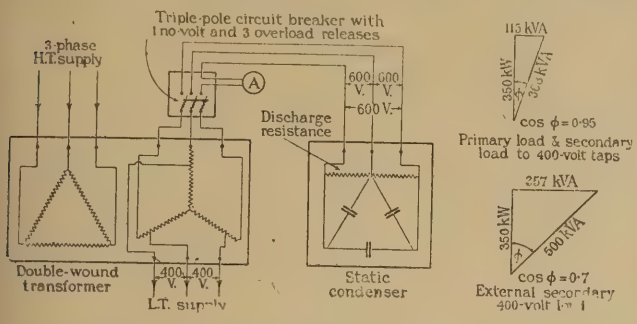
Fig. 1 shows the loading and phase angle of the various circuits of an overwound-connected condenser equipment.

Where a supply undertaking is faced with bad voltage regulation and low power factor, whether or not a power-factor tariff is in force, it should be possible to improve matters considerably by connecting direct across the l.p. busbars in each sub-station feeding industrial load sufficient condenser capacity to neutralise the magnetisation current of the whole bank.

A great advantage of the static condenser is its mobility; it can be put at the end of an over-loaded circuit, but if later on this circuit is underloaded, it can be moved to another position as may be required. The price per kVA of condenser capacity varies according to voltage, frequency, and climatic conditions, but, taking conditions in the United Kingdom and a three-phase 50-cycle supply at from 400 to 440 volts, the cost of equipment ranging in size from 100 to 300 kVA varies

approximately from £3 5s. to £2 9s. per kVA, a good average figure being, say, £3 2s. per kVA.

The "phase-advancer" is an a.c. exciter to improve the p.f. of a slip-ring induction motor. These exciters literally short-circuit the slip-rings and inject the necessary leading current into the rotor. Phase-advancers have been used extensively on the Continent, but do not appear to have found much favour in this country.



Load on primary = 368 kVA (resultant of two secondary loads).
External load on secondary at 40-volt tappings = 500 kVA.
External load on secondary between neutral and 400-volt tappings = 368 kVA (resultant of two secondary loads).
Load on 400-600 volt winding = 300 kVA (condenser load).

Fig. 1.—Loading and Phase Angle of Overwound Equipment.

A comparatively new type of induction motor capable of running at a high power factor at all loads is the so-called compensated induction motor. Among machines of this type is one built by the British Thomson-Houston Co., Ltd., with the trade name of "No Lag." Machines of this type can be built in sizes up to 200 or 300 h.p. for either two- or three-phase circuits up to 600 volts at any commercial frequency. The motor has a commutator which enables the phase of the secondary to be controlled and, hence, the power factor to be corrected. The kVA handled by the commutator is very small, and so it is very small with simple and inexpensive brushgear. This motor is as simple to operate as a plain induction motor, and standard starters as used for the slip-ring-type induction motor can usually be used. It is capable of giving as large a torque at starting as the slip-ring induction motor.

Fig. 2 is a typical power-factor curve of a 17½-h.p., 1,000-r.p.m., 415-V, 50-cycle "No Lag" motor, and, if desired, a leading p.f. of 90 per cent. at full load can be obtained, and in certain cases an even greater leading power factor. Fig. 3 shows the speed and efficiency characteristics which approximate to those of the plain induction motor. It is an asynchronous motor, so that for applications where a slight drop in speed with increasing load is necessary, or desirable, it is admirably suited. As no separate exciter or expensive switchgear is necessary this motor is less expensive than the auto-synchronous motor, and it can be built in small sizes of the end-shield type.

It is reasonable to assume that the time is not very far distant when the great majority of undertakings supplying alternating current will adopt some form of power-factor tariff. The p.f. tariffs in force in Great Britain may be divided as follows:—

Class (A).—A two-part tariff incorporating a fixed charge per month, per quarter, or per annum, per kVA of maximum demand, with a running charge or flat rate per unit consumed.

Class (B).—A tariff which may be either of the two-part type based on the kW demand and the running charge per unit, or a one-part tariff based on units consumed only; in both cases, however, subject to a percentage decrease or increase, bonus/penalty, depending upon the power factor of the load. The tariffs divide themselves into those which give a bonus for reduction in kVA demand only and those which give a bonus on the total bill, that is, the capital charges and running charges. The majority of electricity supply undertakings are favouring the kVA demand tariff, owing to its simplicity; a satisfactory meter can be provided to record the kVA demand and an explanation of the term "power factor" is not involved. In the case of Class (B) tariffs, difficulties are met with in getting the consumer to put in plant for the improvement of power factor, the chief of which are as follows:—

(1) In the case of an overall bonus/penalty on the power-factor supply bill, a consumer with a relatively high load factor has a large supply bill compared with the low-load-factor consumer, both running with the same maximum demand and power factor. To improve the p.f. would require the same condenser capacity in each case, but the consumer with high load factor would get a proportionately greater saving than the one with low, and the inequity of this type of power-factor tariff is very evident.

(2) In those cases where a bonus is given for improvement of power factor above definite limits, such as 85 and 90 per cent., the objections referred to in (1) above also apply, but in addition there is the serious objection that the consumer with, say, 83 per cent. p.f. can, with a comparatively small condenser, correct to either 85 or 90 per cent. and obtain the bonus, but the consumer with a very low p.f., say 50 per cent., would have to correct right up the scale to, say, 84 per cent., without getting a penny piece by way of bonus; in other words, the low-p.f. consumer would have to put in such large condenser capacity that in the majority of cases it would not pay.

(3) This type of tariff involves an explanation of the term "power factor," and it will be generally agreed that the less explanation one has to give to the consumer the better.

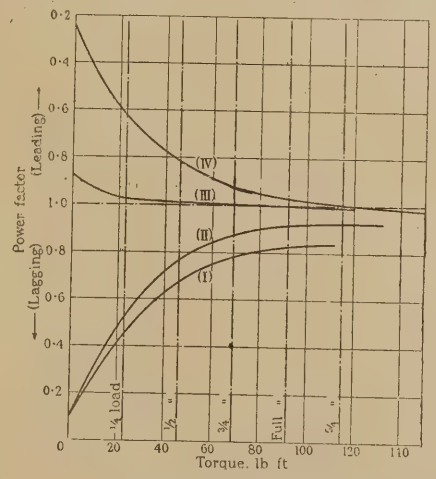
The correction of low power factor is one of the few important economies remaining to be effected, and there seems little doubt that, converted into £ s. d., low power factor is resulting in enormous losses to electricity supply undertakings, not only as regards capital charges, but also running charges, and the losses are being borne by the industrial user of a.c. power. Admittedly, the consumer is responsible for the power factor of the load, but it behoves every undertaking supplying a.c. power to make it worth while for the consumer to raise his power factor and thereby effect a general reduction in electricity charges, thus ultimately benefiting industry in general.

Discussion in London.

Mr. R. O. KAPP opened the discussion by remarking that so much had been written and said about the subject that one would have thought there was nothing left to discuss; both the papers before them that evening, however, contained something new and important. There were two aspects of tariff making: one was the accountant's point of view based on detail costing, and the other was the salesman's point of view, who had to consider many points which the accountant could neglect, including the mentality of the consumer, &c. With regard to Mr. Clark's paper, it did not sufficiently emphasise this salesman's point of view. Bad power factor meant bad voltage regulation, particularly on systems that included many transformers and overhead lines, especially at low pressure. The analogy the author drew from the sale of concentrated and weak sulphuric acid was a very important point. The framing of tariffs should be done with due consideration for the "ignorance" of the consumer; for example, if a bonus were offered the consumer would probably "understand" a tariff much more readily than if a penalty were imposed. A 3-part tariff assumed that the 2-part tariff was based on accurate cost accounting with the introduction of a refinement, but was the average 2-part tariff a true accountant's tariff? The allocation of cost was not easy, and a close approximation to true costing seemed to be hardly possible. Concerning Mr. Dorey's paper, he (the speaker) could confirm the statement that the risk of resonance due to the employment of condensers was by no means serious. The author's details of pole-type condensers were very welcome, as such appliances should have a big field in front of them for rural electrification. A.c. fans had a bad power factor, and he had once had to consider the correction of such a load, but the cost had been prohibitive. Could the author say whether condenser correction would be possible now, either for individual fans, or for groups of fans?

Mr. S. H. HART pointed out the advantages of using motors of a good design and running induction machinery at as high a speed as possible to improve the power factor. Large consumers could be dealt with by means of a tariff, but the small consumer would have to be provided for in co-operation with the supply authority.

Mr. W. B. WOODHOUSE, speaking as a supply undertaker, said that idle current did cost the supplier something, and therefore the consumer should pay for it. Small consumers could not be expected to carry out p.f. correction; the supply authority could do it and charge the consumer accordingly. Large consumers, however, could do their own correction, and they should be offered a suitable tariff. In one case he knew of a saving of £2,000 had resulted in one year and in another case the saving had been £6,000, the inducement to correct



(I) Power factor as induction motor.
(II) Power factor as compensated induction motor; min. compensation.
(III) Power factor as compensated induction motor; unity power factor.
(IV) Power factor as compensated induction motor; max. compensation.

Fig. 2.—Power Factor Curves of Compensated Induction Motor.

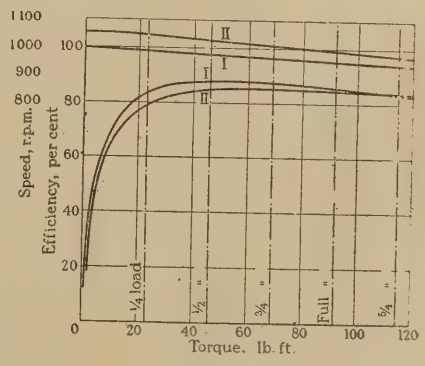


Fig. 3—Efficiency and Speed Curves of Compensated Induction Motor.

being a charge on the kVA basis. The method of charging, however, needed some consideration: Should the charge be based on the sum of the idle ampere-hours, or on the idle current at the time of maximum demand? The latter was perhaps nearer the fact, but there was no really suitable meter for such a system at present.

Mr. R. A. Chattock (president) pointed out that p.f. correction depended on the nature of the supply that had to be given. On a d.c. system, for instance, rotary converters at the most important parts of the network would assist materially in keeping the main trunk lines well loaded up, which was a necessity. Offering discount as an inducement would not pay in Birmingham at present. Regarding the use of condensers in rural districts, it should not be forgotten that if a condenser were left in a circuit at night, when the load was off, it would result in the supply network having a serious leading factor and introduce difficulty in connection with voltage regulation.

Mr. L. W. Migotti said he came from abroad (South America) and he claimed to supply a large amount of energy, but not one of his consumers would take the slightest interest in power factor, except perhaps the British railway officials, who, however, were not yet being supplied. Nevertheless, they had a power factor of from 0.93 to 0.97 at the peak load, which was the most important time. Their method was to estimate what they expected to receive from each consumer and charge him accordingly. In general, the consumer should not be worried about power factor unless he was fully fitted to understand the subject. Correction, where necessary, should be carried out by the supply authority with the help of the designers of machinery.

Mr. A. H. Bennett thought that Mr. Clark had tried to prove on paper something that was not really necessary. All that was required could be accomplished by means of a 2-part tariff. They never attempted to explain power factor to a consumer, but they did show him what it would mean to him in £ s. d., and at the same time offered a condenser on the hire-purchase system, which was usually accepted. The public did not want electricity, but energy, and it was up to the suppliers to give it them. It would be worth the consumer's while to improve his power factor to something over 0.9.

Mr. P. M. Baker expressed the opinion that any tariff which required the consumer to understand power factor was quite hopeless.

Mr. Johnson knew of some consumers charged on the kW basis who had a power factor of 0.4. The whole trouble was due to induction motors being allowed to work at one-third load. Manufacturing costs and other such considerations limited the possibility of reducing the air gap of motors, and static condensers could not be used when the load was variable, whereas motors could be so used. The Clyde Valley case was due to the peculiar geographical position of the generating stations. The use of auto-synchronous motors was a commercial proposition where other means were not justified, and such machines had now been applied to every class of industrial use. Static condensers had limitations which were very soon reached.

Mr. H. S. Ellis drew the author's attention to an instrument known as the "Maxigraph," which he had used and found quite reliable. It was provided with a recorder as well as an indicator and gave the p.f. record on a basis of time.

Mr. E. W. Dorey, in reply, said that small condensers could now be supplied with fan motors and they should have a very wide application in the tropics. In the case of bulk correction a condenser might give a leading p.f. when only two or three of the fans were in use, so that individual correction might be preferable. Squirrel-cage motors were most reliable and would be efficient when installed in combination with static condensers, if the cost proved to be suitable, but each case must be considered on its merits. He often wondered why supply authorities did not do more correction themselves; the chief reason was probably due to voltage regulation problems, because when the consumer carried out the correction his condensers were switched off as the load decreased. A kVA-demand instrument was available, and it was a very reliable meter, although expensive. It was interesting to hear that although Birmingham and Manchester were well situated as regarded power factor, they offered inducements to consumers to correct their power factor. Automatic switchgear might be devised before long to cut out the condensers as the load fell, otherwise it might be advisable to split up condenser capacity. Where kVA-demand tariffs were in use, it was very much easier to induce consumers to install p.f. correcting apparatus.

A Large Frequency-changer—A frequency-changer, said to be the largest piece of electrical machinery of its kind ever designed, weighing more than 600 tons, has been ordered by the Philadelphia Electric Company from the Westinghouse Electric and Manufacturing Company. The contract also calls for the delivery of eight oil circuit breakers for a voltage of 73,000 V and a rupturing capacity of 1,500,000 kVA. The machine will be installed in the Schuylkill River station of the company, to change the frequency of the generated current to that necessary for traction purposes. It will be 55 ft. long, and will rise to a height of 22 ft. above the foundations; the motor section of the unit will develop 60,000 horse-power at 100 per cent. power factor, or 41,250 horse-power at 70 per cent. power factor.

The Lighting of Coal Mines.

Some Interesting Miners' Electric Safety Lamp Tests.

At a recent meeting of the Illuminating Engineering Society in London, at which Mr. C. C. Paterson presided, a discussion on the subject of "The Lighting of Coal Mines" was opened by Mr. Eric Farmer, investigator to the Industrial Fatigue Research Board, who described a series of recent tests which indicate the importance to be assigned to the exposure of the bright filaments of miners' electric lamps. He explained that methods of diffusing the light, *e.g.*, painting the inside of the protecting glass cylinder with hydrofluoric acid, had an evident good effect in diminishing the intensity of "after images" and reducing glare. Although this occasioned some loss of light, it was found that 53 per cent. of subjects had better visual acuity with the translucent light than the transparent; 32 per cent. had equal vision in both cases, and only 14 per cent. had lower visual acuity with the translucent glass. The tests thus supported the view that the diffusion of the light was an advantage, and it was found that in the case of men suffering from "nystagmus" the effect was particularly beneficial. Nevertheless, methods of diffusion would yield still better results if a higher illumination could be provided, and in this connection Mr. Farmer mentioned the possibility of larger batteries being employed, which would enable lamps of higher candle-power to be used.

The hon. asst. secretary read letters from the Rt. Hon. William Brace, M.P., and Mr. Henry Walker (of the Mines Dept.), Mr. E. Fudge (secretary of the Miners' Lamp Committee) and Mr. Frank Hodges (Miners' International Federation), expressing their interest in the meeting and their recognition of the importance of good lighting. Communications from Dr. T. L. Llewellyn, Dr. H. S. Elsworthy, and Prof. W. Thornton were also read. Dr. Llewellyn referred to recent advances, such as the greater use of electric lamps, improvements in both oil and electric lamps, and the whitewashing and stonedusting of underground passages. He believed strongly in the cap-lamp, but this pattern had not been a success except in some districts of Scotland, although it was almost universally used in America. Dr. Llewellyn also endorsed the importance of avoiding glare, but preferred to overcome it either by careful placing of the lamp, by the use of the cap lamp, or by reflectors. Translucent glass had not been well received by miners, but yellow glasses seemed to meet with approval. During the journey to the coal face the use of a shade at the back of the lamp should be compulsory; it was very trying to the eyes to follow a line of unshaded lamps, and difficulty in this respect was an early symptom of eye-trouble.

In conclusion, Dr. Llewellyn presented data for nystagmus and cases of disablement, which showed a disappointing increase during 1923 and 1924. This was doubtless attributable largely to abnormal conditions, and he still believed as strongly as ever in the importance of better light.

Dr. H. E. Elworthy's communication was confined to the use of yellow-tinted glasses. Data presented for a colliery in which they had been adopted showed a marked decrease in the number of cases of nystagmus.

Prof. W. Thornton's communication suggested that, if miners felt the same confidence in the electric lamp as a detector of gases as they felt in the oil lamp, this would overcome a great deal of the reluctance in adopting the former. Nystagmus, in some cases, was partly a mental effect, an "apprehension neurose." Prof. Thornton also indicated the possibility of conveying electricity to working places by suitable cables, using low-voltage a.c. at higher frequencies than those at present used. The idea would need careful testing, but similar methods were already used for signalling purposes.

An interesting discussion followed, in which Mr. J. B. Lawford (past president of the Council of British Ophthalmologists), Dr. D. G. Coles, Dr. Miles, Mr. W. Plummer (Ceag Miners' Supply Co., Ltd.), Mr. S. J. Wrigglesworth (Oldham & Sons, Ltd.), Dr. R. Lessing, Mr. E. A. Hailwood (Ackroyd & Best, Ltd.), Mr. Cooke, Mr. T. J. Sack (G.E.C.), Mr. L. Gaster, and Mr. C. C. Paterson (chairman) took part.

A point strongly emphasised in the discussion was the desirability of supplying bulbs for miners lamps of good quality, operated at a reasonably high efficiency. Mr. T. J. Sack pointed out that small 2-volt lamps for miners' lamps could not be expected to have a life comparable with that of the ordinary household lamp, and that to insist on a life of 1,000 hours meant an efficiency not high enough to give even the legal minimum of 1 c.p. The great gain in light secured by adopting a higher efficiency was strikingly illustrated by a demonstration, and the candle-power attainable from gasfilled lamps, operated at a somewhat higher voltage, was also shown. Mr. Plummer exhibited a "Ceag" lamp working on a 4-V accumulator, giving four times the light from a standard lamp with less than twice the weight.

Other points referred to included the cap lamp, and the possible explanation of the preference shown by miners for the yellow-tinted glass cylinder. Mr. Hailwood dwelt at some length on available statistics relating to nystagmus, and exhibited some lamps of the flame type.

After a vote of thanks to the author and exhibitors, it was announced that the next meeting would be devoted to an exposition of the work of some of the B.E.S.A. committees concerned with various aspects of illumination.

Russian Electrical Notes.

Scarcity of Raw Materials.—The State Electrical Trust (the amalgamation of the Central and the Leningrad trusts) reports great difficulties in obtaining the necessary quantities of various raw materials for the different manufacturing works. This is the case with dynamo and transformer iron and certain qualities of steel, and the question of importing the balance required has been put before the General Electrical Commission as the controlling authority of this trust. The dearth of zinc, lead and tin is said to be even "colossal."

The Schatur Peat Fuel Station.—The Schatur station, which employs peat fuel, and is expected to form the main basis of supply for Moscow, was originally projected for a capacity of 48,000 kW. Owing, however, to the growth in the demand for energy in Moscow it is now proposed to add to the station a 35,000-kW turbo-generator and to build an annexe to house a set of not less than 25,000-kW capacity. It will also be necessary to install six further boilers, and foreign firms have offered to deliver these in May if the orders are placed in January.

Automatic Telephone Exchanges.—The production of automatic telephone exchanges with a capacity for 10,000 subscribers is reported to have been commenced at the Kulakoff works. Hitherto such exchanges have only been constructed in Russia to accommodate 1,000 subscribers.

Interconnection of Stations.—The Nischni-Novgorod station has now been connected up with the Balachn generating station and will regularly receive a supply of energy from the latter. It is intended that the Balachn station shall also furnish electricity to a number of industrial undertakings in the r gion of Nischni-Novgorod.

Production and Demand.—Despite the development of the producing industry it is impossible fully to satisfy the requirements of the market. The production of machines and apparatus in 1924-25 represented a value of 15,500,000 pre-war roubles, which only met the demand to the extent of 75 per cent. In the current year the value of the output of the General Electrical Trust in machines and apparatus is estimated to be 24.5 millions of roubles, but even if this is realised the market will only be supplied with 90 per cent. of its needs, according to the estimates of the General Electrical Commission. It is at present difficult to judge whether this programme of production will be carried out, as the whole were already practically loaded to their full capacity in 1924-25 and any further expansion will depend upon the provision of new equipment. The estimates of the Commission anticiplate that the home demand for machines and apparatus will increase to 39 million roubles in 1926-27, 53.8 millions in 1927-28 and to 67 millions in 1928-29. The manufacture of cables is situated in the relatively best position as beside the cable factories of the general trust there are factories belonging to the Tsbetmeta and the cable factory in Kieff, which will not be fully occupied in the current year. On the other hand the factories of the General Electrical Trust, which turned out cables to the value of 22.5 million roubles in 1924-25, will manufacture to the extent of 33 million roubles in the current year. In the case of lamps it is mentioned that the demand is growing simultaneously with the production, while the imports are constantly diminishing and now only form about 5 per cent. of the total number placed on the market, most of the imports being gasfilled lamps. The development of the home manufacture of lamps is illustrated by the fact that the total output of all the factories amounted to 6,500,000 in 1923-24. 10,500,000 in 1924-25, and the number is expected to be increased to 16,500,000 in the current year. Besides the national production of installation materials at various works, a considerable quantity is imported from other countries. Owing however to the variation in nomenclature consumers are said not always to be able to find what they require, and the General Electric Commission therefore proposes to work out a system of standardisation. Fittings and heating appliances are not entirely covered by home production so that in these cases also a quantity has to be obtained from abroad. The value of the output capacity of the works producing fittings is stated to be 3.5 million roubles and the production of heating appliances is said to amount to 2 millions of roubles. Notwithstanding extensions the home output of carbons is also unable to satisfy the demand, while only 50 per cent. of the market requirements is met by the home production of ammeters, voltmeters, &c.

Steam Turbine Construction.—A conference on the question of the economical construction of steam turbines in Russian works was held in Leningrad at the beginning of January, between the General Metal Commission and the Leningrad Machine Trust. It was stated that the cost of constructing a 5,000-kW turbine was not only greater than the cost of a foreign machine (270,000 roubles as against 200,000 roubles) but also that the steam consumption was higher in the case of the Russian turbine. The conference reached the conclusion that the causes of the higher price were the scarness of materials and the limited number of orders, and it was decided to put before the competent economic bodies the question of the policy to be observed in future in the matter of the construction of machines at Soviet works.

Moscow Supply Developments.—The minimum demand for energy on the stations which supply Moscow is expected to amount to 160,000 kW in the autumn of this year, but as delay may take place in the installation of the third generator at the Schatur station, there will only be a reserve of about 4,000 kW available. Should this contingency arise it will be necessary to make a change in the hours of supply to consumers and temporarily cease connecting up new customers. In 1927 the capacity of the Moscow stations will be increased to 287,000 kW by the erection of a machine of 35,000 kW at the Schatur station, a machine of a similar size at the new Kaschir station, the addition of one of 16,000 kW at the old Kaschir station, and the erection of two units each of 16,000 kW at the first Moscow station. In general the expenditure will be defrayed out of the profits of the Moscow supply undertaking (Moges) for two years and by the utilisation of the redemption fund

Tramway Motors.—The two trusts which are now embodied in the General Electrical Trust have for the past two years been occupied, among other matters, in assisting in the restoration and extension of the tramways in various towns and in the construction of new types of motors and controllers. New motors of 100 h.p. were built at the beginning of 1924, together with motors of 50 h.p. and these are claimed to be equally as good as foreign types. The value of the orders for tramway equipment placed with the trusts rose from 800,000 roubles in 1922-23 to 2,500,000 roubles in 1923-24 and to 5,000,000 roubles in 1924-25, and the output will be considerably increased during the current year. The trust is contemplating the introduction of electric traction on the railways, and a beginning in this direction is to be made by the Commission for Ways and Communications in connection with the Moscow surburban lines in the near future.

Colliery Electrification.—An expenditure of 14,196,000 roubles is being incurred this year on the electrification of the coal mines in the Southern basin of the Donetz, and of this total about 7,000,000 roubles has been or is to be spent on the acquisition of electrical equipment from abroad. Excluding a few exceptional cases, all the mines will receive a supply of energy from the Shteroff generating station, which will be put into operation next June, when 17 mines will be electrically equipped, out of a total of 21 mines for which plant of 6,680 kW has already been ordered.

Transformer Failures.—At the Krasnaya Svesda generating station (62,000 kW) at Baku a breakdown is reported to have taken place in one of the two 12,500 kW transformers made by the Kharkoff works of the former Central Electrical Trust. This is the second recent failure, a 2,000/20,000 V, 2,000 kW transformer having previously burned out and caused a fire in a sub-station.

English Engineers in Russia.—It is reported that English engineers representing Vickers Ltd., arrived in Leningrad in the third week in December for the purpose of undertaking the erection of equipment for the principle sub-station of the Volkhoff hydro-electric works. The installation of high-pressure transformers, each weighing 45 tons, necessitated the construction of special platform trucks at the Putiloff works.

New Stations. — The Electric Planning Commission has expressed the desirability of commencing the construction of a regional station in Artemovsk of a capacity of from 16,000 to 20,000 kW, with a transmission line from this place to Rostoff. The expenditure is to be defrayed out of the funds included in the budget for this year, and by local capital.

The Commission has also had under consideration a scheme for the establishment of a hydro-electric works for the utilisation of the Falls of the Purt at Gizel-Don for the supply of energy to Vladkavkaza, and a number of towns in the Beslansk district, as well as for metallurgical purposes. The capacity of the station is put at from 6,000 to 9,000 kW.

Submarine Cable Restoration.—The Commission of Posts and Telegraphs is about to begin the restoration of the submarine cable between Baku and Krasnobodsk in the Caspian sea. This cable was damaged in many places and has been out of service since 1920. A period of three months will be required to complete the work.

Defective Products.—A committee has been dispatched to the mills of the Gusevsk combination to investigate complaints made by the managers concerning alleged defective equipment supplied by the General Electrical Trust. In general the complaints concern the small motors provided for the weaving looms, no fewer than 12 motors out of 44 having burnt out between October 23rd and November 11th. At the same time two large 6,000 V motors which were imported broke down on the day they were put into operation. As to the failure of the small motors of from 3 to 5.5 h.p. the Trust states that their construction was hurried in order to ensure delivery by the stipulated time; the large motors were tested at the works and taken over by a committee which included representatives of the Gusevsk. In addition it is stated that defects have been discovered in the measuring instruments supplied by the Low Pressure Trust. The electrotechnical section of the conference now sitting on the quality of Soviet manufactures has presented a report dealing with the complaints made concerning the glow lamps turned out by the lamp factories. Despite the improvements already carried out, the conclusion is reached that insufficient care is taken at the lamp factories. The section states that the telephones are inferior to those produced before the war, the reason assigned being the inadequacy of raw materials of the desired quality. It is now suggested that the Electrotechnical Institute should be em-

powered to obtain the services of foreign specialists to assist it in the investigation of the problem.

Defects are reported to have been discovered in boilers at the Sverdloff generating station built by the Leningrad Machine Trust. A commission has been sent to investigate the matter; the defects are said to be due to the absence of representatives of the Trust on the occasion of the erection of the boilers.

Automatic Telephones.—Having in view the realisation as quickly as possible of a scheme for the introduction of automatic exchanges, the Low Pressure Trust has purchased a large quantity of necessary appliances and materials in Sweden. The payment for the orders has been guaranteed by the Bank of Industry.

Rural Electrification.—Adopting a report of the National Commission of Finance and the State Planning Commission, the Council of the National Commissioners has decided to allot 15,350,000 roubles to works of electrification this year in rural localities. Of this total 5,000,000 roubles will be derived from the loan for economic restoration and the balance will be assigned from the State budget.

Electrical Wholesalers' Federation.

Annual Dinner.

THE annual dinner of the Electrical Wholesalers' Federation was held at the Trocadero, W., on February 4th, with Mr. A. HOLMAN (president) in the chair. After a well-served dinner and the loyal toast, Mr. A. G. BEAVER (past-president) proposed the toast of "The Distribution of Electric Supply and Supplies." The speaker referred to the Government's electricity proposals and said that although details were not yet available it had been indicated that development would be left in the hands of private enterprise. It was said, however, that municipal authorities had been advised to apply for full trading powers. If this was a part of the Government's Bill it would be strenuously opposed by the industry. There were municipalities which realised that their best interests were served by working with and through the contractor, but a change of committee might alter this attitude and if full trading powers were possessed they would be utilised. The history of the gas industry would be repeated, where the companies supplied the appliances and did the work and took their profit through the gas consumed. Manufacturers should consider the possibilities. He considered that agreements limiting the scope of municipal trading activities should be arrived at between the interests affected. He pleaded for unification and co-ordination of all branches of the industry; the E.D.A. was the proper body to undertake this task. In conclusion, he said that, so far, the contractors had fought municipal trading alone, but it was now the intention of the E.W.F. to give them adequate support.

Mr. T. ROLES (past-president, I.M.E.A.), replying to the toast, said that his department at Bradford had full trading powers and was exercising them to a certain extent. Electricity was already cheap in the large provincial towns and the Government would find it difficult to secure lower prices. It had to be borne in mind that electricity could be taken to the people, but they could not be forced to use it. Cheap coal had retarded the use of electricity for power; moreover, steam had often to be raised for process work, and the question of driving became a minor item. There were other adverse factors, but in spite of industrial depression, the load had continued to grow, which pointed to an expansion in the domestic use of electricity. With regard to rural development he thought the city consumers would refuse to be bled to support non-paying schemes. The only way to reduce the price of electricity was to increase the output. That could best be effected by unification and consolidation and persistent propaganda. With regard to municipal trading the Government's Bill would no doubt upset a number of interests, but the good of the nation as a whole must be the first consideration.

Mr. D. N. DUNLOP (director B.E.A.M.A.) also replied to the toast. He said that he did not think that it was the Government's intention to interfere with efficient stations. He did not view the matter as a purely electrical problem. He thought that the Government's scheme was an effort to make the best use of our coal resources, and no doubt the gas industry would have to be considered in conjunction with it. The proposal to place the Executive Board under the Electricity Commissioners was an unusual arrangement and not altogether satisfactory. The Board should consist of men of very great experience and should have complete control. The standardisation of voltage and frequency would need very careful treatment and existing conditions in some important areas should not be disturbed until a proper state of development was reached. He did not agree with the suggestion that the E.D.A. should be asked to call the sections of the industry together with a view to co-ordination, it already had enough to do. The sections concerned should get together themselves and thrash out the whole matter. Referring to municipal trading, he said that he hoped that every enlightened municipality would see the need for the wholesaler and contractor.

Mr. H. H. BERRY, in proposing the toast of "Our Guests," referred to the recent death of Mr. Tate, the secretary of the Electrical Contractors' Association, and the company stood in silence as a tribute to his memory. Mr. Berry then made reference to the presence of Mr. T. Alger (president of the E.C.A.), Mr. W. Preston, M.P., Mr. J. W. Beauchamp (director E.D.A.), Messrs. Sully and Fletcher (E.L.M.A.), Mr. Atkinson (director C.M.A.), and Mr. Cramb (I.M.E.A.).

Mr. T. ALGER, in responding to the toast, said that the wholesaler and contractor were placed in a serious situation in connection with municipal trading. The contractor's business was immediately affected, but the wholesalers would eventually feel the strain. This trading was the thin edge of the socialist wedge, and he was very glad that the E.W.F. had decided to support the E.C.A. in its fight against these powers. The House of Lords Committee which gave full trading powers to Bath, Barrow and Burnley last July, did not know what a serious thing it was doing. The contractor had trained fitters, had canvassed and done a great deal of pioneer and educational work, and he should be given a "place in the sun." Elaborate and expensive showrooms and installations which cost more than a consumer was charged, must either be paid for by high electricity charges or by the ratepayers as a whole.

Mr. W. PRESTON said that the electrical manufacturer had every reason to promote the welfare of electrical traders. Energies should not be distributed among sections. There might be too many intermediaries in the coal trade, but this was not the case in the electrical industry; the wholesaler was indispensable. In conclusion, he appealed for the support of British manufactures in spite of the flood of cheap foreign material.

Mr. J. WILSON proposed the health of the president, and Mr HOLMAN briefly responded.

During the evening a musical programme was provided by the Misses Cathcart Lynn, Jeane Paule, and Leonie Lascelles.

Notes from Canada.

(From Our Canadian Correspondent.)

SOME weeks ago a scheme to utilise the great rise and fall of the tides in the Bay of Fundy for power purposes was voted upon in the State of Maine, U.S.A., and received the approval of the electorate. Mr. Cooper, a well-known United States engineer, proposes to spend about 75 million dollars for the purpose of developing from 500,000 to 700,000 h.p. in order to furnish electrical energy for the needs of Eastern Canada and the eastern United States. The scheme would involve building a series of dams from the mainland of Maine to that of New Brunswick, Canada; by this means, according to the *Canadian Engineer*, two basins, 100 and 50 square miles in area, in the Passamaquoddy and Cobscook Bays, respectively, would be formed. The dam gates to the larger basin would be kept open during rising tides and those to the smaller during falling tides. The scheme is of interest to Canada because one end of the dams would be on Canadian soil and also because part of the electricity generated would be available for use in this country. Mr. Cooper believes that the project can be financed if proper agreements between the Governments of the two countries can be arrived at.

Another proposal of a unique character has recently been given publicity by Mr. C. Lorne Campbell, a Toronto engineer. Mr. Campbell believes that two of the rivers (Albany and Ogoki) now flowing into James and Hudson Bays, could be dammed and made to run southward—by cutting a canal through the height of land—to the Nipigon River, whence their waters would reach Lake Superior, thus finally arriving at the Atlantic Ocean by way of the Great Lakes and the Niagara and St. Lawrence Rivers. This bold plan would create a sixth great lake about twice as big as Lake Ontario, measuring some 200 miles by 90 miles and submerging about 18,000 square miles of land.

The extra water flowing in the new direction would, it is claimed, furnish about 200,000 more horse-power at Camero Falls, near Port Arthur, where the Hydro-Electric Power Commission of Ontario has its Nipigon development; about 50,000 h.p. more at Sault Ste. Marie, and about 300,000 h.p. more on the Niagara River. The cost of the proposed scheme is estimated at about $200,000,000. No mention seems to have been made of extra power being made available on the St. Lawrence River, but there would certainly be some. The level of the Great Lakes would also be raised a little, which would benefit navigation. The land to be submerged contains much timber suitable for pulpwood and other purposes which, according to the author of the scheme, could be cut and sold. Such a plan would take a long time to get started on account of the many factors, legal, financial, and engineering, which would have to be considered.

The Iron and Steel Institute.—The annual meeting of the above Institute will take place on May 6th and 7th, at the Institution of Civil Engineers, Great George Street, London S.W.1, by kind permission of the Council, and the annual dinner will be held on May 6th, at the Connaught Rooms, Gt. Queen Street, W.C.2. It is expected that, by the kindness of the Swedish Ironmasters, the autumn meeting, 1926, will take place at Stockholm. As soon as the arrangements have been confirmed, the date and further details will be announced.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

New G.E.C. Motor Starters.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, recently introduced a comprehensive range of multiple-lever contactor motor starters for use with d.c. motors of from 80 to 300 h.p., not exceeding 500 volts, and full-load currents of from 150 to 550 amperes, as starters of the face-plate pattern are not suitable for such large currents. They consist of a single-pole contactor with an overload relay for connection to the line, and a number of single-pole switches, each of which cuts out a section of the starting resistance, the number of sections depending on the capacity of the starter. Operated by a hand wheel and worm, the latter sliding along a keyed shaft, the contactor and switches are mounted on a slate panel, and the cast alloy grid resistances are mounted below the switchgear, the complete apparatus being enclosed in a steel-plate casing. When the "start" push-button is pressed, the solenoid of the line contactor is energised, and with the push button still pressed the hand wheel is turned so as to rotate the sliding worm, which engages with the heel of each of the switches and closes them one at a time. When the last switch is closed, the motor is connected to the line and the push button can be released. The "stop" button causes the line contactor to open, and it is impossible to switch on the current with any of the starting resistance short circuited, or run the motor with a portion of the resistance in circuit. The contactor automatically interrupts the motor circuit should the supply fail, and full protection is provided against overloads. Cable inlets are provided at the back of the starter.

A Screw for Hammer Drive.

The latest development of the RAWLPLUG CO. OF CANADA, Southam Buildings, Bleury Street, Montreal, is the "Drivscru," illustrated in fig. 1. By virtue of a very coarse and wide-angle thread, the screw may be knocked in instead

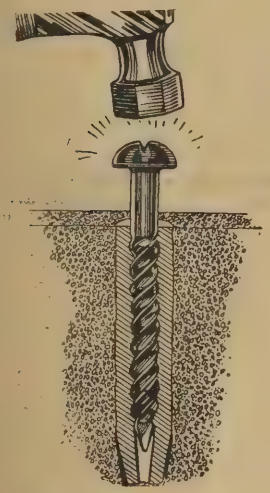


Fig. 1.—The "Drivscru."



Fig. 2.—"Quickfix" Gallery.

of turned with a screw driver in the usual manner. This device should prove an attraction to those wiremen and others, who show a preference for the hammer to the screw driver.

A New Shade Gallery.

A new gallery for electric light shades, the "Quickfix," fig. 2, which has been designed for quick operation, has recently been put on the market by MESSRS. CHARLESWORTH PEEBLES & CO., 5, Eden Street, Hampstead Road, London, N.W.1. The feature of the device is a circular steel spring, fitted with three lugs suitably shaped to fit inside the top of the globe or shade to be supported, which is fixed, at its centre, internally to a metal band composing the base of the gallery. By pressing together the ends of the spring, which are suitably finished outside the band, the diameter of the spring is reduced. The globe or shade is then put in position and the spring released, when the lugs will, it is claimed, firmly grip the shade. It is claimed that this is the only gallery on the market which grips the shade from the inside. The spring arrangement allows for the expansion and contraction of the glass, &c. The absence of tightening screws is another feature which is claimed to give this gallery superiority over the usual types.

An Automatic Current Calculator.

The LANCASHIRE DYNAMO & MOTOR CO., LTD., have sent us a sample of a limited supply of automatic current calculators which is available to those interested. The principle of the device lies in the usual desk calculator, and the attraction between two bar magnets, one fixed and one free.

Electric Rivet Heaters.

The accompanying illustration, fig. 3, shows one of two electric rivet heaters which are being produced by the AMERICAN HOIST & DERRICK CO., St. Paul, Minn., which are intended for rivet-heating work in boiler and tank shops, &c. The model illustrated is designed particularly for use on structural work and four rivets are heated simultaneously. Three contact elements are provided. The centre set is stationary and is used at both top and bottom positions. Upper and lower sets are arranged to slide up and down and are actuated by foot

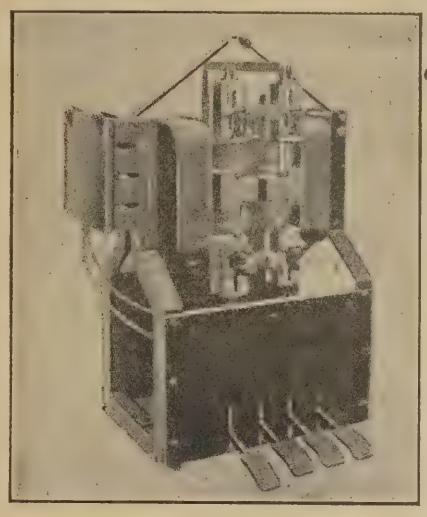


Fig. 3.—Electric Rivet-Heater.

pedals at the front. The stroke and setting of the sliding contacts permit of heating rivets up to and including 9 in. in length. The control switches are interlocked and arranged to regulate the current for varying the heating speeds and rivet sizes.

An Electric Ploughing Tractor.

We illustrate herewith, in fig. 4, an electric ploughing tractor which is marketed by ETABLISSEMENTS JOYA, Grenoble, France, and for which Mr. Paul Dieny, 20-21, Laurence Pountney Lane, London, E.C.4, is the agent in this country. The "Mototreuil" has been designed particularly for market gardeners and for vineyards. The motor and driving equipment are mounted on a two-wheel truck. A driving pulley which is belt driven from the motor is geared to a drum from which

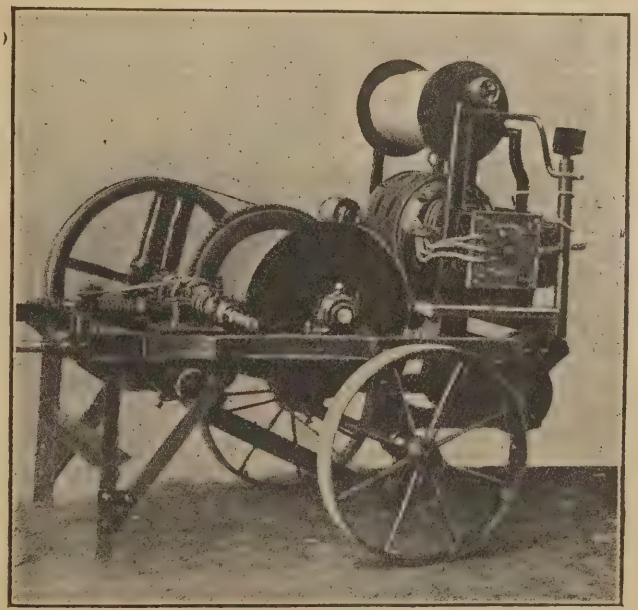


Fig. 4.—The "Mototreuil" Electric Plough Tractor.

the wheels are propelled by a chain drive. The necessary supply cable is carried on a small drum placed over the motor and is wound by means of a small hand winch. It is claimed that when ploughing with a Brabant single, 11-in. plough, making a furrow 14 in. wide, such a machine would cover one acre in seven hours. With a double plough, making two furrows, 7 in. deep on a width of 2 ft., the same area can be ploughed in four hours. Larger machines equipped with motors up to 15 h.p. can be supplied.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

(*Concluded from page 232.*)

H. Tinsley & Co.

Among the large number of exhibits on this stand, including several forms of potentiometers and the strobometer, an improved form of Dr. Drysdale's stroboscope, the most interesting instrument seen was a Willans test set. This has been devised for testing the performance of intervalve transformers by measuring their voltage amplification in conjunction with an appropriate valve. It depends for its operation on a novel bridge arrangement whereby both the phase shift and scalar amplification are given. The anodes of two valves, the filaments of which are controlled by separate rheostats, are connected in parallel through a pair of telephones to a h.p. supply, and to the grids of the valves are applied alternating pressures from any source. If the valves have linear characteristics and identical mutual conductances, and if the grid pressures are equal and in phase opposition, then no sound will be heard in the telephones. Fig. 26 is a simplified circuit diagram of the apparatus. Valve A is followed by an intervalve transformer T, and the object of the measurement is to ascertain the vector voltage amplification of these. The anodes of valves B and B' and the primary winding of a telephone transformer P are connected in parallel. To the grid of the first valve is applied a fraction of the input pressure to a bridge of four arms, three of 1,000 ohms resistance and one in general slightly different from that value. The condenser C can be connected either across the arms 2-4 or 3-4.

The mutual conductances of the valves B and B' are rendered the same by means of connecting the grid of valve B to the point 3 on the bridge, and obtaining a balance, and by adjusting the filament resistances of these valves the sound in the receivers is made zero. By changing over the switch S_1 to the output of the pressure amplifier, and displacing the balance of the bridge until the output pressure is such that no sound is heard in the telephones, the output pressure of the transformer is made equal and opposite to the pressure across the bridge arm 2-4, and the input pressure to the amplifier equal to the pressure between points 1 and 4 on the bridge. Consequently the amplification ratio is equal and opposite to the ratio of these pressures, which may be readily calculated. An essential feature of the instrument is that there is practically no impedance either in the input grid circuit or in the output anode circuit. For the purpose of measuring voltage amplification of very small value, means are provided (not shown in illustration) for connecting the grid of B' to a tapping point in the resistance of the arm 2-4. Numerous measurements are claimed to have been carried out with this apparatus on intervalve transformers of all kinds, and results almost exactly in agreement with theory have been obtained. The analysis of a transformer is far more readily carried out by virtue of the fact that the vector ratio of amplification is yielded by the measurement, and it is possible to predict the amplification of the transformer at frequencies beyond the range of convenient measurement by extrapolation.

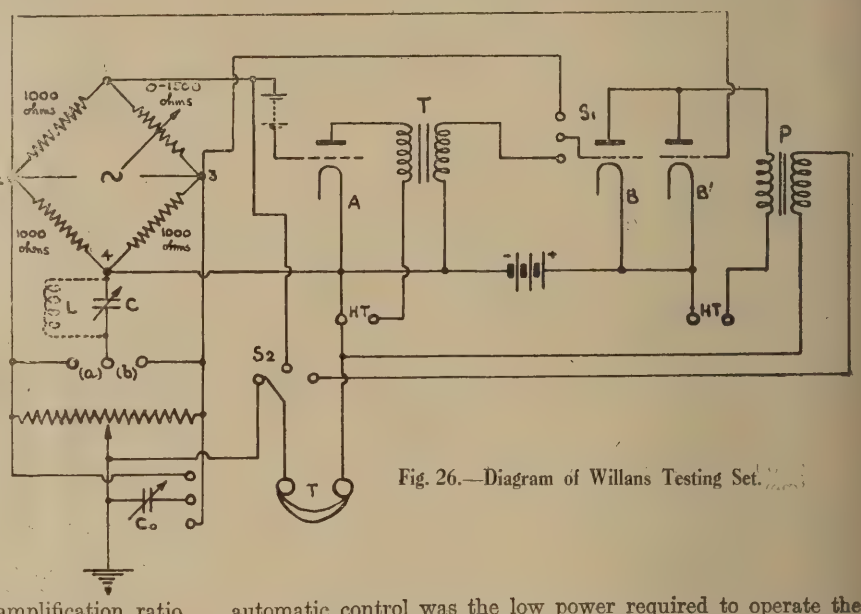


Fig. 26.—Diagram of Willans Testing Set.

Kelvin, Bottomley & Baird, Ltd.

This company had a very interesting exhibit of quartz mercury-vapour lamps, "daylight" lamps, and ultra-violet light apparatus. The mercury-vapour lamps are of the K.B.B. atmospheric type, the radiation from which is very rich in ultra-violet rays. The lamp is started without the use of tilting mechanism by means of a small heating coil surrounding a limb which projects from the arc tube; when the lamp is switched on, the arc is started by the vaporisation of mercury in this small bulb, and directly the arc is established the heating coil is automatically cut out of circuit. The lamp being atmospheric, can easily be opened for cleaning, consequently the quartz burner, apart from mechanical breakage, is practically everlasting. This type of lamp was shown with a variety of portable floor stands and other fittings with which it can be conveniently employed for therapeutic purposes, whilst the operator is protected from the ultra-violet rays by suitable means. Spun aluminium localising tubes of various shapes are provided with the lamps, and the apparatus is so designed that the light can be thrown in any required direction. The lamps are made for any d.c. pressure from 100 to 500 volts, and take a starting current of 4½ amps., the steady current being slightly under 3 amps. when the lamp is burning. The whole of these apparatus are of British make.

The K.B.B.-Macbeth artificial daylight lamps consist of ordinary clear glass incandescent lamps, the light from which is corrected by passing through a special filter which is of solid tinted glass. The filters are graded so that any desired daylight equivalent ranging from sunlight to blue skylight can be obtained, and the lamps are housed in fittings of various patterns. According to a report of tests made by the National Physical Laboratory on one of these lamps, the light exactly matched the colour of an overcast northerly sky.

Gambrell Bros., Ltd.

This firm had a large display of apparatus for general testing, comprising resistance boxes and bridges, potentiometers, galvanometers, voltmeters and ammeters, and accessories, as well as wireless apparatus and components.

A. Gallenkamp & Co., Ltd.

Electric furnaces in operation were shown at this stand as well as electro-titration apparatus and an electrically-heated thermostat bath with automatic temperature control to within one hundredth of a degree Centigrade; a special feature of the automatic control was the low power required to operate the relay, which acts with 0.2 milliamp.

Research and Experimental Section.

This section was a novel and very welcome feature, enabling a number of processes and laboratory expedients to be demonstrated. In group A, the Accoustical Section, War Office (Major W. S. Tucker), showed a sound locator for determining the position of aircraft, a camera and automatic developer for recording galvanometer deflections, and special types of the Tucker hot-wire microphone. From the Admiralty Research Laboratory, Teddington, there came a chronometer with a phonic motor drive designed to measure a time interval of the order of a few seconds with an accuracy of one-thousandth of a second for submarine sound ranging and similar measurements. Other exhibits from the same source were piezo-electric oscillographs, a neon lamp time marker, and visual leader gear.

Prof. H. L. Callendar, F.R.S., and Dr. H. Moss showed their electric air flowmeter. The Research Laboratories of the General Electric Co., Ltd., showed a great variety of ingenious devices for use in a research laboratory; specially interesting features were joints between glass and silica, with the aid of pyrex, and large glass-to-metal joints for use on valves with water-cooled anodes. Henley's Research Laboratories showed Capt. P. Dunsheath's "solid diagrams," illustrating the characteristics of cable dielectrics, and the National Physical Laboratory showed an all-steel mercury-vapour vacuum pump, an X-ray tube for crystal analysis work, a mercury-cup thermo-electric key, and a hot-wire velocity meter, as well as various physical apparatus.

In group B a striking experiment was shown by Mr. G. L. Addenbrooke, in which a column of castor oil is attracted upwards to an electrode of an excited Wimshurst machine. Mr. W. Brooks Sayers showed some magnetic effects, and Mr. F. E. Smith, F.R.S., showed a simple current weigher "designed to show how easy it is to measure current in absolute units." Mr. F. H. Glew demonstrated magnetic levitation and radio-activity.

In group C Prof. Sir William Bragg, F.R.S., showed apparatus illustrating Faraday's discovery of electro-magnetic induction in 1831, and Mr. F. E. Smith exhibited the original rotating coil used in 1862 by the British Association Committee for the measurement of a resistance in terms of the centimetre and second.

A discourse was delivered on each evening, that on January 7th relating to "Electrical Listening," by Major W. S. Tucker, D.Sc. This lecture was illustrated by a series of exceedingly interesting demonstrations of the properties of microphones, especially the Tucker hot-wire microphones used in military sound ranging. It was shown how records were obtained of sound waves from various sources, including a siren and a thunderstorm.

There is no doubt that the new departures on this occasion, including the opening of the exhibition on the third day and the demonstrations of laboratory methods, greatly increased the success and popularity of this event, which has now reached its sixteenth year. Perhaps on the next occasion care will be taken that the general public is effectively informed of the privilege extended to it on the third day; we feel sure that if this were done a very large attendance would be recorded, and the educational value of the exhibition would be greatly increased.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Government Electricity Scheme.—The Government's electricity proposals were frequently referred to in the House of Commons last week during the debate on the motion for the presentation of an address in reply to the King's Speech.

Mr. HURST, the mover of the motion, said that the House would welcome the proposed Electricity Bill, the object of which was to make the supply of electricity more abundant and more universally available in this country.

Mr. LLOYD GEORGE said that the more power we derived from electricity the more coal we saved. He welcomed the introduction of the new Bill, although the saving of coal would mean that more men would be unemployed in the coal-mining industry.

Mr. DENNIS HERBERT said that the new proposals had been received, by those competent to judge, with a considerable measure of caution, although there had been some cautious approval of them. He admitted that they could not allow private enterprise to have its own way entirely. There must be a certain amount of State regulation or co-ordination. Many members of the House sincerely hoped that the Government would be successful in the difficult task of so imposing a modified measure of Government control or Government organisation with regard to electricity, that it would prevent the danger of haphazard development by private enterprise, but would, on the other hand, avoid the blight of Government control.

Captain GUNSTON said that from a recent report he gathered that electricity could be bought in the Newcastle district considerably cheaper than in Ontario, and that should encourage us to develop our latent resources, which might do something to help the mining situation. It was very necessary, however, to educate the people of this country to the advantages of electricity.

Mr. SNOWDEN contended that an essential public service like electricity should not be permitted to be a field for the private exploitation of the public, and any scheme for the reorganisation of the electricity supply should consolidate and co-ordinate the whole of the business under public ownership.

In the House of Lords comment was also made on the scheme. Lord RAYLEIGH contended that in generating electricity, units of not less than 20,000 h.p. ought to be employed, and that necessarily involved the abandonment of all small-scale generating stations. This was one of the essentials of any real improvement in the electrical situation. The supplies of electricity must be linked up in different parts of the country by long-distance transmission lines and the whole country covered with an electrical network. The co-ordination of the electrical supply would require the standardisation of frequency all over the country, and this would be a difficult undertaking, involving, no doubt, the sacrifice of much valuable plant. Exactly how far the process could be carried was something which must be a matter of judicious compromise.

Lord HALDANE welcomed the proposed Bill, and said it was essential to have one standard of frequency. We ought to be the greatest manufacturers of electrical plant for export in the world. We had admirable electrical engineers and firms of electrical constructors, but they could not sell their products abroad as they should do because they had to manufacture for several frequencies here and another for the foreign market.

Notice has been given that the Bill will be introduced in the House of Commons, probably next week.

The Marine Wireless Dispute.—On February 4th, in reply to several questions on this dispute, Sir P. CUNLIFFE-LISTER, the President of the Board of Trade, said that he was aware that there were a number of ships that were without the services of wireless operators, and that on others there were operators who did not possess full qualifications. The question of appointing a Court of Inquiry was one for the Ministry of Labour. The action taken by the Government during the present strike was the same as that taken by previous Governments on similar occasions; it could be challenged in the Courts. The number of ships which had sailed without wireless operators since the beginning of the dispute up to the end of January was 1,187, 85 of which were passenger ships.

No ships subject to the provisions of the Merchant Shipping (Wireless Telegraphy) Act, 1919, had been reported missing since November 26th, 1925. A few such ships had been reported overdue, but they had all since arrived at their destinations.

The Severn Barrage Scheme.—On February 4th, in reply to Mr. Shaw, who asked if a report on the Severn barrage scheme had been presented by a scientific committee, Col. MOORE-BRABAZON, Parliamentary Secretary to the Ministry of Transport, said that the sub-committee of the Committee of Civil Research, who recently considered this matter, had reported to the effect that a *prima facie* case had been established for undertaking further investigations with a view to determining whether the technical difficulties of constructing a Severn barrage could be surmounted, and this recommendation had been accepted by the Government. It was not proposed to publish the report of this sub-committee, which was not a scientific committee, but when data had been accumulated he had no doubt that a report would be published.

Col. WOODCOCK asked Col. Moore-Brabazon whether he was aware that within a few miles of this proposed Severn barrage the city of Bristol was building enormous electric power stations at an initial cost of over £1,000,000. If the Government had given permission for these to be built, why should they go on with the Severn barrage scheme, which would supply the same area?

Col. MOORE-BRABAZON replied that the whole question of harnessing the tide in a country like this was very important. The possibility of the scheme from the point of view of power was in the neighbourhood of 300,000 kW.

The Factory Bill.—On February 4th, Sir W. JOYNSON-HICKS, the Home Secretary, informed Mr. Robinson that it was not proposed to proceed with the Factory Bill during the current session, but it was the intention of the Government that the Bill should be passed during the present Parliament.

Private Bills.—The following private Bills have been introduced into the House of Commons and read a first time:—The Bristol Corporation Bill, the Guildford Corporation Bill, the Hackney Borough Council Bill, the Mynyddislwyn Urban District Council Bill, and the Swindon Corporation Bill, some of the objects of which, among others, are to enable the various local authorities to make further provisions with regard to their electricity undertakings; the Lancaster Corporation Bill, the Hartlepools Corporation (Trolley Vehicles) Bill, and the Ramsbottom Urban District Council Bill, which will enable the local authorities to run trolley vehicles; the London Electric and Metropolitan District Railway Companies Bill, "to empower the London Electric and the Metropolitan District Railway Companies to execute works and the London Electric Railway Company to raise additional capital"; the London Power Company Bill, "to confer upon the London Power Company, Ltd., powers to acquire lands and to construct a generating station and other works"; the Metropolitan Electric Supply Company Bill, "to confer powers on the Metropolitan Electric Supply Company, Ltd."; and the Metropolitan Railway Bill, "to empower the Metropolitan Railway Co. to construct new railways and other works and to acquire lands."

Standards in Belgium.—The Comité Electrotechnique Belge, of Brussels, has adopted the recommendation of the International Electrotechnical Commission with regard to low-pressure standards. In future, therefore, the pressures to be regarded as standard in Belgium are as follows:—Direct: 110, 2 by 110, 4 by 110, 220, 2 by 220, and 440 V. Single phase: 100, 2 by 100, and 220 V. Three-phase: 110, 127 by 220 V (between phase and neutral point). The following table shows the high-pressure standards which have been adopted:—

1,000	volts	...	45,000 volts
2,000	,,	...	60,000 ,,
3,000	,,	...	80,000 ,,
6,000	,,	...	100,000 ,,
10,000	,,	...	150,000 ,,
15,000	,,	...	200,000 ,,
20,000	,,	...	300,000 ,,
30,000	,,		

A standard test for oils for transformers and switchgear has also been adopted.

Domestic Voltage Regulation.—Editorial remarks in the *Electrical World* make the fact apparent that domestic loads have grown so large in America that serious attention must be given both to voltage regulation and wiring in homes. The houses are becoming miniature machine shops with a variety of motors and heating devices which are bound to cause voltage fluctuations if the wiring does no more than comply with the formal underwriters' regulations. Some appliances, such as electric refrigerators, automatic pumps, ventilating motors, and oil-burner motors, have no respect for time, or load, and may start at the peak period, or at night when all lamps are burning. These voltage fluctuations are annoying because of their effect on the light, and they may become more so as relays and controls are developed and used for household applications. The supply authority may enlarge transformers and secondary distribution copper, and yet not improve the situation materially. "The answer to the problem lies in the development of some kind of house voltage regulator. All electrical men who study this situation will admit its serious character, for even now it is affecting the development of domestic load."

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Institution of Electrical Engineers.

It is understood that one of the rules governing admission to the Institution as an Associate Member is that the candidate must have held a superior position in one or other of the branches of electrical engineering for a period of not less than five years. A foreman, for instance, would not be eligible as an Associate Member no matter what degree of knowledge or skill he possessed. On the other hand, an individual with comparatively no electrical knowledge, but having sufficient cash to carry on an electrical business for a period of five years (with other people's brains), would be eligible. The foregoing is my interpretation of the rule referred to, but, of course, I may be in error. Previous to my obtaining particulars regarding the matter in question, I had always been under the impression that superior knowledge weighed more with the I.E.E. than superior position, but my impression has been in error. With all due respect of the Institution, I would suggest that they delete the word "position" and substitute for it "knowledge or skill." By this alteration an unfair and autocratic rule would be corrected.

Non-Member.

January 30th, 1926.

Electrical Showrooms.

The recent article by Mr. W. A. Gillott, A.M.I.E.E., and the letter of Miss Ethel Prentice will, I am sure, show a large number of readers the absolute necessity of electrical showrooms, if the general public is to get a sound idea as to the innumerable uses electricity can be put to for domestic purposes.

Being greatly interested in publicity matter for promoting the further use of electricity in the home, I quite agree that the value of a showroom has been sadly neglected. Every person who wishes to have electricity installed in his home is by no means an electrical engineer. It therefore remains to provide a scheme whereby this person can see with what simplicity domestic appliances can be operated. If given proper consideration, the best, and probably the only, scheme of any real value is a suitably-equipped showroom.

In the lay-out of a showroom, great thought, care, and time should be given to what exactly is required, and lighting schemes must be carefully planned. It is not a bit of use doing the thing haphazard—this will mean failure to attain the object aimed at. Each domestic appliance should be fitted in position with care, and every facility for the easy operation of any appliance should be provided.

The staff engaged in a showroom should be alert, and smart in appearance, and have a thorough knowledge and be able to give quick information on any points relating to the appliances shown, which a particular client may ask for. If possible, arrangements should be made so that practical demonstrations could be given with cooking appliances, &c., taking into consideration that the person chiefly interested in domestic appliances is the housewife; she is the person whose interest should be obtained, and to secure this interest a showroom would form a very good magnet, inasmuch as she would be able to see personally with what simplicity these appliances can be operated.

Further advertising matter would be an advantage. An illustrated booklet, leaflets, &c., dealing with the different domestic appliances, giving estimates of cost, and any further details which would be of service to the prospective purchaser, should be provided.

Mr. Gillott says in his article: "What of the contractor?" I will ask the question: "Is every contractor in a position to have a showroom?" Possibly not!—then, in my opinion, the supply authority in his district should have a well-equipped showroom; this could be a help to him instead of a hindrance. In any case, I hope that those who think not will take the offer made by Mr. Gillott in his article, and let us try to bring the full benefits that electricity can provide to the attention of the public.

A properly-organised and suitably-equipped showroom is undoubtedly one of the best forms of advertising. Now is the time, when electricity is coming so much to the fore, when the question of showrooms should receive the attention it rightly deserves.

R. Williams.

Birmingham, *February 1st*, 1926.

A National Electrical Convention.

In the Electrical Review of January 29th, you invite expressions of opinion from those interested in Mr. S. T. Allen's proposals for the holding of a National Electrical Convention.

It seems to me that the outstanding value of such a function would be its educational value to the lay mind—both men and women—all of whom are potential users of electrical energy in one form or another.

We all realise that what is known as the electrical industry is too remote from the potential customer, who sees most of its difficulties in initiation and little of its tremendous mission as a distributor of comfort and of service, and as a great saver of time.

Further, the public needs to be educated on the question of, and reasons for, the cost of electricity, and to get rid of the idea that some malevolent engineer in the background is deliberately preventing its extension on lines which would bring its use to the door of everybody.

Part of the value of such a conference would be that a question of first-rate importance, such as the need for a better selling organisation, and more practical methods for presenting the electrical idea to the public, would be considered, and the best methods applied to this problem, as foreshadowed by the Prime Minister the other day.

Not one, but all, sections of the industry are vitally concerned in this aspect of our ever-growing needs.

In this connection may I again emphasise a suggestion which has found favour in a number of quarters—that the supply undertakings should train and employ a body of educated women who would eventually understand the general economic difficulties of the industry and be able to impart an understanding of electrical apparatus and methods in the home, in a way that every intelligent housewife can appreciate and understand. Such a liaison between the undertakings and the home consumer would do much to popularise the use of electricity.

Women demonstrators have done and are doing magnificent work, and a greater extension of their calling would do much to make electricity the national servant it is surely capable of being.

Such a conference as is projected, if it could discuss homely topics, as well as the wider questions involved in the industry, would, I am sure, be of the greatest benefit to all concerned.

With all the brains and organising ability possessed by the industry it seems to me that there is no difficulty whatever in the way of arranging a conference such as that outlined by Mr. S. T. Allen.

Caroline Haslett,
Director, Electrical Association for Women.

London, *February 1st*, 1926.

The Government Electricity Scheme.

It is already evident that opinions regarding the above scheme are by no means unanimous, and, further, are not likely to be.

It is evident that a great deal of adverse criticism is based on thoroughly sound reason, but, on the other hand, it is at least reasonable to assume that those responsible for drawing up the scheme found very good ground for arriving at their conclusion that it is financially and economically sound.

If we take these two views as extremes, perhaps the solution lies at a point between them.

We are told that the grid system is to materialise only gradually, and this in itself is sound, but financial soundness seems to me to hinge entirely on the method of growth adopted. It has been suggested that each J.E.A. should be left to develop its own already delimited district. I would suggest a combination of the two ideas.

Again, assuming that the Government has in view a more or less definite idea as to what the final realised plans are to look like, this plan should be published in full. Those parts of the scheme to be first dealt with, which are no doubt concerned with the more densely inhabited areas and where the minimum expenditure on interconnecting mains will bring the maximum benefits, could then be embarked upon. The J.E. Authorities of the remaining areas working with the ultimate plan in their minds could then each be left to develop its district, modelling its mains layout so that eventually with a minimum of further expense its system could be interconnected with adjoining systems.

It seems reasonable to imagine that much good preliminary work could thus be done by those independent authorities who would of course be guided by the Electricity Commissioners in the same way as at present, only with more authority as to the design of the feeder systems. It is the common experience in designing distribution systems that what might appear to be for the best at the moment is not by any means ideal if reasonable future developments are taken into account, and the same might apply to feeders if the "grand vision" is allowed to exert its influence. It is likely that in very many instances such a policy would alter the route of "backbone" feeders. It might conceivably also alter in some cases the class of feeder laid down, and incidentally influence the promiscuous tapping, the point of tapping, and the layout of sub-stations. Many more effects of such a policy will readily suggest themselves, especially to those dealing with larger districts, where the policy would be most applicable.

In any case, it is axiomatic that work done to a plan will mean greater efficiency than will haphazard procedure, and I see no reason why the electricity supply layout of this country should prove an exception.

Sevenoaks, *February 1st*, 1926. **C. F. Mounsdon.**

I was indeed interested in Mr. C. Culmer Hodges's letter in your current issue; so much so that I was constrained to turn up particulars of his station in "Garcke."

I feel that this is a most striking instance of a system which would be greatly benefited by the introduction of the Govern-

nent scheme. Here is an extremely small station (total plant apacity, 180 kW) which sells its electricity at 9d. per unit or lighting, 3d. for power, and 1½d. for cooking; the bulk of ts load is lighting, its revenue being 7.39d., while its work- ng costs were 5.46d., per unit sold, in the year 1924. Mr. Hodges states that a bulk supply would cost 3d. per unit: why ot, then, sell at an average figure of 4.93d. per unit? This vould enable electricity to be sold at the following prices:— d. per unit for lighting, 2d. for power, 1d. for cooking, while till maintaining the same gross profit of 1.93d. per unit. Surely these are better than the present charges; and would hey not most certainly encourage an increased use of elec- ricity? If one assumes that all the electricity at present sold ould be sold on the Dundee Tariff at the same total price including the fixed charge of 8s. per 100 sq. ft.), then the ixed charge works out at 5.89d. per unit sold. If, then, a ulk supply was taken and the same fixed charge maintained, he electricity could be *given away*, and a magnificent profit vould still be made!

It would seem that the small outlying town has much to ain by "Government" electricity.

H. J. Allcock.

Manchester, *February 1st*, 1926.

Let Your Boy Benefit by Your Experience!

The boy who, ambitious to become an engineer, has an ngineer for his father, ought to be a happy boy. The father ught to be a proud father. Too often the father imagines imself a disillusioned man. The pet theme of many such athers is that they know too much to wish their sons to ollow in father's footsteps. So among engineers (as, indeed, n almost every other walk of life) there is a prejudice against ames, junior, following the lead of James, senior.

So far as engineering is concerned—and many other trades r professions also—this is a grave mistake. The father knows, r he should know, the various ropes. Especially if he be self-made man, he will be in excellent case to give his son better start off than he was himself blessed with. Much of he blundering in a youth's career is due to his lack of direction. here are many who could *put him wise;* but, unfortunately, e does not know them, nor they him. But in the case postu- ated, Father knows—again, lucky son! The father can guide he son's career; often he can put a good word in for him ith the people who can turn the wheels. Not infrequently good workman, well in favour with foreman and manager, s able to get a son admirably placed—placed on an equality, s regards opportunity, with the best. Then it is up to the on to make good midst really favourable conditions for aking good. Such a father, helping such a son, forgets his wn disappointments if only his son wins his spurs. Such son, being assisted by such a father, if he succeed, should e happy—not least of all because his father—no great success imself—helped him, the son, to rise. No matter how great is fame may be, the son's triumph will be his father's also.

W. Roland Needham.

Goodmayes.

The Metering of Three-phase Power.

I must thank "A Meter Superintendent" for his correction f my statement concerning the limits of accuracy of a two- lement three-phase meter. The points which he mentioned ere missed by me, as I had it firmly fixed in my mind that he subject under discussion was the metering of *three-phase* ower and not the metering of other phenomenal circuits.

I feel sure that if your correspondent will keep that fact in is mind he will find that the conditions which I mentioned s being necessary for correct registration with a two-element hree-phase four-wire meter are correctly stated.

It is, of course, quite easy to point out that an unequal oltage may be compensated by varying the angle between he phases; but such things do not usually happen in practice nd, therefore, do not enter into this discussion.

If your correspondent will take my three conditions and ead them one by one and treat each one separately, I think e will have no difficulty in finding them accurately stated.

H. Hugh Jaques.

London, *February 1st*, 1926.

Fraudulent Trading.

The radio industry to-day seems to be the happy hunting- round for all business crooks and fraudulent traders. We, n common with many of our friends in the industry, have uffered extensively from these rogues, and we consider that ; is high time the whole of the trade got together, and made supreme effort to get the industry cleared of this parasite.

If all manufacturers in the industry got together—preferably nrough a trade association—it would be quite a simple and peedy matter to do this.

The methods of these fraudulent traders are, in all cases, lmost identical—they start off as dealers in the radio industry, nd are able by some means to furnish references, and offer o pay cash on delivery for goods. This arrangement is kept p for a short time, and then the manufacturer is informed iat owing to large accounts outstanding, &c., they will be lad to have a monthly account, which is also paid promptly or a short time. Then a large order is sent—amounting to undreds of pounds in some cases—and payment is not made. writ is issued, but in the meantime a new company is ormed and the manufacturer is told by his solicitor that the old company has no assets and execution cannot be made. The new company carries on business in the same premises and with exactly the same stock and carries on, presumably, a fresh course of robbery from other manufacturers.

We know of several conscientious, honest manufacturers, in a small way of business, who have been absolutely ruined through these transactions.

We consider that a means of stopping this sort of business would be for the radio manufacturers to form a small association, paying a subscription according to their turnover, and employ a first-class solicitor to take these matters up, however small the amount, and fight the case through to a finish, because if these fraudulent traders can get off scot free with a small amount, the next time the amount will be larger and so on, until very substantial sums are involved, whereas if they are stopped with the small sums, it is highly probable that the matter would end there, and they would be forced out of the trade.

We have a case now of our own in which approximately £300 is involved—a case of absolute fraud—and we intend, whatever it costs, to fight the matter through. Unfortunately it will undoubtedly be an expensive matter, as the law seems to be so loose with these rogues, and for a time they simply laugh at it; but they all make slips, and can generally be brought to book if the matter is pushed to the end.

We are quite sure that if the whole trade got together and pooled its information and notified all such cases, this fraudulent trading could be stopped, and it is high time that some action was taken in the matter.

There is another form of trading which we consider also comes within the category of fraud; a so-called wholesaler sends an inquiry to a manufacturer for a large quantity of goods. He is quoted the usual wholesale factors' discount, and he replies stating that he has to sell to factors, and in view of the quantity he is prepared to order, can he have a special discount? In some cases the quantity required warrants an extra discount, and this is given by the manufacturer. The wholesaler then takes about one-third of the quantity ordered and asks the manufacturer to hold up delivery, as sales have been slow and he has a fair stock, and the balance of the order is never taken. We also have one or two cases on our books of this description, and we intend to fight these cases also. We demand that either the balance of the order be taken, or that the wholesaler shall pay the difference between the ordinary wholesale factors' discount and the extra discount allowed him for the special large quantity ordered.

It would be interesting to hear the experiences of other manufacturers on this question.

For and on behalf of **S. A. Lamplugh, Ltd.**
J. Stanley Spittle, *Managing Director.*

Birmingham, *February 5th*, 1926.

Laundering—As Others See It.

Commenting upon the Government's electricity scheme, "The Power Laundry" points out that "cheap electrical power will mean the wider adoption of the electric drive, and, so far as possible, individual drives for all the large [laundry] machines. . . . This should lead to a substantial cheapening in laundry costs. The use of the electric van for laundry work should also receive a great stimulus. Laundries will be cleaner, brighter and healthier. There is, however, another side to the matter, which is not quite so rosy. The universal distribution of cheap current to every household and the rapidly growing familiarity with its practical use may, and probably will, lead to the production of electrically-driven home washers on a considerable scale. With an electrically-driven washer, an electric iron, and an electrically-heated drying cupboard, the housewife will be tempted to do her work at home rather than send it to the laundry. As a matter of fact, this is what has actually taken place in the United States of America." This candid comment lends added interest to your editorials and articles on electric washers and home-laundry machinery (Elec. Rev., December 18th, *et seq.*), the potentialities of which, from the load-building viewpoint, do not appear to be generally appreciated.

N. L. W. E.

January 30th, 1926.

The All-Electric House.

I think your contributor, Mr. E. W. Dickinson, has a delightful sense of humour in describing himself as an "electrical enthusiast" at the end of his most useful piece of propaganda for the gas people.

But it was cruel of you not to tell him that the things he finds economically impossible are being done, almost at his doorstep as well as in many other parts of the kingdom; and that it was discovered long ago that his figures are only part of the story.

Those of us who have been using not only electric cooking but an all-electric house for years, know that we cannot get a similar service any cheaper with gas. Even if we could, we would rather go with a little less service than go back to such a wretched substitute, should severe financial stress make the saving of a penny or twopence a day a vital necessity.

If enthusiasm for electricity induces Mr. Dickinson to advocate the use of gas, I am longing to see him write on something that leaves him cold!

Ernest E. Sharp.

London, *February 6th*, 1926.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 3rd. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Globar (lettering and design). No. 458,440. Class 4. Carbons and carbon compounds for electrical purposes.—American Resistor Co., Milwaukee, Wis., U.S.A. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Encore. No. 456,530. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—F. W. West and H. W. Jackson, 16, Lower Richmond Road, S.W.15.

Fairy. No. 460,823. Class 8. Thermionic valves.—Louis Kremner, 49a, Shudehill, Manchester.

Stiradio. No. 457,644. Class 8. High- and low-frequency transformers, loud speakers, crystal and valve receiving sets, detector crystals, headphones, variometers, variable and fixed electrical condensers, electric batteries and accumulators, thermionic valves, induction coils, &c., all for use in radio-telephony.—Stirlings, Ltd., 17, Clarence Street, Kingston-on-Thames.

Zenith. No. 461,778. Class 8. Electrical resistances, potentiometers, rheostats, transformers, and rectifiers for accumulator charging and for other purposes.—R. Lehmann & Co., Ltd., Villiers Road, Willesden Green, N.W.2.

Microstat. No. 462,535. Class 8. Variable electrical resistances.—H. A. Yoward, trading as the Lifford Engineering Co., Lifford Lane, Kings Norton, Birmingham.

Radialities. No. 462,751. Class 8. Radio-telephonic and telegraphic receiving and transmitting apparatus.—Partridge's, Ltd., 118, Northwood Street, Birmingham.

Radiolys. No. 462,827. Class 8. Apparatus for use in radio-telegraphy and telephony, but not including receiving sets or loud speakers.—P. Danon, 80, Boulevard Haussmann, Paris. (Perowne & Co., 7, Great James Street, Bedford Row, W.C.1.)

Dikast Cleartron, CT. (lettering and design). No. 465,353. Class 8. Electric condensers.—Clearton Radio, Ltd., 1, Charing Cross, S.W.1.

Warmoto. No. 465,445. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—F. A. Hughes & Co., Ltd., 204-206, Great Portland Street, W.1.

Tonatron, No. 465,532, and Sonatron, No. 465,533. Class 8. Philosophical and scientific instruments.—E. A. Graham, trading as Alfred Graham and Co.

Ardar. No. 465,720. Class 8. Electron discharging tubes for radio and wired telegraphy and telephony, X-ray tubes, and rectifying tubes.—Mullard Radio Valve Co., Ltd.

Day-Fan (lettering and design). No. 464,829. Class 8. Radio transmitting and receiving apparatus and parts thereof.—Dayton Fan and Motor Co., Dayton, O., U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-89, Chancery Lane, W.C.2.)

Igranic Pacent, No. 465,320, and Igrametric, No. 465,342. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—Igranic Electric Co., Ltd.

Neutron. No. 465,321. All goods in Class 8, except detector crystals for radio-telephony.—Neutron, Ltd.

Serenada (lettering and design). No. 462,578. Class 8. Loud speakers for use in radio-telephony.—Serenada Manufacturing Co., Ltd., 22, Paper Street, E.C.1.

Unipower. No. 463,993. Class 8. Electric accumulators and electrolytic rectifiers.—Radio Accessories, Ltd.

MH (lettering and design). No. 464,225. Class 8. Instruments and apparatus and parts thereof for use in radio-telephony and telegraphy.—L. McMichael, Ltd.

Neutroform. No. 464,753. Class 8. Component parts of radio-telephonic apparatus.—De Leeuw & Co., Ltd., Sentinel House, Southampton Row, W.C.1.

Lissenoleon. No. 465,734. All goods in Class 8.—Lissen, Ltd., Friars Lane, Richmond, S.W.

Arrolite (lettering and design). No. 464,677. Class 13. Electric incandescent lamps (ordinary).—Maybrook Electrical Co., Ltd., 15-16, White Cross Place, Wilson Street, E.C.2.

Typerlite. No. 465,437. Class 13. Electric lighting fittings.—Electricity Services, Ltd., 27, Martin Lane, Cannon Street, E.C.4.

Angelus Firefly. No. 461,629. Class 18. Electric heating and cooking apparatus.—Charles Joyner & Co., Ltd., Icknield Square, Birmingham.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

17,071. "Electric reciprocating motors." J. A. Traylor. July 16th, 1923. (219,321.)

19,278. "Telephone transmitters and receivers and the like." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). August 14th, 1924. (245,810.)

24,262. "Wireless transmitters." N. E. Davis and W. T. Ditcham. October 13th, 1924. (245,829.)

24,381. "Wireless telephone receiving systems." P. W. Willans. October 14th, 1924. (245,839.)

24,487. "Electric heating devices." British Thomson-Houston Co., Ltd., and F. W. Leevers. July 15th, 1925. (245,846.)

24,706. "Electrical discharge devices for use as translating apparatus." Westinghouse Brake & Saxby Signal Co., Ltd. October 19th, 1923. (223,589.)

24,717. "Means for eliminating disturbances at the ends of submarine telegraph cables." W. Estaugh. October 17th, 1924. (245,853.)

24,728. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. October 17th, 1924. (Addition to 230,006.) (245,854.)

24,774. "Electric switches, and the manufacture thereof." J. A. Crabtree. October 18th, 1924. (245,855.)

25,362. "Crystal detectors for wireless receiving sets." H. T. Brooker and L. E. Williams. October 24th, 1924. (245,870.)

25,492. "Electrodes for obtaining therapeutic rays from an arc for medical and other purposes." W. G. Moore. October 27th, 1924. (245,872.)

25,553. "Variable resistances." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (H. R. van Deventer). October 27th, 1924. (245,874.)

25,889. "Starting equipment for electric current converters." T. W. Ross, R. Townend, and Metropolitan-Vickers Electrical Co., Ltd. October 30th, 1924. (245,876.)

25,892. "Poles for magnets or solenoids." A. West & Co., Ltd., and R. P. Bossom. October 30th, 1924. (245,877.)

25,898. "Holders for interchangeable electrical devices, such as thermionic valves, for use in wireless telegraphy and telephony." S. J. Levi. October 30th, 1924. (245,878.)

25,984. "Aerial wire." F. Ritter. July 29th, 1924. (237,855.)

28,151. "Power actuators or servo motors." C. S. Bragg and V. W. Kliesrath. December 22nd, 1923. (226,514.)

28,360. "Control systems for electrically-driven vehicles." W. Gilbert, P. A. H. Mossay, and Ransomes, Sims & Jefferies, Ltd. November 26th, 1924. (245,892.)

28,363. "Electric controllers for hoists." Electro-Mechanical Brake Co., Ltd., and M. J. Pattison. November 26th, 1924. (245,894.)

28,500. "Combined thermionic valve holders and filament rheostats for the construction of wireless apparatus." H. Bailey. November 28th, 1924. (245,895.)

28,655. "Transformers and choking coils, especially for use in radio communication." Lissen, Ltd., and R. P. Richardson. November 29th, 1924. (245,898.)

28,877. "Device for winding spools, bobbins, coils, or the like with insulated wire." O. Steed and C. J. Robertson. December 2nd, 1924. (245,899.)

30,161. "Electric welding apparatus." W. R. Hume. December 15th, 1924. (245,911.)

30,204. "Device for supporting electric light or like shades." Wilkins and Wright, Ltd., and J. H. Hewitt. December 16th, 1924. (245,913.)

30,390. "Galvanic batteries." Oldham & Son, Ltd., and W. D. Wilde. December 17th, 1924. (245,916.)

30,483. "Control arrangements of the moving parts of wireless telegraph and telephone apparatus." W. H. Powell. December 18th, 1924. (245,919.)

30,493. "Starters for electric motors." Igranic Electric Co., Ltd., and C. F. Tubbs. December 18th, 1924. (245,920.)

30,784. "Means for indicating when an accumulator is charged." L. Barrett. December 22nd, 1924. (245,922.)

30,926. "Head-lights for motor-cars, motor-cycles, and the like." W. M. Gossip and R. G. Gossip. December 24th, 1924. (245,925.)

31,241. "Plugs and sockets for inductance coils and the like." Lissen, Ltd., and R. P. Richardson. December 30th, 1924. (245,926.)

1925.

545. "Bonding or securing arrangements for electric conductors." Callender's Cable & Construction Co., Ltd., and E. Warbrick. January 8th, 1925. (245,931.)

597. "Fuse carriers." E. W. Jackson. January 8th, 1925. (245,932.)

1,057. "Trip or release mechanisms for electric circuit breakers and like apparatus." G. Ellison. January 13th, 1925. (245,936.)

2,429. "Dry cells." Mannesmann-Motoren-Werke. March 24th, 1924. (231,135.)

2,441. "Electrically-driven rotary printing presses and like machines." O. Y. Imray (Bergmann Electricitäts-Werke Akt.-Ges.). January 27th, 1925. (245,947.)

2,459. "Head-lamps for motor road vehicles and the like." H. C. Rushton. January 28th, 1925. (245,948.)

2,816. "Holders for valves, coils, and the like of wireless apparatus." C. H. Rombach and F. Brown. January 31st, 1925. (245,950.)

3,504. "Electric frequency changers." British Thomson-Houston Co., Ltd. February 9th, 1924. (228,938.)

4,250. "Unit for eliminating local disturbances in wireless reception." A. E. R. Trotman. February 16th, 1925. (245,953.)

4,579. "Aerials and lead-in wires for radio-telephony." E. Hales. February 19th, 1925. (245,955.)

5,635. "Projecting apparatus for illuminated signs." A. R. Meissner and H. H. Byrne. March 2nd, 1925. (245,963.)

8,919. "Inductance devices such as transformers or repeating coils for telephone circuits." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). April 3rd, 1925. (245,981.)

9,586. "Diaphragms for sound-reproducing instruments." J. W. Phillips. April 9th, 1925. (245,982.)

10,299. "Transformer couplings suitable for radio systems and the like." Marconi's Wireless Telegraph Co., Ltd. April 19th, 1924. (232,640.)

10,460. "Magnetic materials." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). April 22nd, 1925. (245,986.)

10,574. "Emergency braking system for electric vehicles." Machinenfabrik Oerlikon and P. Altorfer. April 22nd, 1925. (Addition to 231,905.) (245,987.)

10,664. "Retainers for electric lamp sockets and the like." F. C. Lee and G. S. Peckham. April 24th, 1924. (245,989.)

11,365. "Alarm fuses." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and H. J. Gowring. May 1st, 1925. (245,994.)

11,925. "Electrical resistance units such as rheostats and other conducting coils." G. H. Whittingham. July 12th, 1924. (236,898.)

12,225. "Electrical instruments for medical treatment." Y. Noishiki. May 11th, 1925. (245,997.)

13,183. "Apparatus for winding a wire in the form of a figure 8 on two parallel pins." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 21st, 1924. (234,487.)

14,152. "Micrometer movement device for use with variable electrical apparatus." L. E. Fillmore and L. W. Fillmore. May 29th, 1925. (246,009.)

15,314. "Electric commutators or ignition distributors." A. Tauber. June 12th, 1925. (246,018.)

15,401. "Electrodes for electric arc furnaces." International General Electric Co., Ltd. June 14th, 1924. (235,596.)

15,422. "Electric heaters for waving or curling the hair." E. F. Suter. June 13th, 1925. (246,021.)

15,595. "Electric power systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 16th, 1925. (246,024.)

15,739. "Manufacture of very thin wires." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 18th, 1924. (235,893.)

16,777. "Electric discharge tubes." Namlooze Vennootschap Philips' Gloeilampenfabrieken. November 17th, 1924. (Addition to 235,141.) (242,946.)

17,893. "Electron-discharge apparatus." American Appliance Co. and C. G. Smith. July 13th, 1925. (246,036.)

18,467. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. July 19th, 1924. (237,285.)

18,591. "Synchronising of alternating electric current systems." International General Electric Co., Ltd. August 6th, 1924. (238,206.)

18,963. "Variable electrical condensers." A. H. Midgley. July 25th, 1925. (246,043.)

22,531. "Electric speed indicators." British Thomson-Houston Co., Ltd. (General Electric Co.). September 9th, 1925. (246,063.)

24,129. "Thermionic amplifying systems." British Thomson-Houston Co., Ltd. September 27th, 1924. (Addition to 238,550.) (240,488.)

25,067. "Electric arc lamps." E. Steinberg. March 24th, 1925. (Divided application on 7,895/25.) (246,073.)

27,296. "Process and machine for the manufacture of incandescent lamps, thermionic valves, and like apparatus." General Electric Co., Ltd. October 31st, 1924. (242,303.)

27,303. "U-tube manometers." British Thomson-Houston Co., Ltd. November 8th, 1924. (242,634.)

28,036. "Electrical conductor or filament." Dubilier Condenser Co. (1925), Ltd. November 7th, 1924. (242,661.)

29,247. "Radiogoniometers." E. Bellini. November 20th, 1924. (243,372.)

Board of Education Examinations.—The Board of Education has issued the time table for the science scholarship examination and the examinations for Whitworth scholarships. The examinations will be held on April 28th to 30th and May 1st to 8th at times between 6 and 10 p.m.

The

Electrical Review

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Electrical Travellers.

THROUGHOUT the country there are thousands of men who seldom come before the footlights of our great electrical theatre of operations, yet who in the aggregate handle an enormous volume of orders for electrical goods and thereby contribute an essential service in keeping British electrical factories employed.

It may be that in so far as they compete with each other, they do not add materially to the amount of employment that would exist without them, though we must recognise that "live" men may impart a spirit of enterprise to the retailer which may stimulate public demand and increase the general turnover. In so far as British travellers are able successfully to compete with travellers representing imported goods, however, they have the satisfaction of knowing that every order that they secure in this class makes additional work for British workmen and workwomen.

We wish to pay them this tribute, as in these days of many organisations of larger and higher-sounding purpose, they are likely to be overlooked, because they are part of the merchandising detail—the commercial detail—which receives a little less attention than it deserves.

We are not sure that sufficient regard is paid even to the scattered host of men who are travelling in the Colonies and in foreign fields. We see the statistical returns showing a satisfactory total of exports of this or that class of electrical products, forgetting perhaps that everywhere—or shall we be moderate and say, in many places?—behind this business there are, in addition to the normal sources of trade, men who travel to and fro, sometimes amid many discouragements, seeking orders which shall make work in the Homeland.

We desire to direct attention specially to this purely trade topic of the electrical traveller at the present moment, in order to excite a sympathetic interest among the trade generally in the Electrical Trades Commercial

Travellers' Association, which is just one year old. We described and discussed its objects at the time of its formation, and we are glad that it has made excellent progress in so brief a period. That there is ample room for it in the chain of links of electrical trade organisation was abundantly proved by the success which attended its annual dinner on Saturday last.

A little detail that no doubt will right itself in time is the name of the body. Mr. Joyce, the popular chairman, in his speech gave two abbreviated forms—one the "Etceteras," and the other the Electrical Travellers' Association, which is more concisely descriptive. After all, travellers are still travellers however much we may desire to call them salesmen, and their operations salesmanship. With reference to the objects of the Association, they include benevolence, mutual assistance, and fraternisation. In the main the intention is to bring the travelling members of the electrical trade together and to keep them together so that they may act unitedly in regard to matters of common interest which lend themselves to associated action. Anybody who knows anything about the manifold problems that agitate the minds of such men will appreciate at once how many things there are upon which they can usefully and profitably confer if they have an organisation large and representative enough. This being so, we wish to offer our commendation in support of the movement and to urge upon trade travellers everywhere the desirability of accepting the Association's hearty invitation to them to make application for membership. Companies and firms which may have had an inclination to shake their heads doubtfully regarding the desirability of such a movement have, we understand, no misgivings to-day—indeed, some of those who are most prominently associated with it represent such concerns. The Association is not in any way a trade union, but our own experience in the editorial chair has brought before us scores of matters typical of the difficulties and anxieties of the electrical traveller both at home and abroad, many of them questions which inquirers could place before such an Association as a matter of course and receive guidance upon; topics quite distinct in character from those which occupy the mind of the trade unionist.

We have long regarded the Trade Press and the Trade Traveller as having a very similar or co-operative duty to perform. Both are designed to link up the seller and the buyer. The description or announcement in the Press of some new manufacture prepares the way for the visit of the traveller when he calls, with samples, for inquiries or orders. It is of value to him that his potential customers know in advance what he has to offer. The Trade journal is also of interest to him in keeping him informed of the new articles that others are introducing and in acquainting him with any trend of development which should be taken into account in pushing his own sales.

We repeat that, as an essential part of the body of men who are responsible for actual electrical trading operations, we wish the Association further success.

Women and Electricity Supply.

It was some years ago that we first heard the usefulness of women urged by electricity supply engineers at the meetings of the Municipal Electrical Association. Here and there they were working very successfully as canvassers by reason of their knowledge of the ways and desires of their sex in the household. Since then they have justified their appointments in many places, whether as visiting employés persuading and convincing as to the value of domestic electrical service, and helping the consumer over the initial difficulties of an installation, or whether dealing with the public in large crowds at exhibitions. We do not know their number—it would be interesting to know it—but it is considerable. There are some outstanding examples where striking personality has been accompanied by absolute conviction and ability to express oneself; women of such a type after a time become so efficient that their proper sphere is the tuition of assistants who will profit by the optimism and atmosphere of the department and become like their instructress and be ready to carry on the good work by themselves. It has been suggested that the big electricity supply authorities should lay themselves out systematically for this class of staff development; some of them are not unmindful of the service that women assistants can render, but whether we think of companies or municipalities, we wish once again to put in a good word for women, for they have natural gifts and aptitudes which we mere men do not possess, and they have a way of booking a consumer whose eye we should never catch. Yet there are, admittedly, some ladies who would prefer to talk to a man—even about electricity!

Electricity Supply Statistics.

The volume of statistical returns with regard to electricity supply undertakings, which was issued by the Electricity Commissioners in June last year, which we have described as a vast store of information, related to the years 1920-1923; its compilation must have involved an immense amount of labour, and the care and accuracy with which the work was done reflected the greatest credit on the staff of the Commission.

But events march quickly in the electrical world, and many changes take place in the course of a few years. The Commissioners intimated, when the Return was published, that they were considering the issue of supplementary returns for 1923-24 and 1924-25, and would afterwards publish annual returns. The volume already issued brought the record for municipalities up to March or May, 1923, and for companies up to the end of 1922. The whole industry is awaiting the issue of the National Electricity Supply Bill with keen interest; its provisions will be based upon recent data, and we suggest that the publication of those particulars for the years 1923-25 is a matter of urgent importance. The whole of the material for that purpose must now be in the hands of the Electricity Commissioners, and we hope that the work of preparing it for publication is far advanced; the difficulties inevitably met with in the production of the first volume having been successfully overcome, the path of the supplementary return will be much smoother, and its early issue will be heartily welcomed by the profession.

At the annual dinner of the North-Western Centre of the Institution of Electrical Engineers the President, Mr. R. A. Chattock, expressed the strong conviction that the details of the calculations upon which the Cabinet's advisers founded their conclusions ought to be made public, so that electrical engineers could form their own opinions as to the merits of the Government proposals. With this contention we cordially agree. Not only should the estimates of cost be disclosed, with regard to the high-pressure grid, the standardisation of plant, and the administration of the scheme, but also the data which led to the conclusion that the interconnection of the various districts would bring about material improvement in the general load factor, which is largely relied upon to pay the cost of the scheme and to cheapen the supply of electricity. The cost of reducing the number of frequencies in use to the uniform value of 50 cycles, which is said to be justified by the reduced cost of manufacture of 50-cycle motors, in particular, needs the most careful examination; and the load curves of the districts in which the conditions have been fully investigated ought to be made available.

At a time when a million workers lack employment, when large sums are being paid out to prop up the coal-mining industry, and when it is proposed to spend five millions a year for a long time to come on works which cannot possibly become remunerative for many years, it behoves us to examine most carefully the foundations upon which it is proposed to erect so costly a superstructure. In such a case it is not sufficient to argue that the matter has been investigated by experts; the proofs must be forthcoming, and must be subjected to the closest scrutiny. To make a mistake at this juncture would be disastrous.

The I.E.E. Dinner.

THE attendance at the annual dinner of the Institution of Electrical Engineers on Thursday last week broke all previous records, nearly 600 tickets being issued and many more applied for. The brevity of the speechmaking at this dinner, and the opportunity of meeting friends from all parts of the country at the reunion which follows, render it an exceptionally enjoyable function; it is surprising, however, how many members of the Institution are not aware of the admirable procedure which has so long characterised it, and which makes it so much more attractive than other gatherings of a similar nature.

Mr. Neville Chamberlain is always interesting, and on this occasion, inevitably, dealt with the new electricity supply scheme, doubtless anticipating that his remarks would arouse the enthusiasm of a meeting of 500 electrical engineers. If so, he was disappointed, for his references to the benefits to be conferred upon the industry and the nation by the provisions of the scheme were received with frigid silence, the only attempts at applause being accorded to the assurances that no subsidy, no nationalisation, and no more state interference than was unavoidable, were contemplated.

The President, in the presence of his Ministerial guests, who are his personal friends, refrained from criticism, and not a discordant note marred the proceedings. But the silence was eloquent.

German Activities in Russia.

IT appears that the agreement concluded between the Berlin A.E.G. and the Soviet State Electrical Trust, to which reference was recently made, was entered into several months ago, and proposes to authorise the Trust to use the German Company's patents for machinery, &c. The German Company stipulated that the agreement should be confirmed by the Russian Government, and it is now stated that the latter has ratified it. Nevertheless, some time will still be occupied with the negotiations with regard to the grant of the first proposed credit of £5,000,000 in the form of goods, namely, for the opening up of the oil fields, for which Russia requires a credit of from 12 to 24 months. In A.E.G. circles the opinion prevails that the experience hitherto gained in connection with business with Russia wholly justifies the grant by German interests of large credits for the financing of deliveries, as the transactions with the Russian contractors are said to have been as smoothly liquidated as was generally possible. It is uncertain how much of the £5,000,000 will be applied to the acquisition of steam turbines for the pipe line pumps and how much will be expended on pipes, steelwork and machinery; but it is considered that many firms and banks will participate in the business. In connection with the preceding observations, attention may be directed to one part of the annual report of the A.E.G., which states that the Company regards Russia as a large market, and much is expected from the conclusion of the new agreement, concerning which negotiations have been proceeding for the past two years. The agreement chiefly concerns the grant of licences to the Electrical Trust for the construction of machines, and for this privilege the Trust will pay royalties. After confirming the circumstance that the agreement has now been confirmed by the Soviet Government, the report states that the Company formerly worked Russia intensively, knows the conditions, and is therefore at an advantage over foreign competitors. A considerable business is being done with Russia, and no difficulties have hitherto been experienced in the matter of obtaining payments.

Electrical Research.

IT would appear that the British Electrical and Allied Industries Research Association has perforce to be content in future with a smaller measure of Government financial support. After the larger expectations, consequent upon the known and cordially expressed approval of the Inspectors appointed by the Department of Scientific and Industrial Research, the actual outcome is distinctly disappointing. The powers that be seem to overlook the essential importance of the matter; or perhaps they have never fully realised it. Indeed, it is hard to conceive how such a retrograde decision could have been made were those responsible really awake to the issues involved. There are flagrant instances where a penny saved is tantamount to a shilling thrown away. In this particular case the Government department directly involved lavishes praise upon the good work done by the Association, but the authorities have decided that during the further period of five years commencing in September of last year, the aggregate grants shall be halved, and that at the end of the five years the whole cost must be borne by the industry.

Mr. Ll. B. Atkinson, the newly-elected president of the Association, who announced the decision of the Government on Friday last, at a luncheon at the Savoy Hotel, had many trenchant comments to make in the course of a speech of exceptional eloquence and vigour. As reported elsewhere in this issue, he stated that after public and official indifference to the scientific spirit and methods, things had changed during the war; but a few years later the politicians fell back into their old ways. After referring to the prospective expenditure of twenty millions sterling to support the most backward industry in the country, he urged that "any Government, any industrial leaders, who can fail to see that research by Englishmen can accomplish any and every result convict themselves of blindness to fact, lack of logic, and lack of imagination. Research associations and research workers are not asking for charity. They are urging that the present squalid civilisation should be replaced, as it can be, by a far better one, if applied knowledge in every sphere is encouraged and developed; that instead of being a last charge upon the resources of the nation, research should be a first charge."

Half a loaf is much better than no bread at all. In that the Association knows what awaits it, it has time to prepare for the withdrawal of government support. It is to be hoped that those most intimately concerned will take a long and progressive view of matters. Research is no mere accomplishment, something merely ornamental; it is bedrock necessity. The country is handicapped enough as it is; it were the veriest idiocy to increase that handicap gratuitously by killing the goose whence came the golden eggs. The nation's foremost competitors set Britain a stern race: and in her own defence she *must* put all she knows into the effort. Her crying need is for more and more of the truly scientific temper and methods of research, not for less. So, thrown more upon its own resources, the Electrical Research Association must seek ways and means to carry on. The electrical and allied industries must rise to the occasion. The partial withdrawal of Government aid must be accepted as a challenge to greater efforts, not weakly offered as an excuse for surrender. In the present year of grace it ought to be entirely self-evident that research, rightly undertaken, is a sound proposition on practical and commercial grounds. Those who have saved large sums of money through the work of the Association know that it is so, and ought to subscribe freely to its funds.

There are still five years in hand, and much may happen in that time. Certainly much *will* happen if the people who ought to be interested, and are most concerned, will take it in hand, definitely and deliberately, to see that it shall happen. The reports of the Association show that with adequate funds important economies, comparable with the hundreds of thousands of pounds that are annually saved through the researches on buried cables, can be effected in other branches of the electrical industry. Investigations are required on a scale far beyond anything as yet attempted, in connection with the properties of dielectrics, the design of switchgear, and overhead line construction. It is useless to wait for the Government to mend its ways—the industry can and must act for itself, remembering that money spent wisely on research is repaid not tenfold but a hundredfold.

Boiler-Room Practice.

Coal Flow, Air Flow, and Steam Flow.

By JOHN BRUCE.

(*Continued from page* 251.)

Considering first of all only the indications given by the Pitot tube manometers, it is obvious that with uniform fuel beds of equal thickness, the readings should have the same value. Any change in the fire bed conditions will immediately affect the air quantity and be shown by the manometer indications.

The difference between static and dynamic heads indicated by the Pitot tube manometers increases as the square of the air velocity, and neglecting the amount of gas added to the air above the fire bed as a result of the combustion of the fuel, the pressure drops measured by the differential gauges also vary as the square of the air velocities. There is therefore, for a given furnace condition, a direct relation between all the indications. By adjusting the densities of the measuring liquids, or varying the cross section of the manometer, the instruments will then, if all mounted together, show the same liquid levels for any given correct furnace conditions.

The relations between fuel-bed pressure drop, pressure drop through boiler, total pressure drop across unit, and the relations between the various pressure drops and resistances are very excellently expressed in one of the reports issued by the U.S. Bureau of Mines, and the liberty is taken of quoting the gist of them here:—

(1) "If all the resistances to the flow of gases remain constant, the pressure drop through any portion of the path will have a constant ratio to the total drop across the unit.

(2) "If the pressure drop across the unit remains constant, the pressure drop through any portion of the path will vary in the same direction as does the resistance to the flow in that portion, although the magnitude may not be in simple proportion.

(3) "If the resistance through any portion of the path remains constant, the weight of gas passing through that portion varies as a function of the pressure drop through that portion, *e.g.*, the weight of gases passing through the unit is directly proportional to the square root of the pressure drop.

(4) "If the total pressure drop remains constant and the resistance of the fuel bed is the only variable resistance, the weight of gases will vary inversely as the resistance of the fuel bed."

The young engineer cannot do better than memorise the foregoing facts relating to gas and air flow and also prove the truth of the statements by actual measurements by draught and differential pressure gauges.

So far we have only discussed the factors relating to air flow without considering the interdependance of the other factors affecting boiler efficiency.

Let us now consider the relationship that exists between rate of air flow and rate of fuel flow.

For this purpose we will assume a coal having an ultimate analysis based on the value as fired and as set out below:—

Carbon	C = 70.0	per cent.
Hydrogen	H_2 = 4.5	,, ,,
Oxygen	O_2 = 5.0	,, ,,
Nitrogen	N_2 = 1.0	,, ,,
Sulphur	S = 1.0	,, ,,
Ash	= 10.0	,, ,,
Moisture	= 8.5	,, ,,

Then with perfect combustion the air and oxygen quantities involved and the products of such combustion will be, per lb. of coal consumed, as shown in Table I.

From the Table it will be seen that the theoretical air required for the oxidation of the combustible elements of the fuel is 9.426 lb. of air per lb. of coal, and the theoretical products of combustion, plus inert gases and the vapour from the evaporation of the moisture content of the coal, will be 10.326 lb. per lb. of coal consumed.

TABLE I.

Oxygen and Air Required, and Products of Perfect Combustion.

Chemical symbol	Elements in coal lb.	O_2 and air required for combustion		Products of perfect combustion.				
		O_2	Air	CO_2	O_2	N_2	H_2O	SO_2
C	·700	1·862	8·044	2·562	—	6·182	—	—
H_2	·045	·360	1·555	—	—	1·195	·405	—
O_2	·050	—	—	—	·050	—	—	—
N_2	·010	—	—	—	—	·010	—	—
S	·010	·010	·043	—	—	·033	—	·020
Ash	·100	—	—	—	—	—	—	—
Moist're	·085	—	—	—	—	—	·085	—
Totals	1 000	2·232	9·642	2·562	·050	7·420	·490	·020
Less O_2 in coal & equiv. air & N_2		·050	·216	—	·050	·166	—	—
	To·als	2·182	9·426	2·562	—	7 254	·490	·20

Assuming 40.0 per cent. excess air as a value representative of efficient operating practice, then for an increment of 40.0 per cent. excess in the air requirements of the above fuel, there will appear in and additional to the products of perfect combustion—

0.867 lb. of oxygen
2.903 lb. of nitrogen,

equivalent to 3.770 lb. of air. Therefore it follows that if the foregoing coal was being burned in a steam boiler furnace with an excess air value of 40.0 per cent., each pound of coal consumed would require 13.196, say, 13.2 lb., of air.

It further follows that if at all loads on the boiler complete combustion could be effected with a constant excess air value, then a straight-line law expresses, at any load or combustion rate, the relationship existing between the air required for combustion, the coal being consumed, and the products of such combustion. These relations are shown graphically, expressed for the case given, in fig. 2.

For the point next to be considered, the rates of flow of coal, gas, and air, over a definite range, still assuming 40.0 per cent. excess air, have been extracted from the graphical values in fig. 2, and are set out in tabular form below.

Table II.—Coal, Air and Products of Combustion. Quantities Involved when the Coal Analysed in Table I is Completely Consumed with 40.0 per Cent. Excess Air.

Lb. coal consumed per hour.	Lb. air supplied per hour.	Lb. combustion products per hour.
1,000	13,200	14,100
1,500	19,800	21,150
2,000	26,400	28,200
2,500	33,000	35,250
3,000	39,600	42,300
3,500	46,200	49,350
4,000	52,800	56,400
4,500	59,400	63,450
5,000	66,000	70,500
5,500	72,600	77,550
6,000	79,200	84,600
6,500	85,800	91,650
7,000	92,400	98,700

Now under the conditions assumed, for any rate of air flow there will be a corresponding rate of flow of gaseous combustion products through the gas passes of the boiler, and from the laws governing the flow of air and gases there will be a definite relation between the pressure across, for instance, the boiler, and the rates of flow of air, fuel, and gas.

Assume, in the example at present under consideration, that between two fixed points in the gas path, between which two fixed points the resistance to the flow of gas is constant, at a rate of flow corresponding to 35,250 lb. per hour, the pressure drop is measured and found to be 0.2 inch water gauge. Then theoretically the pressure drop at any other rate of flow, assuming of course complete combustion and the same excess air percentage, will be as follows:—

Let p = actual measured pressure drop inch w.g.
,, f = rate of flow corresponding to observed p.
Then $f^2 = \kappa p$, and $\kappa = f^2/p$;
and the pressure drop for other rates of flow will be:—

$$p1 = f^2 1/\kappa,$$

where $p1$ = required pressure drop inch w.g.
$f1$ = rate of flow at required pressure drop.
κ = constant.

For the case under consideration the pressure drop at a rate of flow of 35,250 lb. per hour is 0.2 in. w.g.
Therefore $\kappa = 35{,}250^2/.2 = 6{,}212^{105}$ (approx.).

The pressure drop corresponding to the other rates of flow will then be as set out in Table III.

Table III.—Rate of Flow of Combustion Products and Corresponding Pressure Drops.

Lb. combustion products per hour.	Pressure drop across gas path.
14,100	0.033 inch water.
21,150	0.072 ,, ,,
28,200	0.128 ,, ,,
35,250	0.200 ,, ,,
42,300	0.288 ,, ,,
49,350	0.392 ,, ,,
56,400	0.512 ,, ,,
63,450	0.650 ,, ,,
70,500	0.800 ,, ,,
77,550	0.967 ,, ,,
84,600	1.150 ,, ,,
91,650	1.350 ,, ,,
98,700	1.570 ,, ,,

These values are shown graphically in fig. 2, and a study of all the values plotted will show that, provided the complete combustion of a given coal can be effected with a definite percentage of excess air, there exists a definite relation between the pressure drop over a path of constant resistance, the rate of flow of air, rate of flow of fuel, and rate of flow of gaseous products of combustion.

All the factors so far discussed can be readily measured in definite terms by simple instruments; moreover, the measurements are such that they are easily understood, and their value is directly influenced by the principal operating controls upon which the resultant performance of the boiler unit is dependent.

The next point to be considered is the relationship between the factors affecting the rate of heat liberation, again assuming the complete combustion of the fuel and the rate of heat absorption by the heat-carrying mediums contained in the boiler unit.

The rate of heat liberation can be expressed in terms of B.th.u. per hour, and the rate of heat absorption can be similarly stated.

Steam is the final form of the medium, carrying from the boiler unit the heat absorbed from that resulting from the combustion of the fuel.

Therefore if the feed water enters the boiler unit at a constant temperature, and the steam produced for useful work has a constant state point, *i.e.*, constant pressure and final temperature, the rate of flow of steam can be substituted for the expression of rate of absorption of heat units. Rate of flow of steam is customarily expressed in terms of lb. per hour, and can be indicated or recorded in such terms by modern steam flow meters to a degree of accuracy well within the limits required for commercial operation.

Considerable controversy has often arisen over the question of a linear relation between coal consumed and water evaporated, or steam produced, over the range of duty of a boiler unit on commercial operation. This controversy reached a notable degree after the presentation of a paper on pulverised fuel before one of the Institutions about two years ago, and this in spite of the fact that the performance of the particular boiler in question, from the results given in the paper, reasonably satisfied a linear equation. Further, various experimenters have from time to time given practical proofs of this relationship. Engineers must realise that power-station operation, in the present state of the art, necessitates common-sense compromises between the ideals of mathematical precision and practical attainment.

(To be continued).

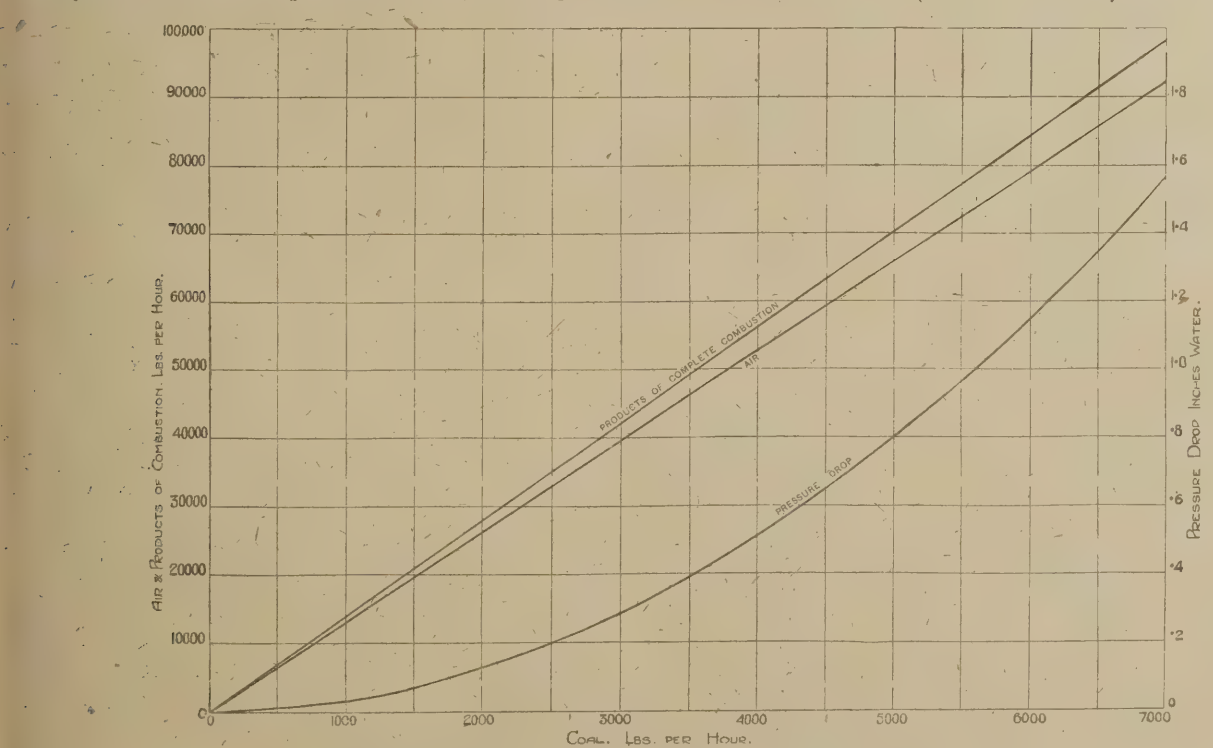


Fig. 2.—Rate of Flow of Combustion Products and Corresponding Pressure Drops.

Railway Electrification in Venezuela.—Owing to the swiftness of the motor traffic on a great concrete road in Venezuela, it is declared that a railway company has found it necessary to substitute electric for steam traction in order to keep its hold on the passenger traffic. This confession is said to have been made by the chairman of La Guaira and Caracas Railway Co., Ltd. (Mr. J. A. Goudge, C.B.E.) at a meeting of shareholders held in London. The situation in Venezuela, he said, was that they had to deal with growing traffic and growing competition, and the Board was convinced that electrification was the only course. They were now seeing the completion of the concrete cart road, and they knew that the motor-car could take passengers between the leading port of Venezuela and the capital in less time than the journey occupied by their railway with steam traction.

Laboratories for Testing Electrical Mining Apparatus.

The Mines Department's Testing Station, Sheffield.

The official testing station of the Mines Department at Sheffield, to which we recently had the opportunity to pay a visit, has lately been established for the testing of the smaller classes of mining apparatus, sent in by the manufacturers, including miners' electric and flame lamps and electric bells, relays and the like

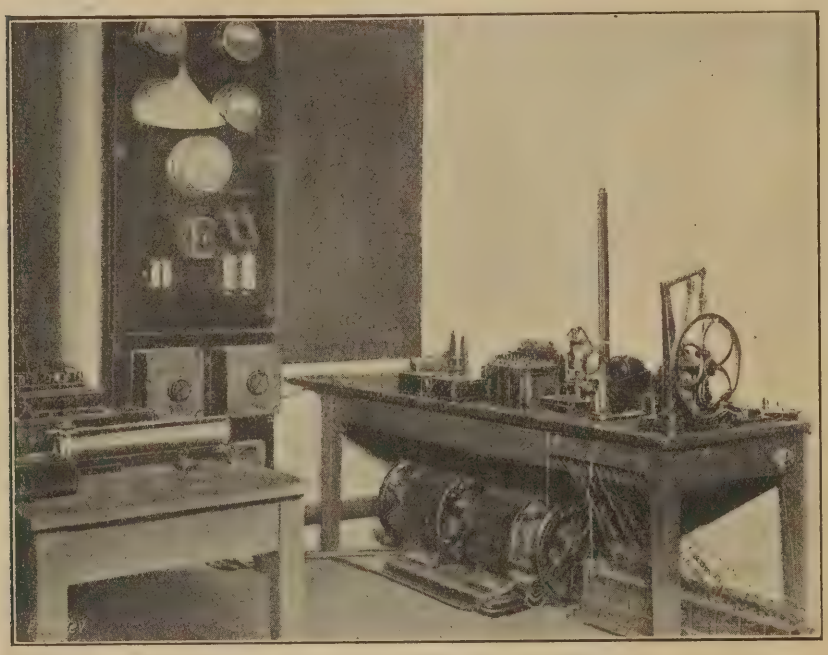


Fig. 1.—Electrical Test Room.

used in the signalling installations, in order to ascertain whether or not the samples comply with the approved specifications laid down in the official regulations. Other work, such as the analysis of samples of mine air and the dust on the mine roadways, sent in to the station by the mine inspectors, is also carried out. The dust samples are analysed to determine the amounts of moisture and combustible matter in them, while the samples of air are so treated to find out the percentages of their constituent gases.

Up to the end of last year the station formed part of that of the Mines Department for experimental work at Eskmeals, and it is due to the inaccessibility of this site that the station has been removed to Sheffield. The experimental station of the Safety in Mines Research Board has also been removed to Buxton.

The premises at Sheffield, 42, Arundel Road, occupy an old factory, which has been reconstructed and converted into laboratories, offices, and the other necessary parts of the station by H.M. Office of Works. Of the number of laboratories which constitute the station, the electrical test room, fig. 1, is probably the most interesting to electrical engineers. This room is equipped with a specially-designed motor-generator for supplying a pure sine-wave alternating current, an oscillograph which is used to obtain the characteristics of the current in various pieces of apparatus, and special equipment in which the safety or otherwise of the sparks produced between the contact points on bells and relays can be tested in mixtures of firedamp and air. The last-mentioned apparatus consists of small strong glass chambers contained in metal casings. Gas mixtures of known quantities are placed in the chambers, and by means of suitable leading-in wires with adjustable air-gaps, sparks are produced in the mixtures and the necessary observations are made and data, such as pressures and temperatures, collected. By noting on the oscillograph the characteristics of the current in a circuit in which an arc is produced, a current of a similar nature can readily be reproduced in the circuit in use with the testing chambers. The testing room is contained on the first floor, which also accommodates the main analytical laboratory, fig. 2. The work of this department is mostly of a chemical nature, consisting of the analysis of mine-dust samples. Six thousand samples of dust are sent into the station each year by the mine inspectors. A modern type of combustion furnace for the ultimate analysis of coal samples is another feature. The powdered coal is placed in clay trays in a glass tube contained in the furnace. When the coal is heated to the required temperature, oxygen is passed over it from one end of the tube, and the combustibles are collected at the other end. A number of electrically-heated drying ovens, fig. 2, for dealing with the various samples form part of the equipment. The mine-air samples are also analysed here. They are collected from the pits in small glass bulbs, which are sent out from the station in a highly exhausted condition, being, of course, hermetically sealed. The inspector, in collecting the sample, simply breaks the glass seal of the bulb, which he re-seals by means of a heavy rubber cap. After analysis of the air samples,

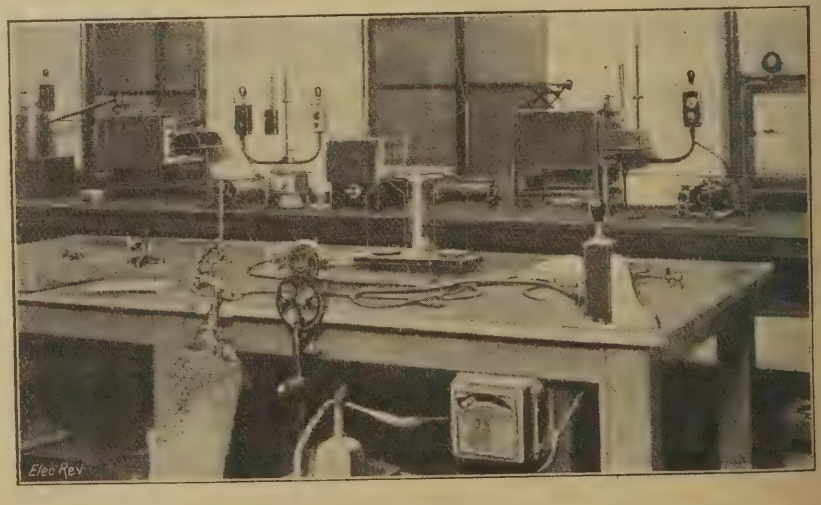


Fig. 2.—Main Laboratory.

the bulbs are re-exhausted in the main laboratory by means of high-efficiency electrically-driven vacuum pumps contained in the basement. To ascertain the degree of exhaustion in the bulbs, they are subjected to high-frequency currents in a dark room, green rays in the bulb indicating the proper vacuum. In passing, it is interesting to note that various inflammable dusts produced in industrial operations, for example, paper, cotton, sugar, and flour dusts, are subjected to

inflammability tests in this section on behalf of the Factory Department of the Home Office. The photographic dark room and a balance room, containing four chemical balances, are adjacent to the main laboratory, and on the same floor is a small research room in which investigations of a special nature incidental to the general work of the station are carried out.

On the ground floor are accommodated the offices, a photometric room and a lamp-testing laboratory. In the former, provision is made for two standard photometers, and at present the instrument which was used at Eskmeals is installed; this has been overhauled and improved technically. The lamp-testing laboratory, fig. 3, is equipped for the testing of all kinds of miners' electric and flame lamps. To the left of the illustration in question will be seen a number of electric lamps under life and efficiency tests. Special testing boards are equipped for the efficiency trials and also for determining the discharge of the accumulators under given conditions. An electrically-heated oven, in which the well glasses of the flame lamps are dealt with, is a feature of this room. The glasses are heated up to 212 deg. F. in a suitable container and then immersed immediately in cold water. An apparatus for the observation of flame in still atmospheres is an interesting feature. Firedamp mixtures are pumped into an inverted glass chamber, fig. 3, by means of an electrically-driven fan, the percentage mixture of air and firedamp being regulated by means of drilled metal disks, which are inserted in the control valve. A mercury-suction air pump, in which an electric arc is produced in the container, is used for determining the inflammability of the mixture.

The basement at present accommodates the necessary stores and workshops, and a lamp gallery is now under construction. In the workshop is housed a Crompton motor-generator with the necessary control gear for the d.c. supply throughout the station. The vacuum pumps are also housed here, and are connected by piping to the various points in the laboratories where vacuum is required. A motor-driven blower also supplies compressed air to the main laboratory for glass-blowing and miscellaneous purposes.

The lamp gallery has been redesigned, and is a modification of that previously used at Eskmeals; the essential principles of utilising vaporised pentane and air as the explosive mixture has been retained. Explosive mixtures travelling at a velocity of 1,200 ft. per minute and more will be available for testing miners' flame safety lamps. An explosion chamber for the testing of miscellaneous apparatus in still explosive atmospheres, and an equipment for testing the mechanical strength of miners' lamps is also installed in the basement.

The testing superintendent, Captain Platt, to whom we are indebted for the above details, has asked us to state that he is anxious that the mining industry should realise that he is concerned not only with the carrying out of strict tests as laid down in the official regulations on the testing of apparatus, but that he desires, where possible, to be of assistance in such matters as come within the field of his activities; he invites those interested in the improvement of the efficiency of miners' lamps and kindred apparatus to communicate with him, when he will be pleased to offer facilities for tests of an experimental nature. The official regulations stipulate that a fee be charged for the test of miners' lamps, and in special cases the amount of this fee is left to the discretion of the testing officer. At the same time, he wishes to point out that, where a manufacturer or designer is anxious to improve the efficiency of his product, no difficulties will be placed in his path in the matter of having preliminary tests and experiments carried out at the station, and for this a fee will not always be required.

The Mining Electrical Testing Laboratories of Sheffield University.

Apart from the work of the official Mines Testing Station, a very important branch of the testing and research operations in connection with mining electrical apparatus, that dealing with flame-proof electrical machinery, is undertaken by the Mining Department of Sheffield University. The work is divided into two sections—experimental and testing—the former being devoted entirely to research by the Safety in Mines Research Board, while the testing of manufacturers' apparatus is undertaken by the University department proper. The testing laboratories are maintained by testing fees, although no profit is made, and the fees vary according to the amount of work entailed. The research room is equipped mainly for investigations in connection with the flame-proof design of electrical machinery and particularly in determining the behaviour of ignited gases and flame inside an electrical-machine enclosure. For the necessary experiments spherical explosion vessels are used. These are constructed in two cast-metal hollow hemispheres with flanged joints, one half (top) being fitted with adjustable electrodes, so as to provide an electrical ignition at any point in the sphere. For the investigation of the desirability of, and the effect produced by, vents between the flanges, small brass distance pieces of given thicknesses are placed between the two halves of the globe, which are



Fig. 3.—Lamp-Testing Room.

then clamped together. The bomb is placed in an explosion chamber, two of which are installed in the laboratory in question; the bomb and the chamber are filled with gas of a required mixture. A spark is then produced in the sphere and the necessary observations are made. It will be obvious that by this means a wealth of information concerning both the gases and the protective measures is obtainable. The air gaps are varied by means of the distance pieces, and the flange-widths are also varied by inserting flat metal rings of differing widths between the sections. The explosion chambers are of wooden construction with relief-valve "windows," the valves consisting of white paper, smeared with linseed oil, suitably secured over apertures by means of frame flanges held by wing nuts. The gas used for these experiments is obtained from the Cymmer Colliery, South Wales, and contains 88 to 98 per cent. methane. The mixtures are made up in two gas holders; these are of 10 and 20 cu. ft. capacity respectively.

All manner of electrical mining apparatus received direct from the manufacturers is tested in an adjacent laboratory. This is equipped with a large explosion chamber designed to accommodate all sizes of mining machinery, up to a normal-size coal cutter, which of necessity must be flame-proof. This chamber is of similar construction to the smaller ones. It is built of pitch pine, the internal surfaces being treated with fireproof asbestos paint. The front and top of the chamber are removable, and in order to facilitate the handling of heavy apparatus, suitable blocks and

tackle are suspended from the overhead girders of the test room. For testing small apparatus, the chamber can be sectionalised by means of a central partition. To ensure the complete diffusion of the gas inside, a 16-in. fan is employed; this is driven by a fractional h.p. electric motor mounted outside on the chamber roof. When a piece of machinery is to be tested, the casing or enclosure is suitably drilled to accommodate a connection to a manometer or pressure recorder, which is used in connection with all such tests, a sparking plug for igniting the internal gas (an ordinary automobile plug is generally used), and the necessary connection for the gas inlet. Although, of course, the primary object of the tests is to ascertain whether the apparatus under test is explosion proof or not, much valuable information is obtained from the records of the manometer. The internal pressures are communicated to a small piston contained in an oil-filled cylinder. The movement of the piston is transmitted to a flat spring carrying a stylus, the latter pressing lightly on a smoked paper chart on a revolving drum. The time records are made by two Deprez time markers. One of these is connected in circuit with an electrically-vibrated tuning fork, making a given number of vibrations per second, enabling the time scale, from the rate of rotation of the drum, to be calculated. The other marker is connected with the primary circuit of the sparking coil and records the actual instant of ignition, and shows a typical time-pressure curve taken from such a test. A sampling-vessel at the back of the chamber is employed for the collection of samples of the gas from the interior of the apparatus under test or the explosion chamber. The samples are subjected to analysis for determining the exact composition of the mixture in the casing.

A certificate, recognised by the Mines Department, and a report of the test results, are issued by the University for each piece of apparatus which passes the standard test, but with a view to assisting the makers in improving the design of their plant or in developing new lines in mining machinery, the laboratories undertake special tests and provide the manufacturers with the full results. It is interesting to note that for the standard test the most explosive gas mixture is used, containing 9.5 to 10.5 per cent. of methane. In the case of motors, tests are made both with the motor stationary, and running at normal speed with resulting turbulence. The effect of the turbulence of the mixture is to hasten the rate of development of the pressure when the gas is inflamed. The ignition spark is obtained from an ordinary induction coil with a pre-measured current.

The two departments, research and testing, while under quite independent authorities, work in very close co-operation; and the data obtained by one are fully at the disposal of the other.

In conclusion, our thanks are due to Professor I. C. F. Statham, B.Eng., of the mining department of the University, for his courtesy in placing the above information at our disposal on the occasion of a recent visit to the laboratories.

The Cologne Wireless Show.

Some Impressions of the First Radio Exhibition in West Germany.

(From Our Special Correspondent.)

The Exhibition at Cologne revealed the important fact that German manufacturers have made great strides in the production of wireless apparatus, particularly in the direction of good and cheap parts and accessories. A general review suggests that they have not yet made up the leeway lost through special post-war circumstances, but they are marching forward and intent on making good the boast that Germany will, before long, compete on equal terms with the United States and Great Britain in the laboratory and in the outside radio field. It does not require a great deal of imagination to believe this, for it has been seen what Germany can do in the electrical world, and her efficiency in this direction is proof of her ability to succeed in "wireless."

Die Westdeutsche Funkaustellung opened (January 30th to February 7th) under the management of the Reichsverband Deutsche Funkändler (Union of German Radio Dealers). While Government duties and the Vienna Conferences prevented the Minister of Posts and Dr. von Bredow (the father of German broadcasting) from being present at the opening ceremony, the Exhibition was given an enthusiastic send-off, and was immediately besieged by great crowds of visitors, who showed the liveliest interest in what, to most of them, was an entirely new art and entertainment; for the Cologne bridgehead has not known wireless, since the allied military forces in occupation on the Rhine forbade its use. But on January 30th the last of the occupational troops left Cologne, the territory became free, and automatically the wireless ban was lifted. Nothing could be more natural than that the Exhibition should, in these circumstances, take on the air of a national demonstration, and the keenness of the crowds which flocked to the permanent Fair Buildings was perhaps keyed up as much by this spirit as by a suddenly-awakened interest in radio-telephony. The Exhibition became a wireless educational centre for those of the inhabitants who had heard of, but never experienced, the joys of radio, and it must be said the standholders rose to the occasion and freely initiated inquiring minds into the mysteries of the new entertainment. Authority also did its best, for it was desirable that what happened after the Ruhr evacuation should not be repeated. Then, many of the inhabitants of the district were defrauded by unscrupulous vendors of obsolete and worthless wireless equipment, the ignorance of the people on the subject being taken advantage of to such an extent that the sound, straight, trader was in danger of suffering considerable harm by the natural reaction.

The Ministry of Posts, therefore, took a large space at the Exhibition, and provided a kind of museum, which included some of the earliest apparatus experimented with, and showed development down to the most modern installations. There were included the first Lorenz-Poulsen generator for telephony, a Tessler arc generator, a Braun coupled-transmitter with sparking gap and resonance inductor, several valve transmitters, variometers, Telefunken's first valve transmitter in direct connection or working off an aerial, and Thomson's experiment, which shows the inductive effect of alternating current on a conductor placed in the magnetic field. Modern short-wave transmitters and receiving-station equipment occupied another part of the museum, with a model of the Berlin-Hamburg train, which is equipped with wireless telephony for service while running.

The Institute of Physics of the Cologne University had a display of advanced apparatus built by the students, who were present to give information to inquirers, while it having been aranged to transmit music and speeches to the Elberfeld transmitting station for broadcasting—Elberfeld being nearest to the Cologne area—a special audience chamber had been constructed with one side made of sound-proof heavy plate glass. Visitors could in this way see the performers before the micro-

phones and get the music back from Elberfeld on the earphones. A Reiss microphone was employed, while two other microphones served for the loud-speakers in the entrance hall and the concert room in the East Gallery, where a giant 10-ft. loud-speaker (by Otto Gennrich, of Düsseldorf) was in operation.

In one wing of the gallery the West German Radio Union displayed apparatus built by members, while in the two main halls practically all the important German manufacturers were represented. It was noticeable that valves and loud-speakers of all makes were predominant, with very efficient earphones, which were comparatively cheaply priced, 10s. 6d. being the figure for the best. Of receiving sets, all kinds were exhibited, but the chief demand was for the two-valve set, the prices of which ranged from £5 to £6. The reason for the run on this particular type of set was the earlier experiments which proved simple crystal sets to be pretty well useless in Cologne, which has no transmitting station in the area. The two-valve set, however, is good enough for most of the German stations, and the cost is little more than that of the simpler instrument.

While the Exhibition became a particularly patriotic affair, its supposedly international character was not entirely lost, for British, Scandinavian, French, and other nationalities were exhibiting and received satisfactory attention. Among the British firms were Marconi's, with the "Sterling" loud-speaker, &c.; Wireless Equipment, Ltd., exhibiting the "Perfex" aerial; and Neutron, Ltd., which reported good business with its particular wares.

In conclusion, it may be remarked that the display was a retailers' show, for German manufacturers did not exhibit on account of the expense involved, but they gave the Exhibition their support. There were over 100 exhibitors, and the novelty of the show was a five-electrode, single-valve, receiver which works a loud-speaker at a distance of 30 miles from the transmitting station.

The Testing of Transformers.

Some Observations on a Method of Ratio Testing.

By D. PEDLEY.

IN the Institution of Electrical Engineers' paper by Messrs. J. L. Thompson and H. Walmsley* there appears to be a serious discrepancy in the authors' method of ratio testing which needs to be pointed out.

In the first place, in fig. 1 of their paper, which I have, I think correctly, reproduced in fig. 1 herewith, it will be understood that when the switch S_1 is closed, the field-coil windings of the wattmeter are directly connected across the high-pressure supply; quite obviously, unless the wattmeter is specially designed (I may emphasise the word "specially") this method of connection is inadmissible.

From a perusal of the article I am inclined to think that Mr. Thompson intends the field coils of the wattmeter to be connected in series with the h.p. winding as I have shown in fig. 2.

Such a method of ratio testing is no doubt workable; but I consider that the degree of accuracy obtained would not be all that is to be desired, and in the testing of instrument transformers would be inadmissible for the following reasons:—

It is obvious from an examination of the circuit that the fundamental principle of this method of testing depends on the fact that when the wattmeter indicates zero, there shall be no current flowing from the l.p. winding, through the shunt coil of the instrument, to the resistance r; or, in other words, that the p.d. between the points a x shall be exactly the same as the p.d. between the points b x. If any current is flowing through the shunt coil of the wattmeter, there would be a p.d. between the points a b, and calculation would be necessary to include the resistance between a b in the resistance r referred to by Mr. Thompson; also, further calculation would be necessary to ascertain what the indication of the instrument should show.

Assuming that the above condition holds good, *i.e.*, that there is no current flowing between a and b, we require to assure ourselves that the wattmeter will indicate zero.

Further consideration leads us to the fact that the wattmeter will only indicate zero, even under the above conditions, if and when the transformer has no phase error: *i.e.*, it may be possible for the instrument to indicate zero, when there is a slight current through the shunt coil.

It is well known that all transformers possess phase error, since even in specially designed instrument transformers it is not eradicable. It is difficult, and of little use, to estimate the error caused by the above, since it may either add to, or subtract from, a possible phase error of the instrument itself.

I would therefore like to draw attention to a modification of the above method, as indicated in fig. 3, which is free from its defects, and possesses all its advantages, together with some others. The principle of the test is as before; *viz.*, that the value of the resistance r is so adjusted that there is no difference of potential between the points a b, thus the instrument will indicate zero, and the ratio of the voltages HP/LP = R/r as before.

It will be noted that this method is free from the effects of phase error in the transformer, since we are actually measuring current, or rather the absence thereof; whereas in the previous method we measure current × cosine ϕ, where ϕ = the angle of phase error in electrical degrees.

This method is at once simple, since it is easily connected up and requires only one instrument observation; and, at the same time, accurate, since a minimum of calculation is required, and the important portion of the apparatus, *i.e.*, the resistance, is not liable to alteration.

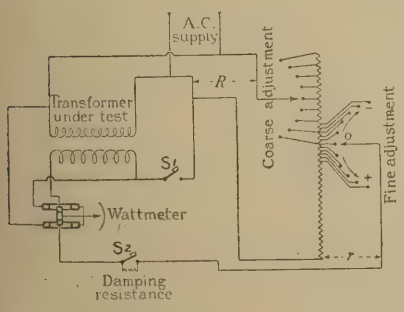


Fig. 1.

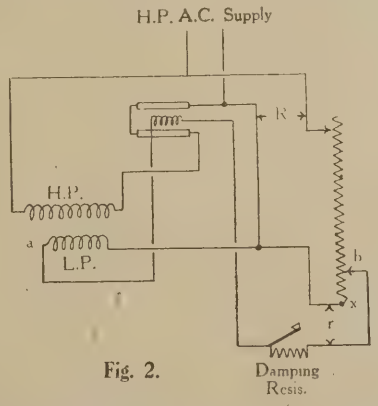


Fig. 2.

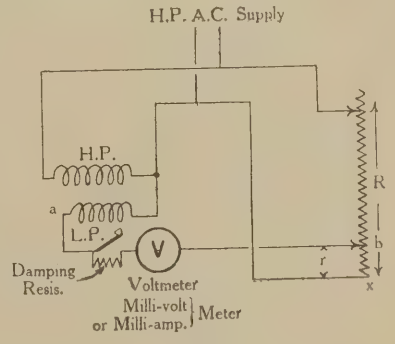


Fig. 3.

* See ELEC. REV., January 29th, 1926, p. 196.

The British Industries Fair—II.

Electrical Features and Meetings.

The British Industries Fair is now in full swing. Unfortunately we have to go to press too early to enable us to report the proceedings of the principal electrical day—Wednesday—but at the Press inspection on Friday last we saw enough of the Electrical Section at Birmingham to enable us to speak with knowledge concerning its forward state and its business-like character. On Monday the official opening took place.

Before proceeding to particularise the numerous electrical and allied exhibits that appear in the Electrical Trade Section and those which appear elsewhere—some firms had selected their positions before it was definitely known that the electrical section would be so successful and they were unable to transfer—we think it will be appropriate if we refer generally to the various directions in which credit is due for the unquestionable success of the movement.

In November last it was feared that notwithstanding the strength and extent of the British electrical industry and its export trade potentialities, electrical products would be few and far between. Mr. T. R. Martin, of Messrs. J. H. Tucker & Co., and several other electrical gentlemen moved in the matter, and at the suggestion of Mr. Martin and the Birmingham Chamber of Commerce, we went down to investigate the situation. We have been closely interested in the British Industries Fair from the moment of its birth when the Electrical Review was conferred with by the Government authorities in these offices shortly after the outbreak of war, and it has always been a matter of some surprise to us that the electrical trade has not previously risen to the occasion. We believe that at the beginning want of space and pre-occupation with the war were to blame for the lack of enthusiasm on the part of electrical manufacturers. Then Wembley was a costly undertaking which compelled our firms to neglect the Fair. This year was regarded as an appropriate time for a re-awakening of interest, but there was no enthusiastic effort made until December. Considering that only about two months have elapsed since that effort was born, it is obvious that credit lies in certain directions, and we wish to give unstinting congratulations where they are due. Of course, without publicity and earnest appeal through the Press, little could be expected. Therefore, as we thoroughly agreed with the objects of the originators, we gave the subject prominence and force in the Electrical Review. The efforts of Mr. T. R. Martin in taking the initiative and of the small electrical committee that was appointed at the meeting held in Birmingham on November 24th; the work of Mr W. A. Gillott, as secretary of the Electrical Trade Section (who undertook space-selling to the electrical firms, we believe, at the suggestion of Mr. Dunlop); the service rendered by Mr. E. J. Jennings, secretary of the Birmingham Corporation Electric Supply Department, as Honorary Secretary of the Electrical Trade Section; the enterprising co-operation of the Birmingham Corporation Electric Supply Department in putting down additional plant at considerable outlay to meet the needs of exhibitors for so brief a display;—all of these have been co-operating factors which made so good and so quickly-executed a show possible. Last, but by no means least, congratulations are due to the eighty or more manufacturers of British electrical products who so readily decided to take space when Mr. Gillott approached them. We believe that if there had been another fortnight in which to arrange matters, half as much space again could have been let.

It now remains to be seen what results will be obtained. It is recognised that the show is more or less an experiment this year. If it is found that Press publicity and the efforts of the Department of Overseas Trade are the means of bringing together the right class of Overseas buyers in sufficient number and if the various organised visits secure the presence of many Home buyers of electrical goods, it will be easy for the electrical industry to make up its mind with regard to the place of electrical goods in the Birmingham Fairs of future years. While the Fair is open, exhibiting firms and others will be forming their own judgment on this and on several other points to which we shall allude later.

The First Function.

The "Press view" of the Fair took place on Friday, February 13th, and Mr. H. E. Parkes, President of the Birmingham Chamber of Commerce, who presided at the luncheon, stated that that body believed in the future of the Fair; and in his opinion it would supply an eloquent reply to those who imagined that British industry was decadent.

The toast of "The Press" was submitted by Mr. R. C. Rodgers, chairman of the Management Committee, who stated that there was no place in the world where the buyer was enabled to visualise under one roof such an immense variety of hardware, and of the allied trades' goods. The stands if placed on end would extend a distance of eight miles. As newspaper men they doubtless appreciated the importance of continuity in advertising, and he was sure they would equally recognise the importance of continuing the Fair as an annual fixture.

Mr. A. H. Bridge (Electrical Review) replied on behalf of the Technical and Trade Press. Speaking of the Fair, he expressed the view that the present electrical display would really mark the beginning of a great electrical section, and that it would become a permanent feature. The electrical industry had been described as one of the bright spots in the industries of the nation. He thought it was going to make a trade atmosphere that it had never made before. He agreed with Mr. Rodgers that the idea of continuity year after year should be pressed home. There had never before, in his long experience, been brought together such a collection of electrical trade articles in market form in so short a space of time. When some of them went down in November and saw the empty buildings that were available for an electrical show they thought it would be very satisfactory if some 50 electrical exhibit shop stands could be secured and prepared within so short a time, but it had been proved that they were not as optimistic as they might have been. Everything depended now upon what happened during the next fortnight. "I hope," he concluded, "that this section of the fair will turn out to be the nucleus of a great annual electrical market."

We commence below descriptions of the exhibits of electrical and allied firms:—

The Chloride Electrical Storage Co., Ltd.

This company exhibits a full range of its batteries for all applications. Among the latest products shown are the company's h.p. batteries for radio work. These are made up in 24-V units in a multi-compartment glass box, or in 20-V units assembled in separate glass boxes. The usual range of batteries in celluloid cases is also exhibited as well as various patterns in glass containers. Higher capacity batteries similar to those used by the B.B.C. are available for inspection, and other types include those for marine radio installations and lifeboat sets and for emergency lighting and gyro-compass operation on board ship. Exide "Iron-Clad" batteries for traction purposes are included, and these are cut away to show the details of the special construction of the cells. Among the smaller types which are shown are cells suitable for miners' hand lamps and for other portable lamps. In contrast with these small models, large cells suitable for the under-water propulsion of submarines are exhibited. The "Lux" battery, specially designed for train lighting, is another type shown and other lighting batteries suitable for country houses, &c., are included. Photographs of Chloride batteries installed in some of the largest power stations in the country appear on the stand, and specimen plates of these large batteries are among the exhibits.

W. Canning & Co., Ltd.

The most recent developments in electro-plating and polishing equipments are exemplified in the exhibits of this company. One of the principal items is the "Rotamatic" electro-plating plant—an automatic apparatus in which the work travels horizontally through the solution. It is claimed that this ensures a uniform thickness of deposit while the solution is continuously filtered and returned to the bath. Electrical elements for heating electro-plating solutions, and enamelling stoves form the subject of another exhibit. These are designed in 110-V units in order that they may be used with any electrical supply. A new type of totally submerged electro-plating barrel and a heavy geared barrel for ball burnishing, together with specially designed resistance boards are also shown. The remainder of the stand is given up to low-voltage dynamos and motor generators for electro-deposition, polishing lathes, grinding machines, and materials used in the electroplating and polishing industries.

George Nobbs, Ltd.

This stand is devoted practically entirely to electric water heating apparatus. In addition to the well-known "Genii" immersion heaters, of which various patterns are shown, the application of these to a number of appliances is exemplified. The "Genii Vectis" water heater shown has a double-jacketed hard-rolled copper body well lagged with heat insulating materials. It is supplied with a loose double-jacketed top covering, a hot water outlet nozzle, and a cold-feed boss with control valve. There is a special immersion heater for constant and booster loadings. The latter range from 150 to 1,000 W to 500 and 1,500 W. The appliance is of neat appearance. The



Fig. 1.—The "National" Calorifier.

"National" calorifier, another exhibit, also has a body of double-jacketed hard-rolled copped lagged with special heat insulating materials, and the range of constant and booster loadings is the same as in the "Vectis" pattern. This calorifier is illustrated in fig. 1. For domestic use a special wall or bulkhead model is shown. This is made in a wide range of sizes, but the main principle is that when the cold water inlet valve is opened the water enters at the bottom of the tank. This pushes the hot water through the internal overflow pipe and out at the hot water nozzle; the cold water, it is said, does not mix with the hot water, but pushes it before it. These heaters are constructed of copper tinned inside and with a polished copper or nickel-plated finish. Hot-water radiators form another section of the exhibit. These are all of neat appearance and consist of cast-iron radiators in "column" design, each unit of which is fitted with an immersion heater. Patterns for affixing to walls or to stand independently are shown. A further exhibit is the "Genii" electric wash boiler. This is a hard-rolled copper tank, with a capacity of 12 gallons, mounted on three legs. It is provided with 3 or 4 kW loading.

The Falkirk Iron Co., Ltd.

Electric cooking appliances form the main exhibit of this company, a number of new patterns being on view. Among the new models is the "Falconette" cooker which has been

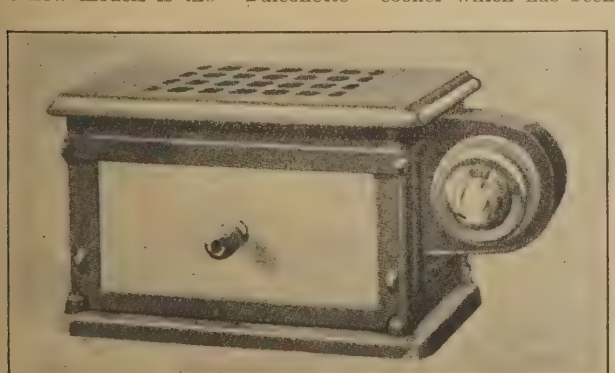


Fig. 2.—A "Falco" Breakfast Cooker.

specially designed for use in small flats and is suitable for a family of two or three persons. The oven has a bottom element only; there is a grill in the hob, which also serves as a boiling plate. The total loading is 2,250 W. The oven is 9 in. wide, 12 in. deep, and 10 in. high; the overall height is 22 in. Several other types of household cookers are shown, and they are remarkable for their very fine finish, most of them being fitted with porcelain enamelled casings. A new type of boiling plate is being employed. This is very strongly made and can be simply removed or placed in position by everyone. It is of the enclosed type and the elements are carefully protected from harm. Among the larger apparatus shown is a double oven range. The ovens are of different sizes and the doors are fitted with white porcelain enamelled panels. There is a large grill, and five semi-enclosed boiling plates. The total loading of this range is 14 kW. A number of smaller appliances are on view, including breakfast cookers, which are really miniature ovens. The pattern illustrated in fig. 2 is 16 in. wide, 10½ in. deep, and 8½ in. high overall. It weighs 32 lb. and the total loading is 2,000 W; a single element serves for the oven or for boiling, frying, &c. Boiling plates, irons and fires are also shown. Among the last is an illuminated dog grate type.

The English Electric Co., Ltd.

This company draws attention to one of its most recent manufactures, a 12,500-kVA, 110,000-V transformer (fig. 3), which is one of 12 built for a power transmission scheme in India. The size and weight of the transformer precluded the exhibition of the actual article, but a part of it appears upon the stand, together with photographs and other details. Each single-phase unit has a maximum output of 12,500 kVA at the B.E.S.A. rating of 65 degrees C. rise as measured by resistance corrected to the instant of shut down, and is of the water-cooled core type. The secondary windings are for 23,000 V; the primary windings are connected in delta and the secondary windings are star connected. The specified test pressure with which the units have complied was 240,000 V between windings and core, and the whole of the high voltage winding had to be insulated for this condition. Owing to the large size of the transformer, it has been found necessary to include many special features of design, including provision of

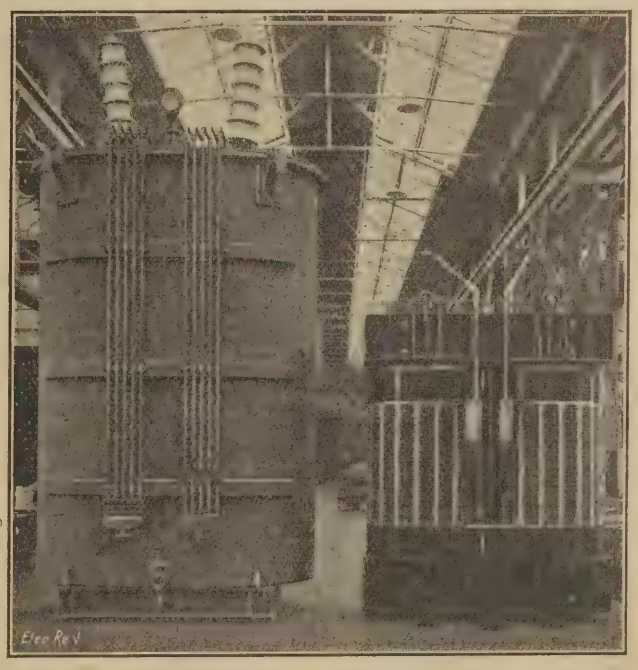


Fig. 3.—An "English Electric" 12,500-kVA 110,000/23,000-V Transformer.

internal cooling ducts throughout the magnetic circuit and the use of welded boiler-plate frames. The English Electric Co.'s "key bolt" construction has been adopted for the core; this eliminates all vertical tie bolts. The high-voltage bushings are of the condenser type and have porcelain shields to give the necessary creepage distance under wet conditions. They will easily withstand 555,000 V dry without flashing over, and 250,000 V under wet conditions. Other "English Electric" products exhibited are a 375-kW, 650-V, 1,500-r.p.m., 50-cycle rotary converter; an ironclad truck type switchboard and switch pillars; various standard a.c. and d.c. industrial motors, one of them a pipe ventilated machine with loose covers showing the method of conversion to the totally enclosed type; also a selection of small tools.

Sturge & Baker, Ltd.

This company is again showing its "Red Rose" fires, which are now made in five sizes, from 300 to 1,500 W. These are bowl fires with the element wires mounted upon a circular base. The design is varied in some new patterns exhibited, the element former being oblong in shape instead of circular. Another speciality of this firm is the flex absorber, and several different types and sizes are shown, the largest of which will support a weight of 10 lb. One pattern shown will take up to 120 ft. of flex.

The General Electric Co., Ltd.

It is the aim of the General Electric Co., Ltd., to show visitors the comprehensive nature of its productions. To this end each of the companies comprising this great organisation shows typical examples of its particular manufactures. The stand is 100 ft. long, and ovals upon the front of it indicate the various sections as well as the many oversea branches of the company imparting an idea of its widespread activities. The Witton Works is represented by heavy electrical engineering products, including generators, motors, switchgear and switchboards. One of these exhibits, a steel-works motor, is illustrated in fig. 4. Fraser & Chalmers Engineering

Works show a model of a turbine and various turbine components as well as a number of other mechanical engineering products. Salford Instruments, Ltd., exhibits measuring instruments, such as ammeters, voltmeters, insulating testing sets, inter-valve and telephone transformers, as well as Salford air circuit breakers, automatic time switches, &c. The Express Lift Co., Ltd., shows the complete gear for a lift installation at Messrs. Lewis's store, Birmingham, and other things connected with electric and hydraulic lifts. Samples of paper-insulated and v.i.r. cables are shown by the Pirelli-General Cable Works, Ltd. The Peel-Conner Telephone Works displays automatic and battery call telephones, including a 100-line section of an automatic exchange. "Gecophone" radio receiving sets also appear in this compartment. The Osram-

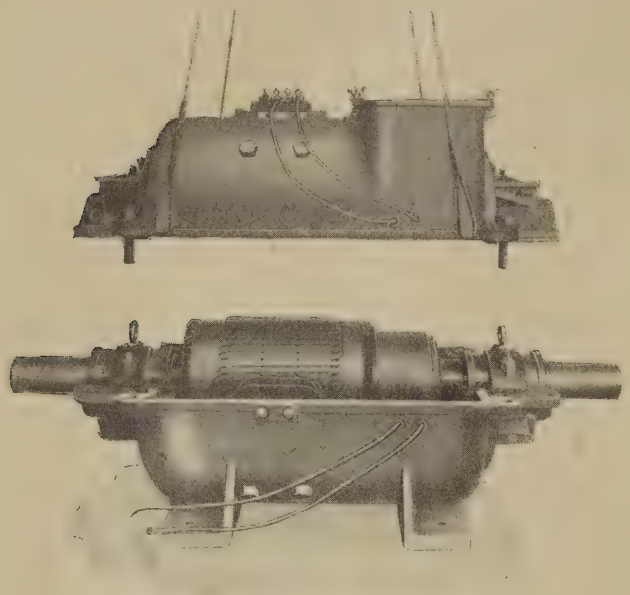


Fig. 4.—A G.E.C. Steel-works Motor.

G.E.C. Works shows examples of all types of lamps which it produces, as well as "Osram" valves in a variety of patterns for all reception and transmission purposes. A special section is devoted to "Magnet" appliances. Here there are electric lighting fittings of all types; British-made power-driven domestic electrical appliances, including refrigerators, clothes washers, dish washers, sewing machine equipment, drink mixers, egg whisks, vibrators, hair dryers, and vacuum cleaners. Electric heating and cooking are also well represented, as are the "Magnet" wiring system and installation accessories. Another part of the stand is devoted to "Freezor" fans of all types, including special patterns for tropical use. "Geekoduct" steel conduit and conduit fittings are shown in a novel manner.

The Castle Fuse and Engineering Co., Ltd.

This company exhibits a large number of "Triumph" fuses ranging from 5-A to 300-A capacity. The contacts used in this type of fuse are of the plug-and-socket pattern. The difficulty of non-alignment between the plugs and sockets has been overcome in a simple but effective manner; the plug is made considerably larger in diameter than the socket, so that it is too large to enter at all. The plug is then slotted by transverse longitudinal saw-cuts extending over the greater portion of its length; then it can be pushed in to enter the socket for some distance, but cannot be pushed right home. The socket itself is therefore slotted with similar longitudinal saw-cuts, and the plug can be pressed completely home in the socket, the pressure required being practically constant throughout the full length of the travel. The slotted end of the plug closes in as it approaches the bottom of the socket, while the top of the socket opens out as the slotted portion of the plug reaches it; thus, while both plug and socket each assume a form that is slightly conical, their relative surfaces are parallel and in intimate contact. The company is also showing various types and sizes of ironclad distribution boards, ranging from small double-pole 5-A boards in cast-iron cases, up to large 3-phase fuse assemblies of 300-A capacity in built-up steel cases with arc-proof and insulating lining. All the boxes are fitted with detachable end plates, which can be removed for drilling and during connecting up.

Credenda Conduits Co., Ltd.

The company's exhibit consists of the well-known "Creda" heating and cooking appliances. There is a range of electric cookers from a size suitable for providing for 18 persons down to a very small model to cater for two persons. The cookers are very well finished, and the chief features are the plug-in interchangeable elements; the oven interiors which can be removed in one piece for convenient cleaning; and the simplicity of the wiring, which is of bus-bar construction throughout. The company informs us that it is making great headway with these cookers, and has found it necessary to open a new factory covering an area of five acres to cope with the demand. A large number of electric fires are on view, representing a great variety of designs and finishes. These are fitted with the "Crater" fire bar. This is a 1-kW unit and has a steel back, which renders it practically unbreakable. The wire is so arranged that the bar gives an appearance of a glowing mass. Among the other domestic appliances shown are a number of electric kettles, most of which are fitted with a protector device which automatically cuts off the current should the kettle be allowed to boil dry. This device is fitted with an easily-renewable fuse. A 10-gallon electric wash boiler is exhibited, and other exhibits are fires, boiling rings, toasters, warming plates, &c., as well as samples of the tube and tube fittings made by the company.

The Relay Automatic Telephone Co., Ltd.

This company is providing the automatic telephone service for the administration at Castle Bromwich. It has a complete 50-line private automatic branch exchange equipped for 30 lines. This comprises an automatic switchboard, a power board, a manual section for using in connection with the public exchange calls, a 24-V accumulator battery and various types of telephones. The switchboard is built on the expanding book-case system; it consists of an iron frame into which relay groups are fitted in multiples of 10. The groups can be increased as required without interrupting the service. The only moving parts in the relay switchboard are small armatures, which have a maximum movement of 1/32 in. There are no electro-mechanical switches or other mechanical devices in the system which require constant adjustment, oiling, or cleaning. On the company's stand a "code calling" device is also installed. This apparatus is designed to enable anyone who is absent from his room and is wanted, to be located immediately. The system is an electrically-operated signal service, which sounds a call for the wanted person throughout the premises. The installation shown is capable of making 25 different calls; a motor generator supplies the ringing current.

Electricars, Ltd.

Two new designs of electric industrial trucks appear on this firm's stand. One is of the elevating platform pattern, and the other a small three-wheel runabout suitable for use in congested areas and along narrow gangways. The platform truck has a capacity of 2 tons, an overall length of 9 ft., and a width of 3 ft. The platform can be raised or lowered 4 in. Steering is applied to all four wheels. Only one motor is used; this drives by silent chains, through a selective dog clutch, either the running or elevating gear as required. The clutch is inter-connected with the controller and a "dead man" switch, so that the motor is automatically stopped on the completion of either raising or lowering the platform. The truck is propelled by an overhead worm-driven axle, and the power is transmitted to the driving wheels through bevel gears mounted on and around the stub axle swivel pins. The gears are totally enclosed and run in oil. The battery has a capacity of 225 Ah. The smaller truck is built to carry one ton. It is 7 ft. long and 2ft. 4 in. wide, and it has a 3-in. lift. The driving and steering are done through a single leading wheel of large diameter, into which the motor is built. The carcase of this may be said to form the hub spindle around which the wheel revolves, driven through suitable reduction gear by the revolving armature. The movement of the platform is operated by hand.

The Cable Accessories Co., Ltd.

This exhibit is divided into two sections, devoted to cooking and heating respectively. In the cooking section there is a comprehensive range of cookers in excellent finishes catering



Fig. 5.—The "Study" Fire.

for the requirements of families up to 10 persons. There are four models—the largest has a total loading of 7,250 W. It has a hot cupboard, a grill, and two large and one small boiling plates. The oven space is 16 in. wide, 16 in. deep, and 14½ in. high. The smallest type, the "Revo" bungalow cooker, has a total loading of 2,500 W, and is equipped with a single plate or grill. In this case the cooking space measures 12½ in. by 10 in. by 10 in. A special type of boiling plate is fitted to these appliances, known as the "Revotherm." This is a semi-enclosed plate embodying many new features. In it the advantages of the open-type plate have been retained and the disadvantages overcome by the introduction of enclosed plate principles. Efficiency is assured by long steatite insulators through which the heavy gauge resistance wire passes,

to make actual heat conducting contact with the grid shaped top plate. In the fire section there is a large assortment of radiators of distinctive design, most of which are fitted with the "Revo" "Emitter" fire bar. This component incorporates the parabolic reflector principle; the surface of the fireclay unilluminated by the radiant coil, is reduced to a minimum, doing away with the dark patches on the face of the bar when the fire is in operation. Heavy section, self-aligning plug-in contacts are provided to facilitate the changing of the fire bars. The general design of the "Emitter" bar is a bowed fireclay former of heavy cross section, traversed by five parallel troughs of parabolical form, the axis of each being tilted slightly upwards from the horizontal, projecting heat rays in the most useful direction. These troughs house the heavy resistor in correct focus. Support is obtained by means of integral webs of fireclay of minimum width, so that in effect the coil lies in a continuous trough and at correct focus at all points along its length. The life of the coil is lengthened by the low current density at which it is worked. A typical application of this fire bar is illustrated in fig. 5. This is the "Study" fire, in which two of the bars, *i.e.*, 2 kW, are fitted.

Petters, Ltd.

The main exhibits on this stand are a 16/20-b.h.p. twin cylinder marine engine and reverse gear, and a 12/14-b.h.p. stationary "S" type cold starting crude oil engine. The marine engine works on crude fuel oil and paraffin and has no magneto. It is a slow-speed medium-compression engine and is claimed to be very reliable and economical in fuel consumption. The stationary engine is also a surface ignition engine without magneto, and is made in sizes ranging from 5 to 36-b.h.p. A general purpose unit for use on farms or in smaller applications, is the 5-h.p. "Handyman" engine shown. An example of the company's "Petter Light" plant which is suitable for country house installations is shown; a substantial battery is provided with this set, and a switchboard possessing all the instruments necessary for the efficient operation of the plant by persons with no electrical knowledge.

"Manda" Motors, Ltd.

Small motors and their applications are displayed upon this stand. There is a range of these machines from 1/20th h.p. to ¼ h.p., d.c., series shunt and compound-wound, operating at any speed from 1,000 to 2,500 r.p.m. A number of new a.c. motors of a similar range, single and polyphase, high and low voltage, are also shown. An a.c. high-pressure rotary converter for radio use is another exhibit. This apparatus enables the h.p. battery to be charged without complicating circuits which are used for l.p. battery charging. The machine gives ⅓ A at 70 V. Several exhaust fans appears with from 10-in. to 48-in. blades. Other applications of small motors are an electric turntable and buffing, polishing and grinding machines. There is a collection of starting and regulating switches for use with these motors.

The Edison Swan Electric Co., Ltd.

This company has a varied collection of its many electrical products. Particular attention is devoted to "Royal Ediswan" lamps, and examples of all types, *e.g.*, carbon filament, vacuum, and gasfilled. The "Fullolite" lamp of opal glass with an inner protective skin of clear glass, is given prominence. Another interesting lamp made by the company is the "Pointolite," which has a bulb housing a tungsten arc. This lamp has many applications, including kinema projection work, and in laboratories where a point source of light is required. The company also has a large display of electrical accessories, including lampholders, switches, junction boxes, fuse boxes, distribution boards, &c. Another section is devoted to domestic electrical appliances, and here are shown the "Little Glutton" vacuum cleaner, irons, kettles, toasters, and other devices. A further part of the exhibit consists of a representative range of "Ediswan" radio valves.

Other Exhibitors.

In addition to the foregoing, which are only a few of the electrical firms, brief mention must be made of the following exhibits, and more space will be devoted to most of them in a later issue:—

Geo. Ellison (switchgear); The B.S.A. Radio, Ltd. (wireless apparatus); Reeves & Co. (electrical accessories); Imperial Engineering Co. (cooking, heating, &c., appliances); Mouldensite, Ltd. (moulding powders and impregnating varnishes); Veritys, Ltd. (motors, starters and lighting fittings); Coley & Swinnerton, Ltd. (cookers, wash boilers, &c.); Steam Fittings Co., Ltd. (valves, regulators, &c.); Blackstone & Co., Ltd. (oil engines); Vickers-Petters, Ltd. (heavy-oil engines); G. Turnock (cable connectors, charging boards, &c.); S. J. Daulby (d.c. motors); C. H. Parsons, Ltd. (switches and lampholders); Tangyes, Ltd. (oil engines and pumps); Commutator Grinding Block Co.; Lightfoot Refrigeration Co., Ltd. (ice-making and refrigerating machines); British Electrical Repairs, Ltd. (generator repairs, &c.); London Electric Wire Co. and Smiths, Ltd. (wires and cables); Julius Sax & Co., Ltd. (alarms, signalling apparatus, &c.); W. E. Burnand & Co. (electric motors and furnaces); W. & T. Avery, Ltd. (weighing, recording and testing machines); Automatic Electric Furnaces, Ltd.; Alfred Herbert, Ltd. (machine tools); Belling & Co. (cooking and heating apparatus); Rapid Magnetting Machine Co., Ltd. (electro-magnetic separators); National Time Recorder Co., Ltd. (recorders and costing machines); British Electric Transformer Co., Ltd. (cookers, fires, &c.); Higgs Motors (dynamos, motors and parts); J. H. Tucker & Co., Ltd. (electrical accessories); Tok Switches, Ltd. (snap switches and plugs); Jackson Electric Stove Co., Ltd. (heating and cooking apparatus); Magnetic Separators, Ltd.; Electric Heating & Hardware, Ltd. (electric fires and domestic appliances); the Arora Co. (electric fires); W. McGeoch & Co. (switch and fuse gear, signalling lamps, &c.); E. H. Millington & Co., Ltd. (lighting fittings); S. A. Lamplugh, Ltd. (radio apparatus); Smith & Paget (electric washing machines); Henry Watson and Sons, Ltd. (electric lawn mower); Eastern Telegraph Co., Ltd.; Holden & Hunt (electric welding plant); Allen-Liversidge, Ltd. (welders and riveters); Babcock & Wilcox, Ltd. (lighting sets); Bowen Instrument Co. (electrical pyrometers); Waygood-Otis, Ltd. (model lift); Sheringham Daylight Co.; Atomised Fuel & Engineering Co., Ltd.; Rustless Surf-Alloy, Ltd. (low-voltage furnace); Hackbridge Electric Construction Co., Ltd. (transformers); R.M.P., Ltd. (mica); the Electrolier Co. (lighting fittings); Spauldings, Ltd. (insulating materials); Record Electrical Co., Ltd. (instruments); Francis Lamplocks, Ltd.; Birkby's (synthetic resins); Dowsing Radiant Heat Co., Ltd. (heating, cooking, &c., appliances); Premier Electric Heaters, Ltd. (domestic appliances); Bulpitt and Sons, Ltd. (electrical utensils); Bastian Meter Co., Ltd. (geysers, meters, &c.); Berry's Electric, Ltd. (switchgear, fires, &c.); Gent & Co., Ltd. (radio apparatus, clocks, and signalling gear); Siemens & English Electric Lamp Co., Ltd. (lighting fittings and domestic appliances); Siluminite Insulator Co., Ltd.; National Gas Engine Co., Ltd. (crude-oil engines and generating sets); Crossley Bros., Ltd. (oil engines and a new lighting set); Young, Osmond & Young, Ltd. ("Lightfoot" heating system); A. W. Beuttell & Co., Ltd. ("Linolite" fittings); Hewittic Electric Co., Ltd. (mercury arc rectifier and "Service Light"); Ruston & Hornsby, Ltd. (cold-starting oil engines, &c.); "Ceag" Miners' Supply Co., Ltd. (miners' lamps); "M.K." Electric, Ltd. (plugs and sockets, switches, &c.); and K.F.M. Engineering Co., Ltd. ("Internalite" signs).

The London Fair.

The London Section of the Fair is housed in some of the buildings of the White City, Shepherd's Bush; it comprises many hundreds of firms, covering a wide range of classes, but the electrical industries are here represented mainly by wireless apparatus. The following firms are exhibiting:—Ashley Wireless Telephone Co., Ltd.; Beard & Fitch, Ltd.; Brandes, Ltd.; British Radio Corporation, Ltd.; British Thomson-Houston Co., Ltd.; S. G. Brown, Ltd.; Burndept Wireless, Ltd.; J. J. Eastick & Sons; Elven Mains Receiver Co.; Finston Manufacturing Co., Ltd.; Formo Co.; General Electric Co., Ltd.; Gilfillan Bros., Ltd.; Halcyon Wireless Supply Co., Ltd.; Lisenin Wireless Co.; London and Provincial Radio Co.; Magonee Specialities, Ltd.; Marconiphone Co., Ltd.; Marconi's Wireless Telegraph Co., Ltd.; M. O. Valve Co., Ltd.; Mullard Wireless Service Co., Ltd.; North London Valve Co., Ltd.; Peerless Productions, Ltd.; Permec, Ltd.; Radio Communication Co., Ltd.; Read & Morris, Ltd.; Red Seal Loud-speakers; Sexton-Barnes, Ltd.; Stratton & Co., Ltd.; Telegraph Condenser Co.; Wates Bros. & Co., Ltd.; Watmel Wireless Co., Ltd.; Western Laboratories, Ltd.

General Electric Co., Ltd.

This company's exhibit (Stand No. C. 48), is in four sections —"Osram" valves, "Gecophone" wireless receiving sets, installation components and accessories, and "Witton" moulded insulation. Every type of the well-known "Osram" valve is shown, both receiving and transmitting, including the dull emitter types, to which the D.E.2 (h.f. and l.f.), have recently been added. The "Gecophone" section ranges from the "Junior" crystal set to the six- and eight-valve superheterodyne receiving sets, covering one, two, three, and four-valve sets. Amongst installation components and accessories are the "Gecophone" low-loss slow-motion variable condenser, the new "Gecophone" l.f. transformer, and the "Gecophone" universal filament rheostat.

Mullard Wireless Service Co., Ltd.

Over a dozen types of receiving valves are displayed by this company, including the P.M.3—a general-purpose valve—the P.M.4, P.M.6, D.F.A.6, D.F.A.7, D.F.A.8—dull-filament power amplifiers, which are recent additions. The dull-filament valves, P.M.3, P.M.4, and P.M.6, have filaments of extremely high emissivity, taking only 0.1 amp.; in the case of the P.M.3 and P.M.4, the filament is of "N" shape and is therefore said to be nearly equivalent to three valves in parallel. The P.M.6 possesses an "M" filament, equivalent to four valves in parallel. These features give rise to the high mutual conductance claimed for these valves. The company produces a large number of types of transmitting valve, ranging from 5 watts up to 30,000 watts. Amongst them there are some interesting additions. The D.0/40 is a dull emitter transmitter capable of handling a dissipation of 40 watts at the anode. Also the new D.F.A.6, D.F.A.7, and D.F.A.8 (offered as power valves for handling very large outputs) are efficient low-power dull emitter transmitters. The transmitting valves from 5 watts to 600 watts are in glass envelopes; above this power the envelopes are of silica. The 30-kW valve is of the water-cooled metal-glass type. Amongst the company's most recent productions is a wire-wound anode resistance made in standard values up to 100,000 ohms.

Legal.

Metropolitan Tunnel and Public Works, Ltd., v. London Electric Railway Co.

In the Court of Appeal, before the Master of the Rolls and Lords Justices Scrutton and Sargant, on February 8th, this case was heard upon the appeal of the defendants from the refusal of Mr. Justice Lawrence in the Chancery Division to stay the proceedings in the action (commenced by originating summons, under Section 4 of the Arbitration Act, 1889). It appeared from the statement of Mr. C. E. Jenkins, K.C., for the appellants, that the matter arose under a contract between the parties entered into in May, 1924, for the execution of some tunnelling work by the plaintiffs for the defendants on the Charing Cross to Kennington extension. Counsel said the contract in question was what was known as a "schedule of prices" contract by which the contractors agreed to execute the work in question for about £395,000. The defendants had already paid to the plaintiffs about £270,000 on the certificates of the defendants' engineer, but a question arose with reference to the *interim* payments to the contractors by the defendants on the certificates of the engineer and the contractors' right to have recourse to what was referred to as the "general contingencies account" or fund in the contract. Counsel contended that Mr. Justice Lawrence had wrongly exercised his discretion in refusing to stay the proceedings under the arbitration clause in the contract. Mr. Owen Thompson, K.C., having supported the decision of Mr. Justice Lawrence on behalf of the contractors, their Lordships, by a majority (Lord Justice Sargant dissenting) allowed the appeal and stayed the proceedings, and the matter in dispute was therefore remitted to the arbitrator.

The defendants were awarded the costs of the Court below and of the appeal.

Traveller Sent to Prison.

William Thomas, 31, traveller and general dealer, of Walworth, found guilty of feloniously receiving 17 wireless valves and two sets of transformers, the property of Messrs. Pettigrew and Merriman, of Tooley Street, was sentenced at the London Sessions on February 9th to three months' imprisonment in the second division.—*The Times.*

Thefts of Radio Material.

At Old Street Police Court, on Saturday, Cecil H. Quinton, warehouse foreman, pleaded guilty to a charge of stealing a l.f. transformer and a condenser, value 21s. 8d., the property of his employers, Messrs. Hobday, Limited, from a warehouse. The prosecution stated that a director of the firm went to defendant's address and found between £250 and £300 worth of radio components. They found at defendant's address a number of receipts for things he had purchased at Hobdays, but these receipts only covered a very small number of articles.

Defendant was, up till a few weeks ago, one of the men employed to search other employés. Holding that position he was not himself searched. Defendant said he had been driven into the position by force of circumstances. In his previous situation he had a number of assistants under him, and he had to show a surplus for the goods that he handled. For several years he was able to show a large surplus. His remuneration was £3 per week and a commission payable at the end of the year. Owing to shortage of stock to which everyone else had access, he was thrown out of employment, and was not paid his commission. Prisoner was sentenced to three months' imprisonment, with hard labour.

Theft of Electricity.

At the Cardiff Police Court, on February 11th, George F. Cooksley, managing director of G. F. Cooksley & Co., Ltd., electrical engineers, Cardiff, was charged with the fraudulent abstraction of electricity, valued at £1 7s. 3d., from the Corporation's mains. For the prosecution it was stated that the defendant took a room which was not equipped with electric lighting. He then engaged an electrician to make a connection to the lighting mains under the floor of the office. The energy thus obtained was used for lighting and later for heating, and was charged to the principal occupant of the premises. Defendant pleaded guilty, and the magistrates imposed a fine of £10, or, in default, two months' imprisonment.

Southport Corporation v. Birkdale District Electric Supply Co., Ltd.

Lords Birkenhead, Atkinson, Sumner, Wrenbury, and Carson, on February 12th, delivered judgment in the House of Lords in this case, it being an appeal from a judgment of the Court of Appeal reversing a judgment of Mr. Justice Astbury upon a question of charges for electricity supply.

The Birkdale Company supplies electricity in the old Birkdale urban district, now included within the Borough of Southport, and the Corporation of the latter town objecting to the company's charging a higher price within its area of supply than the Corporation did in its own area, brought an action with a view to restraining it from doing so. Mr. Justice Astbury dismissed the action, but the judges in the Court of Appeal, in reversing his decision, granted an injunction restraining the company from charging more, so the company appealed to the House of Lords, asking that Mr. Justice Astbury's finding might be restored. Their lordshops unanimously dismissed the appeal.

Lord Birkenhead said the appellants relied strongly on a well-established principle of law, that if a person or public body was entrusted by the Legislature with certain powers and duties expressly or implicitly, for public purposes, those persons or bodies could not divest themselves of these powers and duties. They could not enter into any contract or take any action incompatible with the due exercise of their powers or the discharge of their duties. In none of the authorities cited was this principle questioned. The problem was throughout, on the facts proved, to bring the case within the principle.

The case of the York Corporation *v.* Leatham was somewhat severely criticised in the Court of Appeal. The facts of it were peculiar, and having regard to this peculiarity he regarded that case as distinguishable.

Lord Wrensbury pointed out that in the York case there was a contract between those who controlled the statutory undertaking and a third party as to the price to be charged, but there was no such contract here, the contract being only between the District Council and the company which was taking a transfer of the undertaking. Lords Atkinson, Sumner and Carson concurred, and the appeal was dismissed.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Electrical Commercial Travellers.—The Electrical Trades Commercial Travellers' Association, which was formed about a year ago, held its first annual dinner, at the Manchester Hotel, London, E.C., on Saturday evening last. Mr. C. W. Sully was the chief guest, and Mr. E. A. Joyce occupied the chair. There were many toasts, including "The President and Vice-Presidents," proposed by Mr. A. S. Markes, and responded to by Mr. Sully and Mr. V. Dale. "The E.T.C.T.A. and Chairman" was proposed by Mr. Sully, and responded to by Mr. Joyce. Mr. Sully said that the Association had already done a good deal of useful work. When they came together at meetings like that, they got all the advantages of co-operation and understood the individual points of view of each other. He congratulated them upon the success of their first year's work, and referred to the social and educational advantages of associated activity. Mr. Joyce, in replying, said that they intended to make the Association a power in their daily work; there was no limit to the benefits that they could secure. They had made a start with their Employment Register. It was within their possibilities to be able to advise companies with regard to members' agreements. They would welcome recruits, and he threw out a hint in favour of fraternising with other societies. Other toasts were "The Charities," "The Visitors," and "The Officers." The toast, "The Press," was proposed by Mr. L. Moir, one of the Press secretaries, who thanked the Press for the assistance that it had given the Association since its inauguration, and coupled with the toast the name of Mr. A. H. Bridge (Commercial Editor of the Electrical Review). Mr. Bridge, in responding, congratulated the Association on the success that had attended its operations down to date, and said that it should occupy an increasingly important place among electrical associations as its membership grew. He said that they must not imagine that editors were always writing. Nowadays they spent much of their time talking, and in his case during nearly 35 years in the editorial chair he had had to listen to the troubles of large numbers of electrical travellers. This being so, he was impressed not only with their difficulties, but with the great value which such an association might be to members if it became a large organisation. He had witnessed the birth of most of the electrical organisations, excepting the Institution of Electrical Engineers. Some had died, others had become a great power in the land, and while organisations filling different purposes were not comparable, he thought that there was a place for their body to become a real power for the commercial man. In his pre-journalistic days he had been closely connected with the commercial engineering trade, and had to do with the sending of travellers to South America. In those days orders were as easy to pick up as stones and sand. To-day things were very different. If they looked round the electrical industry they would see men practically at the top who 30 years ago began life as commercial electrical travellers. That circumstance should give encouragement to those present in considering the wonderful future that lay before our electrical industry. The speaker went on to

some of the problems that had been put to him from time to time—troubles between commercial travellers, between travellers and their employers, requests for advice as to whether under stated circumstances it was worth while going to law, whether such and such a salary offered for a post advertised in the ELECTRICAL REVIEW would be sufficient if they went to take up a job at Timbuctoo, Salt Lake City, or Jericho; whether it was safe to go without an agreement; whether there were risks of being landed in India out of a job and without means of getting home. These were typical questions upon which they could centre their thoughts as an association. Communications should be addressed to the Hon. Secretary, Mr. R. F. Norris, 25, Hamlet Gardens, Ravenscourt Park, W.6. The subscription is only 10s. 6d. per annum, this low figure being made possible by the fact that all officers have been rendering devoted voluntary service.

Electricity at the Ideal Home Exhibition.—Messrs. L. G. HAWKINS & Co., LTD., inform us that they have again secured the favourable position which they held in past Ideal Home Exhibitions. One of the features of their stand will be a model electric kitchen in which special demonstrations will be given by Alderman Mrs. Hammer and Mrs. Pearmain, of Hackney. There will also be a good show of lighting fittings and domestic appliances.

Admiralty Electrical Engineers' Pay.—An award of the Industrial Court was issued last week on the salary scales of electrical engineers employed by the Admiralty at headquarters, at the Royal Dockyards, and elsewhere. The Court fixed the following basic salaries—*i.e.*, salaries exclusive of cost of living bonus:—

Assistant electrical engineer—£310 a year, rising by annual increments of £15 to £475; electrical engineer—£475, rising by £25 to £650; senior electrical engineer—£575, rising by £25 to £725. Electrical engineers appointed as senior electrical engineers will enter the higher scale at their existing salaries or at the minimum of the scale, whichever is the greater. Engineers and senior electrical engineers will continue to be provided with a house or house allowance, and the special allowance of £75 a year to senior electrical engineers will be discontinued.—*The Times.*

Co-ordination of Overseas Propaganda.—In a recent letter to the Prime Minister the Federation of British Industries points to the necessity of co-ordinating propaganda for British interests in oversea countries. So far, it is said, every question has been dealt with separately by a separate body, and it is thought that this divided effort should give place to a more effective method. The F.B.I. therefore suggests the appointment of an inter-departmental Government Committee upon which representatives of industry, commerce, finance, shipping, science, arts, education, and other interests should be invited to serve with a view to co-ordinating British propaganda abroad.

Social Events.—The annual dinner of the staff of the Torquay Electrical Department was held on February 6th. The toast of "The Undertaking" was proposed by Mr. H. F. G. Woods, the borough electrical engineer, who referred to the progress made during the past year, particularly with regard to domestic consumers. A musical programme followed the dinner and toasts.

The first annual dance and social of Preston Corporation Electricity Department Sports and Social Club took place on February 10th, over 900 persons attending, including the president, Mr. W. S. Wood (Ribble power station superintendent) and members of the Corporation.

About 120 members and friends gathered to celebrate the first social evening arranged by the Sheffield Illumination Society, held at Stephenson's Restaurant, Sheffield, on the 9th instant, when Councillor W. Melling (chairman of the Lighting Committee) presided. Councillors M. Humberstone, J.P., and S. Warren were also present. Councillor Melling made reference to the greatly improved street lighting of the city since the appointment of a public lighting engineer, and said that Sheffield had been further honoured by Mr. J. F. Colquhoun (public lighting engineer) being asked to deliver a paper at the Conference of the Institution of Public Lighting Engineers, to be held at Newcastle in September next. Whist was followed by musical items and after supper the musical programme was continued.

The annual staff dance of the Paisley Corporation Electricity Department was held on February 5th at the Town Hall. The function took the form of a whist drive and dance, and, at the conclusion of the whist drive, domestic electrical appliances were presented to the winners. The chief electrical engineer and his wife (Mr. and Mrs. Blair Smith) were present, and representatives of a number of local electrical firms also attended.

The Hackbridge Cable Co.'s Sports Club is holding its annual dinner at the White Hart Hotel, Mitcham, on March 13th.

Local Exhibitions.—ENNISKERRY (Co. WICKLOW).—Under the auspices of the Enniskerry Electric Supply Co-operative Society, an exhibition of electrical appliances was held recently in the Carnegie Library and the show was largely attended. Mr. S. P. O'Byrne gave a demonstration and a lecture on the utility and economy of electrical domestic appliances.

BACUP.—At the Mechanics' Hall, Bacup, on February 12th, a week's exhibition was opened by the chairman of the Corporation Electricity Committee, the Mayor (Alderman H. Whitehead) presiding over a large attendance. All kinds of electrical appliances are shown for cooking, lighting, washing, heating, &c., and an electric café and lounge have been installed.

The Amendment of the Bankruptcy Law.—It is reported that the Board of Trade hopes to deal during the present session of Parliament with the law of bankruptcy by the introduction of a Bill based on the report of the Departmental Committee issued last year. In the main the recommendations of the Committee have been accepted. It is proposed that acts committed within twelve months of the presentation of a petition may be made criminal offences, instead of within six months as at present. The books that must be kept will include accounts of all goods sold and bought and sufficient details of the goods and their buyers and sellers to enable them to be identifiable. The Committee also suggested that courts of summary jurisdiction should have power to inflict up to twelve months' imprisonment for a bankruptcy offence, instead of six months as at present, and that in certain cases the maximum punishment should be increased to five years' penal servitude.

Lead.—Reporting on February 13th, Messrs. James Forster & Co. state:—"A little better demand from consumers has been experienced this week, though it still leaves much to be desired. Prompt supplies are still plentiful, but arrivals during the next few weeks are expected to be on the light side. . . . It may be that before long we shall have to absorb surplus American lead, as well as the bulk of the Mexican output. The Board of Trade returns for January show:—Imports, 26,898 tons; exports, 2,355 tons; leaving for home consumption 24,543 tons."

The International 48-hour Week.—Last week a meeting of the Executive Committee of the International Metal Workers' Federation was held in Prague. Mr. J. T. Brownlie, the English representative, moved a resolution expressing satisfaction at the action of the British Minister of Labour in inviting representatives of Continental Governments to a conference upon the institution of the 48-hour week in the engineering industries of those countries, and urging all organisations connected with the Federation to bring all possible pressure to bear upon their Governments to give effect to the Washington Convention recommendations. The Federation, which represents nearly 5,000,000 European metal workers, adopted the resolution.

Engineering Employés' Wages.—In commenting upon the refusal of the employers in the engineering industry to concede the union's request for an increase of 20s. per week in the wages of their members, the *A.E.U. Monthly Journal* (February) says:—"We suggest to Sir Allan Smith and his colleagues that they have not met the claim of their workpeople in the spirit in which their proposals to reduce wages were received in 1921. At that time, we were asked to accept cuts in wages, hitherto unprecedented, in order to assist the employers to bring about revival in the industry, and whilst never agreeing that reducing wages would bring about what the employers desired in the way of improved trade, nevertheless our members accepted the cuts and have continued to make the heavy sacrifices imposed upon them. We firmly believe that the engineering industry generally is in a position to meet an advance of wages to the men engaged therein. If employers hold the view that their employés are to wait until every section of the industry is in a flourishing condition before an increase can be granted, then they are wrong, and signs are not wanting that the patience of our members is at last giving way. During the past month, disputes of no small dimensions have taken place in London and other parts of the country—disputes which we submit would never have taken place had it not been for the feeling which is existing that we are not having a fair deal."

E.D.A. Conferences.—The subject of the E.D.A. Conference which is to be held at Caxton Hall this evening (Friday) is "The Electrical Industry and the Architect," and an architect (Mr G. Blair Imrie, of Messrs. Imrie & Angell) will deal with the matter authoritatively. The next conference, which was to be held on March 19th, has been postponed until March 26th.

Bakers' Exhibition at Birmingham.—The Lord Mayor of Birmingham opened the annual Bakers', &c., Exhibition at Bingley Hall, Birmingham, on February 9th, and it remained open until February 18th. The exhibition was noteworthy for the amount of electrical equipment on view. The Artofex Engineering Works, Ltd., displayed an all-electric equipment, making and baking various foods as required for the modern confectioner. This comprised a three-deck sectional portable type electric oven, with proofer and steam generator; mixing and kneading machines, and a 4-speed "Express" cake mixer. The General Electric Co., Ltd., exhibited an electric baking oven, a portable and self-contained appliance designed to secure ease of operation and continuous working. A good deal of electrical equipment, as used in the bakery, was shown by the Hobart Manufacturing Co., Ltd. Messrs. Alfred Hunt, Ltd., exhibited portable ovens fitted with electric light in the baking chambers. Russell & Co. displayed several whisking machines, a mixer, with motor drive, &c. Electrical advertising signs were shown by the Roto-Sign Co., Ltd., and electrically-heated toasters, grillers, and steamers and poachers, were exhibited by Messrs. W. M. Still & Sons, Ltd., and the "Finnell" system of electric scrubbing was demonstrated by Messrs. W. Robert Wright, Ltd.

American Loan for Italian Electrical Enterprises.—It is understood that arrangements have been virtually concluded with a group of American bankers for the issue of a loan of $20,000,000 to the Italian Credit Institute for the development of hydro-electric enterprises in Italy. The bonds will probably bear interest at a rate of 7 per cent.—*Reuter* (New York).

Unemployment.—There was a further reduction of 25,827 in the number of registered unemployed during the week ended February 1st, the total at that date being 1,175,000. As compared with the corresponding date of last year there was a decrease of over 63,000.

Trade Announcements.—The Electric Wiring and Repair Co. has opened a new showroom and offices at 5, Corn Exchange Street, Cambridge. Manufacturers are asked to send new lists to that address.

Mr. Alan Wright, Sentinel House, Southampton Row, London, W.C.1, has been appointed sole sales representative for Great Britain and Ireland for the radio products of the Hart and Hegeman Manufacturing Co., of Hartford, Conn., U.S.A. A 24-page illustrated price list has been received.

Messrs. Crosland & Bateson, electrical engineers, have opened showrooms and works at 15, Cemetery Road, Heckmondwike.

Mr. L. G. Walker informs us that he is organising a contracting business under the title "West Wales Electric, Ltd.," at 3, High Street, Criccieth. He asks for lists and particulars from manufacturers.

The Athol Engineering Co., of Higher Broughton, has acquired new works at Seymour Road, Crumpsall, Manchester, where it will have a greatly increased output of radio components.

Owing to the re-organisation of affairs in this country, Mr. F. W. Lowenadler has resigned his connection with Messrs. Trelleborg Ebonite Works, Ltd. Pending completion of arrangements communications should be addressed to the company at Audrey House, Ely Place, London, E.C.1.

Mr. A. Moreton Scales, late manager of Kye, Ltd., has entered into partnership with Mr. W. R. Preston, and is carrying on a wholesale electric lamp trade, under the title of Lunar Electrical Co., at Sicilian House, Southampton Row, W.C.1.

The Lancashire Dynamo & Motor Co., Ltd., announces that Mr. G. E. Whitehead does not now act as its agent in South Wales, and that it will shortly be opening an office in Cardiff to deal with both Lancashire and Crypto machinery.

The address of the Croydon Borough Electricity Department is now: Electric House, 38, High Street, Croydon.

Messrs. G. S. Peckham & Co., of 4 and 5, New Compton Street, London, W.C.2, have been appointed London agents for Messrs. Cox-Walkers, Ltd., Darlington.

With reference to the announcement in our issue of February 5th of the death of Mr. E. B. Turner, of Turner Bros., 134, Upper Thames Street, E.C., we are asked to state that the continuity of the business will be in no way interfered with. Mr. S. W. H. Turner is the new principal.

Catalogues and Lists.—Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—February stock list of dynamos and motors.

Messrs. Royles, Ltd., Irlam, near Manchester.—Illustrated pamphlets dealing with liquid strainers, air-heating plant, calorifiers, bath-water heaters, steam traps, &c.

Messrs. F. Gilman (B.S.T.), Ltd., Grange Works, Grange Road, Smethwick.—Illustrated catalogue of "Skatoskalo" electric and other scaling tools for boiler and ship work.

Materiel Electrique Alex Lefebvre (Export Dept.), 9, Rue Arsène Houssaye, Paris.—A stock list of generating sets, motors, and other electrical plant

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Folder B.C. 3991, containing details, illustrations, and prices of "Gecophone" radio components and accessories.

Siemens and English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—A well-illustrated catalogue containing prices and details of "Siemens-Xcel" domestic electrical appliances.

Superlamp, Ltd., 92-94, Paul Street, Great Eastern Street, E.C.2.—Net trade price lists of electrical and radio materials and accessories.

Messrs. Crompton & Co., Ltd., Chelmsford.—Leaflets No. 761, describing the "Unique" cell-testing voltmeter, and No. 762, dealing with the "Alltest" multi-range portable moving coil instrument.

The Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, W.1.—A series of illustrated pamphlets:—S.P. 109, Portable air compressors; S.P. 110, Electric arc welding; S.P. 111, "Little Giant" combination hoist; and S.P. 112, Vertical power-driven air compressors.

Messrs. Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—Catalogue No. 565, illustrating and describing enclosed lighting units and "Holdrite" suspension sets. Priced.

Mr. John Cashmore, Great Bridge, Staffs.—A catalogue of machinery and plant in stock, including electric motors, boilers, pumps, machine tools, &c.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire.—Pamphlet Ta159/1, illustrating and describing a 450,000-V testing equipment for a cable factory.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Publication No. 364A, describing the company's asynchronous-synchronous motors. The booklet also deals with applications of these machines.

Bankruptcy Proceedings.—J. R. Barker, Fanshelf House, Front Street, Pontefract, and 183, Kirkgate, Wakefield, late Gillygate, Pontefract, wireless dealer.—The receiving order in this matter was made on January 11th on debtor's own petition. The liabilities are returned at £221, and there is a deficiency of £129. The first meeting of the creditors was held on January 25th, at the Official Receiver's office, 21, King Street, Wakefield, when the case being a summary one, was left with the Official Receiver as trustee of the estate. The following are creditors:—

	£		£
Albion Electric Stores	24	Carter, R., & Co. (Bradford), Ltd.	21
The British Wireless Supply Co. (1924), Ltd.	38		

The public examination was held on February 11th at the Court House, Wakefield. Debtor attributed his failure to lack of capital, bad trade due to general depression, and loss through a workman. He commenced business at Gillygate, Pontefract, two years ago with £4 capital. He stated that wiring done by a casual workman whom he employed had been condemned and the job was a total loss. The examination was closed.

W. J. Ayling, 2, Rosemont Villas, Ballards Lane, North Finchley, electrical engineer.—The receiving order in this matter was made recently on a creditor's petition. The statement of affairs shows liabilities of £1,052, against assets of £7, leaving a deficiency of £1,045. Debtor attributed his failure to being unable to obtain money owing to him by a limited company. In 1900 he commenced business as an electrical engineer at Carlton Road, New Southgate, with £40 savings, and subsequently occupied premises in turn at Friern Barnet, Crawford Street, Tally-Ho Corner, Poland Street, and High Street, Edgware. In July, 1920, he paid his creditors a composition of 7s. 6d. in the £ on liabilities of £90. In March, 1923, he removed to High Street, Edgware. On November 10th, 1924, he promoted a private limited company, to whom he transferred his business for a consideration of £1,000 payable as to £250 in cash, £250 in fully paid £1 preference shares, and £500 in 2,000 fully paid 5s. ordinary shares, the company taking over his liabilities except a debt of £300 for money borrowed. He was appointed managing director of the company, and spent the greater portion of the £250 he received in cash in meeting claims for wages and materials on behalf of the company. He states that there is now £394 due to him which he regards as irrecoverable. The company is still carrying on business, but he states that the shares are of no value. He became aware of his position in March, 1925. The following are creditors:—

	£		£
Branchli, C.	200	St. Helens Cable & Rubber Co., Ltd.	20
Griffiths, W.	90	Ayling, A.	20
Beaumont, W. (Exors. of) ...	85	McConnell, W. J.	330
Nicholls & Clarke	65	North, D. T.	20
Abrahams & Co.	40	Wagner, C. W.	20
Pearce, W. J.	35		

N. A. Ludwin, trading as N. A. Ludwin & Co., Merchants, 122, Bunhill Row, E.C. The public examination of this debtor was held on February 13th, before Mr. Registrar Francke, at the London Bankruptcy Court, the accounts showing total liabilities of £10,850 (unsecured £8,690), and net assets valued at £1,382. In the course of his evidence, the debtor stated that he had dealt chiefly in hardware and radio goods; he had also acted as managing director of various companies carrying on similar businesses. In September last he was convicted at the Central Criminal Court upon charges of conspiracy and obtaining goods by false pretences, and was sentenced to six months' imprisonment in the second division. Witness attributed his insolvency to depreciation in the value of German currency, to loss of goods removed from store without his authority, and to loss of goods confiscated by the Customs authorities. The examination was concluded.

P. W. Horne, radio dealer, trading as Horne Bros., Borough Road East, Middlesbrough.—This bankrupt underwent his examination at the Middlesbrough Bankruptcy Court on February 12th. His gross liabilities were £4,028, of which £3,807 was expected to rank for dividend. His assets were put at £254, leaving a deficiency of £3,552.

Debtor admitted that he knew very little about the business, but his brother, who was an experienced electrical engineer, had a shop, and gave him the opportunity of taking it over. He denied that his brother was a partner in the business despite the title of the firm. The title was his brother's suggestion. He removed to more suitable premises at a cost of £300, which money he borrowed from relatives. He continued in business because he hoped the wholesale part of the trade in the town, which was keeping the retailer from selling, would ultimately finish. The trade generally were up against a particular wholesaler, and trying to put him out of business.

The Official Receiver suggested that the debtor had come very largely to his present position by spending too much. The examination was adjourned to March 5th.

W. R. Grigsby (Wenham Lighting Corporation), electrical factor, 184, Grays Inn Road, W.C.—Last day for proofs for dividend, February 23rd. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1.

H. Hall, wireless dealer, 26, Egerton Street, and late of 6, Market Place and Albert Chambers, Radcliffe, Lancaster.—First meeting, February 19th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, March 16th, at the Court House, Bolton.

J. F. CARR, electrical goods agent, 89, Aston Avenue, Fallowfield, Manchester.—First meeting, February 16th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination March 12th, at the Court House, Manchester.

F. H. ARMITAGE, electrical engineer, 9, Occupation Lane, Pudsey.—Receiving order made February 4th, on creditor's petition. First meeting, February 19th, at the Official Receiver's offices, 12, Duke Street, Bradford. Public examination, March 8th, at the County Court, Bradford.

C. F. WADE, consulting engineer, 2, Cambridge Arcade, Pinstone Street, Sheffield.—First meeting, February 17th, at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, February 25th, at the County Court, Sheffield.

C. G. HOFMAN (W. J. Chambers & Co.), wireless components manufacturer and electrical engineer, Andrew Works, Calthorpe Road, Wandsworth Road, and 7a, Victoria House, South Lambeth Road, S.E.—Application for discharge to be heard at Carey Street, W.C., on March 5th.

G. J. C. THORNE and A. H. THORNE (Lawrence Trading Co.), electrical engineers, 51, Avondale Square, S.E.1, late of 159, High Street, Notting Hill Gate, W.—First and final dividend of 4½d. in the £, payable at Carey Street, W.C.

A. H. MONCRIEFF, wireless manufacturer, late of 197, Anerley Road, S.E., and 60, Thornton Road, Bradford.—First and final dividend of 1s. 2d. in the £, payable February 20th, at the Official Receiver's office, 12, Duke Street, Bradford.

W. P. YOUNG (W. P. Young & Co., and Leicester Tanning Machinery Co.), mechanical and electrical engineer, 172, Kimberley Road, and 40 and 42, Sanvey Gate, Leicester.—Supplemental dividend of 2½d. in the £, payable February 23rd, at the Official Receiver's office, 1, Berridge Street, Leicester.

Company Liquidations.—RE-ECHO RADIO CO., LTD., 109, Marsham Street, Horseferry Road, S.W.1, manufacturers of receiving sets and accessories.—A meeting of creditors was held on February 10th, at the offices of Mr. C. H. Whatley, Duke Street, W.C., the liquidator appointed in the voluntary liquidation of the company. A statement of affairs was presented which showed liabilities of £911, all due to unsecured creditors. There were debentures for £900, and there was also a contingent liability of £124, claimed by Marconi's Wireless Telegraph Co., Ltd., for royalties, which was at present in dispute. The net assets were £604, leaving an estimated deficiency of £307 The company was registered in September, 1924, being a reconstruction of the Re-Echo Manufacturing Co., Ltd., which was wound up by the Court. The new company purchased the assets of the old company from the receiver. The capital of the present company was £2,500. It appeared from the books that a very fair business was done up to March, 1925, but from April last until January of this year trade had fallen off considerably The present position was attributed to insufficient capital, heavy overhead charges, and the slump in trade. It was hoped that the business could be sold as a going concern, and if that was done sufficient would be obtained to pay the creditors in full. Mr. Whatley stated that if the liquidation was continued with the present liquidator the debenture holder would fall in with the general body of creditors and rank as unsecured. After some further discussion it was decided that the shareholders of the company should be requested to pass resolutions appointing Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, accountants and auditors, 4, Charterhouse Square, E.C., as joint liquidator with Mr. Whatley, together with a committee of inspection of three of the largest creditors. The following are creditors :—

	£		£
Marconi's Wireless Telegraph Co., Ltd.	254	Cobalt Magnet Steel Co., Ltd.	38
Universal Cabinets, Ltd. ...	101	Kent Bros. Electric Wire Co. and E. H. Phillips, Ltd. ...	38
Odhams Press, Ltd.	73	International Electric Co., Ltd.	30
Coan, Robert W., Ltd.	63	Thompson & Norris Mfg. Co., Ltd.	21
Fry's Metal Foundries, Ltd. ...	57		
Lowenadler, F. W.	52		

THE VAUXHALL CHEMICAL CO., LTD., 161a, Upper Kennington Lane, S.E.—Under a compulsory winding up order against this company, the business of which was to place on the market a chemical compound for the charging of batteries, the statutory first meetings of the creditors and shareholders were held on February 11th at Carey Street, W.C. The accounts showed liabilities of £2,056 against assets valued at £412, and a total deficiency of £2,644 with regard to contributories. The Official Receiver remains in charge of the liquidation.

VICTORIA ELECTRICAL (MANCHESTER), LTD.—Winding up voluntarily. Liquidator, Mr. R. N. Brookes, 6, Princess Street, Manchester.—A meeting of creditors was called for February 18th, at Victoria Works, Altrincham. Particulars of claims to be sent to the liquidator by March 1st.

Dissolutions of Partnership.—ERIC JOHNSON & Co., general electrical and mechanical engineers, 134, Old Street, Ashton-under-Lyne.—Mr. J. W. Webster and Mr. E. Johnson have dissolved partnership. Mr. Webster will attend to debts.

LAIRD, HYDE & HYAM, electrical engineers, Hill Cross, Coventry.—Messrs. G. A. Laird, D. Hyde, and T. H. Hyam have dissolved partnership. Messrs. Laird and Hyde will attend to debts and continue the business.

BLAXLEY CABLES, electrical engineers, 230, High Street, Erdington, Birmingham.—Mr. E. E. Peace and Mr. F. H. Blaxley have dissolved partnership.

B. C. BULLARD & Co., electrical engineers, 13, Museum Street, Ipswich.—Mr. B. C. Bullard and Mr. C. W. Tozer, junr., have dissolved partnership. Mr. Bullard will attend to debts and continue the business under the same style.

J. K. COTTON & Co., electrical engineers, 2, Water Street, Rochdale.—Messrs. F. W. Brierley, J. Sugden and A. D. Wickham have dissolved partnership. Debts will be attended to by Messrs. Brierley and Sugden, who will continue the business.

HODDINOTT & Co., electrical factors, 19, Cannon Street, Manchester.—Messrs. H. Hoddinott, A. Dale and G. E. Bayley have dissolved partnership. Messrs. Dale and Bayley will attend to debts.

Book Notices.—"What's Wanted and Advice to Inventors" (1st Edition).—A useful booklet issued by the Institute of Patentees (Inc.), price 7½d. post free, containing many suggestions for the guidance of prospective inventors. A few short articles, including "Patents and the Income Tax," by S. E. Denning, F.I.S.A., and "The Legal Aspect of Patents," by Kenneth E. Bartlett, add to the interest of the publication. The aims and objects of the Institute are also given in detail.

"The *Electrician* Electrical Trades Directory and Handbook." (Pp. civ + 1,417.) London: Benn Bros., Ltd. Price, 25s. net.—This is the 44th edition of this useful directory. The usual features appear, having been brought up to date.

"Art and Commerce." Winning essays in *The Studio* international prize competition; together with an article on "The Organisation of Commercial Art in the United States," by Harry L. Sparks. (8 pp.) London: *The Studio*, Ltd.

"The *Journal* and Record of Transactions of the Junior Institution of Engineers." Vol. XXXVI, Part V, February, 1926. Price, 2s.

"Technologic Papers of the U.S.A. Bureau of Standards." Vol. 19, Nos. 298 and 299, October, 1925 (10 and 20 cents respectively).

"Circular of the U.S.A. Bureau of Standards." No. 1, October, 1925.

"The *Journal* of the Institute of Transport." Vol. 7, No. 4, February, 1926. Price, 2s. 6d.

"The Annual Report and *Transactions* for the 41st session, 1924-1925, of the Derby Society of Engineers."—The Society has now a membership of 225.

"The *Journal* of The Royal Technical College," No. 2, December, 1925. Price, 10s. 6d.

"The Transactions of the South African Institute of Electrical Engineers." Vol. XVI, Part 11. December, 1925. Price, 2s.

"Notes on the Induction Motor," by H. E. Dance. Pp. viii + 152; figs. 70. London: Oxford University Press. Price, 6s. net.

"Who's Who in Architecture (1926)." London: The Architectural Press. Price, 25s. net.

"The National Significance of Electricity." London: British Electrical and Allied Manufacturers' Association (Inc.).—A brochure reprinting four articles which have appeared in the financial Press, dealing respectively with the electrical industry, the national supply of electricity, the Government's electricity schemes, and standardisation.

The Timber Market.—Our Timber Trade Correspondent reports that the wood market for softwoods from the North of Europe, for general construction purposes, is fairly steady, but the country is holding heavy stocks. This latter position is set off to some extent by the better consumption which, it is expected, will improve still further in the early future. Competition on the spot is rather keen. In hardwoods the teak market continues very firm, with stocks light and a paucity of shipments to come forward. Of mahogany logs, those of prime quality and good size are firm in value, but for inferior grades the market has weakened a little. Mahogany planks and boards are highly valued. In other choice hardwoods, such as satinwood, ebony, rosewood, &c., the market is firm. For American oak, ash, walnut, and other woods, the market is steady, due largely to the high ideas of shippers for forward business. Stocks, generally, of States hardwoods are large, and the demand only moderate.

Early Church Lighting.—Messrs. Falk, Stadelmann and Co., Ltd., have been informed by one of their customers that he has recently re-wired Blockley Parish Church, Worcestershire, with the company's "Hitest" lead-covered cable on the "Esyway" system. The customer states that the church was the first in this country to be wired for electric lighting.

New Italian Companies.—Among the new concerns recently formed in connection with the electrical engineering industry in Italy are the Società Industria e Applicazioni Elettriche, Milan, capital 10,000 lire; the Società Astese Filovie Elettriche, Asti, capital 10,000 lire; and the Società Industrie Elettriche, Carolei (Cosenza), capital 600,000 lire.

Hackney: A Contractor's Protest.—The borough electrical engineer of Hackney (Mr. Robinson) recently invited the Hackney and Stoke Newington Chamber of Trade to compete for prizes offered for the best window-dressing displays in the four show-cases in the Electricity Demonstration Halls. An electrical contracting member of the Chamber was invited to take part, but at the last meeting a letter was read in which he resigned his membership as a protest against the action of the Chamber in working with the Borough Council instead of protecting the interests of the individual members. The letter described municipal trading as nothing more or less than the beginning of Bolshevism (surely it began a very long time ago!), but it did not take into account the assistance which the Council's Demonstration Hall is lending to the general extension of electricity supply in the district or the convenience of the service rendered by the Department to the small consumer. The Hall is situated a considerable distance

from the contractor's own shop premises. The Gas Company has a fine showroom in the neighbourhood, and if electrical contractors cannot make displays on such a scale they must be content to see such electricity halls as that in Mare Street. If electrical development can only proceed at the pace it merits there will be work for both contractors and municipalities.

An Index of Consumers.—The Hackney Electricity Committee has considered the question of keeping records of development in the Sales Department and has recommended the introduction of a card index of consumers so arranged that the names of all consumers can be seen on the visible edge of the card on which numbers are printed. These numbers would represent lighting, heating, cooking, power, &c. By the use of coloured transparent signals it could be seen what part of the business required most development in any particular road, and what business had been obtained. This system also lends itself to the classification of trades, which is needed for circulating invitations to lectures, demonstrations, &c. Alderman Genese, in moving that the proposal be referred back, stated that he was opposed to the municipal sale of electrical appliances. He mentioned that the Council had secured a monopoly of a vacuum cleaner, and local retailers were compelled to purchase these appliances from the Council in order to supply their customers. The amendment that the scheme be referred back was lost.

Radio Apparatus in Poland.—*Commerce Reports* says that increased activity in the radio field prevails in Poland. A broadcasting station is being erected in Cracow, and an ex-Prime Minister, in conjunction with the Polish electrical firm of Sila & Swiatlow has been granted a concession to build a station and manufacture and sell radio equipment. Foreign capital participates to a considerable extent in this departure, and the combination is to take over the Government factory which produces telegraph and telephone apparatus.

The Business Efficiency Exhibition.—The Business Efficiency Exhibition, organised annually by the Office Appliance Trades Association, was opened by Sir R. Woodman Burbidge, Bart., on February 10th; it closes to-morrow (Saturday). As in previous years, all kinds of office aids are in evidence, including many electrically-operated machines such as typewriters, calculating machines, time recorders, and duplicators. Intercommunication systems are exhibited by the Reliance Telephone Co., Ltd., Dictograph Telephones, Ltd., and the British Home and Office Telephone Co.

Egyptian Railway Contracts.—The Metropolitan Carriage Works has been awarded a contract by the Egyptian State Railways for the supply of one thousand open low-sided 10-ton wagons. Messrs. Dorman, Long & Co. have been awarded a contract for the supply of 100,000 steel sleepers, and Messrs. Guest, Keen & Nettlefolds have secured a similar contract. The contracts for two further lots of 100,000 steel sleepers have not yet been placed.—*Reuter's Trade Service* (Cairo).

Trade Facilities Acts Extended.—The period under which guarantees may be extended to British traders in the carrying out of projects which employ British materials was to come to an end on March 31st next. The Government has decided, however, to extend the period for a further year and to increase the aggregate amount which may be guaranteed from £70,000,000 to £75,000,000. It is estimated that at March 31st next £5,000,000 of the original sum will remain unused; therefore, the total balance available will be £10,000,000.

The Overseas Trade Acts are to be extended also. The total of guarantees under these is to remain at £26,000,000, but the dates by which they must be granted and beyond which they cannot remain in force are to be extended to September 8th, 1929, and September 8th, 1933, respectively.

Electric Traction in Brazil.—The *Monthly Review* of the Bank of London and South America, Ltd., states that the English Electric Co., Ltd., has presented a proposal to the State Government of Sao Paulo for the electrification of the Cantareira Tramway at a cost of 11,197 contos of reis (about £1,260,000). A concession is being sought to construct and operate an electric line from Sao Paulo to Santos for the transport of passengers and goods. The State Government of Sao Paulo has granted a concession for an electric railway from Espirito Santo do Pinhal to Caracol, a distance of 21 km. The Cia. Electro-Metallurgica de Ribeirao Preto has asked the Government for a subsidy of 3,000 contos for the construction of a railway line between Ribeirao Preto and the Rêde Sul Mineira Railway. The Paulista Railway has completed the electrification of its lines from Campinas to the Tatú station and is proceeding with the conversion of the Rio Claro line.

For Sale.—Victoria Park Hospital, Bethnal Green, invites offers for surplus generating plant. Kingston-upon-Hull electricity department invites offers for surplus generating plant. Mr. H. J. Shaw will sell by auction on February 24th, at 13, High Holborn, W.C., stocks of wireless, electrical and telephone goods. Watford Borough Council electricity department has for disposal a Willans turbine with an E.C.C. 1,000-kW alternator. (See our advertisement pages to-day.)

Municipal Retail Trading.—In a pamphlet which it has just issued, the Electrical Contractors' Association characterises municipal electrical trading and contracting as a "threat to the industry." It fears that the precedent set by the granting of full trading powers to the Barrow, Bath and Burnley Corporations last year will be followed in other cases, and calls for co-operation between supply authorities and contractors rather than competition.

Price Increases in France.—As a result of the fall in the value of the franc several of the radio apparatus manufacturing concerns in France have lately found it necessary to advance their prices to the extent of about 20 per cent.

Irish Free State Electrical Exports.—Electrical goods to the value of £7,709 were exported from the Irish Free State during the nine months ended with September last as against £1,985 in the similar period of 1924.

Our Radio Exports.—In the *Wireless Trader* for February 10th, statistics appeared showing the distribution of British radio apparatus exports during 1925. The total value of these (including valves and re-exported goods) was £1,335,087. Our principal customer was Japan, whose share was valued at about £214,000. Australia was next in importance, having taken goods to the value of about £200,000, and was followed by the Irish Free State (£83,000), the Netherlands (£65,000), the United States (£55,000), India (£55,000), Canada (£53,000) and South Africa (£51,000).

Calendar and Salary Schedule.—We have received from the Electrical Power Engineers' Association a wall calendar for 1926, which sets out the basic salaries of power station technical staffs and a cost-of-living variation table.

New French Companies.—La Société Générale des Condensateurs et Appareils de Protection Electrique is the name of a new concern which has lately been organised in Paris (73, Rue Notre Dame des Champs) with a capital of 500,000 fr., to acquire and develop the business of the Société La Protection Electrique Capart-Dubilier.

La Société l'Herault Electrique is the name of a new company which has lately been formed at Laroque (Department of Herault) with a capital of 1,100,000 fr., to acquire and extend the hydro-electric station at Laroque.

La Société des Véhicules et Tracteurs Electriques (Vetra) is the name of a new company which has lately been formed in Paris (186, Rue du Faubourg Saint Honoré), with a capital of 300,000 fr., to construct industrial electric vehicles and tractors.

La Société des Ondes Dirigées is the name of a new concern which has lately been organised in Paris (46, Rue de la Tour) with a capital of 200,000 fr., to manufacture radio and electrical apparatus.

A company has lately been formed in Paris (94, Rue de la Victoire) with a capital of 2 million fr. and the title La Société Industrielle de la Ville et du Port de Tenes (Algerie) to establish a central electricity distribution system in the town and district of Tenes, Algeria.

The Japanese Market.—*Commerce Reports* states that the past year witnessed a great improvement in conditions in Japan. The prospects for immediate sales of electrical, steam and hydro-electric generator units and equipment are extremely favourable owing to the prosperous condition of the electrical power companies and the probability of industrial and other demands. On the other hand, business in radio apparatus is quiet. This is attributed to the lack of variety in the broadcast programmes. There is some dumping of accumulated stocks.

The I.M.E.A. : Change of Address.—The address of the Incorporated Municipal Electrical Association has been changed to: Electric House, 38, High Street, Croydon. Tel.: "Croydon 1152." Extn. No. 3.

Lighting and Power Notes.

Aldershot.—Opposition to Bill.—The Town Council is to oppose the Bill of the Metropolitan Electricity Supply Co. which seeks powers to supply electricity in parts of Surrey, Northants., Berks., and Bucks.

Bradford.—Street Lighting.—The City Council has decided to ask the Sheffield Corporation to allow its street lighting superintendent to advise the Council in the matter of street-lighting improvements.

Clayton.—Electricity Supply.—By invitation of the Bradford Corporation Electricity Committee, representatives of that Committee and of the Urban District Council recently met in private conference to discuss the situation affecting electricity supply to Clayton, for which both the Bradford Corporation and the Electrical Distribution of Yorkshire, Ltd., are seeking powers. The Clayton local authority favours a supply from Bradford. The Council received a letter recently from the Yorkshire Electric Power Co. (an associate company of the Electrical Distribution of Yorkshire, Ltd.), stating that it intends to lay cables in certain parts of Clayton within one month.

Continental.—Holland.—The A.E.G. of Berlin has recently completed a 24,000-kW steam turbo-generator for the power station at The Hague. The set runs at 3,000 r.p.m. and is one of the largest high-speed turbines so far constructed.

Belgium.—The Société d'Electricité de la Campine, has completed plans for the establishment of a large central power station in the New Campine coalfield for the supply of electricity to the provinces of Limbourg and Antwerp.

The authorities of the Province of Liége are to raise a loan of 10 million fr. for the electrical development of the province.

France.—The authorities of the Loire-Inférieure Department have been authorised to raise a loan of 9½ million francs for rural electrification purposes.

At the recent annual meeting of the Société Bethunoise d'Eclairage et d'Energie, of Bethune, it was stated that the

Company was now supplying electricity to 308 villages, with 72,237 consumers, the latter representing an increase of 13,606 during the past 12 months. The Company has now about 860 miles of h.p. cable and 770 miles of l.p. mains in operation.

The authorities of the Department of the Nord have recently voted a credit of one million fr. for the extension of the electricity supply facilities in the rural districts of the Department.

NORWAY.—By the utilisation of the waterfall at Rjukan, the Norsk Hydro-Elektrisk Rvaelstof Aktieselskap is now developed to a total capacity of 240,000 kW, and the plant has a daily output of 5,700,000 kWh. The annual output of the Rjukan hydro-electric plants is now about 2,000,000,000 kWh.

Coventry.—OPPOSITION TO BILL.—The City Council is to oppose the Leicestershire and Warwickshire Power Bill, 1926, on the ground that it contains a clause which does not give sufficient protection to the interests of the Coventry undertaking. It was stated at a recent meeting that the company only proposed to supply in bulk, and would not incur the expense and responsibility of distribution as was the case with the Coventry station, and would therefore set up unfair competition.

Dalkeith.—TRANSFER OF UNDERTAKING.—The Town Council has received the sanction of the Electricity Commission to the proposal to take over the local undertaking of the Electric Supply Corporation, Ltd., on April 1st. The purchase price is £18,000.

Denholme (Yorks.).—ELECTRICITY SUPPLY.—The Urban District Council has decided not to proceed with its application for an Order to distribute electricity, but to support the application of the Electrical Distribution of Yorkshire, Ltd., which has agreed to have the supply available within two years if the Order is granted.

Holmfirth.—LOAN.—The Urban District Council is applying for sanction to the borrowing of £5,000 for electricity extensions.

London.—HAMMERSMITH.—The Electricity Committee has recommended the following revised scale of electricity charges as from the meter readings for the quarter ending March 31st next:—General lighting supplies: (Prepayment), 5d. per kWh; (ordinary), varying from 4½d. per kWh for the first 10,000 kWh per annum to 3d. per kWh for all energy consumed in excess of 50,000 kWh. Industrial power, cooking, and heating, &c., 1.4d. per kWh. Special rates for large consumers of electricity for combined lighting, heating and power purposes. The following two alternative "all in" tariffs for private premises are recommended:—(1) Fixed annual charge of 10 per cent. of the rateable value of the premises, plus 1d. per kWh for electricity consumed; (2) Fixed annual charge at the rate of £8 per kW on the lighting installation only, plus 1d. per kWh consumed.

The borough electrical engineer has submitted a report on the extension of h.p. feeders in the Brook Green, Shepherd's Bush, and Hythe Road districts, and the Committee has recommended that the most satisfactory method is to provide an additional e.h.p. three-phase ring main between the generating station and the Osram-G.E.C. Lamp Works, Brook Green, and to transfer the whole of the load of these premises direct to the 3-phase distribution. It is also proposed to draw in an additional 3-phase feeder between the Osram-G.E.C. Lamp Works and the Wood Lane sub-station, to deal with the additional load at the latter point and to provide connecting cables between this sub-station and the new sub-station to be built on Shepherd's Bush Green, in order that the load in the vicinity of Uxbridge Road may be transferred to this new feeding source. The estimated cost of the complete scheme is as follows:—E.h.p. 3-phase cables, £6,452; mains from Wood Lane sub-station to Shepherd's Bush Green sub-station, £3,582; switchgear, transformers, &c., £4,492.

HACKNEY.—The Electricity Committee has recommended that the seal of the Council be affixed to the petition of the Conference of Local Authorities Owning Electricity Undertakings against the Metropolitan Electric Supply Company Bill, 1926.

ST. PANCRAS.—The Electricity Committee has recommended that application be made for sanction to a loan of £4,000 for laying an additional feeder main into the King's Cross district.

FULHAM.—The Electricity and Lighting Committee has recommended that an expenditure of £11,298 be authorised for extensions of mains, and that application be made for sanction to a loan of £27,539 for electricity purposes.

Motherwell.—LOAN SANCTIONED.—The Electricity Commissioners have sanctioned the borrowing of £4,141 by the Town Council for additional mains required in connection with the supply of electricity to the London, Midland and Scottish Railway Company's sheds and workshops.

Northern Ireland.—LETTERKENNY (Co. DONEGAL).—The Urban District Council is applying to the Local Government Department for sanction to a loan of £8,000 to cover the cost of the proposed electricity scheme. The plant will include two 75-kVA sets, and it is intended that the scheme will be such as to suit immediate change to the national scheme. The system of supply will be a.c., 3-phase, 230 V and 400 V.

Padiham.—ELECTRICITY IN BULK.—At a recent meeting of the Urban District Council, the Lancashire Electric Power Co. complained that, although electricity had been available for some time, the Council had not yet completed arrangements. Councillor Wiggins said the Council had for some time negotiated over a draft agreement under which the Company was to undertake distribution for 21 years. The draft agreement needed modification, and some members of the Council favoured the Council's undertaking its own distribution. He moved that the Council break off negotiations and arrange to distribute electricity itself by taking a bulk supply from the Company. The proposal was approved.

Peterborough.—LOAN.—Application is being made by the Town Council for sanction to a loan of £140,700 for extensions at the generating station. The amount is made up of the following items: Buildings, coal handling plant and other accessories, £79,250; overhead 50-ton crane, £1,754; switchgear and accessories, £8,666; a 6,000-kW turbo-alternator (estimated), £24,000; two boilers and pulverised fuel plant (estimated), £26,330; salary of temporary resident engineer, £700.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STRATFORD-ON-AVON.—*The Stratford-on-Avon Electricity Co., Ltd.*—Lighting: From 1s. to 10d. per kWh. Heating: From 4d. per kWh for the first 200 kWh and 3d. thereafter, to 3d. per kWh for the first 400 kWh, and 2d. beyond that amount. Cooking: From 2¾d. to 1¾d. per kWh. Power: From 5d., 4½d., and 4d., to 5d., 4d., 3½d. and 2d.

CHASETOWN.—*The Cannock Chase Colliery Co., Ltd.*—Lighting: Quarterly meters, 7d. per kWh; prepayment meters on free wiring system, a rebate of 3d. in the 1s. on all electricity consumed in excess of 10 kWh for the winter quarters and 5 kWh for the summer quarters.

EAST HAM.—Power: All electricity consumed in excess of 12,500 kWh per quarter, from 2d. to 1½ per kWh.

BERMONDSEY.—Lighting: from 5½d. to 5d. per kWh. Power: a reduction of 5 per cent.

FULHAM.—Private lighting: from 4½d. to 4¼d. per kWh. (A corresponding reduction to all slot-meter consumers.) Heating and power: from 1¼d. to 1⅛d. per kWh. Public lighting: from 1¼d. to 1⅛d. per kWh. Power taken under kW system: from £4 10s. to £4 per kW.

CLONMEL (Co. TIPPERARY).—Lighting: From 1s. to 10d. per kWh.

Ripon.—ELECTRICITY SUPPLY.—The Electricity Committee is to interview the Harrogate Corporation, which is prepared to supply electricity in bulk to Ripon. The Committee has agreed to interview representatives of any municipal authority or company on the subject either of bulk purchase, lease of powers for supply and distribution, or by generating electricity by a municipally-owned plant.

Silsden (Yorks.).—ELECTRICITY ORDER.—The Urban District Council, after long negotiations with the Yorkshire Electric Power Co., has decided to apply for an Order of its own, with a view to providing an electricity supply for the district.

South Molton.—ELECTRICITY SUPPLY.—The Town Council has decided to offer no objection to the application of Dr. Purves for a Special Order for the supply of electricity in the borough subject to a clause being inserted in the Order protecting the interests of the Council.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them for the supply by the Wallingford and District Electric Supply Co., Ltd., of electricity in the borough of Wallingford and part of the rural districts of Crowmarsh and Wallingford.

Application has been made by the Slough and Datchet Electric Supply Co., Ltd., for a Special Order authorising it to supply electricity in certain parishes in the rural district of Eton.

Stafford.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of £67,400, made up as follows:—Buildings, £4,400; mains, £29,700; machinery, £33,000. The Town Council has confirmed the proposal.

Stanhope. — ELECTRICITY SUPPLY. — The Urban District Council, at a meeting on February 8th, received a report on the proposed electrification of Weardale, and decided to apply for the necessary powers. It was also agreed that the Council should apply to the Unemployment Grants Committee for a grant toward the cost of the scheme.

Sutton Coldfield.—LOAN.—The Town Council is applying for sanction to a loan of £5,000 for mains and extensions.

Torquay.—ELECTRICITY EXTENSIONS.—The Town Council has applied for sanction to a loan of £990 for transformers and switchgear at the power station in order to convert a portion of the Newton Abbot distributing network from d.c. to a.c. A loan is also to be applied for for the permanent extension of the main sub-station in Upton Valley. The electrical engineer reports that, owing to the increase in consumers, the second new 3,000-kW set will probably only meet the demand for another two or three years, and that at the end of the present year it will be necessary to consider whether power-station extensions involving the installation of a 6,000-kW turbo-alternator shall be put in hand.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World*, the completion this year of the first section of the Kearney (N.J.) generating plant, which is to be operated by the Public Service Electric and Gas Co. and has been under construction since July, 1923, will add greatly to the capacity of the company's system. The equipment to be installed in the new Kearney station includes five turbo-generators, three of 39,200-kVA capacity, and two of 43,750

kVA each. The first of these generating units has already been put into service, and the second unit will be completed shortly. The first section of the Kearny station will thus have a capacity of 205,100 kVA. The second section, when built, will double this rating. Eighteen steel towers have been erected to carry 132,000-V cables connecting Kearny with the Essex and Marion generating stations. Upon completion of the present project, this linking-up will make available a total capacity of 504,500 kVA, and with the erection of the second section the combined capacity of the stations will be 709,600 kVA, making the generating plant one of the largest in the country.

Walsall.—Electricity Extensions.—With a view to giving a supply of electricity to the institutions of the Walsall and West Bromwich Unions Joint Committee at Great Barr, the Corporation proposes to carry out the necessary extension of mains at an estimated cost of £3,000.

Walton-le-Dale.—Street Lighting.—The Lighting Committee has decided to ascertain the cost of converting the present street lamps from gas to electricity.

West Bromwich.—Scheme Rejected.—The Town Council has rejected a recommendation of the Electricity Committee to spend £17,926 in laying cables in connection with the new scheme of the Joint Electricity Authority for the Midland area.

Yeadon.—Electricity in Small Houses.—The Urban District Council has considered the question of the installation of electric lighting in the Council's houses, and the surveyor has been instructed to obtain data as to cost, &c., and to report with a view to application being made for the sanction of the Ministry of Health to the scheme.

Tramway and Railway Notes.

Brazil.—Sao Paulo.—According to the *Manchester Guardian Commercial*, the Government is to obtain permission from the Federal Government to construct a new port, to extend the track of the Sorocabana Railway to the new port, and to start credit operations abroad so that this programme may be carried out. It is estimated that £7,000,000 will be required to construct and equip the new port and to extend and electrify the Sorocabana Railway to the coast.

Continental.—France.—The authorities of the Department of Ile-et-Vilaine have placed the contract for the electrification of the tramways in Brittany with the Sociéte d'Exploitations Electriques, of Paris, which has already commenced operations. The old rolling stock is to be utilised, and contracts will shortly be placed for nine electric locomotives.

Switzerland.—It is reported from Berne that, although the first stage of the electrification of the Swiss railway system is expected to be completed at an earlier date in 1928 than was at first contemplated, the authorities have decided not to proceed with a further electrification programme at present, as it is considered that the economic position is not such as to permit of increased capital outlay on the railways, and it is also desired to await further results of the cost of working the electrified railways.

Spain.—Plans are being prepared for the construction of an electric tramway between Muchamiel and Jijora, in the Province of Alicante.

Germany.—It is reported from Berlin that a beginning will probably be made this year with the long-projected work of the electrification of the Berlin city and circle railway and the connecting suburban lines. The expenditure on the work is estimated at from £5,000,000 to £10,000,000 and a period of three years would be required to complete the conversion of the total length of 97 miles concerned. A second scheme relates to the suggested conversion of the section between Frankfort-on-Main and Basle. The construction of the power station would involve an expenditure of £1,250,000, and the conversion of the Frankfort-Basle section from £2,250,000 to £2,500,000, while £5,500,000 is estimated as the cost of the provision of the electric locomotives in connection with the provisionally projected electrical equipment of the new Baden main lines.

Dundee.—Purchase Scheme Rejected.—In connection with the Town Council's proposal to purchase the tramway undertaking of the Dundee, Broughty Ferry and District Tramway Co., Ltd., the question was considered at a recent meeting of the Council, when it was decided not to purchase the undertaking, on the grounds of high cost, and the possibility of motor omnibus competition. The proposed purchase price was £85,000.

Glasgow.—Inquiry Committee.—According to the *Electric Railway and Tramway Journal*, the Corporation Tramways Committee on Finance has appointed a special sub-committee to examine the traffic and revenue returns of the various tramway routes on the system. It is to inquire into (*a*) the non-paying routes; (*b*) the decline in the revenue per car mile from 21.31d. in 1920-21 to 17.02d. for the current year; the expansion of the system; the increased mileage run, and the decreased revenue during the period under consideration; (*c*) the increase of the department's financial burdens; and (*d*) the cost of the foregoing matters, and to submit a report thereon with recommendations.

Java. — Railway Electrification. — *Commerce Reports* states that according to recent reports the electrification of the line Manggarai-Buitenzorg has been sanctioned by the Government. Plans for the project are now entirely completed, the execution of the work has already been commenced, and the necessary material will be ordered immediately. It is expected that the electrification of the entire line will be completed in two years. An amount of 100,000 guilders has been appropriated for preliminary work in connection with the electrification of the Poerwakarta-Bandoeng line, which will probably be the next to be electrified.

London. — Blackfriars Station.—Important structural alterations are to be made to Blackfriars station to enable it to be linked up with the public subways and also to improve the facilities for handling the traffic at the station itself. The station entrance is to be widened and will lead to a new booking hall 2,500 sq. ft. in area at the existing bridge level. The rearrangement will also permit of an improvement in the interchange facilities between the District Railway and Southern Railway Company's stations. The passimeter system of booking will replace the present type of booking office. Work on the new station is to start at once and it is expected that it will be completed in nine months' time.

Northern Ireland.—Proposed Electric Railway.—It is understood that a syndicate is about to be formed in Newcastle, County Down, with a view of raising £50,000 capital for the construction of an electric railway to the top of Slieve Donard, 2,076 ft. above sea level. The aim of the promoters is to make the ascent from the southern end of the town, *via* the Millstone Mountain, thence to the south side of Thomas Mountain direct to the summit. It is proposed that the descent should be by another route, *via* the Pot of Pulgrave, thence down the slopes of Drinnahilly on the west side of the town.

United States.—Newark (N.J.).—The *Electric Railway Journal* reports that the Pennsylvania Railroad, the city of Newark and the Public Service Corporation of New Jersey have recently reiterated their willingness to enter upon a programme for the expenditure of $25,000,000 for the construction in Newark of a new union terminal and the laying of a vast network of high-speed surface lines, linking northern and western Jersey with Newark. The scheme includes the abandonment of Manhattan Transfer, the extension of the Hudson Tube system to southern sections of Newark, three double-track steel bridges over the Passaic River to accommodate increased traffic brought about by the transfer from electric to steam locomotives at Newark, and the erection of a Pennsylvania passenger station and steam terminal at Wright Street, in the down-town section of Newark. Transportation systems involved in the plan include steam and electric railway lines, electric surface and subway lines and 'buses. The Public Service Railway and railroad branches have the most definite transportation plan outlined for them. This includes a high-speed surface line into north Jersey and the west of Essex County for the passenger traffic to the Newark terminal.

Telegraph and Telephone Notes.

Czecho-Slovakia.—The Postal Administration displayed great activity in developing the Czecho-Slovak telephone and telegraph systems during 1925. It has linked up important commercial and industrial centres with large towns, connected many provincial towns with existing systems, and created local means of communication, exchanges, &c. From January 1st to December 31st (1925), 226 new inter-urban telephone lines and 183 telephone stations were inaugurated. This year the installation of new international telephone lines—Prague-Paris, Prague-Vienna, and Prague-Cracow—will be proceeded with specially. It is also proposed to extend the Prague suburban telephone system, to install at Moravska Ostrava relay plant (of English construction) for international communication, to put into service the inter-urban telephone exchange at Zizkov, and to establish new exchanges at Prerov, Prostejov, Decin, Zvolen, Nové, Zámky, and Poprad.—*Reuter's Trade Service* (Prague).

Italy.—New Radio Service.—The Società Italo-Radio has recently inaugurated a wireless telegraph service between Italy, Egypt, Palestine, and Iraq.

Japan.—Telephone Installation Cost.—It is reported that in Tokio new telephone subscribers must bear the entire expense of installation, at a cost of from 1,500 to 1,700 yen. With the yen at par this would be about £160 in English money. In this country telephone installation is free.

Marine Radio Operators.—Strike Ultimatum.—A conference between the Association of Wireless and Cable Telegraphists and Mr. J. C. A. Ward, chairman of the Engineering Employers' London and District Association, held at the Board of Trade on February 13th, ended in complete failure to reach agreement. The employers, appreciating that they have exhausted the provisions for avoiding disputes contained in the agreement of April 4th, 1923, and having offered proposals for settlement of the strike, which provided for arbitration on all points arising therefrom, have come to the conclusion that it is essential to rehabilitate the service. Accordingly one month's notice, from February 13th, was given to terminate the agreement of April 4th, 1923, but it will be withdrawn

in the event of the A.W. and C.T. accepting this week the terms of settlement of the present dispute as submitted by the employers through the Ministry of Labour on January 27th. In the event of their non-acceptance, the employers will offer to operators signing on in the United Kingdom employment on conditions suitable to the service requirements.

Post Office Accounts.—1925 FIGURES.—The commercial accounts of the Post Office and returns relating to capital borrowings for telegraph and telephone purposes, for the year ended March 31st, 1925 (issued as a White Paper 175, price 9d.), show that the surplus on the telephone service was £463,006 (against £1,596,917 in the previous year), and that the deficit on the telegraph service amounted to £1,645,525 (against a deficit of £1,270,925 in 1925). Telephone revenue increased by £414,966 to £14,782,229, while telegraph revenue decreased by £165,199 to £4,981,580. The Post Office wireless services resulted in a deficit of £27,915, which, with a further sum of £7,736 for experimental work and interest on capital, amounts to a deficit total of £53,358 for the year. Message fees, &c., provided an income of £164,342.

South America.—TELEGRAPH SERVICE.—It is announced that the South American republics of Ecuador and Colombia have lately joined the Bureau International de l'Union Telegraphiqué.

The Telephone Service.—NEW EXCHANGE.—A new telephone exchange, of up-to-date central battery design, was opened at Hoylake on Saturday afternoon, February 13th.

Transatlantic Telephony.—RUGBY TESTS.—It is understood that two-way radio-telephone tests were carried out between the new Government station at Rugby and New York on, and since, February 7th. The experiment commenced at 4 a.m. and lasted until 7.30 p.m., and the results are stated to be very promising; the conversation was also heard in Australia. Transmission took place at Rugby, and reception from New York was carried out at the Post Office station at Wroughton, near Swindon, being relayed through London to Rugby.

Radio Notes.

International Wireless Conference.—WAVE-LENGTH REDISTRIBUTION.—A European conference, to which delegates of all existing or projected wireless organisations have been invited by the International Wireless Office at Geneva, is to be held on March 25th and the following days at Geneva. The conference will be preceded by a general assembly of old and new members of the International Wireless Union. In the course of the meetings proposals for the allotment of wave-lengths for the different European stations will be put forward, experiments which have been made with this end in view being now practically completed.—*Reuter* (Geneva).

Licences.—PROSECUTIONS.—Fining a man 10s. 6d. with 31s. 6d. costs at Hull, on February 10th, for having an unlicensed crystal set, the stipendiary magistrate said the licence must be obtained before the parts were put together, and whether the results were good or bad. A written reply to a question in the House of Commons points out that since the passing of the Act of last session, proceedings have been instituted in 49 cases; 43 cases have been tried, of which 42 were successful, the fines imposed ranging from 4s. to £20 10s.

Post Office Accounts.—B.B.C. LICENCE FEES.—The commercial accounts of the Post Office and returns relating to capital borrowings for the year ended March 31st, 1925 (issued as a White Paper 175, price 9d.), show that the income from the sale of broadcast radio receiving licences to the public during the year was £599,261, of which sum £472,003 is shown to be payable to the British Broadcasting Co., the department retaining £127,258, which is subject to certain adjustment. During the previous year receipts for licences issued totalled £250,055. Licences of the B.B.C. during 1924-25 are returned at £803, compared with £366 in the previous year. On the expenditure side of the account it is shown that administration expenses at headquarters in respect of the issue of licences were £23,770 (in 1923-24 the figure was £23,560), and issue to the public cost £50,411, against £14,463. The year resulted in a surplus of £54,346, over double the previous figure of £20,729.

The daily Press has lately drawn attention to the ultimate effect of a clause in the Supplementary Broadcasting Agreement which came into operation last year. This clause provides that the Postmaster-General shall have the right to reduce the proportion of the licence fee payable to the B.B.C., according to the number of licences and the Company's expenditure. Also, any surplus, after allowing for the depreciation and obsolescence of plant and a maximum dividend to the B.B.C. shareholders of 7½ per cent., must be surrendered to the Post Office. The Postmaster-General decided to limit the B.B.C.'s total income to £500,000, and on June 31st, 1926, the B.B.C. will find its proportion of the licence fees very much reduced. At the moment licences number approximately 1,850,000, bringing in a total of £925,000 per annum. Under the ruling which has hitherto existed, the B.B.C. would receive £693,750 and the Post Office £231,250. The P.M.G.'s limitation would mean that the Post Office would receive £425,000 and the B.B.C. £500,000, but the Company maintains that it should have a larger share of the licence money.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—SYDNEY.—March 31st. New South Wales Government Railways. One air compressor for Zarra Street power house.

April 21st. Four motor-generator sets and four switch-operating batteries for Hornsby and St. Leonards sub-station. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

MELBOURNE.—April 7th. City Electrical Department. One 2,000-kW rotary converter, with transformer and accessories,* d.c. switchgear and accessories, and one a.c. control panel.*

April 7th. Victorian Government Railways. One hydraulic plate-bending press.*

Bedford.—March 3rd. Electricity Department. E.h.p., h.p., and l.p. underground cables for 12 months. (See this issue.)

Bristol.—February 25th. Board of Guardians. Electrical fittings for six months. Mr. T. S. Lamb, clerk, St. Peter's Hospital.

Cardiff. — February 22nd. Electricity Department. Twelve months' supply of paper-insulated cables, one 1,500-kW rotary converter, and one 2,000-kW ditto. (February 5th.)

March 8th. One 10,000-kW turbo-alternator and condensing plant. (February 5th.)

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or alternatively, one 20,000-kW turbo-alternator with condensing plant. (February 5th.)

Hoyland (near Barnsley).—February 26th. Electric lighting installation at Hoyland Council school. Specifications from Mr. A. Rayner, 151, Cross Hill, Ecclesfield, near Sheffield.

Huddersfield.—February 25th. Town Council. Electrician's work in erection of 45 houses, off Town End, Almondbury (5 blocks). Specifications, &c., from Borough Architect, 26, Ramsden Street.

Hull.—Corporation Electricity Committee. Automatic table telephones and bell sets. (See this issue.)

Leeds.—March 2nd. Tramways and Transport Department. Stores for year ending March 31st, 1927, including electrical sundries. Particulars from Mr. W. Chamberlain, general manager, 1, Swinegate.

Leicester.—Electricity Department. One 18,750-kW, 3-phase turbo-alternator, with condensing plant. (February 12th.)

Leytonstone.—West Ham Union. Alterations to the electric lighting station and the installation of a steam-driven generating set, &c., at the Central Home, Leytonstone. (See this issue.)

London.—ST. PANCRAS.—March 2nd. Electricity Department. E.h.p. switchgear at the Grafton Road sub-station. (February 5th.)

METROPOLITAN ASYLUMS BOARD.—February 24th. Installation of electric lighting at the Upper Southern Convalescent Fever Hospital and the Joyce Green Hospital, Dartford. Installation of kitchen fittings and appliances at the North-Western Fever Hospital, Lawn Road, N.W.3. (February 12th.)

Manchester. — March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (See this issue.)

Newark-upon-Trent.—March 1st. Corporation. Two electrically-driven centrifugal pumps. (February 5th.)

New Zealand.—WELLINGTON.—April 23rd. Public Works Department. 11,000-V metering equipment and switchgear for the Arapuni electric power scheme.*

Oldham.—March 2nd. Electric lighting fittings at Bardsley Conservative Club. Particulars from Mr. E. W. Robins, secretary.

March 8th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to Board of Guardians, Union Offices.

Portsmouth.—Electricity Supply Department. Erection of a steel-frame turbine house. (See this issue.)

Richmond-upon-Thames.—February 22nd. Town Council. Electrically-driven centrifugal pump, with switchgear, &c. Mr. Hugh P. Williamson, water engineer, Riverside.

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)

CAPE TOWN.—March 17th. Electricity Department. Electric cables, electric light poles, cross arms, insulators, &c.

MOOREESBURG.—March 20th. Municipal Council. Engine-room equipment, including oil engines and tanks, main generators, motor booster, pumps and air compressor, travelling crane, switchboard, battery and connections, distribution system, instruments, meters, &c.; and house service connections.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Andover.—Town Council. Accepted:—
Installing pump at the water works (£1,617).—Edwards & Armstrong, Ltd.

Australia.—Melbourne.—Postmaster-General's Department.
515 tons h.d. copper wire (£53,327).—British Insulated Cables, Ltd.
Automatic telephone exchange equipment, Canberra (£11,828).—Automatic Telephones, Ltd.

State Electricity Commission of Victoria.
6,600-V and l.p. lead-covered and armoured cables.—British Insulated Cables, Ltd. (£12,525); Johnson & Phillips, Ltd. (£1,347).
Electric lamps (£3,522).—Edison Swan Electric Co., Ltd.
22,000-V and 6,600-V lead-covered single-core cables (£1,342).—Johnson and Phillips, Ltd.

Melbourne and Metropolitan Tramways Board.
Two motor equipments (£6,006).—Metropolitan-Vickers Electrical Co., Ltd.
Air-brake equipments.—Westinghouse Brake Co. (£148); Australian General Electric Co. (£992).

—Tenders.

Carlisle.—Electricity Committee. Accepted:—
Works and instruments for boiler-house (£200).—Stirling Boiler Co., Ltd.

East Ham.—Electricity Committee. Accepted:—
Cable and joint boxes (£1,077).—Enfield Cable Works, Ltd.

Gravesend.—Electricity Committee.
Circulating-water and exhaust pipes:—

Foster Bros.	£1,283
Stewart & Lloyds	1,170
Aiton & Co., Ltd.	1,145
Scottish Tube Co.	1,025
John Thompson, Ltd.	925
The Steel Pipe Co.	906
H. & T. Danks, Ltd.	850
John Spencer, Ltd.	834
Clayton, Son & Co., Ltd. (Recommended.)	**755**
Bolling & Lowe, Ltd.	731

Lamp Contract.—The Government of Northern Ireland has placed a contract for carbon drawn-wire and gasfilled lamps with Edison Swan Electric Co., Ltd.

Leigh (Lancs.).—
2,000-kW, h.p. turbo-alternator set at Messrs. J. & J. Hayes, Ltd., cotton spinners.—Metropolitan-Vickers Electrical Co., Ltd.

London.—London County Council.—Education Committee. Accepted:—
Extension of electric lighting installation at Park Central School, Greenwich (£85).—A. Dean & Co.
50 sets collecting gear.—Edison Swan Electric Co., Ltd.

Kensington.—Finance Committee. Recommended:—
Synchronised time system at town hall (£255).—Magneta Time Co., Ltd.

Shoreditch.—Electricity Committee. One 1,000-kW turbo-generator, complete with condenser, pumps, air cooler and circulating-water pipes, &c.:—

Fraser & Chalmers Engineering Works (Recommended)	**£43,608**
British Thomson-Houston Co., Ltd.	£43,716
Metropolitan-Vickers Electrical Co., Ltd.	£44,765
English Electric Co., Ltd.	£45,264

Boiler plant:—

		Evaporative capacity of boiler. lb.
Stirling Boiler Co., Ltd. (Recommended)	**£13,600**	**70,000**
(alternative)	£13,109	50,000
Babcock & Wilcox, Ltd.	£12,877	50,000
John Thompson Water Tube Boilers, Ltd.	£11,125	50,000
Clarke, Chapman & Co.	£11,919	50,000
Vickers-Spearing Boiler Co., Ltd.	£12,900	50,000

Luton.—Board of Guardians. Accepted:—
Installing electric lighting at the children's home (£78).—E. W. J. Whitelock & Co.

Middlesbrough.—Corporation. Accepted:—
H.p. cable (£2,745).—Enfield Cable Works, Ltd.

Portland.—Water Committee. Accepted:—
Dynamo, cable and lamps at main station (£126).—Smith & Son.

Prestwick.—Town Council. Accepted:—
Nine 300-V lamps of 600 c.p., for the Esplanade (£273).—Ayrshire Electricity Co.

Sheffield.—Tramways Committee. Recommended:—
25 sets "Maley" electro-pneumatic barkes.—Electro-mechanical Brake Co., Ltd.

South Africa.—Durban.—Municipal Council. Accepted:—
2 miles 6,600-V cable (£1,427); 5 tons bare copper wire (£452).—T. Barlow & Sons, Ltd.
385 yd. connecting cable (£218).—British Insulated Cables, Ltd.
10 e.h.p. truck-type switch cubicles (£1,238).—British Thomson-Houston Co., Ltd. Two ditto (£293).—Johnson & Phillips, Ltd.
276 battery plates (£208).—Tudor Accumulator Co., Ltd.
—South African Engineer.

Forthcoming Events.

Diesel Engine Users' Association.—Friday, February 19th. At Caxton Hall, Westminster, S.W. Paper on "Heavy-oil Engine Installations—Choice of Site and Lay-out of Plant," by Mr. G. Porter.

Manchester Electro-Harmonic Society.—Friday, February 19th. At the Albion Hotel, Piccadilly, Manchester. Concert.

British Electrical Development Association Conference.—Friday, February 19th. At Caxton Hall, S.W. At 7.30 p.m. Lecture on "The Electrical Industry and the Architect," by Mr. G. Blair Imrie.

Institution of Mechanical Engineers.—Friday, February 19th. At the Institution, Storey's Gate, S.W. At 6 p.m. Annual general meeting. Paper on the "Measurement of Cutting Temperatures," by Mr. E. G. Herbert.

Junior Institution of Engineers.—Friday, February 19th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Coal-Cutting Machinery," by Mr. S. Reilly.

Institution of Electrical Engineers.—Informal Meeting.—Monday, February 22nd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Some Changing Characteristics in the Application of Electricity to Public Supply," to be opened by Mr. A. F. Harmer.

Institution of Electrical Engineers—(*continued*).
(Irish Centre, Dublin).—Thursday, February 25th. At Trinity College, Dublin. At 7.45 p.m. Paper on "An All-Electric House," by Prof. S. P. Smith.
(North-Eastern Centre).—Monday, February 22nd. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. "Notes on the Testing of Static Transformers," by Mr. J. L. Thompson and Mr. H. Walmsley.
(North-Midland Centre).—Tuesday, February 23rd. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Paper on "The Electrification of the Paris-Orleans Railway," by M. Parodi.
(North-Western Centre, Students' Section).—Tuesday, February 23rd. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Paper on "Electric Winding Engines for Collieries," by Mr. H. Pryce Jones.

Royal Society of Arts.—Monday, February 22nd. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture on "The Production and Measurement of High Vacua," by Dr. C. W. C. Kaye. (Lecture II.)
Wednesday, February 24th. At 8 p.m. Paper on "Domestic Heating," by Dr. Margaret Fishenden.

Faraday Society.—Monday, February 22nd. At Burlington House, W. At 5.30 p.m. Ordinary meeting.

Paisley Association of Electrical Engineers.—Tuesday, February 23rd. At 16, High Street, Paisley. At 7.30 p.m. Debate on "Tramways *v.* 'Buses," to be opened by Messrs. W. R. Bruce and P. Hamilton, Junr.

Institution of Civil Engineers.—Tuesday, February 23rd. At the Institution, Great George Street, S.W. At 6 p.m. Papers on "The Khyber Railway," by Mr. V. Bayley, and on "The Survey and Construction of the Khyber Railway,' by' Col. G. R. Hearn.

Electrical Power Engineers' Association (Midland Division).—Wednesday, February 24th. At the Grand Hotel, Birmingham. At 7.30 p.m. Lecture on "Protective Gear," by Mr. G. L. Porter.

Association of Consulting Engineers (Incorporated). — Thursday February 25th. At St. Stephen's Club, Victoria Embankment, S.W. At 7 for 7.30 p.m. Annual dinner.

Birmingham Electric Club.—Friday, February 26th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Discussion on "Power Factor Improvement," to be opened by Mr. F. R. Unwin and Mr. F. C. Hall.

Royal Institution.—Thursday, February 26th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Atom of Light and the Atom of Electricity," by Dr. C. D. Ellis.

Institution of Production Engineers.—Friday, February 26th. At 83, Pall Mall, S.W. At 7.30 p.m. Debate on "Payment by Results," to be opened by Mr. R. H. Hutchinson.

Physical Society of London.—Friday, February 26th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary Scientific Meeting.

Notes.

The Electrical Engineers' Ball.—The twenty-second Electrical Engineers' Dance took place at the Hotel Cecil on Friday last, and was in every way a distinct success. The arrangements made by the Executive Committee were admirable, and everything passed off most smoothly and satisfactorily. The company present numbered about 640, practically the same total as at the Ball of 1925. Congratulations are due to the members of the Executive and the honorary secretaries.

Wages in Railway Power Stations.—At a meeting of representatives of the Electrical Trades Union, the National Union of Railwaymen, and the London railway companies held at the Ministry of Labour on Tuesday last, an agreement was arrived at in respect of the power-house men's claim for increased rates. The terms of settlement were not disclosed, but it was announced that there would be no strike.

Coal Resources Research.—In pursuance of the policy of the Department of Scientific and Industrial Research of carrying out the physical and chemical survey of the national coal resources, which is one of the main features of the fuel research work of the Department, a committee has been appointed to deal with the survey of the coalfields of Nottinghamshire and Derbyshire.

The Shannon Scheme.—Some additional technical details of the Shannon hydro-electric scheme are given in the *Irish Trade Journal*. A broad-gauge railway for the transport of materials is to be built from Longpavement Station to the site of the power house at Ardnacrusha, and a narrow-gauge railway is to be extended along the works from Longpavement to the end of the embankments near Killaloe for the delivery of materials and plant, and for transporting earth for the embankments.

The excavation work for the power house, tail and head races will be carried out by huge electrically-operated excavators supplied from a temporary Diesel-engine power station, and it is estimated that ten million tons of earth will be excavated. Most of the tail-race excavation will be in rock. The power house will be of concrete construction comprising the dam, turbine house, and generator and switch house. For conducting the water to the turbines steel penstocks, 140 ft. long and 20 ft. in diameter are to be employed. Three 30,000-h.p. turbine and generator sets will be initially installed. In the partial-development stage the head-race channel will be about 260 ft. wide at the water level, 100 ft. wide at bottom, and 30 ft. deep; it will be capable of delivering 550 cubic metres of water per second with an average speed of 1.5 metres per second. The weir above O'Brien's Bridge will be of concrete with six sluice openings. Two of these will have a sill level 28 ft. below the high-level surface, and will be capable of discharging 34.000 cusecs., and the other four will have a sill level 10 ft. below high-water level, and will be capable of discharging 15 000 cusecs. Inlet works will be constructed at the entrance to the head race above the weir, and will consist of concrete foundations and piers with three wide sluice openings and one ship's gate. By closing the sluices and ship's gates it will be possible to cut off the head race from the river should it be necessary to lower the water for purposes of inspection and repair.

Appointments Vacant.—Foreman jointer, for the Spenborough (Cleckheaton) U.D.C. electricity department. Showroom manager (£307) for the Burnley Corporation electricity department. Junior assistant engineer for the Corporation of Ealing electricity supply department. Shift charge engineer, for the Watford Corporation electricity department. (See our advertisement pages to-day.)

An "All-Electric" Comparison.—The following interesting figures show the costs for a period of 12 months of two houses, one using electricity only and the other using electricity, gas, and coal for all domestic services, on the Sheffield electricity supply undertaking's system. All-electric house: Fixed charge, 10 per cent. of rateable value, £3; energy consumed, 7,647 kWh at 0.5d. per kWh, £15 18s. 8d.; plus 20 per cent., £3 15s. 9d.; total cost £22 14s. 5d., averaging 0.7d. per kWh. Electric, gas, and coal house: Electricity for lighting, 223 kWh at 4d. per kWh, plus 10 per cent. and meter rent, £4 11s. 4d.; gas for cooking, 18,700 cu. ft., £2 18s. 6d.; coal for heating, cooking and hot water (10 tons 2 cwt.), £20 8s. 5d.; total cost £27 18s. 3d.

The figures for the all-electric house, the rateable value of which was £30, represent the costs for the 12 months ending June, 1925, and the electricity, gas and coal figures for the other house, rateable value £24, are the costs for the equal period ending December, 1924.

Fatalities.—An inquiry was held recently into the cause of the accident when A. White and W. Merritt, linesmen employed by the G.P.O., who were working on a telephone pole, fell from a five-storey building on to the "live" railway line near Farringdon Street station, receiving fatal injuries. It was stated that one of the wire stays supporting the pole was perished with rust and that the pole was reported as being unsafe in 1923 and in 1925. A verdict of "Accidental death" was returned, the jury adding the following rider:—"The jury are unanimously of opinion that the renewal of the stays had been too long delayed."

Edward Brushwood, employed at the Stockwell sub-station, received a fatal electric shock on February 11th through some cause unknown. The current was cut off for about 20 minutes, and the L.C.C. tramway service between Brixton and Stockwell was brought to a standstill. An inquest was opened on Monday last, and was adjourned until Tuesday next.

Educational.—KING'S COLLEGE, LONDON.—Amongst the special advanced lectures which are being delivered in the Faculty of Engineering of London University, King's College, is a course of three on "Electrical Sub-stations: their Design and Operation," by Mr. H. Brazil, M.I.E.E. (engineer, City district, Charing Cross Electricity Supply Co.). In order to enable shift engineers and others to attend them, it has been arranged for the lectures to be given twice, as follows:—Lecture I was to be delivered on February 16th and 23rd; Lecture II will be delivered on March 2nd and 9th; and Lecture III on March 16th and 23rd. The fee to non-students is 10s. 6d. for the course.

E.D.A.'s Annual Dinner.—The annual dinner of the British Electrical Development Association is to be held on Friday, March 19th, at the Hotel Cecil, at 7 for 7.30 p.m. The speakers will be Viscount Burnham, C.H., Sir Laming Worthington-Evans, Bart., G.B.E., M.P. (Secretary of State for War), and others.

Harnessing the River Dee.—"The Utilisation of the Potential Resources of the River Dee" was the subject of a recent lecture by Mr. S. E. Britton, electrical engineer to the Chester Corporation, before the Chester Natural Science Society. He said that before water resources could be developed to the best advantage, radical alterations to the legislation which governed the use of water were needed, but before such changes were made, a national principle should be established, based upon a careful consideration of (*a*) the proprietorship of water, (*b*) the precedence of the various interests concerned in water, and (*c*) the character of existing restriction upon the free use and upon the abstraction of water for public and private purposes.

While straightening various bends in the river would assist in relieving floods, in improving the conditions of a particular length of the river for development of power and navigation, a further scheme suggested itself, *i.e.*, impounding some of the flood discharge by the construction of one or more dams across the upper valleys of the Dee or tributaries; the water so impounded could be made use of for a comprehensive water supply scheme, or it could be retained for the generation of power. From Llangollen to Erbistock, hydro-electric power stations could economically utilise the run-off water on 275 days per annum, and from Erbistock to Chester on 235 days per annum. As a result of surveys and levelling, it appeared that the water power of the Dee, between Chester and Llangollen, could be most economically harnessed for the generation of electrical energy by the erection of 16 weirs and hydro-electric installations. It was estimated that they would produce 60,000,000 kWh of electricity per annum. The capital cost of such a scheme would amount to £660,000 and would be capable of earning, by the sale of electricity, £198,000. The yearly working expenses, repayment, and interest on capital, spread over 25 years, would amount to £72,000, *i.e.*, an average cost of 0.288d. per kWh, leaving a profit of £126,000 per annum. The effect of impounding 6,250,000 gallons of water annually, which could not otherwise be economically used, and its discharge when there was a greater demand for electricity than the natural flow would produce, would generate approximately 20,000,000 kWh per annum, which, if sold at an average price of 1d. per kWh, would bring in £80,000, and would be sufficient to repay in ten years impounding works costing £600,000. The possibilities of this scheme for producing power were equivalent to the consumption of upwards of 70,000 tons of fuel per annum. The River Dee appeared to possess potential resources which, if developed in the interest of the common good, would provide water, electricity, and means of access, at a cost which would be a boon to industrial and domestic life, and give facilities and convenience of a magnitude which would surpass the most sanguine hopes of any scheme hitherto promoted. The hydro-electric works at Chester were completed in October, 1913, at a cost of £18,482. At April of last year water power at the weir had been converted into 19,640,000 kWh of electricity, the operating costs amounting to £8,659, an average cost of 0.1068d. per kWh. The annual repayments of the original cost of the scheme had amounted to £12,122, *i.e.*, an average cost of 0.1495d. per kWh; by the use of this water, approximately 38,900 tons of fuel had been conserved.

Birmingham and Midland Electrical Engineers' Ball.—It has been decided to hold the annual ball at the Grand Hotel, Grosvenor Suite, on Friday, November 19th, 1926.

Henley's Dramatic Club and the E.T.B.I.—We are pleased to announce that Henley's Dramatic Club, which has done so admirably during the last few seasons, has promised to give a performance in aid of the Electrical Trades Benevolent Institution. "If Four Walls Told," a village tale in three acts by Edward Percy, will be rendered at King George's Hall, Caroline Street, Great Russell Street, W.C.1, on Thursday, March 4th, at 8 p.m. The tickets will be 10s. 6d., 7s. 6d., 5s., and 3s., all numbered and reserved, and can be obtained from Mr. E. G. King, the Assistant Honorary Secretary, Electrical Trades Benevolent Institution, 98, Grosvenor Road, London, S.W.1.

The Electrical Power Engineers' Association.—At the annual dinner of the Scottish Division of the Electrical Power Engineers' Association at Edinburgh on Saturday last, Mr. F. Proudfoot presided over a company of 90, which included Mr. A. J. Ostler, president of the Association, Mr. R. B. Mitchell, city electrical engineer, Glasgow, and president I.M.E.A., and Mr. A. W. Crompton, of Newcastle.

Mr. E. Seddon, manager of Edinburgh Corporation Electricity Department, proposed the toast of the Association.

Mr. Ostler, who replied, said it was borne in on all technical men that they were really responsible for a great part of the management of modern life. That responsibility was growing every day.

Mr. Crompton, proposing "The Electricity Supply Industry," said the effect of putting into force the Government proposals would be to remove industry from the towns and spread it out throughout the country, and to do something to put agriculture on a better footing. Mr. Mitchell, in replying, said the one bright spot noted recently in the industrial situation was the increase in the exports of electrical goods. The lighting load throughout the country was increasing rapidly. In Glasgow the output for the months of November and December showed an increase over the same months of last year of 24 per cent. They were, he believed, on the eve of a development in industrial heating; he thought there was a remarkable future for that. If the Government electricity scheme was brought to fruition consumers in small, and even medium, undertakings would be able to buy their electricity cheaper than at present. It would have a considerable effect on a large number of the members of that Association if over 400 stations had to be shut down; but these undertakings for the most part would be very small, and he hoped those members of the staff who were displaced would be absorbed—and he did not see why they should not very rapidly be absorbed—in the industry, which would go on from success to success.

Manchester Housing and Housekeeping Exhibition.—A Better Housing and Housekeeping Exhibition is being organised by the *Daily Dispatch* to be held at the City Exhibition Hall, Manchester, from April 9th to May 1st. One of the principal features will be an all-electric home equipped with the latest appliances.

Institution of Mining Electrical Engineers.—In a paper on "Mine Signalling Apparatus and Telephones," read before the London branch of the above Institution by Mr. O. D. Kennedy, the signalling requirements in mines, as laid down by the Coal Mines Act, are outlined and the modern methods and apparatus employed for signalling are reviewed. Varying methods of meeting the requirements of the Act are dealt with, together with the difficulties met with in that direction. In dealing with the advantages and disadvantages of mechanical and electrical signalling, the author said that the work of operating mechanical signals, especially from the bottom of a deep pit, was very hard compared with that of operating an electrical system, also a considerable amount of time was lost in giving the signal by the former method. The parts of a mechanically-operated visual indicator had to be made heavy to withstand the strain of the pull. The arrangement of interposing a switch on the pull wire to operate an electrical dial indicator introduced an element of danger; a signal might not be visually indicated through the pull being too short or the indicating device strained by too long a pull. With electrical signalling a perfectly satisfactory automatic arrangement could be obtained by installing special sending switches. The initial cost of the cable was much higher than that of the ropes required with the mechanical gear, but providing a first-class

quality of cable was obtained it should last for a very considerable period, and the saving in maintenance cost and the time in signalling would very quickly recover the initial outlay. When running a cable down the shaft the mistake was often made of not providing adequate fastenings. It was better to err on the other side, and to provide substantial cleats spaced not more than 60 feet apart throughout the length of the shaft so that the weight was well distributed and a minimum strain placed on the cable. It was an undoubted fact that the varying conditions at different collieries were better met by an electrically operated system of signalling, which was invariably more flexible than the mechanically operated systems.

Institution Notes.

Institution of Electrical Engineers.—At the informal meeting on February 8th Mr. R. J. Mitchell opened a discussion on "Some Modern Applications of Ball and Roller Bearings." He said the manufacture of precision bearings occupied the capital and energies of over 50 firms in Europe and America. The product of this considerable industry was a marvellous example of diversity and range, showing that in engineering there was no best way of achieving a result but that improvement in technique brought into being broad classes of competing types, all of which would have a fair trial in the field of hard use. Since loads on bearings supporting rotating shafts might be either pure journal loads or a combination of journal and axial loads, bearings must be designed to meet one or both conditions. To meet the requirements three broad classes of bearings had been developed—plain ball bearings, spherical double row ball bearings, and plain roller bearings. Many years of experience in the field of general engineering, and in particular in the automobile industries, confirmed that where properly applied the precision bearing left little or nothing to be desired in respect of performance. Some electrical engineers still hung back, however, when the decision had to be made between plain and precision bearings. By using precision bearings the designer was able to ensure not only a close air-gap, but that the air-gap would be uniform around the periphery of the rotor or armature and would remain so for the whole lifetime of the machine. Subsidiary advantages were that commutation was more reliable as chatter was impossible, whilst machines kept cleaner, ran cooler, started more easily, and were slightly more efficient on account of the reduced frictional losses. There were exhibited a number of ball and roller bearings, and Mr. Mitchell showed a quantity of excellent slides illustrating these in service. Mr. A. F. Harmer stressed the importance of clean lubricant, and said the cause of much bearing trouble was bad fitting. Mr. H. Brazil thought ball bearings were excellent on smaller machines. He wondered if the excellent results obtained on tramway motors would hold if the motors ran continually nine hours a day. Messrs. C. Belcher, C. S. Clark, W. A. Erlebach, C. R. Garrard, W. E. Rogers, — Smith, and W. L. Wreford also spoke.

Institute of Metals.—The annual and extraordinary general meetings will be held at the Institution of Mechanical Engineers on March 10th-11th, 1926. The annual general meeting will begin at 10 a.m. on the first day, and the extraordinary general meeting at that time on March 11th. The latter is being called for the purpose of passing a resolution to adopt a new set of articles of association, these being the "Regulations contained in the printed document to be submitted to the meeting." On March 10th the annual dinner of the institute will be held at the Trocadero Restaurant at 7.15 p.m. Among the papers which are expected to be submitted are:—"Some Experiments on the Soft-Soldering of Copper," by T. B. Crow; "The Influence of Gases on Copper at High Temperatures, Part 1," by A. Glynne Lobley and Douglas Jepson; and "The Die-Casting of Aluminium Alloys —A Review of Current Methods," by George Mortimer.

Institution of Heating and Ventilating Engineers.—In his presidential address before the above Institution, Mr. Oswald Stoll said some people thought that the science of heating and ventilating was not sufficiently advanced to be honoured as an art; hence arose what he believed was their greatest drawback. The designers and makers of a steam engine, steam turbine, or electric motor knew that they could buy material with which to manufacture those machines which bore a guarantee. Hence they were in a position to predict, from past experience, the results which would be obtained. The materials used in the construction of buildings varied considerably, and this fact made it much more difficult to obtain definite results. Their scientific knowledge and experience to-day had to be of a high order to enable them to overcome those initial difficulties and to produce the degree of accuracy which was expected. In a paper read before the Institution by Mr. H. G. Cathcart some useful figures as to the consumption of gas and electricity in different institutions were given.

Junior Institution of Engineers.—Mr. W. H. Patchell, M.Inst.C.E., took as the subject of the Honorary Member's Lecture which he delivered to the Institution on February 12th, his visit to some of the power stations in the United States in 1925. His remarks had, for the most part, reference to illustrations shown on the screen. He said that large power stations existed in the U.S.A. because conditions of supply were such that it paid all commercial firms and domestic households to use electricity. The demand was met because large plants were put down in the first place to save labour costs, and ever since that time the engineers had realised that in electricity they had something to sell. The result was that now, although 1921 was a bad year, the difference between kilowatts installed and kilowatts generated was doubling annually. Machines of 50,000-kW capacity were none too big when the load on one system varied by 60,000 kW between a dark day and a light day. It was remarkable that in Great Britain everybody waited for the Government to decide upon a standard frequency. What they did in America was to put in frequency changers, such as the 350,000-kVA machine at Brooklyn, and it paid to do so.

Mr. Patchell said that a comparison of British and American electricity prices was very hard to make, for the same reason that it was difficult even to compare the prices of everyday food. American charges might seem greatly different in different towns but that was because the unit charges were based on a standard rate which might be proportionate in one municipality, for example, to house frontage. The Americans certainly knew that a householder soon forgot his standard charge and appreciated the thought, when he saw his lights on, that they were costing only, say, twopence a unit and not eightpence.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

On Monday last Mr. F. A. B. Lord celebrated the completion of fifty years' connection with the hardware trade in the City of London. Mr. Lord began his career with the firm of W. F. Dennis & Co. when he was a boy, in 1876, and the whole of his fifty years' connection with the hardware, electrical and metal trades has been with that firm, of which he is now the head. In 1877 the firm became the agents in this country for Messrs. Felten & Guilleaume, and this arrangement continued down to the outbreak of war in 1914, when it was suspended until about a year after the cessation of hostilities; it was then resumed, and it remains in existence to-day. Mr. Lord's partners in the firm of W. F. Dennis & Co. are Messrs. J. E. Hood and L. H. Hurburgh.

Ing. Francesco Manfredi has resigned his position with the Società Lombarda per Distribuzione di Energia Elettrica in order to take up the appointment as Director General of the Milan municipal electricity undertaking and to supervise the construction of the new Valtellina power station.

Among the recent nominations as Chevaliers of the French Legion of Honour are M. Dardeau, works director of the Paris underground electric railways and M. Lemon, director of the Société Force et Lumière des Pyrenees.

Mr. J. A. T. Barnes, manager of the Kendal Electricity Works, has informed the Corporation that he accepts an increase of salary to £450 per annum without prejudice to a revision of the matter later.

Mr. H. J. Smith, resident engineer of the North Metropolitan Electric Power Supply Co. in the Hertford, Ware and Hoddesdon district, is leaving to take up a position with the Beds., Cambs. & Hunts. Electricity Co., and will be succeeded by Mr. C. R. Marshall, who has acted in a similar capacity at Chingford Mr. Smith was presented with an engraved casket by the staff on his departure.

Mr. E. F. Darker, the London representative of the Benjamin Electric, Ltd., is shortly leaving for South Africa.

Upon leaving Dartmouth, in which district he has spent 24 years, Mr. G. E. Smith, late engineer and manager of the Urban Electric Supply Co., has been presented by the Dartmouth staff with a pair of binoculars. He is taking up a position in London.

The marriage took place on February 11th, at St. Andrew's Church, Ashley Place, Westminster, of Mr. Aubrey Llewellyn Coventry Fell, C.B.E., of Ryestead Common, Chiddingfold, late general manager of the London County Council Tramways Department, and Miss Florence Ruby Wynn, daughter of the late Mr. T. H. Wynn, of Middlesbrough.

Mr. John L. Griffiths, late of the Lancashire Dynamo and Motor Co., Ltd., Manchester, has been appointed assistant electrical engineer to the East Indian Railway, and is now stationed at Lillooah, E.I.R. (Bengal), India

The marriage took place at St. Thomas Cathedral, Bombay, on January 29th, of Mr. Harold Walter Puttick, A.M.I.E.E., A.M.I.Mech.E., resident electrical engineer, Lillooah, East Indian Railway and Leigh-on-Sea, Essex, and Miss Violet Waring, of Aubrey House, Maida Hill, W.2.

Messrs. Wallis-Jones & Dent have removed their offices to 9, Old Queen Street, Westminster, S.W.1. Their telephone number is unaltered: "Victoria 8070."

The *South African Engineer* states that Mr. Andrew Roberts, elder son of Mr. John Roberts, M.I.E.E., borough electrical engineer at Durban, has obtained his degree of Bachelor of Science in Engineering at the Witwatersrand University, and has taken up an appointment with Messrs. Dougall & Munro, Ltd., engineers and contractors.

Obituary.—Mr. J. Stephens.—The death of Mr. John Stephens, of Millwall, a brief reference to which appeared in our issue of February 5th, has removed from amongst us

another of the pioneers of the electrical industry. In the years 1883 to 1888, Mr. Stephens brought a great deal of knowledge and perseverance to bear upon the problem of making satisfactory lead castings for the plates of storage batteries. He was able, after many trials, to make chills in which to cast plates which were both light and strong In association with the late Mr. Anthony Reckenzaun, he worked out details of a Very light, and what was at that time considered a very efficient, electric motor. Such motors were used for propelling battery driven tramcars and launches. An electric tramcar was built by the firm of Stephens, Smith & Co., of which Mr. John Stephens was the founder, and dispatched to Australia. The same firm built and equipped an electric locomotive for use in a mine, also several electrically propelled launches. One of these launches was supplied to the secretary of the Sultan of Turkey. Another electrically propelled boat was the *Volta*, which in September, 1886, successfully made the trip from Dover to Calais, and back to Dover, on one charge of the accumulators. Motor and equipment were all made by Mr. Stephens's firm. It is recalled that on this voyage a Solan goose, asleep on the sea, was seized by an occupant of the *Volta*, and brought alive to the shore, forming an illustration of the noiselessness of the vessel. Much other pioneer work was done by Mr. Stephens, and the industry owes much to his determination to solve difficult problems.

M. J. PERRETT.—The death is reported from Paris at the age of 56 years of M. Joseph Perrett, the chief engineer of the Société des Forges et Ateliers de Constructions Electriques de Jeumont. The deceased who was well known in the French electrical world commenced his career with the old Postel-Vinay concern, which was later absorbed by the French Thomson-Houston Co.

ING. GALLI.—We regret to learn from Milan that Ing. Galli, editor of the Italian electrical journal *Energia Elettrica*, has passed away.

MR. E. R. HILLS.—The death took place, on February 5th, at the age of 64 years, of Mr. Edward Robert Hills, St. Peter's, Broadstairs, who had for about 25 years been on the staff of the Isle of Thanet Electric Supply Co., Ltd.

MR. W. A. CAVE.—The death took place, on January 5th, at the age of 49 years, of Mr. William Alfred Cave, who had for 23 years been with the Marconi Co. at Chelmsford. For 15 years he was foreman of the Mounting Shop.

MR. J. R. CALDECOURT.—The death occurred on February 6th, at the age of 59 years, of Mr. John R. Caldecourt, who was in business as an electrical engineer in Station Road, Upminster, Essex.

MR. D. S. CAPPER.—We regret to learn of the death, which occurred on February 11th, at the age of 61 years, of Mr. D. S. Capper, who was for nearly 20 years Professor of Engineering at King's College.

Will.—The late Mr. ROBERT SUTTIE, a director of the Glenboig Union Fire-Clay Co., left £36,917.

New Companies Registered.

Certax, Ltd. (211,592).—Private company. Registered February 8th. Capital, £800 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in all kinds of electrical (wireless or otherwise) machinery, plant, apparatus, appliances and accessories, electricians, &c. The subscribers (each with one share) are:—W. A. Bourdon, 35, Mortlake Road, Ilford, clerk; A. E. Evans, 130, Thurleigh Road, Clapham Common, S.W.12, clerk. The first directors are to be appointed by the subscribers. Remuneration as fixed by the company. Solicitors: Timbrell & Deighton, 90, Cannon Street, E.C.4.

Radio Photographic, Ltd. (211,583).—Private company. Registered February 6th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and photographic apparatus, wireless photographers, &c. The directors are:—S. W. Chetwood, 1, Leopold Avenue, Wimbledon, S.W.19, dental surgeon; C. T. Millns, 10, Clyde Road, Croydon, certified accountant. Secretary: C. T. Millns. Solicitors: Guscotte, Wadham, Tickell & Co., 19, Essex Street, Strand, W.C. Registered office: 5, Lambeth Hill, Queen Victoria Street, E.C.4.

City of London Radio Corporation, Ltd. (211,537).—Private company. Registered February 5th. Capital, £1,000 in 700 10 per cent. non-cumulative preference shares of £1 each and 6,000 ordinary shares of 1s. each. The preference shares take priority for return of capital. Objects: To carry on the business of electrical engineers, manufacturers of, and dealers in wireless and electrical apparatus, machines, accessories, and goods, &c. The subscribers (each with one preference share) are:—R. O. G. Maxwell, 20, Pendarves Road, Raynes Park, S.W.20, traveller; W. Sanders, 3, Cranbrook Road, S.W.19, engineer. The first directors are to be appointed by the subscribers, and may (if so provided in their appointment), retain office for life or for a specified period. Remuneration, £25 each per annum. Solicitors: Lord & Co., 154, Bishopsgate, E.C.

Harko, Ltd. (211,630).—Private company. Registered February 9th. Capital, £500 in £1 shares. Object: To carry on the business of electricians, manufacturers of and dealers in radio apparatus, mechanical, electrical and radio engineers, manufacturers of and dealers in electrical appliances and apparatus, advertising contractors and agents, &c. The life directors are:—A. V. Mead, 4, Chandos Avenue, Chingford Road, Walthamstow, engineer; Dorothy Sheehan, 2, Macdonald Road, Walthamstow. Qualification, 10 shares. Solicitor: P. W. Pardy, 172, Bishopsgate, E.C. Registered office: 172, Bishopsgate, E.C.2.

Fraser Mares, Ltd. (211,629).—Private company. Registered February 9th. Capital, £1,500 in £1 shares. Objects: To carry on the business of electrical, radio and mechanical engineers, marine wireless engineers and contractors, manufacturers of and dealers in wireless apparatus, founders, metal workers, motor engineers and repairers, &c. The subscribers (each with one share) are:—H. Holmes, 98, Frederick Street, Cardiff, moulding manufacturer; A. H. Mares, 9, Waterloo Road, Cardiff, wireless engineer. The first directors are not named. Remuneration as fixed by the company. Secretary (*pro. tem.*): T. A. Tyrrell. Solicitors: Phœnix & Levinson, 8, Dumfries Place, Cardiff. Registered office: 27, Bute Street, Cardiff.

James Gray & Son, Ironmongers and Electricians, Ltd. (13,985).—Private company. Registered in Edinburgh on February 4th. Capital, £20,000 in 10,000 preference and 10,000 ordinary shares of £1 each. Objects: To acquire the business of general furnishing ironmongers, kitchen-range and grate makers and electrical engineers carried on by R. E. Douglas at 89 and 89a, George Street, Edinburgh, as "James Gray & Son." The directors are:—R. E. Douglas, 114, Polwarth Terrace, Edinburgh, ironmonger; A. J. Robertson, of "Stormont," 34, Morton Street, Joppa, ironmonger; J. C. Henderson, 97, Marchmont Road, Edinburgh, ironmonger; R. A. Douglas Elliott, 24, Merchiston Park, Edinburgh, ironmonger. Qualification, 250 shares. Registered office: 89, George Street, Edinburgh.

H. C. Brown, Ltd. (23,997).—Private company. Registered in Edinburgh February 11th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of electrical engineers, motor-car and cycle accessories factors and agents carried on at Kirkwall by H. C. Brown and S. Banks as Brown & Banks. The first directors are:—H. C. Brown, 16, Bridge Street, Kirkwall, electrical engineer; J. J. Chedgey, 16, Bridge Street, Kirkwall, electrical engineer. Secretary: J. J. Chedgey. Registered office: 14, West Castle Street, Kirkwall.

Raphoe Electric Lighting Co., Ltd. (7,460).—Private company. Registered in Dublin on February 11th. Capital, £1,500 in £1 shares. Objects: To carry on the business indicated by the title. The directors are:—John Moffatt, Junr., Diamond, Raphoe, Co. Donegal, draper; Richard Hamilton, Diamond, Raphoe, Co. Donegal, provision and general merchant; Robert Thompson Whyte, Diamond, Raphoe, Co. Donegal, boot and shoe merchant; Hugh Carlin, John Craig, Dr. John English Snodgrass, all of Raphoe. Secretary: John Moffatt, Junr. Registered office: Diamond, Raphoe, Co. Donegal.

Official Returns of Electrical Companies.

Lisbon Electric Tramways, Ltd. (62,983).—Capital, £1,250,000 in 750,000 ordinary and 500,000 preference shares of £1 each. Return dated November 11th, 1925. 634,026 ordinary and 425,553 preference shares taken up. £134,026 paid on 134,026 ordinary shares. £925,553 considered as paid on 500,000 ordinary and 425,553 preference shares. Mortgages and charges, £466,300.

V. G. Middleton & Co., Ltd.—Satisfaction to the extent of £700 on December 31st, 1925, of debentures dated April 29th, 1920, securing £4,000.

Merthyr Electric Traction and Lighting Co., Ltd. ((57,908).—Capital, £100,000 in 6,000 preference and 14,000 ordinary shares of £5 each. Return dated June 18th (filed September 15th), 1925. 6,000 preference and 13,000 ordinary shares taken up. £95,000 paid. Mortgages and charges, £48,400.

A. Behm (London), Ltd.—W. Strachan, of 50, Gresham Street, E.C.2, ceased to act as receiver or manager on February 3rd, 1926.

Thermal Electric Works (Hackbridge), Ltd.—D. Watson, of 88, Alexandra Road, East Croydon, engineer, was appointed receiver and manager on February 4th, 1926, under powers contained in debenture dated January 5th, 1925.

Isle of Thanet Electric Supply Co., Ltd.—Satisfaction to the extent of £1,384 on September 30th, 1925, of charges dated January 18th, 1902, and September 15th, 1924, each securing £150,000.

Specialities (Liverpool), Ltd.—Satisfaction in full by the payment of £360 7s. (the amount due) on October 29th, 1925, of charge dated January 26th, 1924, securing all moneys due or to become due not exceeding £1,000.

Sterling Telephone and Electric Co., Ltd.—Transfer dated January 25th, 1926, of mortgages dated May 15th and September 24th, 1924, securing all moneys due or to become due from the company to the Westminster Bank, Ltd., not exceeding £130,000, charged on all the freehold hereditaments to which the documents specified in the schedule to the mortgage of May 15th, 1924, relate, and the company's undertaking and property, present and future, including uncalled capital, if any.

H. G. Cooper, Ltd.—First mortgage debenture dated January 16th, 1926, to secure £5,000, charged on the company's undertaking and property, present and future, including unpaid capital. Holder: H. G. Cooper, Lawnrise, High Road, Laindon Hills, Essex.

Van Raden & Co., Ltd. (78,383).—Capital, £10,000 in £1 shares. Return dated November 30th, 1925. 6,754 shares taken up. £4,654 paid. £2,100 considered as paid. Mortgages and charges, £6,200.

Red Seal Products, Ltd.—Debenture dated February 3rd, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: L. Cohen, 33, Westgate Road, Newcastle-upon-Tyne.

L. Weekes (Luton), Ltd.—Particulars filed of £3,000 debentures authorised January 29th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

G. H. Turner & Co., Ltd.—P. M. Harper, of 329, High Holborn, W.C.1, incorporated accountant, ceased to act as receiver and manager on February 3rd, 1926.

G. Davenport (Wireless), Ltd.—M. G. Jemmett, of 30 and 32, Ludgate Hill, E.C.4, was appointed receiver and manager on January 29th, 1926, under powers contained in certain debentures dated August 14th, 1924.

Stearn Electric Co., Ltd.—Issue on January 25th, 1926, of £1,100 debentures, part of a series already registered.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Northampton Electric Light and Power Co., Ltd.

The net revenue account for the past year shows a balance on working of £53,564. To this are added £4,025 brought forward (after paying dividends up to December 31st, 1924), and interest amounting to £2,307, making £59,896. The allocations include £22,284 to the depreciation fund, £4,955 to the reserve fund, £1,000 to the battery suspense fund, and £1,000 to the employés' benevolent fund. The dividends on the ordinary shares total 9 per cent. for the year, as in 1924, and £8,327 is carried forward. Continued progress is reported; during the year the company commenced to supply energy to Daventry,

Weedon, Wolverton, Newport Pagnell, Olney and several villages. The maximum load increased by 26 per cent. to 8,498 kW, and the energy sold rose from 11,729,635 kWh to 14,278,101 kWh. Substantial price reductions were made during the year. The meeting was to be held yesterday (Thursday), and the shareholders were subsequently to be asked to sanction an increase of the company's capital to £500,000 by the creation of 150,000 additional "B" shares to be issued either as preference or ordinary shares.

The "Underground" Group.

The final dividends for the year ended December 31st last have been declared by the companies forming this group, as follows:—

London Electric Railway Co.—Ordinary shares: 1¾ per cent., making 3½ per cent. for the year, as compared with 4 per cent. for 1924. £45,000 is placed to reserve and £94,282 (against £74,506) is carried forward.

Metropolitan District Railway Co.—Ordinary stock: 1¾ per cent., making 3½ per cent. for the year, as for 1924. The reserve receives £45,000 and £51,347 is carried forward, as compared with £69,230 brought in.

City and South London Railway Co.—Consolidated ordinary stock: 1½ per cent., making 3 per cent. for the year, as against 4 per cent. for the preceding year. £25,000 is put to reserve and £25,037 is carried forward (as compared with £18,766).

Central London Railway Co.—Undivided and preferred ordinary stocks: 2 per cent., making 4 per cent. for the year, as in 1924. Deferred ordinary stock: 4 per cent. for the year (the same). £40,000 is transferred to reserve, and £81,008 (as against £85,885) is carried forward.

Underground Electric Railways Co. of London, Ltd.—It is proposed to pay the full interest and dividends on the 6 per cent. first cumulative income debenture stock and the 6 per cent. income bonds, as in 1924. The balance carried forward is £145,959, as compared with £126,685 brought in.

Metropolitan Railway Co.

The statement of accounts for the year ended December 31st, 1925, shows gross receipts of £1,998,979 (as compared with £2,264,040 in 1924), and an expenditure of £1,325,263, leaving a balance of £673,816. To this are added miscellaneous receipts of £306,107 and a balance of £51,127 brought forward, making £1,031,050. Preference dividends, interest, rentals, &c., absorb £600,910, and out of the balance (£430,140) dividends amounting to 5 per cent. are received by the ordinary shares, leaving £51,402 to be carried forward. In the preceding year the ordinary dividend was the same, but in addition £25,000 was placed to the general reserve fund. As we have already reported the dividend on the Surplus Lands Stock was raised from £3 7s. 6d. per cent. to £3 10s. per cent. The report states that the extension to Watford, constructed jointly with the London and North-Eastern Railway, was opened for traffic on November 2nd last. The reconstruction of the Aldgate and Edgware Road stations is in hand and is expected to be completed during this year. It is also hoped to complete new car sheds at Wembley Park to house ten trains of electric rolling stock. Following the ordinary meeting, which was to be held yesterday (Thursday), a further meeting was to be held to approve of the Metropolitan Railway Bill now before Parliament. This provides for the construction of a relief line connecting the Harrow extension line with the Circle line.

St. James' and Pall Mall Electric Light Co., Ltd.

The net profit for the year ended December 31st, 1925, was £67,907; to this is added £18,393 brought forward, making £86,300. The interim dividends absorbed £13,500, and it is proposed to deal with the balance (£72,800) as follows:—To employés' superannuation reserve, £25,000; final dividend on the 7 per cent. preference shares, £3,500; and a final dividend of 7s. 6d. per share and a bonus of 5s. per share on the ordinary shares, making a total distribution of 17½ per cent. for the year; leaving £19,300 to be carried forward. The report states that the connections increased from 24,073 kW to 26,631 kW and the amount of energy sold from 21,143,734 kWh to 23,650,969 kWh. Reference is made to the passing of the London Electricity (No. 2) Act which extends the tenure of the company and other companies until 1971 and regulates the dividends to be paid in future. The directors are taking the necessary steps to carry out the arrangements embodied in the Act. The extension of tenure enables the board to recommend the establishment of a superannuation fund for the employés. An extraordinary meeting for this purpose will follow the ordinary meeting which is to be held on March 2nd.

Central Electric Supply Co., Ltd.

After providing for sinking fund and depreciation the net balance for the past year is £5,001; £9 from the last account is added, making £5,010. A dividend of 5 per cent. upon the ordinary shares is recommended and a balance of £10 is carried forward. During the year the company supplied a total of 78,429,805 kWh to the following undertakings:—The Westminster Electric Supply Corporation Ltd the St. James & Pall Mall Electric Light Co., Ltd., the Chelsea Electricity Supply Co., Ltd., the Kensington and Knightsbridge Electric Lighting Co., Ltd., the Notting Hill Electric Lighting Co., Ltd., the Metropolitan Electric Supply Co., Ltd., and the St. Marylebone Borough Council.

Westminster Electric Supply Corporation, Ltd.

The balance of net revenue account for the past year, after providing for general reserve, depreciation fund, and other charges, is £172,801. Interim dividends absorbed £50,156, leaving a balance of £122,645, which it is proposed to allocate as follows:—Final dividend on the 4½ per cent. preference shares, £12,375; final dividend of 2s. per share (making 3s. for the year) upon the ordinary shares, £75,562; leaving £34,708 to be carried forward. The report makes reference to the reorganisation of London's electricity supply, and states that, owing to continued ill-health, Capt. Bax has resigned from the board and the directors have elected Mr. P. J. Hannon, M.P., to the vacancy.

Allgemeine Elektrizitäts Gesellschaft.

The report for the year ended September 30th, 1925, states that the brisk activity which started with the year slackened in the course of subsequent months. The invoiced sales showed an increase of 50 per cent. over the previous year, while the orders on hand represent an advance of 30 per cent. The net profits amounted to 8,363,000 marks as compared with 7,223,000 marks in 1923-24. The works were fully occupied until the middle of the year; but then the scarcity of capital and the uncertainty concerning the collection of payments falling due caused the directors to exercise great caution in the acceptance of orders and in demanding considerable sums on account. In the machinery works the number of types was reduced, and a particularly light type of electric motor was placed on the market. The large machine works delivered for Norwegian account four generators which were the largest hitherto made there. The steam turbine department was hampered through labour troubles at the beginning of 1925, this causing delays in deliveries. Present orders exceed those on hand a year ago, other countries taking a notable part in the orders. The department has under construction three 70,000-kW sets for the Rummelsburg power station, and it is stated that the total orders in the turbine works represent 750,000 kW. After referring to other central station work the report mentions that the company undertook the construction of high-pressure long-distance lines for various undertakings. Concerning the question of traction it is stated that business was brisk with regard to the covering of the requirements of the tramways in electrical equipment, but new orders for electric locomotives and motor cars declined. The future of the electrical industry is considered by the directors to be fairly promising. Whereas formerly 60 per cent. of the total turnover was disposed of in the home market and 40 per cent. abroad, the respective relationship is now 70 to 30. The reduction in the export percentage is attributed partly to protective tariffs abroad, unreasonable commercial policy, &c., although the hope is entertained that the pre-war percentage will be regained.

Swedish Company.—The *Allmanna Svenska Elektriska A.B.* (*A.S.E.A.*), after having made provision for depreciation, reports net profits of 3,010,000 kr. for 1925, as compared with 2,030,000 kr. in the previous year, and the rate of the dividend rises from 2½ per cent. in 1924 to 4 per cent. last year. The favourable result is attributed to the expansion in export trade; Sweden increased her electrical exports from 17,500,000 kr. in 1924 to 21,000,000 kr. last year, and the chief share was obtained by the A.S.E.A.

Mersey Railway Co.—The accounts for the year ended December 31st last show receipts of £225,897, expenditure amounting to £146,914, and a net income of £88,767, to which is added £2,731 brought forward, and an additional sum in respect of mail contract of £4,702, making £96,000. After meeting interest, rentals, depreciation and renewal charges, &c., there remains a balance of £21,797. Out of this the directors propose to pay the full dividend on the 3 per cent. perpetual preference stock, leaving £2,325 to be carried forward. The report makes mention of Mersey Tunnel Bill promoted by the Liverpool and Birkenhead Corporations, and states that as the result of opposition the company secured the introduction of important conditions for its protection. The annual meeting was to be held yesterday (Thursday).

National Gas Engine Co., Ltd.—A net profit of £39,147 was earned during the past year; to this is added £13,247 brought forward, making £52,394. After paying the preference dividend, one of 4 per cent. is to be paid on the ordinary shares, leaving £16,394 to be carried forward. Meeting: February 23rd.

Mather & Platt, Ltd.—Dividend on the ordinary shares of 10 per cent. per annum, together with a bonus of 5 per cent., both free of tax, less interim dividend of 5 per cent. already paid, leaving to be carried forward to next account £178,281.

Torquay Tramways Co., Ltd.—Dividend of 4 per cent. and bonus of 1 per cent., both free of tax, on the ordinary shares.

County of London Electric Supply Co., Ltd.—Final dividend of 10 per cent. less income tax, on the ordinary shares, making 15 per cent. for the year.

South London Electric Supply Corporation, Ltd.—Final dividend of 10 per cent., less income tax, on the ordinary shares, making 15 per cent. for the year.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Enfield Cable Works.—47,944 new ordinary shares of £1 each, issued at £2 5s. per share, partly paid and fully paid, Nos. 202,057 to 250,000.

Oliver Pell Control.—74,411 ordinary shares of £1 each, fully paid, Nos. 1 to 74,411, 25,000 8 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 25,000.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.—50,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,160,001 to 1,210,000; 42,137 new "B" ordinary shares of £1 each, fully paid, Nos. 607,864 to 650,000.

Reading Electric Supply Co., Ltd.—£150,000 6 per cent. first mortgage debenture stock, issued at 102½ per partly and fully paid.

Siemens Bros. & Co., Ltd.—500,000 new ordinary shares of £1 each, issued at £1 3s. per share, of which 13s. is payable on application and allotment, Nos. 1,500,001 to 2,000,000.

Application has been made to the Committee to allow the following to be officially quoted :—

Auckland Electric Power Board.—Scrip, fully paid, for £250,000 5 per cent. water power conversion and general extension purposes debentures, 1925.

Johnson & Phillips.—100,000 ordinary shares of £1 each, fully paid, Nos. 500,001 to 600,000.

Electrical and Industrial Investment Co., Ltd.—After meeting debenture interest, taxation and other charges, the net profit for 1925 was £17,300 and the addition of £29,440 brought forward makes £46,740. The following dividends have been declared :—6 per cent. on the cumulative preference shares; 7 per cent. on the preferred ordinary shares; and 6d. per share on the deferred ordinary shares. £31,490 is being carried forward.

Rushden and District Electric Supply Co., Ltd.—The balance on the revenue account for the past year was £4,293 and sundry additions give an available balance of £6,121. From this £500 has been transferred to reserve and £1,990 to the depreciation fund. A final dividend of 4½ per cent. is recommended, making 8 per cent., as in 1924. The energy sold rose by 32 per cent. to 1,131,691 kWh. The meeting was to be held yesterday (Thursday).

Montreal Light, Heat and Power, Consolidated.—The gross earnings for 1925 were $18,348,806, as compared with $17,394,091 in 1924, and the net revenue rose from $7,670,190 to $7,890,026. The working capital rose to $10,647,089, and the total assets from $86,354,148 to $88,914,498. A dividend at the rate of 7 per cent. was paid for the first quarter; for the other three quarters the rate was 8 per cent.

Pennsylvania Water and Power Co.—The total revenue for 1925 was $2,960,436, as compared with $2,686,466 in the preceding year. The surplus increased from $1,264,837 to $1,343,320. A dividend of 8 per cent. has been paid (as in 1924), and $220,850 has been transferred to the depreciation reserve, $100,000 to sinking fund reserve, and $140,000 to contingent fund, leaving $22,774 to be carried forward.

North Metropolitan Electric Power Supply Co.—The directors recommend the payment of dividends due on the preference capital and a dividend on the ordinary shares at the rate of 10 per cent. per annum for the year 1925, the same rate as last year. £150,000 is to be placed to reserve, compared with £132,718 for the previous year, leaving £6,675 to be carried forward, compared with £7,297 brought in.

Mansfield and District Tramways, Ltd.—The balance available in respect of 1925 (including £1,374 brought forward) is £16,408. A dividend of 2 per cent. (making 5 per cent. for the year) is recommended on the ordinary shares, and £1,148 is to be carried forward. Meeting : February 22nd.

Isle of Thanet Electric Supply Co., Ltd. — At an extraordinary general meeting on February 12th a resolution was passed sanctioning the creation of 140,000 shares of £1 each (increasing the capital to £500,000) and the issue of 72,000 of these as preference shares.

Charing Cross Electricity Supply Co., Ltd.—The directors recommend a final dividend on the ordinary shares of the West End Undertakings of the company at the rate of 1s. 6d. per share, making 3s. per share for 1925.

Mexico Tramways Co.—A half-year's interest is to be paid on the general consolidated first mortgage 50-year 5 per cent. gold bonds on and after March 1st.

London and Suburban Traction Co., Ltd.—The directors state that they are again unable to recommend the payment of a dividend on the 5 per cent. cumulative preference shares.

Telegraph Construction and Maintenance Co., Ltd.—A final dividend of 7½ per cent., free of tax, has been declared, making 10 per cent. for the year as in 1924.

Stocks and Shares.

MONDAY EVENING.

THE Stock Exchange settlement which falls due to be dealt with in the present week, while one of the smallest that has been handled for well over a year, is also likely to prove to be one of the most difficult. There was a good deal of undesirable gambling towards the end of 1925, and one result of the rubber share boom was the upbuilding of speculative accounts, both in rubber and in other shares. These take a good deal of money to finance now that the tide has definitely turned downwards, and prices in many markets are heavy. Investment stocks and shares are affected by the unfavourable elements in the speculative divisions, through the necessity which holders discover of selling good stock in order to meet their engagements. Moreover, just now, people are realising Stock Exchange securities in order to meet income tax demands.

There is, on the other hand, a good deal of absorbing power on the part of money, and new issues that come to market are taken without difficulty where they present reasonable attraction to the speculator or the speculative investor. Compared with three months ago, the volume of business being transacted in the Stock Exchange is barely a fifth to-day of what it was then.

Electricity supply companies are declaring their final dividends, and several important announcements have appeared during the past few days. In no case have these caused any change in prices. The Westminster pays 15 per cent. for last year, St. James' 17½, London 10, Charing Cross 15, North Metropolitan 10, Central Electric Supply 5, Smithfield 8 per cent. These are the same, in every case, as the rates paid for 1924. It is taken for granted that, in the light of these dividend announcements, all the companies are likely to maintain their previously-paid rates, and that there will be nothing to enthuse over in the 1925 dividends. Considering, however, the excellence of the latter, shareholders are not likely to feel any particular disappointment at a repetition of the previous rates From the market point of view, however, prices are tame, the only change of the week that is worth mentioning at all being a rise of 1s. 9d. in County of London ordinary to 60s. Yorkshires at 30s. 6d. are 6d. lower. Clyde Valleys lost a similar sum at 30s. Fife Tramways weakened to 22s., a drop of a florin, on the announcement of the dividend making 6 per cent. for the year as against 8 per cent. in the previous year. The falling off is due, the directors explain, not to a decline in profits, but to the situation that has arisen in connection with coal.

The Underground Electric Railways have declared their dividends, and Districts get the expected 3½ per cent. for last year. The figures of the group, however, are not particularly good. Central London deferred receives 4 per cent., as before; London Electrics 3½ per cent., as against 4 per cent. The City and South London 3 per cent. for 1925 compares with 4 per cent. in 1924. Underground Income Bonds have their full 6 per cent. tax free, the same rate as is paid on London General Omnibus stock. The allocations to reserve are about the same as they were, except that of the London General Omnibus Company, which has gone up £50,000 to £300,000. The Central London and the District reduce their carry forward; the other four companies increase their balances. The Metropolitan Railway carried 105 million passengers last year, a decrease of 13 millions : the average fare of 2.693d. is a little over a farthing per passenger less than that taken in 1924. The net receipts came out at £674,000, a reduction of about £120,000, but the dividend of 5 per cent. is maintained, as we have already indicated. On the week, Metropolitans are 10s. lower, and the Underground Electrics are also a little easier, the £10 shares giving way to 2¼ on selling, some of which came from Continental sources.

Siemens at 30s are ex rights to-day, Monday, and the price of the new preferences is quoted at 5s. 3d. premium. Telegraph Constructions are 10s. up at 29, and British Aluminiums at 38s. 9d. are 1s. 3d. to the good. The rest of the group leans to the dull side, with small declines in Brush, 28s., Electric Construction 33s. 9d., Henleys 3⅝, Johnson & Phillips 27s. 6d. People are not taking the interest in this section that they were a few weeks ago, and in some directions shares have had to be sold on behalf of speculative purchasers who had to meet pressing liabilities incurred elsewhere. General Electrics can be sold at 31s. 6d., which is slightly better on balance.

The accounts of the Northampton Electric Light & Power Company show an expansion of £11,700, to £55,871, in the net revenue, and the directors propose to create 150,000 "B" shares of £1 each. This will raise the capital to half a million pounds sterling. The "B" shares last changed hands, some five weeks ago, at 32s. 6d. Victoria Falls ordinary shares are a good market at 49s., on the expectation that the company will benefit from a very comprehensive scheme of electrical development that has been arranged by the Union of South Africa. The Victoria Falls undertaking has four large power stations, and it is thought that these will be linked up with the Union Government's station at Witbank.

Wireless shares make an uninteresting display. There is hardly any active trade in them. Radio common are 9, the preference 9½. Canadian Marconi 4s. 6d., and the parent Marconis 25s.

London Traction issues maintain their recent improvements. Under the tightening hand of Traffic Control, it is assumed that the tramways will be afforded greater scope for profit-earning, if only from the fact that the L.C.C. and other important bodies have sunk too much money in trams for the systems to be treated with complete indifference. Consequently, according to this argument, something will have to be done to raise the business to a profit-producing plane once more. No dividend is to be paid in respect of last year upon London & Suburban Traction preference, which have had nothing since March, 1924. Foreign traction varieties are easier for choice. Mexican Light & Power preferred shares have gained 2 points better at 64½.

Cable stocks and shares exhibit a somewhat easier tendency. Globe ordinary fell back to 18¼. Automatic Telephones reacted to 51s. 3d., speculative interest in the shares having subsided for the time being. The rubber share market remains lumpish and is very disappointing to those who bought at the time when raw rubber soared to 4s. 8d. per lb. Its descent to 2s. 8d. per lb. has brought in a steady and continual stream of small selling, to counter which there is but little support, the result being, of course, that the daily disposition is for prices to sag.

Share List of Electrical Companies.

	Nom. £	Dividend. 1923	Dividend. 1924.	Price Feb. 15, 1926.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1⅝	—	*5 14 3
Charing Cross Ordinary	1	14½	15	47/-	—	6 7 8
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2⅛	—	5 12 11
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/-	—6d.	5 6 8
County of London	1	15	15	60/-	+1/9	5 0
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14¼	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅛	—	5 7 10
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/9	—	5 1 1
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9⅓	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅛	—	5 8 3
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 5/16	—	5 6 8
Urban Ordinary	1	4	4	19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	46/3	—	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	30/6	—6d.	5 4 11
Home Rails.						
Central London Ord. Assented	Stock	4	4	69	—	5 16 0
Metropolitan	,,	4	5	68½	—½	7 6 0
do. District	,,	3½	3½	47½	—	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2¼	—¼	Nil
do. do. "A"	1/-	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	6	6	99	—	*6 1
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23¾	—¼	6 6 4
Automatic Telephone	1	3	6	51/3	—1/3	2 5 8
Chili Telephone	5	6	5	6 7/8	+1/16	*3 17 8
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	176½	—1	*5 13 4
Globe Tel. and T. Ord.	10	10	10	18¼	—¼	*5 9 7
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	1¼	—	8 0 0
Marconi Marine	1	10	7½	⅞	—	8 11 6
Oriental Telephone Ord.	1	12	12	2⅝	—	*5 12 11
United R. Plate Tel.	5	8	8	7 1/32	—	5 2 7
Western Telegraph	10	10	10	17⅞	—	*5 11 11
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3¼	—1/16	8 9 2
do. do. 2nd Pref.	5	6	6	3⅜	—1/16	9 12 0
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	106	—	5 13 2
Brazil Traction	100	4	4	93	—1	4 6 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18
do. do. Preferred	,,	96/-	96/-	103½	—	*4 12 0
do. do. Deferred	,,	129/5	129/5	128	—	*5 1
do. do. Deb.	,,	4¼	4¼	79	—	5 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	4/6	—	Nil
London United Tram. Deb.	Stock	4	4	45	—½	8 17 10
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	64½	+2	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	17/6	—	5 14 3
Manufacturing Companies.						
Babcock & Wilcox	1	12	12	2⅝	—	*4 11 5
British Aluminium Ord.	1	5	10	38/9	—1/3	5 0 2
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3 1/16	—	4 17 11
Brush Ord.	1	10	10	28/-	—9d.	7 2 10
Callenders	1	15	15	3⅜	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	—9d.	5 18 6
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/6	—	4 15 3
Henley	1	15	16	3⅜	—1/8	4 8 3
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1½	—	*4 0 0
Johnson & Phillips	1	10	10	2 1/16	—	3 8 8
Met.-Vickers, Ord.	1	8	8	27/6	—6d.	5 16
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	30/-xr.	—6d.	5 0 0
Telegraph Construction	12	20	10	29	+½	*4 2 9

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price February 16th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£256	£6 inc.
Grade II	,, ,,	£181	£4 inc.
Grade III	,, ,,	£100	£2 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£67 10s.	£2 inc.
d ,, ,, Sheets	,,	£143 10s.	...
d ,, ,, Wire Rods	,,	£77 10s.	£2 inc.
d ,, ,, H.C. Wire	per lb.	9 1/16d.	3/16d. inc.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/7	2d. dec.
i Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£12	...
g Lead, English pig	,,	£35 10s.	5/- dec.
g Mercury	per bot.	£14 15s. to £15	5/- dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£286 to £287	£9 inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
o C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Canadian Hydro-Electric Development.—*Reuter* states that the speech from the Throne at the opening of the Ontario Legislature referred to the development of hydro-electric power on the Ottawa River, which forms the natural boundary between Quebec and Ontario. The hope was expressed that an amicable arrangement would be made with Quebec, for an equal division of power. The speech also indicated that the Government would press for the development of power on the St. Lawrence River.

Electrical Association for Women.—A meeting is being held at the British Industries Fair, Birmingham, on February 23rd, at 2.30 p.m., with a view to inaugurating a Birmingham and District Branch of this Association. Mrs. G. Lawson will act as honorary secretary, and the branch has the support of Mr. Chattock, the city electrical engineer, and his department. At 3.30 p.m. on the same afternoon the party will be conducted around the Electrical Section of the British Industries Fair, and at 4.30 p.m. the Fair authorities will invite the party to tea, over which Lady Brooks (the late Lady Mayoress) will preside. Mr. G. S. Frances, of the B.E.A.M.A., will give a short talk on matters of electrical interest at the tea. The business meeting will be addressed by the London director, Miss C. Haslett. Those interested in the formation of the branch can obtain particulars from Mrs. Lawson at 19, Southam Road, Hall Green, Birmingham, or from the London Director, The Electrical Association for Women, 26, George Street, Hanover Square, London, W.1.

Electrical Progress in New Zealand.

Recent Power-Board Developments.

(From Our New Zealand Correspondent.)

AUTHORITY was recently given to the Auckland Electric Power Board to raise £650,000 for electrical-transmission purposes in its district. A scheme has been approved for the provision of electrical energy from the Arapuni project, and it is anticipated that the supply will be available in three years and will obviate the need for the present supply from the Hora Hora Rapids plant, recently taken over from the Waihi Goldmining Co., and that from the present steam plant at the King's Wharf. It was suggested at the time of the proposal of the scheme, about a year ago, that the requirements from Arapuni would be 15,000 kW, but this figure has been exceeded, and the demand is already over 18,000 kW.

£250,000 has just been raised for the installation of equipment at the various sub-stations. Part of the equipment will include three rotary converters, each of 2,000 kW capacity, to be erected at the King's-Wharf station, where the pressure will be reduced. 22,000-V switchgear will be required at this station, and five 22,000-volt cables will be laid underground between the Government sub-station at Penrose and the King's Wharf—a distance of seven miles. At the Penrose sub-station the existing 6,600-V switchgear, now being used in connection with the Hora Hora supply, will be replaced by apparatus of a heavier type, and a 6,600-kVA transformer bank will be installed to reduce the pressure. At the Beresford-Street station a second 2,000-kW rotary converter will be installed.

The work yet to be carried out in the Auckland Board's district, especially in the southern area, is held up temporarily on account of the non-arrival of supplies of material, due to the recent shipping strike. As soon as the shipments arrive, the Te Papapa, Mt. Albert and Point Chevalier sections of the scheme will be proceeded with, as well as the extensions of the city street-lighting scheme, which are to cost £30,000; and the additional city business and residential connections, estimated to cost another £22,000.

The change-over works outlined above will take about 15 months to complete, and other works under the extensions scheme will be completed as opportunity offers.

Although the work of installing an additional 20,000-kW of plant at the Lake-Coleridge undertaking is proceeding rapidly, the pace is apparently not fast enough for Christchurch's requirements. The normal load of the existing plant is 12,000 kW, and the peak load has reached the 14,000-kW mark. A few setbacks have been experienced. Recently a fall occurred in one of the tunnels and several men lost their lives; it was decided to divert the tunnel, and considerable time was thereby lost. Trouble was also experienced with the placing of the huge steel caisson in the lake bottom to the base of which the intake tunnel had been driven. The floating into position of the caisson and sinking it into the bed of the lake proved to be a work of rather delicate manipulation.

The extensions to the power house are almost completed, and the erection of the new pipe lines is being pushed ahead. New switchgear is in course of erection and additional gear is being assembled at the Addington sub-station. A second transmission line is being erected between Hororata, on the Lake-Christchurch line, and Timaru, and a further extension from Timaru to Oamaru is now under consideration. These lines will be used for the 11,000-V transmission contemplated in connection with the new works. The completion of the scheme will bring hydro-electric service within the reach of practically the whole of the Canterbury Province.

In the North Island the three main generating stations at Mangahao, Waikaremoana, and Arapuni, when completed, will be linked up as a major triangle, to provide in all some 240,000 kW when the full supply is available. From these stations 110,000-V lines convey the energy to the numerous sub-stations, whence it is distributed over 11,000-V lines to the local distributing agencies. Some 33 Power Boards act as middlemen in the supply of Government energy to the local consumers, each Board operating its own sub-station. Almost the same conditions apply in the South Island, the ultimate idea being to link up Lake Coleridge with other plants to be erected in a manner somewhat similar to that of the northern system.

It is interesting to note that the 11,000-V lines are built on double type hard-wood poles.

Work on the hydro-electric undertaking at Arapuni Rapids is proceeding, and is already ahead of the contract time in some portions. The construction of one of the main 110,000-V lines has been completed between Hamilton and Auckland, and over this a temporary supply of energy from the Hora Hora works is being transmitted. The 50,000-V line from Arapuni to Rotorua is now almost completed, and the extension of the Te Awamutu 50,000-V line to Hangatiki for the Waitomo Power Board is well under way.

The Arapuni scheme is the largest yet undertaken by the Government; it consists in diverting the waters of the Arapuni Gorge into its old river bed and thus utilising a fall of 165 ft. where the old bed returns to the present channel. The available flow is calculated as 5,300 cusecs, and the average load, with a 50 per cent. load factor, is 120,000 kW. The site of the power house is some 105 miles from the city of Auckland, where the greater portion of the energy generated will be consumed, but it is also in the heart of the Waikato country, where there are several growing towns and where the farming and dairying inhabitants will take a considerable quantity of energy. The Arapuni project is expected to be completed by the end of 1928.

The rapid growth of hydro-electricity in New Zealand can be gauged from the following facts. From a capital outlay of £9,566,589, a net profit of 1.31 per cent. was last year (financial) returnable to the 87 Power Boards operating on behalf of 930,980 people, or 70 per cent. of the entire population of the country. The number of consumers increased by over 20 per cent., and is now over 155,000. The working charges for the supply during the year were £780,826, capital charges £732,086, and the net profit for all the Boards £125,884. 34 Power Board districts have taken polls for the raising of loans, all of which were successful, and the total amount required is £9,372,074. The net profit, £125,884, is represented by a profit of £162,376 from 59 Boards, and a loss of £36,492 from 28 Boards. Most of the latter were in their first year's working.

The total length of power lines in the Dominion is now 6,200 miles, an increase of 215 per cent. since 1921, while of the 90,000 kW supplied, water and steam account for 94 per cent., gas 4 per cent., and oil 2 per cent. The increase in the supply available has risen by 24 per cent., and the farming community is increasingly utilising hydro-electric energy. A return shows that the number of milking machines in the Dominion has increased by over 5,000 during the year, bringing the total in use up to nearly 20,000. In one Power-Board district alone there are over 1,000 milking machines—a figure which approximates one machine to every three consumers in the district.

Electric cooking is also becoming increasingly popular; the increase in the number of cooking ranges installed last year was 1,526 in the Mangahao district alone, or three to every hundred persons. In some other districts the figure is as high as 5 per hundred. This figure would have been higher in all probability had it not been for the shortage of material on the market caused by the shipping hold-up.

Electrical Exports and Imports of Czecho-Slovakia.

Below is a statement of the quantities of electrical and allied material exported from and imported into Czecho-Slovakia in 1924, based on the recently-issued official statistics for that year. These statistics are now being issued on a new plan, and those for 1924 include goods exported or imported for improvement or repair, and also imported goods having undergone similar treatment. Figures for the previous year do not include such trade. They are, however, given below in order to afford a rough comparison, and notes or increases or decreases are added.

IMPORTS.

	1923. Kilogrammes.	1924. Kilogrammes.	Inc. or dec. Kilogrammes.
Electric lamp bulbs, glass—			
Total	6,000	24,000	+ 18,000
Electrical insulators (plain)—			
Total	27,000	64,000	+ 37,000
From Germany	24,000	59,000	+ 35,000
Dynamos and motors, transformers and converters weighing 25 kg. or less—			
Total	103,000	85,000	− 18,000
From Germany	74,000	58,000	− 16,000
,, Austria	19,000	17,000	− 2,000
,, Great Britain	3,000	1,000	− 2,000
Ditto, weighing from 25 kg. to 5 quintals—			
Total	363,000	323,000	− 40,000
From Germany	222,000	201,000	− 21,000
,, Austria	125,000	101,000	− 24,000
,, Switzerland	10,000	16,000	+ 6,000
Ditto, weighing from 5 quintals to 30 quintals—			
Total	288,000	205,000	− 83,000
From Austria	149,000	115,000	− 34,000
,, Germany	126,000	76,000	− 50,000
,, Switzerland	6,000	4,000	− 2,000
Ditto, weighing from 30 to 80 quintals—			
Total	134,000	91,000	− 43,000
From Germany	73,000	5,000	− 68,000
,, Austria	50,000	67,000	+ 17,000
,, Switzerland	11,000	12,000	+ 1,000
Ditto, weighing over 80 quintals—			
Total	213,000	331,000	+ 118,000
From Germany	118,000	80,000	− 38,000
,, Austria	95,000	207,000	+ 112,000
Telegraph and signalling apparatus—weighing 5 kg. or over—			
Total	14,000	17,000	+ 3,000
From Austria	8,000	12,000	+ 4,000
,, Germany	3,000	3,000	—
,, France	2,000	1,000	− 1,000
Ditto, weighing under 5 kg.—			
Total	2,000	6,000	+ 4,000
Telephones and microphones, weighing 5 kg. or over—			
Total	69,000	75,000	+ 6,000
From Austria	55,000	63,000	+ 8,000
,, Germany	12,000	11,000	− 1,000
Ditto, weighing under 5 kg.—			
Total	11,000	23,000	+ 12,000
Lightning arresters, weighing 5 kg. or over—			
Total	5,000	1,000	− 4,000
Ditto, weighing under 5 kg.—			
Total	1,000	1,000	—
Electrical measuring instruments, weighing 5 kg. or over—			
Total	59,000	61,000	+ 2,000
From Germany	41,000	45,000	+ 4,000
,, Switzerland	10,000	10,000	—
,, Austria	7,000	5,000	− 2,000
Ditto, weighing under 5 kg.—			
Total	143,000	83,000	− 60,000
From Germany	104,000	48,000	− 56,000
,, Austria	21,000	10,000	− 11,000
,, Switzerland	15,000	22,000	+ 7,000
Switchgear—			
Total	19,000	31,000	+ 12,000
Incandescent lamps, electric—			
Total	102,000	117,000	+ 15,000
From Germany	38,000	34,000	− 4,000
,, Hungary	28,000	34,000	+ 6,000
,, Austria	19,000	21,000	+ 2,000
,, Netherlands	16,000	26,000	+ 10,000
Electric lamp sockets—			
Total	16,000	13,000	− 3,000
From Germany	12,000	8,000	− 4,000
Regulators, resistances, &c.—			
Total	405,000	327,000	− 78,000
From Germany	250,000	174,000	− 76,000
,, Austria	138,000	112,000	− 26,000
,, Switzerland	7,000	11,000	+ 4,000
Cable and insulated wire, metal covered—			
Total	16,000	12,000	− 4,000
From Germany	9,000	4,000	− 5,000
,, Austria	6,000	5,000	− 1,000
,, Sweden	1,000	3,000	+ 2,000
Ditto, covered with paper or asbestos—			
Total	4,000	10,000	+ 6,000
Ditto, covered with rubber—			
Total	2,000	4,000	+ 2,000
Ditto, covered with asbestos, paper, rubber, &c.—			
Total	10,000	12,000	+ 2,000
From Austria	5,000	6,000	+ 1,000
,, Germany	4,000	5,000	+ 1,000
Accumulators—			
Total	43,000	18,000	− 25,000
From Austria	31,000	7,000	− 24,000
,, Germany	11,000	9,000	− 2,000
Electric light carbons—			
Total	19,000	24,000	+ 5,000
From Jugo-Slavia	—	137,000	+ 137,000
Electrodes—			
Total	367,000	517,000	+ 150,000
From Germany	301,000	379,000	+ 78,000
,, Austria	33,000	—	− 33,000
,, United States	25,000	—	− 25,000

EXPORTS.

Glass bulbs for electric lamps—			
Total	595,000	854,000	+ 259,000
To Hungary	515,000	729,000	+ 214,000
Electrical insulators—			
Total	510,000	1,233,000	+ 723,000
To Belgium	117,000	49,000	− 68,000
,, Austria	79,000	1,812,000	+1,733,000
,, Great Britain	65,000	434,000	+ 369,000
Electric dynamos and motors, transformers and converters, weighing 25 kg. or less—			
Total	2,000	4,000	+ 2,000
To Germany	700	2,000	+ 1,300
,, Austria	600	1,000	+ 400
,, Poland	300	100	− 200
Ditto, weighing from 25 kg. to 5 quintals—			
Total	76,000	102,000	+ 26,000
To Austria	27,000	16,000	− 11,000
,, Poland	19,000	5,000	− 14,000
,, Jugo-Slavia	10,000	12,000	+ 2,000
Ditto, weighing from 5 quintals to 30 quintals—			
Total	78,000	178,000	+ 100,000
To Hungary	18,000	15,000	− 3,000
,, Poland	10,000	8,000	− 2,000
,, Jugo-Slavia	10,000	19,000	+ 9,000
,, Italy	6,000	83,000	+ 77,000
Ditto, weighing from 30 to 80 quintals—			
Total	37,000	44,000	+ 7,000
To Switzerland	20,000	—	− 20,000
,, Austria	17,000	26,000	+ 9,000
Ditto, weighing over 80 quintals—			
Total	242,000	112,000	− 130,000
To Germany	75,000	10,000	− 65,000
,, Austria	65,000	28,000	− 37,000
,, Switzerland	45,000	—	− 45,000
,, Jugo-Slavia	32,000	—	− 32,000
,, Hungary	21,000	—	− 21,000
,, Poland	—	52,000	+ 52,000
Telephones, weighing under 5 kg.—			
Total	3,000	300	− 2,700
Electrical measuring instruments, weighing 5 kg. or over—			
Total	1,000	6,000	+ 5,000
Ditto, weighing under 5 kg.—			
Total	1,000	4,000	+ 3,000
Switchgear—			
Total	10,000	12,000	+ 2,000
To Brazil	2,500	—	− 2,500
,, Poland	2,000	1,000	− 1,000
,, Belgium	—	200	+ 200
,, Holland	600	700	+ 100
,, Jugo-Slavia	600	—	− 600
,, Austria	—	4,000	+ 4,000

	1923. Kilogrammes.	1924. Kilogrammes.	Inc. or dec. Kilogrammes.
Incandescent lamps—			
Total	210,000	249,000	+ 39,000
To United States	65,000	111,000	+ 46,000
,, Germany	33,000	16,000	− 17,000
,, Poland	32,000	14,000	− 18,000
Electric lamp sockets—			
Total	6,000	16,000	+ 10,000
To Austria	1,500	3,000	+ 1,500
Regulators, resistances, &c.—			
Total	65,000	155,000	+ 90,000
To Jugo-Slavia	39,000	8,000	− 31,000
,, Austria	6,000	43,000	+ 37,000
,, Germany	5,000	37,000	+ 32,000
Cable and insulated wire, metal covered—			
Total	82,000	70,000	− 12,000
To Belgium	45,000	16,000	− 29,000
,, Rumania	16,000	15,000	− 1,000
,, Poland	14,000	6,000	− 8,000
Ditto, covered with paper or asbestos—			
Total	8,000	5,000	− 3,000
To Bulgaria	3,000	—	− 3,000
,, Germany	2,000	200	− 1,800
,, Rumania	—	4,000	+ 4,000
Ditto, covered with rubber—			
Total	4,000	1,000	− 3,000
To Rumania	4,000	—	− 4,000
Ditto, covered with asbestos, paper, rubber, &c.—			
Total	261,000	126,000	− 135,000
To Rumania	115,000	38,000	− 77,000
,, Jugo-Slavia	80,000	45,000	− 35,000
,, Poland	29,000	1,000	− 28,000
Accumulators—			
Total	3,000	14,000	+ 11,000
Electric light carbons—			
Total	25,000	1,000	− 24,000
To Bulgaria	12,500	—	− 12,500
,, Great Britain	12,500	—	− 12,500
Electrodes—			
Total	41,000	1,000	− 40,000
To Germany	15,000	—	− 15,000
,, Holland	15,000	—	− 15,000
,, Austria	11,000	—	− 11,000

The Institution of Electrical Engineers.

Annual Dinner and Reunion.

The annual dinner of the Institution of Electrical Engineers was held at the Hotel Cecil, London, on February 11th, the President, Mr. R. A. Chattock, city electrical engineer, Birmingham, being in the chair. That it is one of the most popular yearly functions is evident from the fact that the attendance grows larger each year; the diners numbered 586, and a most enjoyable evening was spent.

The King and members of the Royal Family having been toasted, "The Institution of Electrical Engineers" was proposed by the Right Hon. Neville Chamberlain, Minister of Health, who pointed out the fact that the Institution membership was in excess of 12,000, and it was the largest Institution in the country. He knew of no other agent on behalf of which such extravagant claims had been made as electricity by a public whose enthusiasm was only equalled by its ignorance. It must be admitted, however, that electricity had no rival as a producer of light, and it had become the most popular form of power. The first sketch of the Government's scheme had been welcomed by the public with a unanimity which was positively alarming. The only thing which consoled him was that it was praised quite as much for what it did not do as for what it proposed to do. To begin with, there was to be no subsidy; that was quite a change, and no nationalisation—in fact, as little State interference as was compatible with the purposes they had in view. The Government's aim might be expressed under three heads—to provide for concentration of production, for the pooling of power reserves, and for the standardisation of equipment. If they could achieve those three objects, they might hope to see throughout the country, on the average, some considerable cheapening of electricity, and certainly a very much increased availability of supply. Purposes of that kind were worthy of a serious national effort, but, of course, changes of that kind could not be made without interfering with local and personal interests. There would be a certain amount of dislocation and change and the abolition of existing offices, but what they were after were changes in the national interest, and what benefited the community as a whole sooner or later must percolate to every individual part of it. In the carrying out of the proposals, after they had received Parliamentary sanction, the Government would look to that Institution for assistance, and he felt confident it would receive it.

Mr. R. A. Chattock, President I.E.E., in responding, remarked that they were often told that they were still in their infancy, but they should reflect that they were now over 50 years old and held a position in the scientific world second to none. It was satisfactory to note the interest which members took in their Institution, but a question sometimes heard was: "What has the Institution done for me"? His reply to that was: "You are the Institution"; he had no patience for men who expected others to do for them what they could very well do for themselves. The Institution was willing and anxious to do everything it could to assist the Government to further the interests which the Institution represented. What ultimate changes the electrical age which they were now inaugurating would bring, he would be a bold seer who could prophesy. He was confident, however, that they were on the fringe of enormous developments.

Mr. W. B. Woodhouse toasted "Our Guests," saying that the presence of the president of the Royal Society (Sir E. Rutherford) reminded them of the dependance which they placed on the work of other Societies and he hoped they, too, found the work of electrical engineers useful. After reference to many of the distinguished guests, including representatives of a French kindred body (Mr. M. Leblanc, vice-president of the Société Francaise des Electricians) and of the I.C.E., he specially welcomed the representatives of the great Dominions for which manufacturers had a special regard. It was pleasing to mark the growth of exports of electrical machinery; 1924 was a record year and in 1925 some 25 per cent. had been added to the previous year's figure, which placed this country in the place of the biggest exporter of electrical machinery in the world. Perhaps the most striking index of their progress was the ardent desire of all political parties to foster so rosy a youth. He hoped new legislation would not disturb healthy and natural growth.

Sir A. Steel-Maitland, Minister of Labour, in reply, said that the electrical industry at this moment, as he knew from the information which came to him every day, was one of the brightest spots in a picture which would otherwise be dark. He hoped it would continue to be bright and that the rest of the picture would become brighter to match it. There was hardly an institution which made itself felt more than the I.E.E., and that was because electrical engineers made up their minds about what they were going to say and then said it with one voice.

Sir Lynden Macassey, K.C., also responded to the toast.

A message of greeting from the Société Francaise des Electriciens was read by the president, and the British Imperial Orchestra played a selection of music during dinner and at the subsequent reunion in the Victoria Hall.

Illumination and Light.

The Faraday Lecture of the Institution of Electrical Engineers.

The Faraday lecture on the subject of "Illumination and Light" was given by Mr. A. P. Trotter, before the members of the North-Western Centre and others, at the Manchester College of Technology, on January 19th. Mr. A. G. Ellis, chairman of the centre, presided; in opening the proceedings he said it was about 100 years since Michael Faraday took up the position of Director of the Laboratory of the Royal Institution, and about five years later he made his great discovery of electromagnetic induction. In optics, also, Faraday covered an immense field; he was one of the earliest seekers after the connection between electricity and magnetism and light, so the subject of the lecture was a very appropriate one in commemoration of Michael Faraday.

Mr. Trotter said he had been asked to speak about something which had been a hobby of his for some 45 years.

During the last 15 years a branch of engineering had developed which had for its object the study of the application of light, natural or artificial, for the use and convenience of man.

The Illuminating Engineering Society had been formed in recent years for the study and development of this subject; if it had done nothing more than collect statistics of the amount of illumination necessary for different purposes—houses, factories, schools, public buildings—it would have done good work, but in fact it had accomplished much more. The subject of "glare" had also received attention from illuminating engineers. Examples of it were easily found. A motor-car with headlights, on a dark night in a country road, gave an absolutely blinding glare, but the very same lamps, in the same car, would be hardly perceptible in bright sunshine. It was purely a matter of contrast, not of intensity of light. Although far more light was present in the latter case, it was much less dazzling.

The amount of illumination required for different purposes had been studied; the minimum for good street lighting had been ascertained and illuminating engineers had long lists giving the amount of illumination which experience had shown to be necessary for domestic purposes, railway platforms, workshops, schools, &c. The Home Office had made most useful recommendations as to the amount of illumination required in workshops for various kinds of work, ranging from 3 foot-

candles for ordinary work to a much higher figure in special cases, and no compulsion had been necessary to enforce those recommendations. Factory managers were becoming aware that accidents were reduced and the quality and quantum of the output were improved where there was light. The improvement was not only in higher candle-power, but also in the judicious arrangement of lamps and reflectors for different classes of work.

Light was not supposed to have any relation to any other branch of physics until 1846, when it dawned upon Faraday that there was an irresistible suggestion of similarity between the lateral or side to side disturbances of magnetic lines of force and the movement of light.

There was strong reason to believe that light itself was some kind of electro-magnetic disturbance in the form of waves.

So far as was known, all these vibrations and disturbances—from X-rays to the longest waves used in wireless telegraphy—were of the same nature, consisting of electromagnetic vibrations in a medium called "ether." Ether remained a speculative hypothesis; all that was asked of it was that it should vibrate; it was assumed that it had inertia or mass and that it was elastic and had absolutely unbroken continuity. Einstein said he had no objection to ether, his system being independent of it, but some of his followers declared that the hypothesis of ether was useless, unwanted, and unnecessary. Sir Oliver Lodge had replied that ether could not be dismissed as a mere negation; that a negative dogma was as bad as a positive one, but he distinctly said that it was not matter.

It was agreed that matter was composed of minute atoms which were formed of small particles called electrons rotating like planets round a central nucleus. Electrons varied in number in different atoms, and each electron had an orbit which it could change on impulsion; it might fly outwards or towards the centre. It was supposed that in doing so it liberated a certain amount of radiant energy. There was a mysterious limitation of the amount of energy so set free; the amount liberated at a time could be calculated. About 10 per cent. of the hitherto unexplained features of the spectrum, interference, the refraction of light, and other physical facts, might be accounted for in this way. Others could not be so explained, but appeared, as hitherto, to be fully explained by the ordinary undulatory wave theory of light. The discordance must be settled. The fact was that matter might have to be redefined. Our ideas of energy and matter were in the melting pot, and we must wait till they had been tried by the fire of mathematical analysis. Meanwhile it could be taken that there was nothing seriously wrong with the ordinary undulatory wave theory of light, but the complete theory was still unknown to the most eminent philosophers and mathematicians. A constructive theory of the nature of waves had been long overdue. As Sir Oliver Lodge had said, the end was not yet, and we should see common sense coming out of it. A new Faraday was wanted.

The lecture, which was illustrated with experiments, has been delivered also at Liverpool, Dublin and Cardiff, to large audiences.

Totally-Enclosed Switches and Fuses.

Messrs. Switchgear & Cowans New Ironclad Interlocked Unit-Type Gear.

The service demanded from ironclad, unit-type, airbreak switchgear has become more strenuous and one of the advantages of the new design of Messrs. Switchgear & Cowans, Ltd., is the fact that the hinge principle has been discarded. The new switch has been developed similarly to an oil-immersed circuit breaker, and has the advantages of a positive quick-make and quick-break reciprocating motion with two simultaneous breaks per pole.

In addition to accessibility the gear, as will be seen from fig. 1, is of very sturdy build; the two covers of the cast-iron cases of connected switches and fuses are interlocked by means of heavy lugs so that the fuse case can only be opened at the same time as the switch case, the switch then being "off" and the fuses "dead." The switch case cannot be opened when the switch is "on," neither can the switch be closed when the cover is open. Again, the top and bottom flanges of all cases of the same capacity are identical, which allows of the switch case being erected either on the top or bottom of the fuse case; it is therefore easy for the incoming "live" connections from the bus-bars to be made to the switch terminals and the outgoing cables to be so connected to the fuse terminals that the fuses can always be renewed in safety. Between each pole of the switches and fuses are arc barriers, dividing the cases into separate compartments for each pole or phase. The barriers are specially shaped to enable them to be easily removed and replaced. The moving copper contacts are held by a malleable-iron clamp at their centres where a tube of Bakelite surrounds each bar. The bars are mounted on a steel carrier to which the operating mechanism imparts a reciprocating motion. Hinges are thus dispensed with, and the bars can be removed with little trouble, each contact being entirely independent of the others, while the straight backward and forward movement of the contacts removes all torsional strain from the insulation.

The fixed copper contacts are of the bent-over spring type mounted on gun-metal bases. The two sets of upper and lower contacts are clamped by their bases to steel bars which are fastened to the back of the case. Between the ends, the bars are covered with a tube of Bakelite. The Bakelite tubes on these two bars and on each of the moving contact bars, are the only insulation on the switch. Both the upper and lower ends of the moving contacts make connection with corresponding fixed contacts, thus providing two simultaneous brakes per pole, and the terminals are right at the back of the case where they are not liable to be inadvertently touched. The operating gear is a simple lever-and-cam mechanism with spiral springs providing the quick-make and quick-break action, and is duplicated, the two sets being mounted inside the case at each end, with the operating spindle and moving contact carrier bar extending between them, imparting a reciprocating motion to the contact carrier bar, so that the pressure is evenly distributed and the alignment of the contacts is always maintained. The handle is free, except for the short time the catch is moving the cam and spindle round to open or close

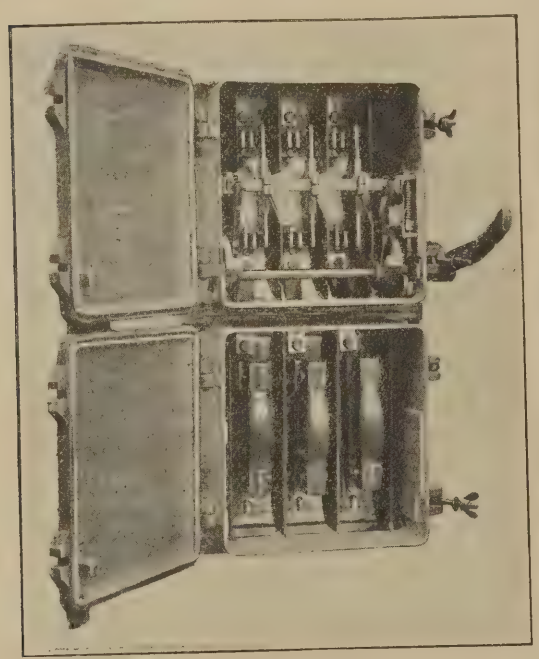


Fig. 1.—Ironclad Triple-pole Switches and Fuses.

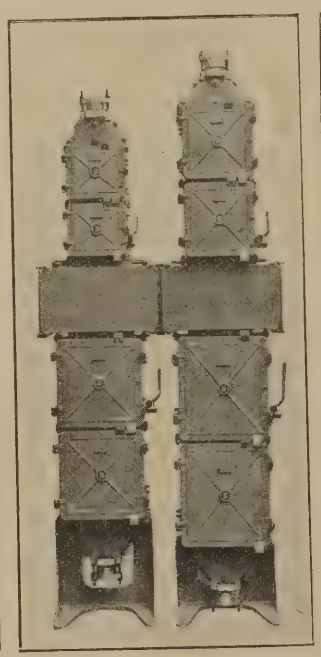


Fig. 2.—Unit-type Airbreak Switchgear.

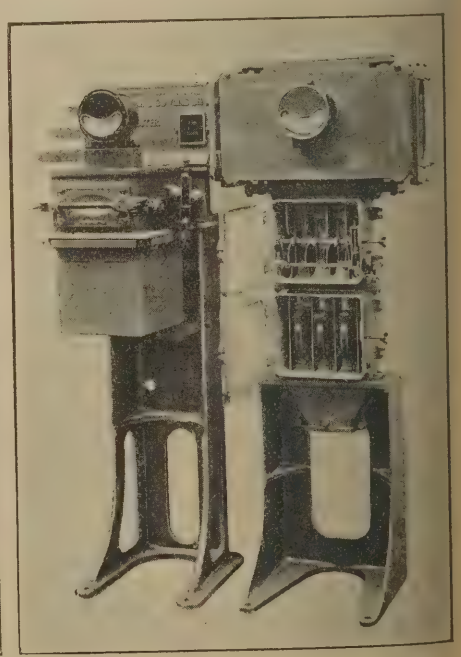


Fig. 3.—Combined Oil-immersed and Airbreak Pedestals.

the switch and the final opening and closing of the switch is done by springs; thus, a high speed is ensured independently of the speed at which the handle is moved by the operator. The switch is prevented from being operated when the cover is open by an interlock, nor can the moving contacts themselves be pushed in by hand. To comply with B.E.S.A. regulations, the interlock is arranged so that a competent and authorised examiner can operate the switch when the cover is open.

The S. & C. fuse carrier is said to be unbreakable; both the handle and fuse baffle are made of moulded insulating material, and, with the exception of the terminal screws, no small screws whatever are used in the construction of the carrier and contacts. The switchgear is made for either wall or floor mounting; cable boxes of any class, also pipe adaptors and instruments, are fitted when required. Various combinations of switches, fuses, and busbar chambers can be built up to form dust-tight ironclad switchboards of robust and pleasing design. When the current in any one circuit is in excess of 400 amps. an oil-immersed circuit breaker is used in place of the switches and fuses, as indicated in fig. 3. The switches and fuses are standardised in five sizes from 60 up to 400 amps., double and triple pole, for either a.c. or d.c. circuits up to 650 volts, and are successfully employed in many situations where conditions prevent the use of ordinary patterns.

Power Factor and Tariffs.

Types of Correction Plant, and a New Three-part Tariff.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

At the February 4th meeting of the Institution, two papers on the above subject were presented. Mr. E. W. Dorey's contribution, which summarised the principal types of apparatus employed for the improvement of power factor, was abstracted last week, together with the subsequent discussion.* A résumé of the other paper was read by Mr. E. L. Hill, in the absence of the author in Australia; it contends that the wattless component of current, despite its having no energy content, involves the electricity supply undertaking in extra running costs, and that therefore a charge should be levied for supplying it as outlined below :—

A Three-part Tariff.

By E. V. Clark, B.Sc., A.M.I.E.E.—*Abstract.*

The great attention now being given to power factor suggests that the tariffs commonly used to-day are unsuitable in the present circumstances, which fact presents a paradox. In what other field of supply and demand are similar conditions possible? One cannot imagine a gas company imploring its satisfied consumers to adopt (for the benefit of the company and the supply generally) a type of engine which uses less gas. The point which lies at the root of the whole matter is the fact that an electricity supply undertaking is essentially a supplier of "electricity" and not merely of "power." A motor absorbs electricity and delivers mechanical power; the law of the conservation of energy tells us that a motor delivering so much brake-horse-power requires a certain minimum energy component in the electricity it consumes, in accordance with its inefficiency as a converter of energy; and in accordance with its inefficiency as a converter of electricity into energy, so it requires a wattless component in addition.

Extending the Hopkinson principle, one might suggest dividing to-day's cost of supplying electricity as follows :—

(*a*) The running costs involved in supplying the energy component of the electricity consumed.

(*b*) The running costs involved in supplying the wattless component of the electricity consumed.

(*c*) The standing charges incurred in being ready to supply the energy component of the maximum demand.

(*d*) The standing charges incurred in being ready to supply the wattless component of the maximum demand.

However, it seems quite impossible to frame a tariff which would differentiate adequately between standing charges on plant to supply energy and wattless component. To combine the two items (*c*) and (*d*) into one charge (based on kVA of peak load), though not strictly rational, is undoubtedly advisable. It would appear at first sight that a customer whose maximum demand is 1,000 kVA at 70 per cent. p.f. entails upon the supply undertaking somewhat less standing charges, *cæteris paribus*, than a customer whose maximum demand is 1,000 kVA at unity; but this is not necessarily the case, since diversity factor has a material influence and the diversity factor of the wattless component is, in general, much lower than that of the energy component. Combining (*c*) and (*d*) we arrive at a three-part tariff for the supply of a.c. power as follows :—

(i) A charge based on the kWh of energy used.

(ii) A charge based on the kVA-hours of wattless component used.

(iii) A charge based on the kVA of maximum demand.

With an appropriate tariff of this nature, the undertaking would gain by increased supply of electricity, no matter what the power factor. The use by consumers of the simplest and most reliable form of motor (the plain induction motor rated appreciably above its normal load) would no longer be a source of annoyance to the supply undertaking, but a direct gain; the onus of improving p.f. would be placed upon the consumer and the manufacturer's salesman. The suggestion that a low power factor should be a source of profit to a supply undertaking may appear revolutionary, but directly the wattless component is charged for at a price, however small, which covers its cost, its supply is no longer a disadvantage.†

An undertaking with an average p.f. of 95 per cent. supplies one kVA-hour of wattless component for every three units of energy supplied, and the economy in running costs secured by supplying at unity power factor would be barely perceptible. Yet where the average power factor is about 70 per cent., so that the kVA-hours of wattless component are equal to the kWh of energy, the total running cost of the wattless component is certainly much more than three times that in the former case.

The chief item in the actual running cost of wattless component is the increase in I^2R loss in generators, cables, and transformers. Upon a system of average p.f. (70 per cent.) whose layout is such that the units spent in these I^2R losses are 10 per cent. of the units generated, a saving of 5 per cent. of the units generated would be effected by abolishing all wattless current. Hence in a system such as this the running cost per kVA-hour of wattless component from this cause alone is about one-twentieth of the running cost per kWh. A second item is the extra generator excitation required to compensate, not only for the extra drop in the system, but also for the actual demagnetising effect of such wattless component. With a station of the above nature the order of this loss would be about 1 per cent. of the units generated. Another is the increased iron, friction, and windage losses in generators, &c., due to their being designed on a kVA basis; a direct increase in running costs may arise from wattless component being sufficient to require an extra turbo set to be operated (with reduced station efficiency) at times when the running turbine has not yet reached its limit of capacity, owing to the overloading of the alternator. Other disabilities lie in the greater complexity necessary to maintain a satisfactory pressure on the distribution system (since wattless component, as a rule, causes a larger drop than an equal current in phase) and in the increased difficulty it causes in effectively tying two distant stations; while the use of reactances to prevent disturbances in one part of a system from affecting other parts would be feasible to a much greater extent if wattless component were absent. In general, these disabilities have to be met by increased capital expenditure, and therefore increase standing charges rather than running costs. It is quite certain, however, that under heads such as these the supply undertakings incur running costs which could be avoided if wattless component were absent.

If, on a three-part tariff, standing charges are levied on the kVA of peak load irrespective of power factor, it is desirable that extra expense due essentially to wattless component should be regarded as running cost rather than as a standing charge, whenever any doubt occurs as to its allocation. The author suggests that for such a system as that cited above the total running cost per kVA-hour of wattless component is in the neighbourhood of 10 per cent. of the amount normally regarded as the running cost per kWh. In other words, an undertaking which at present operates on a two-part tariff of £z per annum of kVA peak load, plus 10y pence per kWh of energy supplied, might appropriately adopt a three-part tariff of £z per kVA of peak load, plus 9y pence per kWh of energy, plus y pence per kVA-hour of wattless component; or, more specifically, a two-part tariff of £5 per kVA demand, plus 0.5d. per kWh, might be replaced by a tariff of £5 per kVA demand, plus 0.45d. per kWh, plus 0.05d. per kVA-hour of

*Elec. Rev., Feb. 12th, 1926; pp. 270-272.

†Analogy : If it were the custom that sulphuric acid, whatever its degree of dilution, should be sold at a rate based solely on its acid content, on the ground that water is of too little value to be worth considering, then it would be to the advantage of sulphuric acid manufacturers to sell acid at that degree of concentration at which it was most cheaply made. It might pay them to keep a staff of men whose main duty was to urge customers to use strong acid, and to show them how strong acid might conveniently be used in their businesses. It would certainly pay manufacturers, while still charging on acid content, to allow a discount based on the degree of concentration of the acid required. But with the realisation that water, though practically valueless compared with acid, still costs something for distilling and for delivery, the manufacturer may frame a tariff based not merely on the acid content, but also on the water content of the dilute acid he is asked to supply. And with an appropriate tariff it will be more profitable to him to sell 100 tons of concentrated acid broken down to a specific gravity of 1.2 than 100 tons in the concentrated form.

wattless component; such a tariff might include any existing discount according to quantity, and sliding scale in accordance with price of coal, &c.

Assuming that this ratio of 9 : 1 is correct in the case of 70 per cent. p.f., the cost per kVA-hour of wattless component will be much less in the case of 95 per cent. and much greater in the case of 55 per cent.; this leads to an important difference between the assessment of the charge per kVA-hour on a three-part tariff and per kWh on a two-part tariff. In the latter case increased sales mean, in general, reduced costs of generation, and, consequently, it pays to assess the running costs per unit on a low basis in order to encourage the use of as great a number of units as possible. With wattless component, however, the opposite is the case; the tariff per kVA-hour of wattless component should be on the high side, tending to discourage, and an undertaking may with advantage assume an average power factor somewhat worse than that acutally existing. It should be profitable to allow for leading wattless component a bonus equal to the rate charged for lagging. Leading component taken by static condensers during the slack hours is on quite a different footing, and to levy no extra charge for out-of-phase current upon those customers whose p.f. is above 90 per cent. appears to be both illogical and impolitic.

Any form of charging for electricity which is confusing to the lay mind is intrinsically bad from the psychological standpoint, but the three-part tariff suffers from no undue trouble on this score, nor in most cases from difficulty in metering.

For measuring a single-phase supply on the three-part tariff one would require a maximum-demand kVA meter, an ordinary watt-hour meter, and a sine meter, *i.e.*, an ordinary watt-hour meter modified by introducing a time-lag of 90 deg. into the current or voltage. For three-phase work, similar meters of a three-phase type might be suggested, but in most cases a simpler form of metering may be used. The kVA-hours of wattless component will never exceed twice the kWh of energy consumed with any normal power user, and will rarely exceed it by 50 per cent.; whilst the rate charged will be of the order of one-tenth. It follows that an error of 5 per cent. in the measurement of kVA-hours is of less importance than an error of 1 per cent. in the measurement of kWh. Consequently, it will be quite sufficient to assume that the three-phase load is balanced, so far as the measurement of wattless component is concerned, and the sine meter need be nothing more than a simple single-phase watt-hour meter, the series coil being connected in one main and the pressure coil between the other two, the reading of such a meter on a balanced load giving $1/\sqrt{3}$ of the total kVA-hours of wattless lagging component taken, with a negative reading if the current is leading. The dial might read $\sqrt{3}$ times the actual consumption, so as to record the wattless kVA-hours of the three phases; or, alternatively, it might read "equivalent units," so that the wattless component recorded might be charged for at the same rate as the units of energy.

The sine meter, if it is allowed to reverse, gives full credit for leading current taken by condensers left in circuit all night; if provided with a pawl to prevent reversing, it fails to give credit for leading current taken at the time of load. However, there are ways of overcoming this defect, in the case of balanced loads, without introducing additional complications or requiring special meters, since two ordinary single-phase meters, their series coils being connected in two of the mains and their pressure coils thence to the third main, measure by the sum of their readings the total energy consumption, irrespective of any want of balance, while the difference between their readings gives the kVA-hours of wattless component, assuming balanced load, from the fact that the lagging wattless kVA-hours equal $\sqrt{3}(w_1 - w_2)$, or leading wattless kVA-hours equal $\sqrt{3}(w_2 - w_1)$, where w_1 and w_2 are the respective readings of the two meters. The use of two such meters involves little difficulty in computing the power bill from the meter readings, if the tariff is suitably quoted. Three methods may be devised, the following being probably the most satisfactory:—The tariff charges f_1 pence per unit for all units recorded, less a rebate of f_4 pence per unit for all units recorded on meter No. 2. (In this case $f_1 = x + \sqrt{3}y$, and $f_4 = 2\sqrt{3}y$.)

With two such meters, consumers get full benefit for leading power factor at the time of load, whilst a non-return pawl on No. 1 meter ensures that the consumer's rebate for leading current extends only down to a power factor of 0.5. However, if the units of energy do not constitute a rational basis for the electricity bill, it seems quite unnecessary to measure them, if one can provide a meter that will directly measure something else which gives a truer basis for computing the charge. By slight modification, a standard type of three-phase watt-hour meter is readily adapted to record, upon a balanced load, the kWh of energy consumed, plus or minus any desired fraction of the kVA-hours of lagging or leading wattless component consumed. That is to say, one may adopt a three-part tariff, using for those consumers whose load is reasonably balanced a maximum-demand kVA meter and an ordinary three-phase watt-hour meter, the latter being biased to read not in Board of Trade units, but in "virtual" units, to be charged for at a flat rate in accordance with the requirements of the proposed three-part tariff. The three-phase meter must comprise two single-phase armatures upon a common spindle, recording upon a common dial in the usual manner. The only modification necessary is to arrange that when one element is tested on single-phase current, the meter shall run a certain percentage fast, and that when the other element is similarly tested the meter shall run an equal percentage slow. If x per cent. fast and slow, we have a meter which, appropriately connected to a three-phase balanced load, measures accurately the kWh of energy consumed, plus $x/(100\sqrt{3})$ times the kVA-hours of lagging wattless component, minus $x/(100\sqrt{3})$ times the kVA-hours of leading wattless component. If the lagging wattless component costs (per kVA-hour) one-ninth as much as each kWh of energy, then $x = 19.2$ (that is, the two elevents of the meter are adjusted to run respectively 19.2 per cent. fast and slow) and by charging 0.45d. for all virtual units recorded, we are actually charging 0.45d. per unit of energy, plus 0.05d. per kVA-hour of lagging wattless component, less 0.05d. per kVA-hour of any leading wattless component.

The requisite bias may be given to a three-phase meter by designing the armatures or fields to have different strengths, by having different ballast resistances in their shunt circuits; or where current or pressure transformers are used, by having a different number of turns in the secondaries. Probably existing meters could be given the appropriate bias by so adjusting the brake as to make the meter run the required degree fast, and inserting an extra ballast resistance in the one shunt circuit. A non-return pawl is desirable to prevent the reversal of the meter under the effect of static condensers. The sanction of the Electricity Commissioners would be required before biased three-phase meters could be used, as they do not record the units of energy consumed, nor is it possible to deduce from their readings what has been the actual energy consumption, and therefore they do not comply with the requirements of the Electric Lighting Acts. Nevertheless, they measure the consumption of electricity on a balanced three-phase load on a perfectly definite basis, and their accuracy can readily be tested by testing each single-phase element separately. The determined charge for wattless component, however small, can be introduced with no expense save the initial one of altering the watt-hour meter installed. The consumer is not troubled by the addition of an extra meter that he does not understand, nor are his bills made up in any different form from that he is accustomed to, save that he is assessed in "virtual" units instead of in "Board of Trade" units. Any misgivings that he may have on that score will be largely alleviated by the fact that, while the number of virtual units recorded is not markedly greater than the Board of Trade units recorded hitherto, the price charged for them is 5 or 10 per cent. less. Indeed, for all power customers, large or small, except where the load is seriously out of balance, the biased meter should be quite satisfactory.

Electric Water Heating on Board Ship.—The internal-combustion engine-driven vessel *Belnor*, which has lately been completed by Sir W. G. Armstrong, Whitworth & Co. for Capt. Christen Smith, of Oslo, is of interest in that the water required for baths, &c., by the officers and crew is heated electrically by means of R-type storage geysers of the Bastian Meter Co., Ltd. (incorporating Bastian & Allen). The ship concerned is specially adapted for the transport of locomotives and has a dead-weight capacity of 4,100 tons. The type of geyser used consists of a tank to which the electric current is always switched on, thus giving 100 per cent. load factor, and at the same time a very small load. When hot water is drawn off, instead of the tank filling up immediately with cold water, it enters the tank at a rate proportional to the heating effect, and thus the remaining water is not lowered in temperature. It is only necessary to provide sufficient storage and a correctly-designed load to obtain a hot-water supply to meet all requirements that may be expected. In the case of the *Belnor*, two Bastian storage geysers are fitted. The one aft for the crew's use is of 100 gallons capacity, loaded at 2.8 kW, which, it is anticipated, will always be left on, and an extra heat of 1.2 kW for emergency. For the captain's requirements a 30-gallon geyser is provided with a continuous load of 450 watts. Thus for a continuous load of no more than 3.2 kW, the entire water heating for the crew and officers is provided. The geysers in question are rectangular, well lagged, and specially designed for ship work. To the best of our knowledge, this is the first sea-going ship which has a complete installation for water heating by electricity, and this has been followed up by an order for three other ships. Another point is the use of "Quartzalite" heating elements, designed to have a very long life, but when they do fail it is only a matter of a few minutes to replace them, and this can be done without in any way interfering with the installation.

Fuel Control in Italy.—In accordance with the replies to questions put by the Ministry of National Economy to the Commission appointed to deal with this matter last year, the Cabinet has approved of two bills of great importance. By the first, which provides for the control of fuel, the present associations of users of steam boilers are fused into a single body called the National Association for Fuel Control (Ente Nazionale per il Controllo della Combustione). The new association will exercise control over all apparatus and engines using fuel for any purpose with the view of enforcing the regulations suggested by the latest developments of technical science in order that the utilisation of fuel may be attended by as little waste as possible. New plant must fulfil all modern technical demands, and old apparatus and engines consuming large quantities of fuel and possessing a low degree of efficiency must be replaced within a reasonable length of time by modern apparatus and engines so as to realise the greatest economy possible. The second bill concerns measures for the better utilisation of home-produced fuels.—*Reuter's Trade Service* (Rome).

The Electrical Research Association.

Annual Meeting and Luncheon, and Report, 1920-1925.

The Luncheon.

ON Friday last the annual general meeting of the British Electrical and Allied Industries Research Association was held in private, at the Savoy Hotel, London. An abstract of the report of the Council for the year 1925 was printed in our last issue (p. 264). Mr. Ll. B. Atkinson, chairman of the Council, occupied the chair, and it was learnt that he had been elected president of the Association.

After the loyal toast, Mr. R. A. CHATTOCK proposed "The E.R.A.," congratulating the Association on its having passed the age of infancy and completed its fifth year. The work which it had done, he said, was very valuable and encouraging, covering all electrical interests and catering for the allied interests also. The inspectors appointed by the Research Department, who had reported so favourably, had pointed out that users derived great benefit from the Association's operations as well as manufacturers, and Mr. Chattock urged that they should share the expenses, seeing that they benefited financially from the work that was done. The Government offered further support if an extended programme was entered upon; the minimum requirements absorbed £16,000 a year, and additional funds should be provided.

So far the Association's work had been mainly electrical; as regarded the allied industries, a beginning had been made with condensers and turbines; and this work should be extended to include the corrosion of steam boilers; also the results obtained at power stations working on different systems should be collated and the most economical methods of operation deduced. The work done on poles for overhead lines would be useful in connection with the proposed national network; but the most valuable results were those obtained from the research on buried cables, by which large sums of money had been saved, which alone justified the support of the supply side of the industry. He wished all success to the Association, and paid a tribute to the ability of the director, Mr. E. B. Wedmore.

Mr. LL. B. ATKINSON, responding, recalled the formation of the Research Association, and said that agreements had been made under which the Association's supporters—mainly manufacturers—had guaranteed subscriptions, and the Department would assist them for the next five years, but on a reduced scale. At the end of that period the industry must provide for itself. Unfortunately, most people in this country were out of touch with science; little was taught in the schools, and the business world was recruited from the classes with a classical training. Business men had no individual knowledge of scientific method based on known facts and not on opinions; during the war science was called in, with astounding results, but afterwards the politicians fell back into their old ways. So the Government of this country, which was foremost in science, stood back from research and failed to realise what research could do for it. Did our countrymen realise that modern industrial and scientific knowledge was almost wholly the production of British effort? English agriculture was unrivalled throughout the world; in engineering our inventors led the world, and the locomotive, the railway, and the iron steamship were all British. The textile industries and the coal-gas industry were due to British inventors; in mathematics Napier, Newton, and Taylor, followed by Hamilton and Heaviside, laid the foundations, and navigation was made possible by Hadley's sextant and Harrison's chronometer. Optics, physiology and medicine, and surgery were revolutionised by Englishmen, and the secret of cancer recently yielded to British research. Chemistry owed the atomic theory, the production of sodium and potassium (and hence aluminium), benzole, and the aniline dyes to English researchers, and in electrical science, after the voltaic battery and the magnetic action of electric currents, almost every great discovery was British, up to the present day. Our fundamental discoveries had been developed by hundreds of brilliant workers in all lands, but the claim that every great step forward in modern science was a British product could not seriously be refuted.

It was unbelievable that any civilised State with such a record should have as its deliberate policy that it would not support research. The problem of employment in this country on the scale necessary to maintain the present population depended wholly on the finding of new products, new methods, new outlets. Within a few months the nation would have to find 20 millions to support the most backward industry in the country—a sum which, if applied to research, would almost certainly in a few years enable the production of coal to be abandoned for ever. Research associations and workers were not asking for charity—they were urging that the present squalid civilisation should be replaced, as it could be, by a far better one, if applied knowledge in every sphere was encouraged and developed. Instead of being a last charge upon the resources of the nation, research should be a first charge.

Mr. A. R. EVEREST proposed the health of the new president, expressing the indebtedness of the Association to him since, seven years ago, he was appointed to represent the I.E.E. on the Council of the Research Committee.

Mr. ATKINSON, responding, said that no presidential office that he had occupied had given him greater pleasure and pride.

Report on the Work of the E.R.A.

In addition to the annual report above-mentioned, a report covering the work of the Association over the whole of its existence was recently issued. The report points out that prior to the formation of the Association, large sums were spent by individual manufacturers and others on research, but there was no provision for co-operative research. After recounting the events which led to the birth of the present Association, the report shows that there are important classes of work which can only be carried out in this way, and that the "E.R.A." has filled a recognised gap in the organisation of the industry. The results already obtained point clearly to the great possibilities of large-scale fundamental research. The research on oil circuit breakers has been marked by the production of revolutionary ideas which point the way to increasing rupturing capacity by hundreds per cent. Experience is showing that fundamental research in science is needed for the resolution of known problems. The standardisation of measurements and practice has produced material improvements in connection with insulating materials, as well as with switchgear, mining apparatus, and overhead line equipment; new and important data have been obtained by tests on a large scale of cables and overhead line equipment, leading to extensive revisions of practice and economy of materials. Revolutionary changes have been effected in some industries.

The Council of the Association is thoroughly representative of the electrical profession and industry, and all available facilities of research are used to the full, with the co-operation of the resources of individual members, the N.P.L., universities, polytechnics, other research associations, paper and silk manufacturers, public institutions, &c.; only in one section (electric control apparatus) is the experimental work done through its own staff, though 150 experts are engaged on committees in framing programmes and supervising researches. There are 13 sectional committees and 41 executive sub-committees. The report proceeds to review the numerous researches which have been and are in progress, indicating the nature of the results obtained, which in many instances are of a striking character. For example, insulating paper made to a specification based on the research work has shown better "ageing" properties than any previous sample; as great progress in the quality of asbestos products has been made in the last two years as in the preceding 20 years; ample supplies of insulating oil can now be obtained with an electric strength much above the tentative standard set up two years ago; the work done on the heating of buried cables is saving the country £250,000 to £300,000 a year; current practice in the design of "A" poles has been shown to be radically wrong; new data of great importance in oil circuit breaker design are constantly coming to light, and the breaking power of existing types will undoubtedly be increased many fold.

The report concludes with a schedule of researches in hand, a list of reports issued, lists of members of committees, members of the Association, &c.

Electric Bell-ringing.—It is hoped that before long "Great George," the 9½-ton bell in the tower of the University of Bristol, will begin sounding the hours. It is interesting to learn that the mechanism which will actuate the bell was made in Bristol, Prof. David Robertson, head of the Electrical Engineering Department in the Engineering Faculty of the University, having designed the apparatus which is now being tested. It consists of an electric motor-driven striking machine to lift and drop the hammer; a time device to cause the former to function; a master pendulum to drive the time machine and electric clocks throughout the building; and the time signal apparatus to regulate the pendulum by means of time signals received from Greenwich over the Post Office lines. In the event of the failure of the public supply of electricity, the first stroke will be sounded only. The time machine and the master pendulum were made by Messrs. Brecknell, Munro and Rogers, Ltd., with some assistance from Messrs. G. Langford & Sons in connection with the fine work of the pendulum mechanism. The latter firm is also making the dial for the master clock, which will be in the same case as the time machine and pendulum, but as an independent mechanism driven electrically by one of Messrs. Gent's standard movements. The striking machine has been made by Messrs. Olver & Fry, and credit is due to all these firms for the way in which they have carried out tasks entirely outside their ordinary experience.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

Guy's Hospital Outfit.

Guy's Hospital has been added to the list of institutions that have been equipped with broadcast radio-receiving apparatus under the *Daily News* fund scheme. In this case arrangements have been made for 500 listening posts initially, the installation having been carried out by the Marconiphone Co., Ltd., and special provision has been made to simplify adjustments and general manipulation.

An indoor aerial is used, which is quite suitable for reception from London and Daventry, in conjunction with a long-range Marconiphone V2; the amplifying unit is of special design to suit the particular case and possesses a six-way output, making each distributing line independent of the others. Three stages of low-frequency coupling are used by means of transformers in conjunction with one Marconi D.E.5 and seven D.E.5A valves. Each of the latter serves about 100 points in parallel through a specially designed step-down "Ideal" trans-

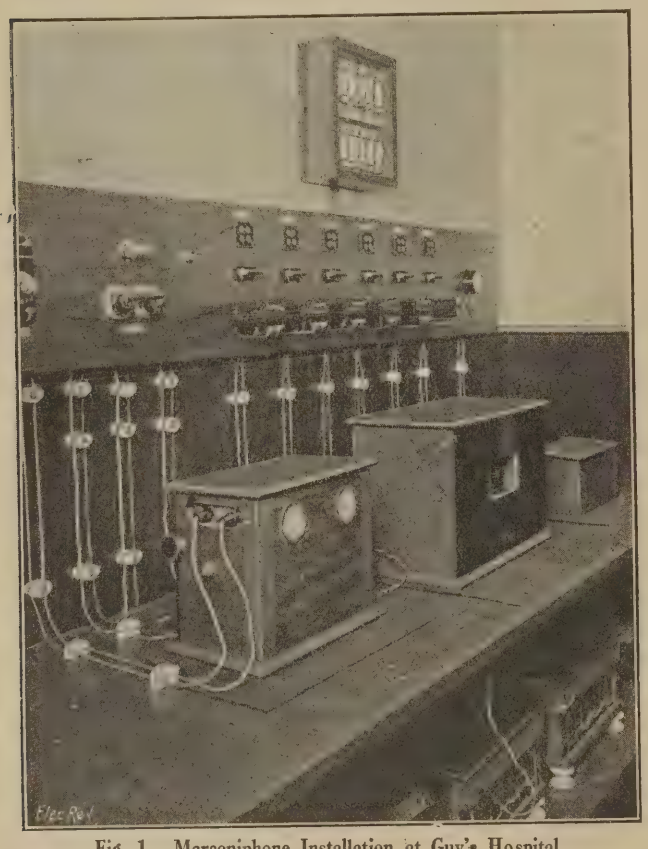


Fig. 1.—Marconiphone Installation at Guy's Hospital.

former with a ratio of 5 to 1 to maintain an even electrical balance; attached thereto are 'phone sockets for testing the output of each line at the amplifier end of the lines, also special damping resistances are arranged in order to balance the output of each line to suit the load, or number of 'phones in circuit. The wiring throughout the system is composed of lead-covered cable, a wise precautionary measure which reduces the possibility of faults developing on the distributing lines. A six-way double-point fuse box, situated between the line transformers and 'phone lines, somewhat facilitates the testing of the lines and also acts as a safety factor.

The high- and low-pressure supplies are obtained from a group of Exide accumulators, the former being composed of four 32-volt, 3-amp. batteries, and the latter of 6-volt, 105-amp. cells. A pilot lamp has been installed as a guide, which glows when the set is in operation, and special battery-charging facilities are being arranged for by the Marconiphone Co.

The "Radiostar" Receiver.

The recently introduced 4-valve receiving set bearing the above name has been designed by the EDISON SWAN ELECTRIC CO., LTD., to supplement rather than supplant its "Radiophone" model. It is capable of dealing with all wave-lengths with the aid of a number of range blocks in the form of single plug-in coils. The lowest coil will give a range of from 60 to 200 metres, and the highest up to about 2,600 metres. Tuning by means of a calibrated dial is unusual in this country; the aerial-tuning condenser control comprises a celluloid dial on which a hair line is engraved, and a second dial of metal on which the names of the principal stations are engraved. The celluloid dial is rotated over the engraved dial, the hair line being set to the station required. The metal dial has three concentric circles: on the inner one figure the low wave-length ranges; the middle circle bears the names of the B.B.C. and other stations between 250 and 550 metres, and the outer circle those of long-wave stations, such as Daventry and Radio Paris. The double condensers provide a simple method of tuning on the short waves; separate filament-rheostats are provided of the dual type, for either dull or bright emitter valves, and a Dewar switch brings in either 2, 3, or 4 valves, while the current supply to the valves is controlled by a "pull and push" switch, which enables one to switch on or off without interfering with the settings of the rheostats. The instrument is enclosed in a polished walnut cabinet with hinged doors. All connections are made to terminals on an ebonite strip at the back of the receiver, batteries being housed inside the cabinet and the valves are also inside. The plug-in inductance coils have 6 pins, similar to valve pins, which fit into a special socket, and for control there are 2 main dials only, while it is necessary to change only one coil to alter the wave band.

The "Seamark Connode."

A novel combination of two-coil holder and variable condenser is manufactured in London for MESSRS. C. E. NEEDHAM AND BROS., LTD. As fig. 2 indicates, a projection on the lower ebonite end plate serves as the fixed coil holder, the moving holder being attached to a spindle that is concentric with, and passes through, the hollow spindle of the movable condenser vanes; a separate knob having a short extension handle operates the coil holder. The condenser is of the usual square-law

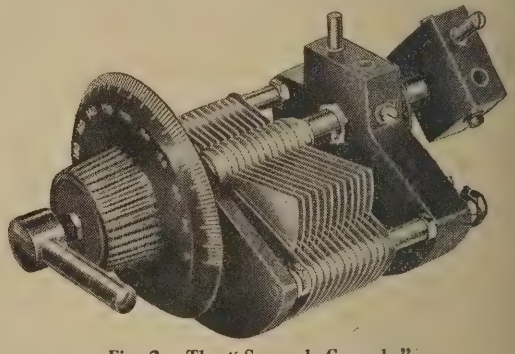


Fig. 2.—The "Seamark Connode."

pattern and a compact component of this type should be found very useful, as it facilitates the adjustment of reaction and capacity. The N.P.L., we understand, found the capacity between the movable plates and the fixed coil in its socket to be 3 micro-micro-farads, while in addition to its suitability for the broadcast and Daventry wave-lengths the device can be used for reception on waves down to 45 metres in length with a suitable circuit.

Some Igranic Components.

Realising the advantages that should accrue from co-operation between British and American manufacturers of high-grade radio components, the Igranic Electric Co., Ltd., has concluded arrangements whereby, in addition to its present range of components, it has become the exclusive manufacturing licensee of the products of the Pacent Electric Co. Consequently, some of the accessories which are

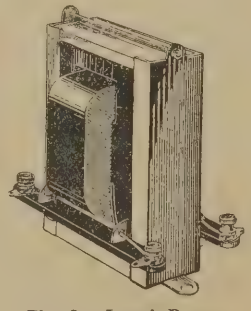


Fig. 3.—Igranic-Pacent "Superaudioformer."

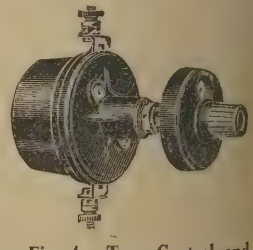


Fig. 4.—Tone Control and Damping Resistance.

offered are worthy of special notice; for instance, the "Superaudioformer," shown in fig. 3, is claimed to amplify uniformly all frequencies from 100 to 8,000, and so to be unique amongst l.f. transformers. It is suitable for use with general purpose valves, particularly for power amplification, and the insulation is made to withstand plate voltages up to 500 V. Soldering tags and slotted hexagonal nuts are provided.

A tone-controlling device and damping resistance is illustrated in fig. 4; its usual position is across the secondary winding of a l.f. transformer, but it may also be used to stabilise the h.f. portion of a receiver. In outward appearance it is exactly similar to the Igranic variable grid leak, 0-5 megohms, the resistance value in this case, however, being 0

to 1 megohm; it is suitable for use to cut down volume when receiving from a nearby station, obviating the necessity of mistuning the receiver, or dimming the amplifier filaments, so that the probability of interference and distortion which may be caused by resorting to these means is eliminated. For use as a damping resistance to increase stability in a valve receiver it may be connected in shunt with a tuned anode coil. It will be found reliable and constant in operation; the conducting parts are well separated from the control knob, thus eliminating hand-capacity effects, and single hole fixing is provided for.

The special feature of "Xllos" extra-low-loss coils (fig. 5) is the method by which adaptability in mounting is obtained. Precision wound, the coil is enclosed in a moulded Bakelite container, which excludes damp and dust. The contact pin

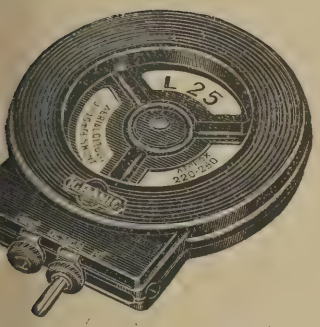


Fig. 5.—"Xllos" Low-loss Coil.

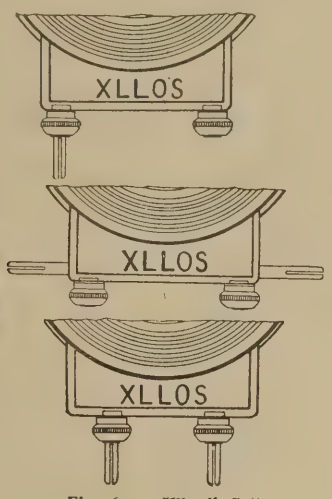


Fig. 6.—"Xllos" Coil; Methods of Mounting.

and socket, as indicated in fig. 6, are arranged to slide in slots formed in the moulded plug which is part of the Bakelite container. Thus the spacing between the plug and socket can be adjusted so that the coil may be used in standard holders, or they may be widely spaced for mounting the coil in a special low-capacity holder. The spacing is altered by loosening the milled ebonite nuts shown, and an extra pin is also supplied, which may be screwed into the socket to provide for double-pin mounting. It is thus evident that "Xllos" coils are valuable for experimental purposes; they are obtainable in six sizes.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The All-Electric House.

Electricity supply engineers should feel obliged to Mr. E. W. Dickinson and the Editors of the ELECTRICAL REVIEW for the article on "Fuel Economy and the All-Electric House."

I believe a coke-fired hot-water radiator system meets the constant requirements for warming that most recent milestone of progress, Electric House, Hackney. For comprehensive warming from a central boiler it is economical, effective, and hygienic—when properly installed.

But, quoting from the figures in the article, electricity with an effective 17 per cent. of the coal's c.v. beats gas with its ½ per cent. on all counts without further argument.

I acknowledge the utility of the coke and all other products from the distillation of coal, but this need not, and, in my opinion, should not, necessitate the distribution of gas in a network of pipes. It is the gas which accompanies the electric cables down the streets—though not, be it noted, into the rural areas where heat, light, and power is badly needed.

The increasing use of electrical energy is automatically reducing the selling price of electricity to its correct level. Meanwhile, the astutely advertised solicitude of the gas industry for national fuel economy forms an appropriate recessional.

Invictus.

Wrexham, *February 9th*, 1926.

The interesting facts contributed by Mr. E. W. Dickinson would have served a wider purpose to electrical readers if the commercial values had been given for gas and coke in relation to B.th.u. from the distillation of coal.

The 1 lb. of coal with an average calorific value of 14,500 B.th.u.; am I right in assuming that 75 per cent. of the B.th.u. is still retained in the coke and gas in the proportion of 50 per cent. and 25 per cent. respectively? Also, what is the relation of the value of the gas, plus the coke, to the value when the same coal is used at the rate of 1.8 lb. per kWh, taking electricity at 1d. per unit, coke at 30s. per ton, and gas at 9d. per therm?

If we knew the weight of the coke per ton of coal used, it would be helpful.

Can we rely on the figure 50 per cent. efficiency for gas heating for domestic use? It would be helpful to many to give relative facts, especially in view of the exaggerated claims made by enthusiasts on both sides.

B. Gill.

Leicester, *February 9th*, 1926.

In an article on "Fuel Economy and the All-Electric House" in your issue of February 5th, the author presses the need for fuel economy in the production of domestic power; but should this aspect take precedence of other considerations?

It would appear that the greatest efforts should be made to secure the maximum possible comfort, convenience, and efficiency for the present and immediately future generations.

The author of the above-mentioned article, in common with others, admits that electricity can afford a standard of comfort in the home higher than that attainable by other means. All that the public requires is the best, and it will have it, provided that it can be obtained at a competitive price.

Turning now to the question of fuel conservation (with especial reference to fuel supplied for domestic purposes), various estimates have been made regarding the period for which our coal supplies will last at our present rate of consumption of coal, electricity, and gas. Consider the approximate figure of 150 years, which is probably on the low side; we find that if all our present output (of coal) were to be entirely absorbed by modern power stations, so that electricity only were used for all purposes, the overall heat efficiency when considering the useful output at the consumers' end of the power chain would be about 17 per cent., a figure that, for the present purpose, may be considered as approximating to that actually obtaining under the present system of supplying coal, electricity, and gas. Therefore, if we were to completely electrify, in the manner suggested above, our coal supply would still last for the 150 years. Now taking Mr. Dickinson's overall efficiency ratio regarding "all-electric" and "all gas and coke," we see that if instead of converting it into electricity, we converted our coal into gas and coke, the country's coal would last for something approaching 300 years.

We see, then, that if we use electricity exclusively, we shall be able to enjoy its benefits for 150 years, after which something drastic will have to be done; whereas, if we use gas exclusively, we have nearly 300 years to go before the discovery or development of other sources of power becomes imperative. Now in 150 years many things may happen, and one can reasonably assume that a radical change in our present-day fundamentally inefficient method of generation will occur, or else a practical source of power other than coal will be discovered. One must remember that "necessity is the mother of invention," and it is hardly to be thought that future generations will lack creative ability.

The point of view that I would suggest is?—Should we consider rather distantly future generations at the expense of the present, where the benefit resulting from such consideration will very probably never be needed by such generations? If we are able, on account of various economic conditions and peculiarities, to generate the best form of energy, *electricity*, at a *selling price* which compares favourably with the costs of other forms of energy—well, why shouldn't me? Why should we attempt to stay the tide of progress?

L. F. Ryland.

Manchester, *February 8th*, 1926.

I quite enjoyed Mr. E. E. Sharp's letter in your issue of the 12th. If it misses the point and leaves me cold, yet I still feel I can write something. There is a vast difference between sane enthusiasm found on fact and the uncontrolled variety fed on fancy and generally ending in trouble.

If my contribution on "The All-Electric House" means anything, it means that the electrical industry should not be blind to the good selling points of the products of its competitors, but should rather wake up and become supreme by manufacturing a cheaper and better means for providing heat in the home.

Curiously enough, on page 352 of the last issue of the ELECTRICAL REVIEW, there appears an article which describes an experiment on four houses of the six-roomed cottage variety, built by the Woolwich Borough Council under its housing scheme. The results show that with electricity at 1d. per unit the average cost of providing light, power, and heat to the four houses was £27 18s. 5d. per house for 13 months, or £25 15s. 5d. per annum, subject to a 20 per cent. rebate. Does Mr. Sharp consider that, out of a wage of £4 to £5 a week, this is a reasonable sum?

If the Borough Council could be persuaded, for experimental purposes, to install four more houses with electricity for lighting and power, and with gas and coke for cooking and heating, I think the results would show a very substantial saving probably amounting to 30 per cent. in cash paid out, with almost equal comfort in the house, and conserving the nation's source of energy.

I have by your courtesy seen the letters of "Invictus" and Mr. B. Gill. "Invictus" is at fault in assuming that the thermal efficiency—c.v. of coal to the c.v. usefully applied in the home—of gas and electricity is 12½ per cent. and 17 per cent. respectively. A little consideration will show him that the gas is obtained from the destruction of one-third of the coal,

while the 17 per cent. is from the whole. The true comparison is 37½ per cent. and 17 per cent. Mr. B. Gill is correct in assuming that 75 per cent. of the B.th.u. contained in the original coal is retained in the gas and coke in approximately the division of 25 per cent. and 50 per cent. His other query may be answered by means of a small table given below :—

Heat in the Home.

Source.	Unit of measure.	Cost in pence.	Cal. value of unit.	Use factor in home.	Resultant cal. value.
Electricity at 1d. per kWh	1 B.O.T. unit.	1·00	3,412	100%	3,412
Coke at 30/- per ton	1 lb.	0·16	11,000	35%	3,850
Gas at 8d. per therm	1 Therm.	8·00	100,000	50%	50,000

That is to say :—

(a) Electricity gives... ... ... 3,412 B.th.u. for...1d.

(b) Coke ... ⅝ lb. = 2,406 } = 3,406 „ { ·10d. } = ·26d.
Gas ... 1/500 therm = 1,000 } { ·16d. }

On these assumptions electricity is much dearer than gas and coke for heating purposes.

Improvements in the generation, distribution and application of electricity will no doubt remove this disadvantage, but there is a vast field for improvement, and my only object is to disclose this field and make our industry absolutely impregnable.

E. W. Dickinson.

London, *February 13th*, 1926.

Sales and Prices.

The article on " Sales and Prices " in the Electrical Review for February 5th represents a considerable amount of labour, but it may be doubted whether any really useful purpose is served by a comparison on this basis.

If a sufficient number of cases were taken to make sure that each group of points for each small range of sales represented about equal proportions of the same kinds of sales, the mean curve would have some significance. Such a mean curve is faintly indicated by the graph for sales between 1 and 20 million units, but the scattering of prices on each sales ordinate indicates that the number of cases taken is insufficient for any general deductions. For the graph between 20 and 200 million units the number of cases is altogether too small for any " law " to be indicated. The reason is that these larger undertakings differ enormously among themselves in the character of their sales.

" Units Sold " are not the same articles in different cases. The average prices are a compound of :—

(*a*) Prices at the factory (as for bulk and traction supplies metered at the station switchboard);

(*b*) Wholesale prices for deliveries to the retailer (as for bulk supplies metered at the end of suppliers' transmission lines);

(*c*) Retail prices for delivery at the consumers' premises in very varying amounts.

(*a*), (*b*), (*c*) are in very various proportions in different cases.

The retailer has often to carry out finishing processes—transformation and conversion—before he can deliver the retailed article.

The retailer has to provide, maintain, and operate the distributing system.

Two examples of London companies will illustrate how meaningless average prices against sales may be. They are all taken from the 1923 figures in the Commissioners' Report.

The Central Company generated 51.102 m. units, and sold 47.188 m. It generated 108 units for every 100 units sold.

Its three customers—the retailers—bought and generated 62.166 m. units and sold 51.365 m. They bought and generated 121 units for every 100 units sold.

The St. James & Pall Mall Company bought 99.9 per cent. of its generated and bought total; 125 units for every 100 units sold; so that the Central Company generated 135 units and sold 125 units for every 100 units sold by this retailer.

The Central Company had expended capital on distribution to the amount of £77,167, or £1,630 per million units sold.

Its three customers had spent £1,529,155 on distribution, or £29,770 per million units sold. Their expenditure on meters alone—£95,606—is greater than the whole distribution expenditure of the Central Company.

The City of London Company generated 51.997 m. units (not far from the 51.102 m. of the Central Company) and sold 42.606 m., or it generated 122 units for every 100 units sold.

Its expenditure for distribution capital was £1,121,825 (£109,959 for meters alone), or £26,330 per million units sold.

It is unnecessary to carry on the comparison to working expenses on distribution and accounting, or to do more than mention load factor.

The figures given demonstrate that any comparison between individual undertakings on the basis of sales against prices is without meaning, unless their sales are of the same character.

Henry M. Sayers.

London, *February 8th*, 1926.

[The necessity of making full allowance for local conditions was indicated in the article and in our leaderette. There was no suggestion that any " law " could be deduced from the data plotted; the diagrams, indeed, suggest a total absence of conformity to any law. One of their striking features is the fact that throughout the output scale both small and large power stations are found supplying electricity at an average price between 1.5d. and 2.0d. per kWh; another is that quite small stations can supply energy for less than 1.5d.

The fact that bulk supplies cost the retailer more than he pays the seller, on account of subsequent transformation and conversion, tells against the bulk seller's average price, which ought to be proportionately increased in order to be comparable with the prices charged by undertakings which supply energy ready for use, to which class the small stations belong.

That the London companies are working under exceptional conditions—and making exceptional profits—must be admitted. A loss of 35 out of 135 kWh generated, between the source and the consumer—more than 25 per cent.—within an area of a few square miles is rather startling.—Eds. Elec. Rev.]

Portable Apparatus in Bath Rooms.

In your leading article headed " Unusual Dangers," of February 12th, you, in common with your contemporary, the *Electrical Times*, express the opinion that " portable apparatus should never be used in a bath room." It puzzles me to think how the use of electrical apparatus in bath rooms will be avoided. In the first place, it is the most natural thing to have an electric radiator in the bath room. It is just the place where gas and coal are unsuitable and electricity is the only reasonable agent, and as it is not required there for long periods, it is, even at the present prices of electricity, a reasonably economical means of obtaining the desired comfort in the bath room.

Apart, however, from the electric radiator, I cannot help wondering how it is possible to prevent other portable electrical apparatus from being taken into a bath room, for example, hair driers, hair curlers, shaving-water heaters, towel rails, &c. Even if it can be understood in the industry that no wall plugs shall be fitted in the bath room, there is still the lamp socket to which small portable apparatus will be fixed. Moreover, there are portable appliances used in the household with long flexible cables, such, for example, as the vacuum cleaner, which will be brought into the bath room from plug connections in the hall, on the landing, or in other rooms.

I am apprehensive of electrical Press statements against the use of portable apparatus in the bath room, but if it must be done, then it should be done thoroughly, and all lay users of electricity should be warned. The usual way in " safety first " propaganda adopted in works is to draw up a scare notice showing realistically the disastrous results of carelessness. If your attitude is correct, the public should be warned in this way. Personally, I doubt very much if it is the correct attitude to take. The plan adopted in a factory for dealing with the same " unusual dangers " is to use a 3-core cable which includes a separate strand for earthing, and there must be visible terminals showing the earth wire connection.

Unfortunately, the risk of shock does not stop in the bath room. It applies in all parts of the house " where water or low-resistance earthing media are present." For example, a breakfast room is heated from a central heating system. It is a very likely occurrence for the electric toaster or electric kettle to be placed on the water radiator. In the scullery also, what is more natural than that the water tap should be held in one hand and the electric kettle in the other?—or even a cigar lighter may be hung up on a disused gas bracket. The rarity of fatal accidents proves the safety of electricity as compared with other domestic service agencies, but there must be innumerable occasions where the residents of a house obtain shocks which, to say the least, do not contribute to comfort in the home, and tend to scare persons off the use of electricity. Owing to the very large amount of exceedingly poor 2-wire flexible cables which are in use everywhere, it must be years before a satisfactory system can become universal. Why not let us try to get it started? A sound system of earthing the framework of all portable electrical apparatus is possible. Earthing terminals and wires can be substantially connected and locked in such a way that they will not work loose. Admittedly the practice is at present rare in domestic application, but is there any reason why it should not be propagated? The protected type of wall plug with a metal casing is now the common property of all manufacturers, it having been specified in all details essential for interchangeability and good earthing by a British Engineering Standards Association Panel, and I understand that the publication of the specification is not far distant. I feel that if our electrical Press would only advocate good workmanship, design, and good quality of material, that would be a better policy than to deprecate the use of electricity in one part of the house, which advice, if taken logically by the public, is likely to be detrimental to the general use of electricity in domestic service.

Is it too difficult a matter to attempt to educate the public into the observance of the principle of earthing all metal work which contains electrical elements? A start, of course, must be made with the average wiring contractor, who, I believe, to-day is very reluctant to attempt an " all-earthed " house wiring system.

I enclose a sketch in case I have not made my meaning clear as to the type of cable and earth contact. As with everything else, there is always some risk, however remote it may be, and this must be faced with an " all-earthed "

system. Good and visible terminal connections are merely a matter of good mechanics, in which men in this country do excel. The remaining risk is that the earth wire in the flex may be broken, and this, again, I believe, is mainly a matter for careful mechanical construction of the cable itself, and the gland and terminal fittings.

The principles involved are very much the same as those relating to the larger switchgear installations. At one time the "all-earthed" metal-clad systems were almost universally deprecated, but advance in the art and experience has proved their sterling merit, and now metal-cladding and earthing have become the recognised measures for safety. I can foresee that objections will be raised to the "all-earthed" electric house on the ground of increased cost. The same arguments were used against metal-clad switchgear. To-day it is known to effect economies in the cost of electrical installations, and so I believe the future will see a time, maybe 10, 20, or must it be 50 years hence, when our present methods of flimsy electrical connections in domestic service will be looked upon askance as relics of the courage and fortitude of the present age.

H. W. Clothier, Director,
For A. Reyrolle & Co., Ltd.

Hebburn-on-Tyne, *February 13th*, 1926.

[We appreciate our correspondent's leaning towards earthed metal casings, with which he has been so successful on the larger scale, and we heartily approve of it in the case of fixed apparatus. We expressly said that in our opinion *portable* apparatus should not be used in bath rooms, and we emphasise the word portable because in the very next line to his quotation Mr. Clothier departs from the question by writing of "the use of electrical apparatus" without that word. Fix the radiator and earth it permanently and our case is satisfied. The same applies to shaving-water heaters and towel rails. Hair driers and curlers are more likely to be used in the bedroom, and, at any rate, not whilst one is in the bath, which is the danger spot (in every fatal case that we remember, the victim was in or on the bath). For the rest, we can only exclude wall-plugs and hope for the best; gas-heated geysers are still used in bath rooms, though people are killed by them every year. We included the scullery and cellar in our remarks. Elsewhere only hand to hand shocks are conceivably possible; a firm grip of opposite poles is most unlikely to occur, and with dry hands the risk of fatal shock from casual contact is too remote to require attention. "The rarity of fatal accidents proves the safety of electricity"; we know of no fatality in a living room or bedroom, hence there is no need to take elaborate precautions in such places.—Eds. Elec. Rev.]

An Electric Vehicle Association.

There appears to be a good deal to be said both for and against the formation of another association of those interested in electric vehicles.

Mr. R. J. Mitchell warns us again of the danger of having too many societies, and suggests that Mr. J. C. Elvy should join one of the existing societies. So far as I am aware, there is none wholly devoted to electric vehicles, nor any at present where members interested in such would not be entirely lost. It might be possible to get the Councils of the Electrical, Automobile, or Transport Institutions, for instance, to accept an electric vehicle paper once a year, or once in two years, but this is insufficient to allow users and makers to ventilate their opinions and get down to details. Most of us are aware that the discussion on an Institution paper extends to perhaps an hour and is usually very disappointing owing to limitations of time.

No doubt any meetings of a new Electric Vehicle Society would be very small, although probably more enthusiastic, and difficulty might arise in carrying on at all, as I know from experience. The Electric Vehicle Committee cannot invite all interested in this subject to join it, and we therefore arrive at suggesting some compromise to start with.

Why should not the Electric Vehicle Committee arrange meetings, with suitable papers and discussions, after its business meetings to cover all interested?

There need be no elaborate organisation, printing of proceedings, &c., to start with and the cost to such associate members, as they might be designated, would be only a nominal sum.

When the movement has grown, form the Institute if desirable and substitute a technical committee for the present Electric Vehicle Committee.

C. G. Conradi, M.I.Mech.E.

Otley, *February 9th*, 1926.

Battery-charging Equipment.

I should be glad if any readers of your pages could help me in a difficulty, as I have been unable to find anything capable of suiting my requirements, except at some extraordinary price, whereas it should be capable of a fairly cheap solution.

I wish to charge accumulators used for experimental purposes as follows:—

4, 6, 8, 10 or 14 volts at any rate from 1 ampere or upwards if possible—if higher so much the better, as, say, 5 amperes.

Then I also wish to charge 30-volt units at from ½ to a total of 1 ampere, this, of course, depending upon the number of units put on to charge in parallel.

The job must require a minimum of attention, be clean, free from objectionable noise, and not have a high upkeep charge. I don't wish to be compelled to purchase transformers, as I prefer to use my own, as I can then alter the tappings to suit, and if alterations are required later they can be made. I don't want any fancy cases—it is for experimental work, and I can house it to suit myself.

I should much appreciate any help offered, and if the a.c. voltages required to suit my requirements were stated for the apparatus recommended, it would further help.

It appears that experimenters are not catered for in this respect.

E. J. Capper.

Sheffield, *February 11th*, 1926.

[Probably a good many readers would be glad to know where such apparatus could be obtained for experimental work, as distinguished from the high-class finished apparatus supplied to the public.—Eds. Elec. Rev.]

High-pressure Cables.

With reference to the letter on this subject, in your issue of the 5th inst., I do not know whether I can agree with Mr. Addenbrooke that the Pirelli cables are at the "commercial" stage, when, according to the *Electrical World* of June 20th, 1925, they cost £14,000 per mile of single cable!

Assuming this figure to be correct, one wonders whether the idea is to have enough margin in the price to enable the whole line to be duplicated, and the pressure lowered, should it be found unworkable to operate at the pressure proposed; or whether the new system is so terribly expensive that it could not be put in for less money.

The work could probably be done with 30,000-volt cables at the price quoted, were it not for limitations in the size and number of conduits available.

A. M. Taylor.

Birmingham, *February, 13th*, 1926.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Bristol Electricity Scheme.—On February 8th, Colonel Woodcock asked the Minister of Transport whether permission had been granted for the city of Bristol to proceed with a new power station at Portishead before the Bill sanctioning the undertaking had been before the House.

Colonel Ashley replied that he was informed by the Electricity Commissioners that no decision on the Corporation's application had yet been reached.

Severn Barrage Scheme.—On February 8th, Colonel W. Ashley informed Colonel Woodcock that no expenditure had been incurred to date by the Ministry of Transport in connection with the Severn barrage scheme, but the estimated total expenditure on the further stage of investigation now about to be carried out was £28,875. The expenditure was being spread over two years, and it was impossible to estimate the cost of any further investigations before those now proposed were completed.

Heavy Oil Engines. — On February 8th, Sir V. Warrender asked the Prime Minister whether his attention had been drawn to the British Standard Specifications which had been prepared by the British Engineering Standards Association, and in particular to that for heavy oil engines in connection with electrical plant or otherwise; and whether Government departments would be directed to use this specification for their inquiries.

Mr. A. M. Samuel, who replied, said he had no doubt that the Government Departments concerned would in appropriate cases, make use of the work of the Association.

The Government's Electricity Scheme.—On February 9th, Col. Ashley, in reply to Mr. Day, who asked if, in framing his electrical power proposals, he would consider what legislative provision would be necessary to ensure that power cheaply generated under the Government electricity scheme would be as cheaply distributed to consumers by supply undertakings enjoying local monopolies; and whether, with that object, the consumer would be directly represented on the central authority to be set up under that scheme, said that the question had not been overlooked.

The Wireless Dispute. — On February 6th, Mr. Betterton, Parliamentary Secretary to the Ministry of Labour, stated that officers of his department had been in constant communication with both parties, with a view to arranging a settlement of the wireless operators' dispute. The employés' Association had informed the Department that the proposals of the employers for the settlement of the dispute were unacceptable, and had submitted an alternative proposal which was being considered by the employers. Both parties included a reference to arbitration among their proposals, but differences existed between them, both as to the basis of arbitration and as to the terms upon which work was to be resumed. A com-

munication had been sent to the employers and it was hoped that it might be possible to arrange a joint meeting when their reply had been received.

On February 9th, Mr. Betterton said that since November 26th last, 1,258 British ships had sailed from United Kingdom ports without wireless operators.

Broadcasting.—On February 9th, in reply to questions, Lord Wolmer, the Assistant Postmaster-General, said that the total number of wireless receiving licences in force on January 31st, 1926, was approximately 1,841,000. Since the passage of the Wireless Telegraphy (Explanation) Act, last Session, there had been 28 prosecutions for installing or working wireless receiving apparatus without a licence. Twenty-seven of these prosecutions were successful and one case was dismissed. Summonses for installing or working wireless receiving apparatus without a licence had been issued against 46 persons. Seventeen of the cases had not yet been heard.

New Telephone Exchanges.—On February 9th, Lord Wolmer informed Mr. Hudson that the number of telephone exchanges opened in rural areas during the year ended January 31st, 1926, was 224. Communication with any exchange within a radius of five miles from a rural exchange was afforded at the minimum fee.

Safeguarding of Industries.—On February 9th, Sir P. Cunliffe-Lister, the President of the Board of Trade, said that the number of definite applications made under the Safeguarding of Industries procedure up to date was 34. Of these, 13 had been rejected, as not disclosing a *prima facie* case, without reference to a Committee of Inquiry. Nine Committees had been appointed to consider 11 applications; and reports had been received and published in respect of nine of these applications. One application had been withdrawn. The others were either still under consideration or in abeyance.

Gas and Electrical Undertakings.—On February 11th, Mr. B. Peto asked the Prime Minister whether he would consider the advisability of arranging for the allocation of an equitable share of profits of statutory companies or municipal undertakings for the generation and transmission of electrical energy, referred to in the Speech from the Throne, to persons employed by those new undertakings on the precedent operated for many years by the South Metropolitan Gas Company and other gas undertakings; and whether he would also consider including provision for employés to invest in the capital of the undertakings and for their representatives to have a share in the management.

Mr. Baldwin said he had watched with interest the operation of profit-sharing schemes where they had been introduced, notably in the case of gas companies. While welcoming an extension of the principle on satisfactory lines, he felt that the matter was primarily one for agreement between employers and employed.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from February 10th :—

Symetro. No. 464,266. Class 6. Electric motors and parts and grinding machinery.—F. L. Smidth & Co., Copenhagen, and Victoria House, Victoria Street, S.W.1.

Thor (lettering and design), No. 464,601, and Thorola (lettering and design), No. 465,602. Class 8. Instruments and apparatus for use in radio-telephony.—The Reichmann Co., Chicago. (British representatives: Haseltine, Lake and Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Triggerdyne. No. 465,983. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Princes Electrical Clocks, Ltd., 173, New Bond Street, W.1.

Triumph. No. 465,615. Class 16. Electrical fuse fittings of porcelain or earthenware.—Castle Fuse and Engineering Co., Ltd., 72, Haigh Street, Liverpool.

Redot. No. 456,519. Class 18. Electric fires.—J. & W. B. Smith, Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

385. "Telephones and the like." H. J. Round. January 5th, 1924. (246,096.)

20,667. "Electric rheostats." R. Woods. May 20th, 1925. (246,189.)

22,656. "Means for generating signalling impulses for transmission over ocean cables and long land lines." M. I. Pupin. September 25th, 1924. (246,193.)

23,208. "X-ray tubes." R. K. Hezlet, V. E. Pullin, A. G. Warren, and G. D. West. July 1st, 1925. (246,194.)

23,500. "Method and apparatus suitable for receiving cable and like signals." Telegraph Construction & Maintenance Co., Ltd., and G. E. Stevenson. October 4th, 1924. (246,195.)

23,638. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), A. M. Searle, and J. H. E. Baker. October 7th, 1924. (246,196.)

25,031. "Ventilation of dynamo-electric machinery, transformers, and the like." Sir C. A. Parsons and J. Rosen. October 21st, 1924. (246,209.)

25,057. "Magneto-electric machines." British Thomson-Houston Co., Ltd., L. Griffiths, and C. Morton. October 21st, 1924. (246,212.)

25,177. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. October 22nd, 1924. (246,219.)

25,622. "Electric time-switches and other clockwork automatic lighting appliances." J. R. J. Bowden. October 28th, 1924. (246,226.)

25,819. "Electrodes for electrolytic decomposition apparatus." C. F. Holmboe. October 29th, 1924. (246,228.)

26,115. "Resistances for use with thermionic valves." H. Stevens and A. J. Stevens & Co. (1914), Ltd. November 3rd, 1924. (246,233.)

26,116. "Electric switches." H. Stevens and A. J. Stevens & Co. ((1914), Ltd. November 3rd, 1924. (246,234.)

26,118. "Means for bridging terminals of an electric circuit." H. Stevens and A. J. Stevens & Co. (1914), Ltd. November 3rd, 1924. (246,235.)

26,419. "Starters for electric motors." British Thomson-Houston Co., Ltd., G. O. Watson, and L. S. Billson. November 5th, 1924. (246,244.)

26,543. "Means for closing and opening electric circuits." C. L. T. Abalsamo. November 6th, 1924. (246,247.)

27,991. "Coupling or connection of electrical wires and the like." L. H. Reid. November 22nd, 1924. (246,263.)

28,135. "Inductance coil holders." W. Haggett. November 24th, 1924. (246,265.)

29,127. "Electric signal transmission systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.), (Western Electric Co., Inc.). December 4th, 1924. (246,274.)

1925.

198. "Shade supports for electric lamps and the like." S. W. Hamlyn. January 3rd, 1925. (246,294.)

1,086. "Brush-tensioning device for dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. A. Pollock. January 13th, 1925. (246,298.)

1,518. "Electric connectors." G. Duncan. January 17th, 1925. (246,301.)

1,852. "Construction of grid-leak for wireless telegraphy or telephony." C. Chapman. January 21st, 1925. (246,305.)

3,464. "Crystal detectors." Ideal Radiotelefon & Apparatefabrik Ges. December 13th, 1924. (244,393.)

3,806. "Cooling of enclosed electromotors and other dynamo-electric machines." Enclosed Motor Co., Ltd., N. W. Gilbert, and H. C. E. Jacoby. February 11th, 1925. (246,323.)

3,862. "Automatic telephone systems." T. Lenaghan. February 21st, 1924. (229,651.)

3,971. "Two-wire amplifiers." Dr. H. Keller. December 10th, 1924. (244,394.)

4,342. "Variable electric resistances." J. F. Smith. February 17th, 1925. (246,325.)

4,516. "Laying of electric conductors." A. Eimers. February 18th, 1925. (246,327.)

4,627. "Electric control apparatus." C. G. N. Poolman. February 19th, 1925. (Addition to 230,207.) (246,328.)

5,480. "Sound amplifiers." J. V. Godbery. February 27th, 1925. (246,332.)

5,787. "Folding cabinet for radio-therapeutic use." T. Smith. March 3rd, 1925. (246,334.)

5,855. "Thermionic tubes." M. Heussen & Co. February 11th, 1925. (246,336.)

8,619. "Ignition systems and switches therefor." W. Hemingway, jun. April 28th, 1924. (232,940.)

8,848. "Filtering device for wireless receivers fed by the main supply." Compagnie pour la Fabrication des Compteurs et Materiel d'Usines à Gaz. April 8th, 1924. (232,210.)

8,948. "Shielding microphones and associated amplifier apparatus." De Forest Phonofilms, Ltd. (L. de Forest). April 3rd, 1925. (246,351.)

11,316. "Transformer winding for very high voltages." Maschinenfabrik Oerlikon. May 28th, 1924. (234,795.)

11,557. "Inductance coils for use in high-frequency telegraphy and telephony." A. Carpmael (Telefunken Ges. fur Drahtlose Telegraphie). May 4th, 1925. (246,359.)

12,662. "Variable electrical condensers." J. G. Newey and C. B. Jerred. May 15th, 1925. (246,362.)

12,944. "Speed-reducing gear for electric starting motors and generators for automobiles." Soc. Anon. pour l'Equipement Electrique des Véhicules. August 1st, 1924. (237,873.)

13,597. "Branch terminal for overhead lines." W. Schroeder and J. Nolte. May 25th, 1925. (246,364.)

14,029. "Electric remote control apparatus." British Thomson-Houston Co., Ltd. May 28th, 1924. (234,828.)

14,336. "Headlights for small-sized motor-cars and motor-cycles." "Fenag" Akt. Ges. Singer, F. and F. Schneider. June 2nd, 1925. (246,369.)

16,844. "Electrical regulator devices or rheostats." Metropolitan-Vickers Electrical Co., Ltd. July 19th, 1924. (237,234.)

19,035. "Insulated conductors." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Bell Telephone Laboratories Inc.). July 27th, 1925. (246,389.)

20,969. "Headlight." F. W. White. August 21st, 1925. (246,396.)

21,617. "Electric power systems." C. Meyer. May 23rd, 1925. (Addition to 208,487.) (246,401.)

21,625. "Loaded signalling conductor." Felten & Guilleaume Carlswerk Akt. Ges. August 30th, 1924. (239,231.)

21,938. "Choking-coil switches for step-up transformers with continuous regulation." International General Electric Co., Inc. September 4th, 1924. (239,514.)

22,040. "Electric condensers." Dubilier Condenser Co. (1925), Ltd. September 3rd, 1924. (239,523.)

22,852. "Combined electric switches and electric couplings." J. A. Crabtree. September 14th, 1925. (246,403.)

23,220. "Process for the manufacture of very fine tungsten wires, in particular for electric incandescent lamps." General Electric Co., Ltd. May 16th, 1925. (246,406.)

23,427. "Electric railway signalling." Siemens & Halske Akt. Ges. September 20th, 1924. (240,182.)

25,578. "Electric baths." H. Aub. October 13th, 1925. (246,412.)

25,900. "Electrical apparatus which is immersed in an insulating liquid." Metropolitan-Vickers Electrical Co., Ltd. December 4th, 1924. (244,056.)

27,944. "Electric braking systems." International General Electric Co., Inc. November 6th, 1924. (242,657.)

London Traffic Control.—The report of the London and Home Counties Traffic Advisory Committee, which has been submitted to the Minister of Transport, contains proposals designed to control the competition of omnibus companies with the tramway undertakings. It is understood that the Committee does not urge the actual restriction of the number of 'buses using the various routes, but that the number of journeys in each direction be limited. The number of journeys will be increased during the rush hours (7 to 10 a.m. and 4 to 7 p.m.). The first Order will probably apply to services running between Uxbridge and Shepherd's Bush, and will take effect at Easter. Later Orders will affect the routes between Aldgate and Ilford, Euston and Enfield, Victoria Embankment and Wimbledon, and Barnet and Acton. The statutory obligations imposed on the tramways appear to have influenced the Committee in its decision, it being of opinion that the profit obtained by the tramways in the year ended March 31st, 1922, was reduced to a loss of £153,557 three years later owing to omnibus competition. The Committee urges that some immediate check must be applied if essential tramway services are not to become bankrupt, with serious results to the travelling public.

The

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The Fair and the Future.

SEVERAL months ago at a London meeting of representative electrical authorities—but not for some reason or other open to the Press—the question of future policy of the industry with reference to exhibitions was under discussion, and as we were able to report at the time, a committee embracing all the various interests concerned was appointed to deliberate and report.

We are unaware whether the committee has yet met. Possibly the urgency of the subject was not considered to be such as to render expeditious action necessary. Certainly it is sometimes the case that policies form themselves under the influence of events more definitely than under the influence of discussion; and it may well be that what has been happening during the past few weeks at the British Industries Fair in Birmingham and in London has carried weight with some representatives and will not be without decisive effect when discussions eventually take place.

We believe that there is a general consensus of opinion amongst those whose judgment matters most that large electrical exhibitions such as took place at Wembley, Olympia, and Manchester, are only necessary at long intervals. We refer to exhibitions involving the erection of large plant, and lasting for prolonged periods. Conjoint action among manufacturers can ensure that any attempts by private parties to exploit the industry by promoting such shows shall be controlled. At the same time option must always rest with individual manufacturers regarding taking part in exhibitions of specialised industries in connection with which their own particular products have special application.

Another class of display—and one which must not be bound about with any jointly imposed restrictions—is that designed to popularise the applications of electricity in everyday life—domestic and small power work particularly. The Ideal Home Exhibition, which opens

on March 2nd, probably comes within this class, though the main electrical interest here, as last year, will be the combined domestic exhibit organised by the British Electrical Development Association and so popular with many thousands of the public. Local electrical exhibitions stand in a category by themselves as being desirable anywhere and at almost any time, though it is possible that these, if held with too great frequency, might involve a unity of policy on the part of some manufacturers. Electricity supply authorities which run permanent showrooms on enterprising lines as a definite part of their operations, have no need of special exhibition efforts apart from showroom activities; but even these showrooms must not be allowed to become too quiescent or somnolent—they must be so run as to maintain or stimulate the public interest; their existence must not be allowed to be forgotten. Co-operation between the electricity supply department, manufacturers, and local contractors should ensure success at such shows. Contractors may supplement these efforts by making their own shop windows more effectively impressive and demonstrative instead of letting them contain a general jumble of everything electrical and dropping the blinds or putting up the shutters at 7 o'clock at night when brightness would attract.

Then there are exhibitions such as we have at convention times—possibly these might be on a more ambitious scale. And some hold that if there is to be a big annual convention in future years with all departments of the electrical profession, industry, and trade taking part, the simultaneous holding of exhibitions, as in America, would be justifiable.

But whatever views may be in process of formation respecting any of the foregoing, there is no doubt that the future of the electrical industry in relation to the British Industries Fair is exercising many minds as the outcome of the successful operations which come to a close at Castle Bromwich, Birmingham, to-day. Various questions are being discussed. It is thought that the industry is now in a position to decide definitely in favour of co-operation at the Birmingham Fair for at any rate a specified number of years; that the response of manufacturers this year in so short a space of time may be regarded as a proof that many more firms will be prepared to take part, each in a small market shop form, next year; that this year's show can be made use of to increase the number of electrical overseas buyers next year because they will have heard of the excellence of this year's collection; that the wireless and other exhibits of a more or less electrical character that appeared in London this year should be transferred to Birmingham in future; in short, that Birmingham, with its vast hardware and metal trade collection, should be the place where every spring, colonial and foreign and home buyers could meet for a few weeks, perhaps a little longer than this year, with the certainty of finding a great market display of electrical manufactures, including apparatus, switchgear, cable, accessories, material, and so forth, and with the reasonable anticipation of meeting those who are competent to discuss their requirements with them.

We hardly think that there is any reason to doubt the majority feeling in regard to this matter, for as we have said already, it is to us unthinkable that the ever-growing electrical trade can be content with anything short of a magnificent business-getting demonstration among the other great trades of Great Britain. It would do us all good to have a regular trade fixture to look forward to and to put zest into. It need not be a costly matter for anybody.

Perhaps we shall have the satisfaction ere long of hearing whether the committee already mentioned holds views such as we have expressed, but from what we can learn from different quarters it is necessary that the announcement of a definite policy on this one point at least should be reached without any delay. We hope that that will be done.

Railway Electrification.

The interesting paper by Mr. H. Parodi, chief engineer of the Orleans Railway Company, which was read before a joint meeting of the Institution of Electrical Engineers and the British Section of the Société des Ingénieurs Civils of France on Thursday last week, comes at an opportune moment. We have on previous occasions drawn attention to the practical views on electrical engineering which characterise our French *confrères*, and the extraordinarily rapid development of electricity supply in the rural areas which they have brought about within the few years which have elapsed since the end of the war. That development is still in steady progress, and Mr. Parodi's paper is intended to show how the important scheme of electrification which is now being carried out by the Orleans Railway Company fits into the general electrification programme of France. The conditions differ from those obtaining in this country in that in France electricity is generated both by steam and by water power; but the conclusions arrived at by the engineers concerned are largely independent of this consideration, in so far as they arise out of the nature of the load.

As the author remarks, it is a question not merely of substituting electric for steam traction on a line having a dense traffic, but also of providing a large distribution system, of which the power plants and transmission lines can be utilised for a supply of electric power in all the districts through which the railway passes. In France the electrification of the railways is considered as a part of a more comprehensive scheme—not as itself the sole end to be attained, as in most other countries.

The author points out that the general direction of the main transmission lines should practically coincide with that of the railway lines on which there is heavy traffic. As the urban industrial load is far greater than the traction load, this procedure relieves the railways of the excessive burden of capital charges that would result if the transmission lines were erected solely for traction. On the other hand, the long-hour load of the railways enables the shorter-hour industrial load to be handled more economically than would be possible if the latter were alone to be dealt with.

It is interesting to learn that the French Government is considering a programme of gradual equipment and of progressive linking-up of the various distribution systems, rather than Government control of electricity generation. This mode of attaining the desirable end of interconnection—which eventually would take place through the bus-bars of the sub-stations—was commended by Mr. Roger T. Smith in his comments on the paper, in preference to the installation of a grid of high-pressure interconnecting lines, which, he said, offered little prospect of a cheap supply of electricity. Incidentally, it is identical with the procedure which we have advocated in these columns on more than one occasion, as the natural and most economical course to follow in the evolution of a national network.

The paper was read also before the Institution at Birmingham, when Dr. C. C. Garrard and Mr. F. J. Moffett, in the discussion, emphasised the importance of including the electrification of railways in the national scheme, in order to improve the load factor. The same view was expressed by Mr. R. A. Chattock and Mr. R. B. Mitchell at the British Industries Fair on February 17th.

In view of the excellent work that the French electrical engineers have accomplished, to which our columns have borne witness, it would appear that British power supply and railway engineers would find it well worth their while to cross the Straits and see for themselves the materials employed in France; and as the whole question of electricity supply in this country is shortly coming before Parliament, it would be a good thing if members of that body also investigated in person not only the legislation which controls (and *hastens*) development there, but also the enlightened methods of administration that have been adopted and the excellent results that have thus been attained. By that means they would learn more in a week than by any other course in six months.

The Electric Propulsion of Ships.

We have recently had occasion to mention that the electric propulsion of ships is not regarded in this country as being such a practicable proposition as it is in the United States, although both on steamers and on motor-ships the necessary auxiliary machinery is to a rapidly increasing extent being electrically driven. It must, however, surprise many shipbuilders and marine engineers to learn that there are no fewer than 49 ships, nearly all of which are of American origin, ranging from the largest and fastest warships of 180,000 horse-power each down to harbour tugs, in which this system of propulsion has been successfully employed. The North-East Coast Institution of Engineers and Shipbuilders is, therefore, to be congratulated upon having persuaded Mr. Eskil Berg, of the General Electric Co., of America, to present to its members a paper setting forth the advantages which, it is claimed, are obtained by utilising electricity as the means of propelling a ship in preference to the more usual systems of propulsion employed on British-built vessels.

From the abstract of Mr. Berg's paper, which will be found elsewhere in this issue, it will be gathered that the electric drive has much to recommend it, both as regards initial cost and the subsequent operating and maintenance charges. The General Electric Co., of America, has been responsible for the electrical equipment of a large number of the vessels built in that country, and in a competitive tender for a 22,000-ton liner having machinery of 17,000 h.p., it was found that the price of the complete electrical propelling equipment was substantially the same as that of an ordinary geared-turbine installation; but on account of the simpler and less costly foundations, piping, oiling system, &c., it was cheaper than any other method of propulsion proposed. It is unnecessary to reiterate the other favourable aspects of electric propulsion as applied to a vessel of the liner class, as they are set forth in detail by Mr. Berg, but it may be noted that on other types of ship, such as the cargo carrier which forms the bulk of the merchant tonnage of the world, equally substantial advantages would accrue. This is demonstrated by the fact that electric propulsion has been applied to almost every type of ship afloat, including not only the various kinds of screw-driven ships, but even paddle-wheel and stern-wheel driven vessels. It is almost unthinkable that any American commercial concern would purchase electrically-propelled vessels unless it was convinced that it was getting value for its money, and certainly it would not be expected to book repeat orders as many of them have actually done.

The question will at once arise: why has not electric propulsion been tried to a greater extent in this country? We have it on the authority of a high official at the British Admiralty that electric propulsion was seriously considered for the propulsion of some of our recent warships, but that for certain reasons—not due to inherent defects in the electrical system itself—it was deemed inadvisable to adopt it. In the case of merchant ships, the true reason is, we think, indicated—albeit accidentally—by Mr. Berg when he mentions that the equipment required on board ship, both as regards the engines and the electric generators, is of the type so successfully developed by designers and builders of land plant. This means that the contract for the machinery of an electrically-propelled vessel laid down in a British shipyard would be best supplied by a firm of engineers building ordinary electric power-station machinery, or, alternatively, the shipbuilder would have to face the initial expenditure on the necessary patterns, new equipment, &c., which is inseparable from the production of an entirely new type of machine. The shipbuilding industry has during recent years been passing through a period of deep depression; indeed, it is still the most depressed of the different branches of our great iron and steel trades, and it is certain that few, if any, of our great shipbuilding firms would be prepared to undertake so great an expenditure without the prospect of its being justified by numerous repeat orders. Moreover, the contract for such ships as are being built are eagerly sought after, and the prospect of sub-letting the contract for the machinery to a firm of electrical engineers is met by quoting the lowest possible price for marine machinery of the more conventional form. We feel, however, that with the return of prosperity to the shipyards of these islands—prosperity which is long overdue and which, we hope, will soon materialise—the prospect of a contract for the propelling machinery of a ship being placed with a firm of electrical engineers would be far greater, and the electrically-propelled ship might then have a chance of proving its merits to the British shipowner.

The London Power Co.

The appearance, at the beginning of the week, of the prospectus of the London Power Company, shows that the West End group of the London Supply Companies are getting under way at last. The £3,000,000 capital they are starting with ought to give them an opportunity to release some of that pent-up energy for reform and reconstruction which, according to abundant evidence given at courts and hearings, has been dammed up for unnumbered years by restrictive legislation. Anyhow, they are free now to proceed with a comprehensive centralisation scheme. We see by the prospectus that the new company embodies a concentrated essence of the directive genius of the ten West End companies, one director from each company constituting the Board. As regards administration, this staff ought certainly to augur success. The engineers are Sir Alexander Kennedy and Mr. G. W. Partridge. Sir Alexander, *inter alia*, has two of the most successful, financially, of the London companies to his name (Westminster and St. James'); and Mr. Partridge brings, also *inter alia*, an obvious aptitude for obtaining contracts for power supply from recalcitrant bodies (as witness his railway supplies) and for successfully carrying them out afterwards. Turning to the general manager, Mr. W. A. Pearman, here also we have a record of success in his work on the financial and administrative side of the Westminster company. It was Mr. Pearman, it will be remembered, who so effectively dealt with the financial side of the West End Companies' scheme before the Commissioners at the London and Home Counties inquiry. Also he played no mean part, we understand, in modelling and finally knocking into shape that all-important sliding scale under which the West End companies will now operate. But he does not often come into the limelight.

We wait with great interest the effect of this unification of control upon the operation of such an important group of companies. The figures as to economies effected will be valuable, as this is the first really comprehensive scheme of the kind. Moreover, this practical example will encourage the others and perhaps dispel the timidity of those still standing on the brink of reform. The company, as we learn whilst going to Press, has lost its Bill, and this may hamper its progress; but there is plenty of scope remaining for its activities. Captained as it is, and cargoed with three millions, this barque ought certainly to sail to success, and we wish it heartily *bon voyage*.

Boiler-Room Practice.

Coal Flow, Air Flow, and Steam Flow.

By JOHN BRUCE.

(*Concluded from page* 285.)

Some time ago the writer made a series of observations on two large modern boiler units, and the relation between coal consumed and steam produced for the two periods is shown graphically in figs. 3 and 4, while the data expressing the conditions of operation are shown in Tables IV and V.

On the assumption that the performance of the unit is expressible by a linear equation, it is seen that the no-load losses are 300 lb. of coal per hour, *i.e.*, 300 lb. of coal per hour would be necessary to maintain the unit at working pressure, but not supplying steam for any commercial load.

TABLE IV.

Total coal consumed	lb.	18,144	26,432	19,484	25,088	20,608	18,144	15,904
Total water evaporated ...	lb.	119,250	166,650	139,375	159,375	137,250	109,700	100,625
Coal consumed per hour ...	lb.	7,260	10,580	7,800	10,030	8,240	7,260	6,370
Water evaporated per hour	lb.	47,700	66,660	55,750	63,750	54,900	43,880	40,250
Calorific value dry coal	B.th.u./lb.	12,720	12,150	12,890	12,040	11,750	11,690	11,800
Calorific va ue as fired ...	B.th.u /lb.	10,760	10,340	11,000	10,280	10,110	10.045	10,150
Moisture content of coal	Per cent.	15·4	14·9	14·7	14·63	14·0	14·05	13·95
Ash content of coal ...	Per cent.	9·7	14·75	7·75	15·35	16 5	17·0	16·55
Duration of test period	... Hours.	2·5	2·5	2·5	2·5	2·5	2·5	2·5

TABLE V.

Total coal consumed	lb	13,440	14,336	20,608	24,192	16,576	18.144	16,576	18,144
Total water evaporated ...	lb.	86,000	100,000	148,750	166,000	117,000	126,500	113,000	120,360
Coal consumed per hour	lb.	5,376	5,734	8,243	9,676	6,630	7,260	6,630	3,024
Water evaporated per hour ...	lb.	34,400	40.000	59,500	66,400	46,800	50,600	45,200	20,060
Calorific value dry coal ..	B.th.u./lb.	11,860	12,670	12,500	12,520	12,260	12,320	12,090	12,040
Calorific value as fired ...	B.th.u./lb	10 130	11,095	10,845	10,480	10,500	10,280	10 200	10,380
Moisture content of coal	Per cent.	14·60	12·41	13·25	14 96	14·38	16·37	15·65	13·83
Ash content of coal ...	Per cent.	15 85	11·75	13·00	12·95	14·00	12 25	13·60	13 20
Duration of test period ...	... Hours.	2 5	2·5	2·5	2·5	2·5	2·5	2·5	6·0

These are not in the nature of tests, in the true meaning of that word, but are the ordinary observations that were made for station log-sheet purposes while the units were in commercial operation.

The measurements involved were made by instrument equipment provided for ordinary operation, and were as follows:—

Coal: Metered by Avery weighing machines.

Water evaporated: Indicated by steam flow meters, and calculated from readings of such indications.

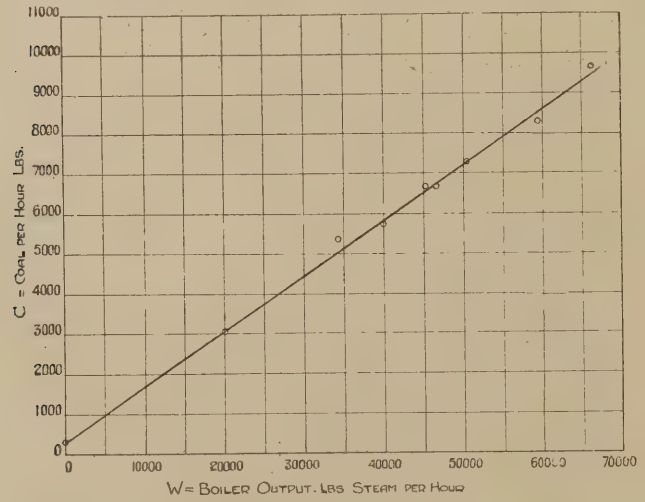


Fig. 3.

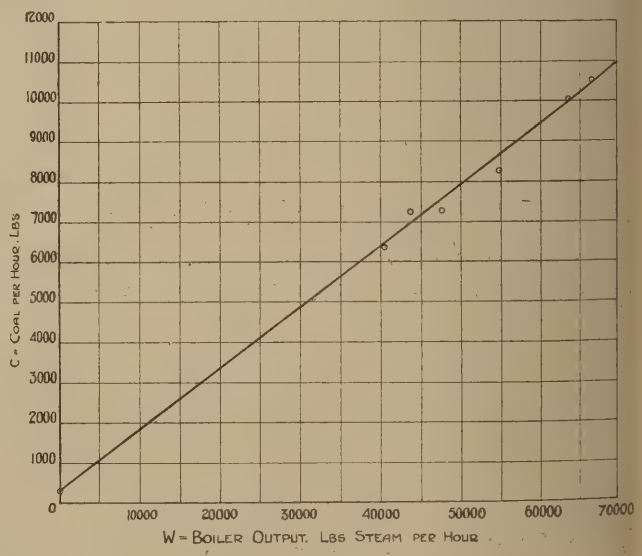


Fig. 4.

Relation between Coal Consumption and Boiler Output.

Temperatures: Measured by thermocouple and resistance pyrometers.

The only addition to the routine of ordinary operation was that the coal was regularly and more frequently sampled for analysis and calorimetric determinations.

From figs. 3 and 4 it will be agreed that the performance of these two boiler units can be reasonably represented by a linear equation, for even at a rating below that of half normal load, the linear relation between coal and water could be maintained (see fig. 3, boiler output 20,060 lb. steam per hour, coal consumption 3,024 lb. per hour).

A considerable number of tests were made to determine this no-load value experimentally, and the figure obtained varied between limits of 280 lb. and 320 lb. per hour. Further, the coals consumed varied over the range usually supplied to the boiler plant, and the effect of any variation is included in the results.

It will be seen from the ash contents of the coals reported in Table IV that there was a considerable variation in the quality of the fuel over the period shown, but the variation did not affect to any great extent the linear relation between coal and water.

From what has now been said, it will be agreed that (1) if the combustion of the fuel is complete; (2) if such combustion can be effected with a constant air/coal ratio, or in other words constant percentage of excess air; (3) if the resistance to the flow of gases through the boiler is constant; (4) if the internal and external heat transmitting surfaces are constantly free from heat retarding coatings; (5) if the combined equipment forming the boiler unit is maintained in a condition of

mechanical perfection; then at all times there exists, within reasonable limits, a definite relation between the factors discussed. These are rate of flow of air for

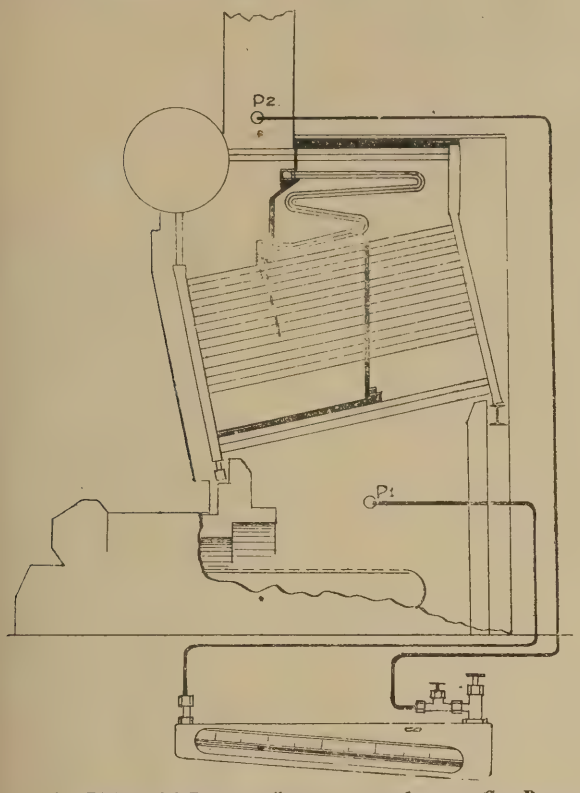


Fig. 5.—Differential Pressure Gauge connected across Gas Passes.

combustion, rate of flow of fuel, rate of flow of gaseous products of complete combustion, pressure drop of gases across gas paths of unit, and rate of flow of steam produced.

Considering the detailed assumptions on which this statement of facts is made,

(1) and (2) are under the control of the operating engineer, and can be attained by correct operation.

(3) Can be attained by the use of soot blowers for the purpose of maintaining the cleanliness of the heat transmitting surfaces in the path of the gaseous products of combustion.

(4) Can be attained by the use of soot blowers and attention to the treatment and production of the water fed to the boiler for the production of steam.

(5) Can be attained by continual attention to maintenance requirements.

It should now be obvious that if an instrument is provided to measure the rate of flow of steam produced and another instrument provided to measure the pressure drop of the gases between two fixed points, a comparison of the two indications considered together will express in certain easily interpreted terms the performance of the boiler unit, and if referred to a predetermined standard, they will further be a measure of the efficiency at any instant at which the boiler plant is being operated.

We will now consider the application of these theories and assumptions to actual operating practice, and for this purpose the case of definite examples will be given.

The writer made a series of tests on different boiler units, the purpose being to determine the relation between boiler output at different loads expressed in terms of steam flow, lb. per hour, and the pressure drop through the gas passes of the boiler.

The units on which the tests were made were of the Babcock & Wilcox C.T.M. type, with Green economisers, B. & W. chain-grate and Underfeed travelling grate stokers. The units were also equipped with Diamond soot blowers.

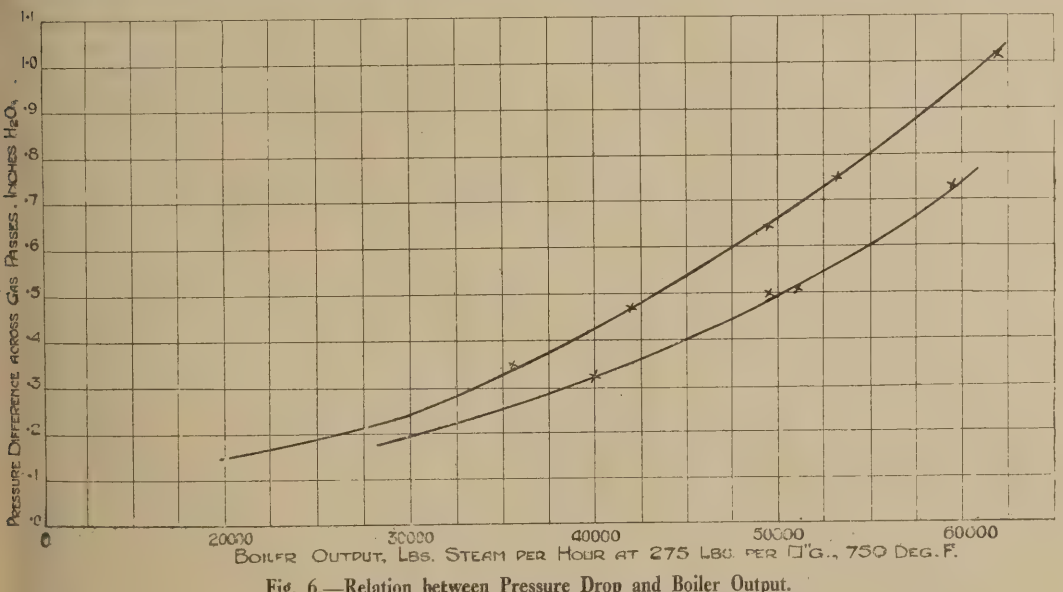


Fig. 6.—Relation between Pressure Drop and Boiler Output.

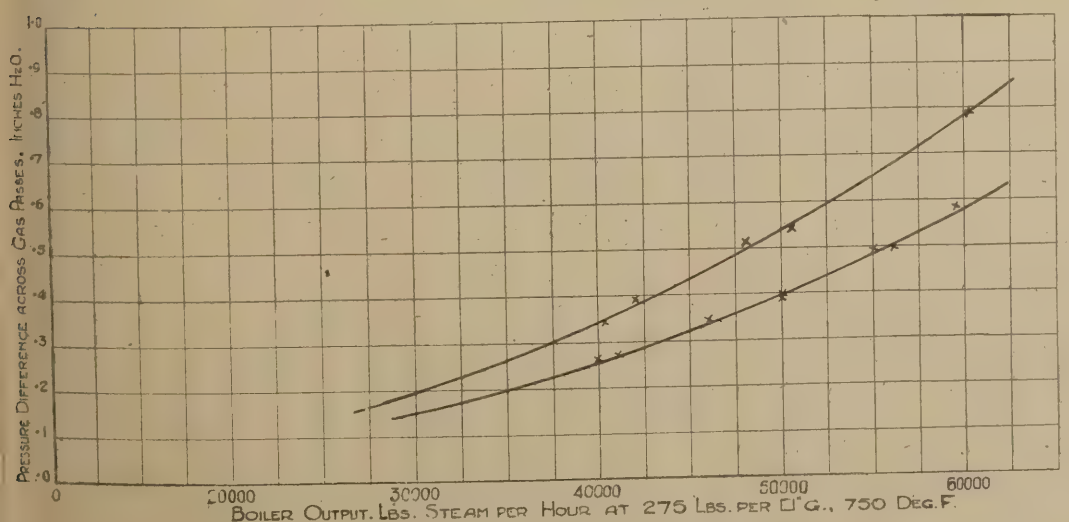


Fig. 7.—Relation between Pressure Drop and Boiler Output.

The instrument equipment of each unit consisted of steam flow meters, Avery automatic coal-weighing machines, a CO_2 indicator, thermocouple and resistance pyrometers, draught gauges, and a Hay inclined leg type differential pressure gauge. The last-named instrument was connected as shown in fig. 5. The foregoing represents the standard instrument equipment of the boilers tested, and in addition to that equipment, an Orsat set was used to check the air conditions and the automatic CO_2 indicator.

The tests were carried out as follows: Conditions were set to maintain a definite output at a constant rate of combustion. The feed temperature and the final condition of the steam being maintained as constant as possible.

The CO_2 content of

the gases, while not having any relation to the *weight* of excess air with which combustion has been effected, nevertheless has a definite relation, for any particular coal, to the *percentage* of excess air with which such coal has been consumed.

The air quantity supplied for combustion was therefore controlled by the CO_2 indications, checked by the Orsat set, and conditions were set to maintain as nearly as possible 12.0 per cent. CO_2.

When conditions throughout the unit were stable, a series of readings, taken at short intervals, was made of CO_2, steam flow, and pressure drop. The test periods were from one to two hours, and at the end of the period the average was taken as being representative of the conditions under which the test was made.

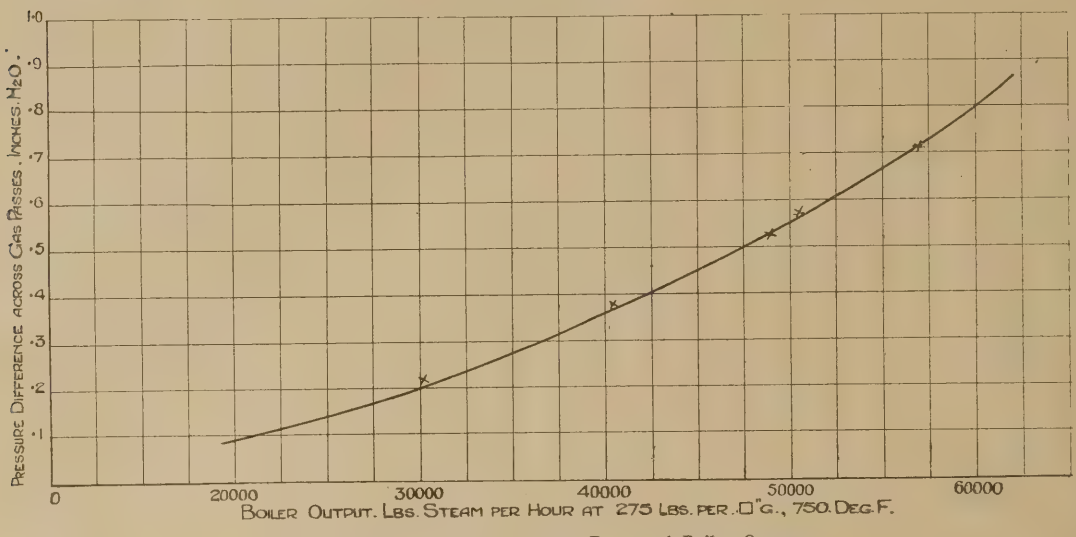


Fig. 8.—Relation between Pressure Drop and Boiler Output.

It was found that with stable combustion conditions the variations in CO_2 and pressure drop were negligible, and though the steam flow meter indications varied, the variations were only of the order of 2,000 to 3,000 lb., and were possibly caused by irregularities in the operation of feed-water regulation.

After the first test run, the pressure drop and the corresponding output of the boiler in lb. of steam per hour were expressed graphically. This point is that on the lower curve of fig. 6, corresponding to 50,000 lb. per hour output and a pressure drop of 0.395 inch of water.

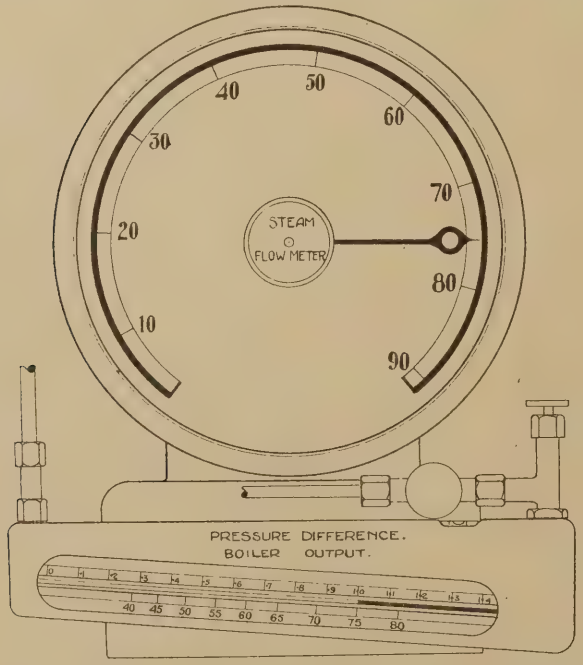


Fig. 9.—Combination of Steam Flow Meter and Differential Pressure Gauge.

From the information thus obtained, the theoretical pressure drops for other outputs were calculated. Plotting these values gave, for this particular boiler and operating conditions, the lower curve of fig. 6.

The output of the boiler was then altered by stabilising another set of combustion conditions, but still maintaining the same coal/air ratio.

It was found that once stable conditions were set, the new actual pressure drop coincided with that particular point of the theoretical curve.

Different outputs covering the commercial range handled by the unit were tried as described, and in every case the pressure drop varied in a definite relation to the output.

The results of the tests are shown in figs. 6, 7 and 8, the actual test results being plotted as crosses against the theoretical curve deduced from the first measured pressure difference.

To further prove the relationship with other air conditions the air quantity was increased to a value corresponding to a reduction to as nearly as possible 11.0 per cent. CO_2.

A series of tests was again made, and the results of these are expressed in the upper curves of figs. 6 and 7.

The application of this operating information necessitates a separate calibration test on each boiler unit. One or more tests are made under the best conditions that can be maintained, the pressure difference corresponding to, say, the commercial range of steam output of the unit are then calculated, and thus a standard of performance is set up which gives the operating staff something definite to "shoot at."

In the case in question, this was done by calibrating an extra scale for the differential gauge in terms of output corresponding to pressure drop, and the gauge and flow meter were then mounted together so that both their indications were observable at once. This assembly is shown in fig. 9.

This arrangement provided what is really one instrument, immediately susceptible to the least change in the operating conditions, the only other items requiring a certain proportion of the operator's attention being the final temperature of the flue gases and the prevention of combustible being carried over by the ash discharged from the grate.

It should, of course, be pointed out that there are reliable instruments on the market which can be installed for the purposes outlined in this article, typical representatives being the Bailey boiler meter, and the combination of steam and air-flow metering instruments produced by Electroflow Meters, Ltd.

Electrical Location of Ore Deposits.—Dealing with some practical points concerning the electrical location of ores, at a meeting of the Swedish Mining Association at Orebro last week, Mr. Sven Lundberg, of Stockholm, is reported to have stated that methods for the electrical discovery of ores have now reached such development that it is possible to localise a conductive ore body, and also ascertain the form of the ore, calculate its depth, and form an idea whether the indications received denote a compact ore or a conductor of a stratified nature. After referring to the discovery of copper ore by electrical means at Bjurfors in Vasterbotten and the Boliden ore in the same district, the author says that the method is very economical. At the same time the work is so complicated that it requires a specially-trained staff. Under these circumstances an organisation has been formed for the development of electrical research under the title of the A. B. Elektrisk Malmletning. The speaker added that it could not be denied that many of the efforts made in Sweden in connection with the electrical surveying of ore had totally failed, the interested parties having materially over-estimated the general applicability and range of the electrical methods.

The "Electrolux" Refrigerator.

An Interesting Development of the Platen-Munters System.

THE above-named refrigerator is unique in that it is a contrivance for continuously producing cold without the aid of any mechanical moving parts. Its simplicity is an indication of its reliability in service, while it is impossible for the user to upset the action.

The appearance of the finished article is shown by fig. 1; as will be evident from fig. 2, the essential



Fig. 1.—The "Electrolux" Refrigerator.

apparatus consists of three cylindrical iron vessels connected by iron pipes, charged with distilled water, ammonia, and an inert gas (such as hydrogen), the whole system of pipes and cylinders being welded together and thus hermetically sealed to prevent the escape of their liquid or gaseous contents.

Means are provided for heating one of the cylinders, electricity being of course the most convenient agent for this purpose, and a small quantity of cold water is allowed to flow over one of the other cylinders and also around one of the connecting pipes, cold being continuously produced in the third cylinder so long as the supplies of heat and cold water are maintained. The liquids and gases are used over and over again and will last indefinitely.

The inventors have ingeniously contrived to entirely overcome the difficulty (due to the pressure difference) which is encountered when an attempt is made to circulate a refrigerant. Taking advantage of Dalton's law, according to which the total pressure in a vessel containing a mixture of gases is the sum of the pressures which would be exerted if each of the gases occupied the same vessel alone, they have introduced an inert gas (hydrogen) into the low-pressure side of the apparatus, the effect of which is to raise the total pressure on the l.p. side so that it equals that on the h.p. side; the pressure is practically uniform in all parts of the apparatus, and consequently circulation is set up by the application of heat to one part of the system.

The evaporator is shown on the left in fig. 2; on the right, outside the cabinet, are the generator and absorber with the rectifier and condenser at the top and the heat exchanger at the bottom. It is advisable to place the evaporator in a tank containing a liquid of low freezing point (salt and water) which will act as a "cold" accumulator and make it unnecessary to maintain the continuous operation of the refrigerator. This cooling tank is so arranged that small trays containing water can be inserted in it for the formation of ice for cooling beverages, &c., for household use.

The process of refrigeration is as follows (see fig. 3): When the mixture of ammonia and water in the generator (1) is heated, the ammonia is driven off into the pipe leading to the evaporator (3); the water vapour is condensed in rectifier (9), which is provided with metal fins, and falls back (due to the inclination of the pipe) into the generator (1). The ammonia gas is further cooled and condensed in the water-jacketed condenser (4) and in falling on to the disks (14) evaporates and mixes with the hydrogen which enters through pipe (12). The mixed gas is now heavier than pure hydrogen, and so falls to the bottom of the evaporator (3), whence it is conducted through pipe (13) into the absorber (2).

The evaporation of the ammonia gas in the evaporator results in a great lowering of its temperature, which, in turn, cools the non-freezing solution around it and the chamber in which it is situated. The lower the pressure of the ammonia gas, the lower will be the temperature. As previously explained, the *total* pressure is the same as in the generator, but by introducing sufficient hydrogen gas to produce the greater part of this total, the ammonia pressure can be only equal to the difference. A reduction of the ammonia pressure with the consequent lowering of temperature is thus obtained.

Returning to the generator, the weak liquid remaining in (1) after the ammonia gas has been driven off flows through pipe (5 and 11) into the water-cooled (10) absorber (2) due to the difference of levels in the two vessels and in falling over the disks (15) it rapidly absorbs the ammonia gas that is with the hydrogen, thus allowing the lighter hydrogen to rise and pass again through pipe (12). The strengthened ammonia liquid flows out at the bottom of (2) and is preheated at (5); it is then boiled in the coil (7) (which surrounds the heating medium (6) and the gas bubbles so formed result in a pumping action sufficient to lift the liquid from the absorber (2) to the higher level (8) of the generator (1). The invention is of Swedish origin, but we understand that Messrs. Electrolux, Ltd., intend to manufacture the refrigerator in this country. A demonstration was given at the Savoy Hotel on Tuesday by Dr. Hele Shaw, F.R.S. Major H. A. Wernher, D.S.O., presided. Further reference to the matter will be made next week.

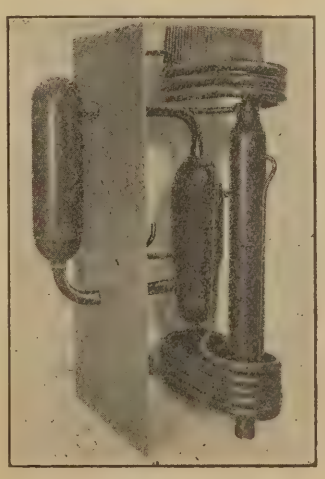


Fig. 2.—The Cooling Unit.

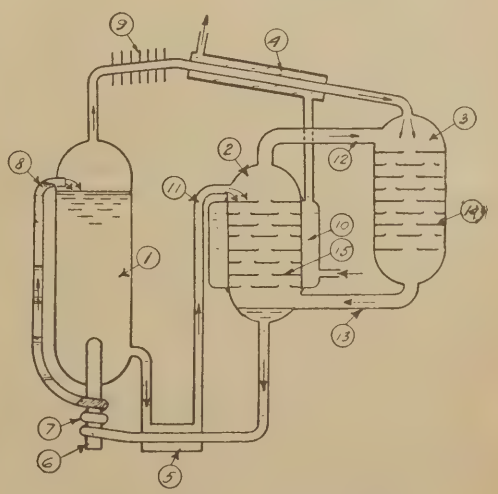


Fig. 3.—Diagram of Circulating System.

Electrical Freedom—The Contractors' Creed.

By L. L. ROBINSON, M.Inst.C.E.

No supply engineer who enjoys a little innocent humour should be content until he gets a copy of the flame yellow pamphlet published by the Electrical Contractors' Association, entitled "Electrical Freedom."

On the first page the contractors' creed is set forth:—

We believe wholeheartedly in the need for ample, cheap, and uniform Public Supplies of Electricity.

We believe that such public supplies of electricity should be under Public Control; that such supplies of power should be under State or semi-State Direction or Regulation.

We do not believe that Public Control or Public Trading should extend beyond the provision of such ample supplies of the Power itself.

The pamphlet does not say why the electricity supply industry should be under public control, but the supply of installations and fittings under the control of the electrical contractors only.

Surely, if the supply of electricity is to be cheap and abundant, the installations must be cheap and abundant also. All the newer uses of electricity must be catered for as energetically as lighting. The contractors are alive to the fact that the municipalities give the cheapest and most efficient supplies of electricity; is there any sound reason to suppose that they or the companies cannot likewise supply the cheapest and most efficient installations and service to consumers?

On the contrary, certain outstanding examples have shown that the consumer gets the best service where the supply authority takes the responsibility for the complete service to the consumer. In the very successful undertakings of the United States, the supply authorities are laying greater and greater stress upon the necessity for the supply authority to look after all the consumers' needs. The contractors need only read the American technical Press to find this out for themselves.

The humorous side emerges from the examples of other services used by the authors of the pamphlet to show why installations should not be provided by the supply authorities, such as the following:—

"We believe, for example, that the provision of adequate water to meet the Public needs should be in the hands of Public Authorities under Public Control.

"We do not believe that plumbing work, the sale and installation of domestic pipe lines, boilers, baths, kettles and other water conveying or using apparatus should be undertaken by Public Authorities.

"We believe that such Retail Trading should be in the hands of existing plumbers and ironmongers, who already handle such water-conveying and water-using goods."

What an unfortunate example to take! Water supply is an absolute necessity and monopoly. Electricity is not an *absolute* necessity. However desirable its use may be, it is by no means a monopoly, since light, heat, power, &c., can be supplied by other means.

Water is usually supplied at a fixed annual charge based on rateable value. Obviously, the less water used the better for the water supply authority. With electricity the reverse is the case.

When the piping is done by "existing plumbers," the water supply authority's desire for economy in use is usually served by the plumbers' anxiety to use the smallest possible pipes and the cheapest possible fittings.

My own London flat is a beautiful example of this. I live on the third floor. All the hot-water cisterns are served by an inadequate common feed pipe from the cold-water tank in the attic. The cold water goes in at the bottom of the tank and the supply to the bath also goes from the bottom of the tank; it should go from the top, but as the supply pipe is so small, the expedient of taking it from the wrong place was resorted to by the "existing plumber." A second bath-full is not available until some considerable time after the first one has emptied the inadequate hot-water cylinder.

If a resident in a lower flat uses water as fast as he can, he gets my hot water (or rather he did, until I put a non-return valve in), because the feed pipe is too small to supply him adequately from the cold tank.

Yet do not contractors for electrical wiring do much the same thing, namely, put in wires so small to lighting points that when the inevitable iron, kettle, vacuum cleaner, or small radiator comes along they are found wanting, and the installation has to be done again?

No!—the case of water will not do to illustrate the ideal method of dealing with electricity.

Why is the gas industry not taken as an analogous example? Is it not because all, or nearly all, gas supply undertakers have realised that they could not for a year withstand the electrical competition if they did not provide complete service of gas and installation work for their consumers?

The contractors, at last, believe in assisted wiring and hiring. A welcome change—but only if it brings grist to their mill without effort on their part. But do they really want it? I have prepared a schedule of prices which show a good profit on my costs and on which I will willingly give out a very considerable amount of work to registered contractors. Several have had orders on this schedule, but only one or two contractors are glad to have them and ask for more—others won't touch the work unless they get a higher price. The electrical contractors state that installation work is not fitted for public bodies, and that public bodies cannot do this work efficiently. How does this fit in with the fact that there is not a rush for my work at prices which show at least 20 per cent. profit on my costs, and in connection with which the contractors would have no business-getting costs or financial risk?

If I, as a public servant, am inefficient, a price which shows 20 per cent. on my cost must produce a far greater profit on their efficient work, so they ought to be scrambling for my orders!

In my area the united efforts of the retailers did not connect four vacuum cleaners per month to my mains. That did not satisfy me, so I started to sell vacuum cleaners on up-to-date lines. I am thereby connecting about 27 per week, and doubtless the contractors are doing better than they did since I have sold the vacuum cleaning idea to the public.

Of course, they are crying out now about the business I am taking from them. Nonsense! I have made a new business that they dreamt not of. If I had told them a month ago that the district could absorb this quantity of vacuum cleaners they would have laughed at me.

What have the contractors done in other lines than lighting and fittings? In my area this is not an unreasonable statement of their record:—

Vacuum cleaners.—Very little.
Washing machines.—Nil.
Power.—A little—after the undertaking had well sold the idea to the manufacturers.
Coking.—None. Water heating.—None.
Heating.—Some. Domestic refrigerators.—None.
Factory uses other than power.—None.

Who is going to sell my product fast enough to make it ever cheaper and ever more abundant if I do not go in and look after the service and selling myself?

The contractors have not done it in the past. Could I trust the future to them? I fear not, and, therefore, I must continue to sell the means of selling my product myself, lest the business be doomed to stagnation. No supply engineer wants the worry of a sales department. If the contractors had energetically pushed the sale of electricity for all purposes the supply authorities would have been well content to leave the work in their hands.

But sales were slow, and largely restricted to the lines which sold most easily, without systematic canvassing, &c., so the electricity supply engineer, like the gas supply engineer, was forced to take a hand in a business which has been more than adequately justified by the results achieved. After all, the proof of the pudding is in the eating.

The British Industries Fair.—III.

Electrical Features and Meetings.

WEDNESDAY, February 17th, was "Electrical Industry Day" at the Birmingham section of the British Industries Fair. Six associations of the industry were represented as well as 20 supply undertakings, both company owned and municipally owned, and all were potential buyers. Representatives were present from the Incorporated Municipal Electrical Association, the Institution of Electrical Engineers, the Association of Mining Electrical Engineers, the Provincial Electric Supply Committee of the United Kingdom, the Association of Electric Power Companies, members of the Birmingham Electric Supply Committee, and a number of exhibitors and others attended and among whom were the following:—Sir Hugo Hirst, Dr. Railing (G.E.C.), Mr. Barnard (Callender's), Mr. Tippetts (British Electrical Federation, Ltd.), Mr. Lumley (N.P.L.), Dr. Kaye (N.P.L., Mr. Legge (Shropshire Power Co.), Mr. Beauchamp (E.D.A.), Coun. J. Hewitt (St. Helens Corporation), Coun. G. Beaumont (Huddersfield Corporation), and Messrs. Cossens and Coulthurst (South Wales Power Co.). Councillor H. E. Parkes, President of the Birmingham Chamber of Commerce, presided at a luncheon. We reproduce a group photograph taken subsequently (fig. 6).



Fig. 6.—Representatives of the Electrical Industry at Castle Bromwich.

Mr. T. R. MARTIN (of Messrs. J. H. Tucker & Co.), vice-chairman of the Fair Management Committee, pointed out that that was the first official electrical visit in connection with the Fair. For the first time, the display of the electrical industry was of a representative character, something like 80 firms being exhibitors. That Section of the Fair was national and not local in its outlook, and the organisers were hopeful that the exhibitors and others identified with the industry, would become annual participants. The one object of the Fair was to promote British trade, and to attract overseas buyers. Such a Fair held annually in unbroken continuity should be a real asset, for business could be done in a proper atmosphere, and under conditions which enabled manufacturers to show their products to the best advantage. He knew of no other industry that was better served by its Press, and the organisers of the Fair owed to them a particular debt of gratitude for their help. He thought they would do a good service to the industry if they went to Leipzig and told manufacturers all about it. They entertained the hope that they would be able to make the Fair at Birmingham a world market, for at least two weeks in the year.

Sir HUGO HIRST, in proposing "The Electrical Industry," observed that that industry was becoming a very powerful factor in our industrial and social life; and the manufacturer could look squarely in the face any manufacturer from any other country. If they were to "deliver the goods" the whole industry must work together as a team. The experience of all engaged in it must be put into the common pool. Manufacturers were doing much and spending large sums of money in the field of research. Every industry would be rejuvenated if electricity was properly introduced into it. He asked those present to welcome the forthcoming Electricity Bill. There might be details in it, with which some would disagree; there might be important points of details which they would like to see altered. Nevertheless, the object of the Government in introducing the Bill was in order that real service might be given to the country, and he believed that the ultimate result would be that electricity would do for this country what steam did for it one hundred years ago.

Mr. R. A. CHATTOCK (President of the Institution of Electrical Engineers), in responding to the toast observed that Sir Hugo Hirst had referred to the value of collaboration between the supply side and the manufacturing side of the electrical industry. That point had not been lost sight of and a joint committee of the two interests was doing useful work in trying to ascertain the views of both sides across the table with regard to the design of electrical machinery, steam generators, &c. He thought that form of collaboration was most valuable to the industry and it was a point for satisfaction that both supply undertakings and manufacturers were represented at the Fair. He put forward an earnest appeal to the supply branch to support the British Electrical and Allied Industries Research Association, because it was out to benefit quite as much as the manufacturing side by the work that was being done. The Institution of Electrical Engineers was anxious to give the Government's electricity measure all the support possible. They wanted a scheme that would not only cheapen the cost of supplies in the country but would extend the use of electricity. He thought they could whole-heartedly support the Government in that ideal. The method that were proposed must be open to criticism but as they had not yet had an opportunity of seeing the Bill they did not know what the financial proposals were. He thought that they ought to be glad that the Government was not going to subsidise the in-



Fig. 7.—A View of the Electrical Section.

dustry, because subsidies meant control of some kind and they in the electrical industry did not want to be unnecessarily controlled. They were carrying on very well now and he thought they could develop in the future on the lines the Government wished, without control. He considered that railway supply should be included in the scheme.

Mr. R. B. Mitchell (President of the Incorporated Municipal Electrical Association) also replied, and endorsed what Mr. Chattock had said with reference to the joint work of the committee representing supply undertakings and manufacturers. Regarding the condition of the industry and the satisfactory export position, he expressed the hope that before long an equally good report would be forthcoming so far as the home trade was concerned. On the supply side he thought it was correct to say that fair progress was being made in nearly



Fig. 8.—The Corporation's Mercury-vapour Rectifier Substation.



Fig. 9.—A View of the Birmingham Electricity Supply Department's Stand.

every undertaking. In Edinburgh they had doubled their output during the past few years and very good headway had also been made in Birmingham and Manchester. In Glasgow the lighting load showed a substantial increase. He agreed that railway electrification was a necessary adjunct to the scheme as a whole and he was hopeful that the railway companies would come into line.

Reverting to the exhibits, we continue below our description of some of the stands and reproduce (on p. 329) a view of a section of the electrical display (fig. 7).

The Birmingham Electric Supply Dept.

As previously reported, one of the principal exhibits of this Department is a mercury arc rectifier sub-station of 184-kW capacity, as used in outlying areas to convert 5,000-V, 25-cycle, three-phase alternating current to direct current at pressures of 220 V and 440 V for distribution to consumers for lighting,



Fig. 10.—The G.E.C. Stand at Birmingham.

power, heating and cooking purposes. This is illustrated in fig. 8. A sub-station as installed by the department on larger consumer's premises is also shown, including high- and low-pressure switchgear, and a 100-kW transformer to reduce the pressure from 5,000-V, 25-cycle, three-phase a.c. to 440 V, 25-cycle, three-phase for power, and 110-V, 25-cycle, single-phase for lighting purposes. Another exhibit is an electrically-driven boiler scaling outfit complete with a small motor, and mounted on a trolley to enable it to be moved from point to point; also a similar machine especially suitable for scaling condenser tubes. A double spindle pedestal-type polishing machine is on view, the polishing mops being carried on the shaft of the 1½-h.p. motor supplying the power. There is also a plating outfit, the power being furnished by a 5-h.p. motor generator set. Among the electric tools shown are a bench drill of ½-in. capacity, with a motor suitable for working on either d.c. or a.c.; and a chipper suitable for breaking concrete, steel chipping, riveting, &c., operated by a 1-h.p., 220-V, d.c. motor. A static condenser is shown controlling the power factor of a squirrel-cage motor, thus demonstrating the apparatus required to improve the power factor on large consumers' installations, thereby entitling them to the special discounts allowed by the Department. The effect of switching on the condenser is shown by the operation of a special power factor meter. Four automatic electric furnaces are shown by Automatic Electric Furnaces, Ltd., suitable for working on 220 V d.c., and fitted with automatic temperature control as follows: (1) Internally-heated resistance furnace for annealing iron, copper, brass, nickel, aluminium, silver, &c., also for enamelling and carburising (load 23 kW); (2) a 3-kW oven suitable for tempering tools, &c.; (3) a 3-kW automatic tool-hardening furnace complete with magnetically-operated device for indicating the exact point when an operation is finished; and (4) a 9-kW furnace for hardening high-speed steel, &c. A 6-kW, 220-V, coffee boiler, capable of dealing with large supplies at café rush hours, is exhibited. A small electric coal-cutting machine is also shown, and in addition, there is a representative supply of lighting fittings, various types of electric fires and heating apparatus, fans, irons, cookers, and modern labour-saving appliances. A view of the stand appears in fig. 9.

General Electric Co., Ltd.

This company's exhibit was dealt with in our last issue. This week we reproduce a photograph of the stand (fig. 10) which was received too late for insertion with the description. The stand occupies practically the whole of one wall of the building "C," in which the bulk of the electrical exhibits are housed.

George Ellison.

A great deal of heavy switchgear is shown on this stand, apart from a working exhibit on an adjacent stand from which a mercury-arc rectifier sub-station provides power for the building. A prominent exhibit is a two-panel unit-type draw-out l.p. switchboard, comprising a 250-A and an 800-A circuit breakers with the usual no-volt and overload releases, adjustable time-limit attachments and tank lowering gear. Mechanical interlocking arrangements ensure that the breaker is open before it can be withdrawn or replaced. The units are mounted on tubular stands and are bolted together to form a continuous switchboard. A h.p. panel is also shown; this is illustrated in fig. 11. It is an oil-immersed free-handle draw-out equipment rated at 200 A and 3,300 V. It consists of a main circuit breaker fitted with no-volt and direct-acting overload time-limit release coils, fully interlocked tank-lowering gear, and instruments all mounted on tubular stands. Another apparatus on view is a three-way l.p. lighting board specially suitable for collieries and other exposed positions. It comprises three 40-A oil-immersed free-handle d.p. circuit breakers, each provided with two overload release coils and various forms of cable boxes. Other exhibits are a 150-A l.p. flameproof oil circuit breaker; a 100-A l.p. air-break, triple-pole, explosion-proof, gate-end breaker with free handle, three overload time-limit release coils, cable box and reversing plug, the whole mounted on skids; a l.p. air-break, air-cooled stator and rotor control panel, consisting of a mill-type free-handle breaker provided with the usual automatic features, mechanically interlocked with a non-automatic air-cooled rotor starter; a l.p. oil-immersed and cooled stator and rotor control panel; a l.p. oil-immersed auto-transformer starting panel with a change-over switch and correct-sequence device; a l.p. 20-A, totally-enclosed, oil-immersed, star-delta starter; a l.p. drum-type reversing controller; a d.c. drum-type reversing controller with

patent magnetic blow-out system and roller contacts; a resistance frame; junction boxes, &c. A patent double-valve time lag device is shown for the first time. This is designed to provide a sufficiently long delay under the overload due to the starting current taken by a squirrel-cage motor while giving the desired delay with normal overloads. There is a hollow piston which houses a valve mounted on the same stem, a spring being provided between the piston and valve to keep them apart normally. With currents up to about twice normal in the overload coil this spring holds the piston and valve apart, leaving the clearance between them in addition to the ordinary clearance between the piston and the cylinder for the

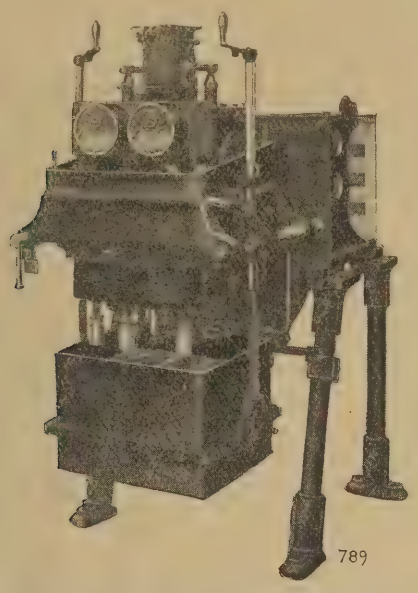


Fig. 11.—An Ellison 3,300-V Draw-out Unit.

passage of the oil, thus reducing the retardation. With currents exceeding about twice normal the pull on the overhead core is sufficient to compress the spring, bringing the valve on to its seating in the piston and leaving only the clearance between the piston and the cylinder for the passage of the oil. This clearance can be adjusted in the ordinary way by screwing the cylinder up or down relatively to the piston, the retardation being so lengthened or shortened.

A section of the stand is devoted to a display of a new synthetic resin impregnated paper insulation. This is used by the firm in its switchgear and is available for other firms who require it. In appearance it is chocolate coloured and has a very fine surface. It is easily machined, although it is too hard to stamp. Excellent dielectric properties are claimed for it.

The Siluminite Insulator Co., Ltd.

Prominent on this firm's stand is the dog safely seated on a live rail, which is a feature of most of its advertisements. A variety of switchboard panels ranging from sizes suitable for power work down to small panels for radio sets, are exhibited. Several of these are in special colours, as white and blue enamel. Samples are shown of the new "Grade 2" insulating material which has recently been placed upon the market. This is able to withstand a certain amount of arcing without carbonising, and on this account is very suitable for switch bases with divided fillets moulded in one piece, and for the insulation of core plates. The company is showing a further new material which is at present under test. This is known as "Arcovite Grade 2." The growing use of overhead power lines in this country gives added interest to a special type of bird guard which the company exhibits. This guard will not cause a short circuit in the event of birds coming in contact with the overhead lines. It is mechanically strong and easily fixed. The remainder of the exhibit is composed of track insulators of various designs as supplied to leading railways, sections of insulating material in different grades for overhead line insulators, arc shields, finger shields, and tubes and rods of the company's various materials.

Siemens & English Electric Lamp Co., Ltd.

The lighting on this stand is carried out with Siemens gas-filled lamps in "Silvaray" fittings, which are suitable for shop window illumination. Apart from this "working" exhibit, the company shows a selection of "Siemens-Xcel" domestic electrical appliances; the cooker (fig. 12) is a new design. It is a standard upright type of cooker with a hob mounted on the top of the oven. Under the hob is ample space for warming plates and grilling. The hob has two special type boiling plates and a 3-heat grill with a removable damper. The oven measures 15 in. x 16 in. x 16 in., and is equipped with elements of 2,100 W; the total loading of the appliance is 6,900 W. The boiling plate consists of a special circular fireclay plate, 7 in. in diameter, in which are deep grooves which house the nickel chrome spirals. The plate is well perforated to allow escaping liquid to pass through it, and is held in place by a novel cast-iron support provided with three plug-in terminals which engage with sockets mounted on the side of the cooker. A white enamel crown plate slides under the hob to collect anything that is spilt. The entire boiling plate can be instantly removed and replaced. There are also shown various types of irons; electric fires, including bowl fires, well fires, and the standard up-

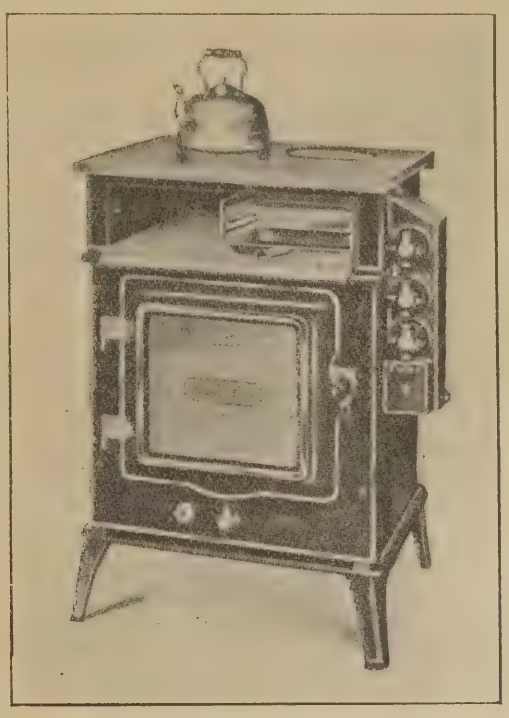


Fig. 12.—The "Siemens-Xcel" Cooker.

right types; electric table cookers; and boiling plates and kettles. The exhibit is rounded off with a display of Siemens "Zed" fuse materials.

Premier Electric Heaters, Ltd.

This company has, as usual, a very attractive display of domestic electrical appliances, all of which are notable for their high degree of finish. Electric fires are one of the chief items, and this year's display includes a range of new designs. These, as will be noted from the example illustrated in fig. 13, have the elements mounted horizontally at the foot of a highly-polished reflector back, which is extended underneath the fire-bars to the front of the appliance. A new form of fire-bar is employed. This consists of a strongly-made fireclay former of double radius, which gives a fairly wide distribution. A large number of kettles are shown, in



Fig 13.—A New "Premier" Fire.

polished and nickel-plated copper; these are fitted with the fusible-plug safety device which we described in connection with last year's Fair. This device is also fitted to some electrically-heated glue pots which are exhibited. For the rest, the exhibit consists of "Smoothwell" irons, hot-plates, urns, saucepans, and many other household appliances.

The National Gas Engine Co., Ltd.

The main feature of this display is a newly designed 66-b.h.p. crude-oil engine, self starting from cold, complete with compressed air starter consisting of an independent engine compressor and receiver. It is suitable for working with the cheapest fuel oil and with minimum compression and low average pressures. A 7-kW generating plant is shown arranged as an automatic engine-driven sub-station for use in connection with d.c. distribution systems where h.p. alternating current is not available. This plant is entirely automatic in its working, and should prove of value to central station engineers. The plant consists of an engine driving a compound-wound generator together with a starting motor and battery. The switchgear is automatic, the controlling feature being a current relay and feeder circuit. When the current in the feeder reaches a pre-determined amount, this relay contacts and the sub-station generating plant is automatically started up, and as soon as its voltage exceeds that of the feeder they are paralleled and the sub-station takes the local load, any excess current being fed back to the main generating station. The plant is shut down again when the local load is reduced to a pre-determined minimum. A 3-kW generating plant with automatic switchgear, is also shown. The electrical portion of the equipment has been made by the Austin Lighting Co., Ltd.

Young, Osmond & Young, Ltd.

This firm's stand is devoted to the display of the "Lightfoot" tubular electric heating system. This is a low-wattage method of heating in which tubes are loaded to 40, 50 or 60 W per foot run, giving temperatures of 160, 180 and 205 degrees F. respectively. The tubing can be fixed round the skirting boards of rooms or corridors, and also made up into appliances. Among the latter are towel rails, garage and car heaters and electric window heaters, examples of which are exhibited on the stand. This is an economical and safe system of heating, and the elements are guaranteed for 5 years.

A. W. Beuttell & Co., Ltd.

Examples of the "Linolite" reflector are shown by this firm, made up for various applications, including shop window lighting, picture lighting, portable showcase lighting, &c. The "A.A." clip is another exhibit. This is an adjustable earthing clip which can be used for pipes varying in diameter from ½ in. to 1¼ in. The same clip can also be used over a rubber band to form a joint between water pipes.

K. F. M. Engineering Co., Ltd.

This exhibit consists of examples of "Internalite" electric signs. These are of distinctive design. Hidden in a small framework are standard type tubular electric lamps, from which light enters the edge of the glass plate affixed to the tube, and is invisibly transmitted between the polished surfaces of the glass by internal refraction. This only becomes apparent when it is reflected by the lettering or design upon the glass which it illuminates, producing a striking result.

Electric Fires, Ltd.

A very representative collection of heating apparatus is shown by this company. One of the principal features is a number of "Electricoal" fires in various designs and finishes. These fires consist of an art-metal grate packed with a realistic imitation of glowing coals. At the back is a polished metal reflector, and heating elements are fitted at the front. The elements are composed of 1-kW plug-in bars, which consist of formers of a dark-red refractory material wound with nickel-chromium wire in a continuous coil. A large number of different patterns of immersion heaters are shown with loadings ranging from 50 W to 12 kW. The latter size is employed for warming Diesel-engine oil to reduce its viscosity. Some of these immersion heaters are made up as self-contained units complete with a snap-switch and plug and socket. Low-temperature heating is represented by examples of finned cast-iron radiators, suitable for installation in garages or other places where radiant heat is not desirable. Other exhibits are bowl fires, treble-purpose cooker-radiators, sample elements, &c.

J. H. Tucker & Co., Ltd.

This company, which is a regular participant in the Fair, has a comprehensive display of its electrical accessories. Among the heavier equipment shown are cast-iron cased combined switches and fuses, knife switches and distribution boards. All types and finishes of tumbler switches are on view, as well as plugs and sockets of distinctive design. The latest products are a new range of tumbler switches of the quick-make-and-break pattern, and grid boxes for sinking switches into a wall. The former include a number which have withstood severe tests at Faraday House and have only broken down when their normal current and voltage ratings have been doubled or trebled. A 5-A switch of this type is shown controlling a fire taking 15 A. The switch box has a grid to which the front plate is secured by four adjustable pins. It is thus possible to make the plate come flush with the wall with little trouble. Other exhibits are examples of multi-way switching, "Kwikwire" plug-in terminals, lampholders, &c.

The London Fair.

Illuminated Signs.

An interesting collection of exhibits of devices for advertising purposes has been brought together in the "General" section, near the Wood Lane Entrance. The one feature common to all of these is motion; in other respects they are "of infinite variety." Amongst those employing electricity are the Attracta Electrical Co., showing various mechanical, thermal, and gravitational devices, flashers, &c., many of which are operated solely by the heat from a small lamp; Messrs. Marathon, Ltd., showing the "Runsyne" machines; the Autochrome Signs, Ltd., showing a large variety of signs; Mr. T. J. Gabb, and the Brilliant Sign Co (1907) Ltd.

Engalithic Mfg. Co. (1925), Ltd.

This company shows "Engalith," a non-inflammable composition of the casein type, which is made in sheets and rods of any colour, and is suitable for electrical insulation as a substitute for ivory, ebonite, &c.

Shades and Fittings.

Several stands are devoted to exhibits of shades for electric lamps, mainly of the silk-on-wire type. Messrs. S. L. Miller and Co. have a very attractive range of shades to meet all tastes, and specialise in hand-painted designs; Messrs C. O. Goring show vellum lamp shades, bound with leather thongs, cemented, or stitched; Messrs. Henry Harvey & Co., Ltd., show mother-of-pearl articles, including shells for use as reflectors; Messrs. Waite & Son have a great variety of silk and linen shades. Messrs. F. Parks, Ltd., besides silk shades, show charming hand-painted flaky vellum shades, laced with leather, as well as colour-washed and perforated vellum shades, and their new "crackle" designs on jap silk.

Metal and glass fittings of handsome design are on the stand of the Pearson Page Co., Ltd.

Ever Ready Co. (Gt. Britain), Ltd.

A large stand is occupied by this company with stacks of its well-known dry cells and batteries of every description. A notable feature is a high-pressure wireless battery in a metal container; this is put up in the most popular sizes, up to 126 volts, and is considered proof against rough usage.

Marconi's Wireless Telegraph Co., Ltd., and the Marconiphone Co., Ltd.

These companies have two stands showing their numerous designs of wireless transmitting and receiving apparatus to advantage, as will be gathered from the accompanying illustration, fig. 14. A prominent feature of the exhibit is the "Straight-8" set, which has been designed to combine the maximum range and selectivity with pure reproduction and



Fig. 14.—The Marconi Stand at the White City.

ease of manipulation. It comprises eight valves—five h.f. and two l.f. amplifiers and a detector. No reaction is used. It is claimed that with this set within one mile of the London station Bournemouth can be received without interference. At night all the Continental stations can be received, and usually the American stations also.

British Electrical Sales Organisation.

We called at this stand just after the King had visited it. His Majesty having used the company's "Rolls" portable wireless set to hear the opening of the Fair by the Prince of Wales. This model, which includes a small loud speaker, weighs 20 lb., and measures 15 by 11 by 7 inches; it has a range of 25 miles, or, with 'phones, 75 miles, and is entirely self-contained. A larger set is made with a mahogany cabinet. Another exhibit is the "Beco" de luxe loud speaker, which is of very neat design, without a horn. Many other patterns are shown on this stand.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

"Do Not Annoy the Editor."—We are indebted to a writer in the current issue of the *Newspaper World* (the column of notes on "Technical, Trade and Class Journals" for the following:—

"This heading was prompted by the remarks of the editor of a certain well-known weekly journal as he slammed the telephone ear-piece on to its hook. 'That confounded contributor,' he said, 'worries me by 'phone, letter, reply-paid telegram, and in person. He sends me a 500-word article by post, follows it up in person to know if it suits, 'phones me as to proofs, and generally makes himself a nuisance. He's a capable man, but I'm dropping him.' Do not be over-anxious to please, ye free-lances!"

The E.C.A. Conference at Brighton.—We are informed that preliminary arrangements for the first annual conference of the E.C.A. and Allied Associations, to be held at the Royal Pavilion, Brighton, on Thursday and Friday, June 24th and 25th, are well in hand, and that there are indications that the event will prove an outstanding success. The present outline arrangements are as follows:—The conference will open on Thursday morning with an address of welcome by the Mayor of Brighton, followed by the E.C.A. presidential address. Later the E.C.A. annual general meeting will be held. On Thursday afternoon there will be papers and discussions on matters of immediate interest to the supply, wiring and sales sections of the industry. During the evening there will be a smoking concert in the music room. On Friday morning papers and discussions will be heard on "Apprentice Training," "Registration," and other matters of vital trade interest. At the close of the business session there will be a short address by the new president for the year 1926-1927. In the afternoon there will be a garden party in the Royal Pavilion grounds, followed, in the evening, by a ball in the Royal Pavilion rooms. A final and detailed programme will be circulated shortly, together with particulars of railway and hotel arrangements.

Unemployment.—On February 8th, the total number of unemployed registered at the Employment Exchanges was 1,164,900, representing a decrease of 10,078 during the week and one of 78,060 during the preceding 12 months.

Municipal Retail Trading.—The Doncaster Corporation is to promote a Bill in which application is to be made for powers to enable that Corporation to sell electrical apparatus. This has aroused keen opposition locally, and the Electrical Contractors' Association has issued a statement in the course of which it is stated: "It is grossly unfair that public funds should be used to set up retail trading competition against existing private traders and that capital raised on the security of the rates should be used in direct competition with rate-paying traders. British electrical engineers and contractors are skilful, competent and enterprising men fully capable of dealing with all the electrical wiring and electrical sales needs of the nation. These men have established businesses all over the United Kingdom, and it is grossly unfair that their pioneer efforts for the past thirty years on behalf of British electrical development should be brought to utter ruin as a consequence of municipal rate-aided trading."

Ship Lighting.—We are informed that the recently-launched R.M.S.P. *Asturias*, which is the largest motor ship yet built, is illuminated throughout with "Siemens" electric lamps.

Orders for British Plant.—Among the orders recently received by members of the British Engineers' Association are the following:—The Royal Mail liner *Asturias*, the largest and most powerful motor liner in the world, has been equipped by the Marconi International Marine Communication Co., Ltd., with one of the most complete wireless installations carried by any ship afloat. This installation will enable the ship to keep in constant communication with land stations and other vessels throughout every voyage. In addition two of the lifeboats carry Marconi apparatus. In connection with the electrification scheme of the Bombay, Baroda and Central Indian Railway, Messrs. Petters, Ltd., have received orders for their direct-coupled electrical generating plants, comprising Petter "S" type oil engines and generators of Laurence Scott & Co.'s manufacture. This firm reports also successful developments in connection with its business in electric lighting plants and oil engines in Venezuela. There has been a considerable expansion in mechanical coal mining in Czecho-Slovakia in recent years. Competition between makers to supply coal-cutting machinery has been keen. British, German and American coal-cutters are in use, yet 40 per cent. of all the machines at work were manufactured by one British firm, Messrs. Mavor & Coulson, Ltd. This firm has also manufactured and supplied 66 per cent. of the coal-cutters at present in use in Belgium, where six other makers are represented. An important contract has been placed with Messrs. Ruston & Hornsby, Ltd., by the Ashford Urban District Council for the supply of three vertical cold-starting oil engines of 600 b.h.p. each. These are required for the new electricity scheme which has been sanctioned by the Electricity Commissioners.

A Manufacturer on National Electricity Supply.—Mr. George S. Francis, of the British Electrical and Allied Manufacturers' Association, addressed a meeting of the Birmingham and District Council of the National Industrial Alliance on February 17th, on "The National Development of our Power Resources." He said that, courageously planned and greatly conceived, electrical energy could provide us with a power more abundant and cheaper than any other. Electrically we were a backward nation, but we possessed the essential resources for leadership if we could evoke the will to employ them. We had lagged in developing electric power for industrial purposes, and supply for domestic purposes was still under-explored and under-developed. The primary condition of realising the vision of the electrical engineer was a broadly-conceived and nationally concerted plan, backed by a well-informed public opinion. The first step towards its realisation was legislative standardisation of frequencies and voltages.

Canton Harbour Improvements.—The *Chinese Economic Bulletin* reports that a scheme for the improvement of the Whampoa harbour, Canton, which has been under consideration for a considerable time, is to be proceeded with. It provides for the erection of quays and warehouses; the building of a light railway 2½ miles long; the purchase of dredging apparatus; and the construction of an electric light and power plant. It is stated that the last item appears in the second part of the scheme, which is to be carried out when funds are available.

The Philadelphia Exhibition.—The Sesquicentennial International Exposition which is to be held at Philadelphia, U.S.A., from June to December this year, is to include a British section with an area of 45,000 sq. ft., and a net exhibiting space of 26,000 sq. ft. A pamphlet which we have received from the secretary of the British Section, 24, Buckingham Street, W.C.2, contains particulars of arrangements and charges, and includes a form of application for space.

Registered Contractors: The Latest Additions.—The following is a list of applications accepted by the Executive Committee of the National Register of Electrical Installation Contractors on February 12th. At the same meeting five applications were declined and two were withdrawn:—

Harrison, Norman & Co., Preston.
Palfree, C. E., Southport.
Westoe Electrical Co., South Shields.
Gordon, Alexander, Houghton-le-Spring.
Schofield, J. L., St. Annes-on-Sea.
Brantingham Bros., Sunderland.
Watson, William, & Co., Sunderland.
Lankester & Son, Ltd., Southampton.
Marler & Co., Ltd., Newport, Mon.
Dixon, S., & Son, Ltd., Leeds.
Hall, John F., Burton-on-Trent.
Wilson, Albert V., Oadby, Leicester.
White, Alfred, Sunderland.
Jones, F. J., & Sons, Ltd., Chester.
Russell, Joseph W., Watford.
Thompson, John, Hetton-le-Hole.
Wilkinson, Bentley & Co., Ltd., Sheffield.
Henderson & Lawson, Paddington, W.2.
Cooke, George, & Co., Wilmslow, near Manchester.
Assersohn, D., London, E.C.4.
Gilkins, A. V., & Co., Ltd., London, S.W.1.
Higgs & Hill, Ltd., London, S.W.8.
Lee, Beesley & Co., Coventry.
Gompertz, G., South Shields.
Bennett, V. H., & Co., Weymouth.
Davies, G., & Co., Llandrindod Wells.
Malcolm & Allan, Ltd., London, W.C.2.
Jacobs & Drane, Ltd., Cheltenham.

Social Events.—The members of Messrs. LUNDBERG'S Social and Athletic Club held a very successful dance at the Islington Public Library on February 11th. All departments were well represented, nearly 200 members and friends being present, including Mr. G. C. Lundberg.

The second annual dinner of the staff of the St. Helens Corporation electricity undertaking was held on February 11th. Mr. F. N. Rendell Baker, borough electrical engineer, presided, and the guests included the Mayor and the chairman of the Electricity Committee. Mr. Rendell Baker referred to the splendid team spirit of the staff, which was an important factor in low production costs. Reference was also made to the development of the undertaking during the past few years. A musical entertainment was provided by Messrs. Lowe, Cockeram, Dingsdale, Garside, and others.

The annual dinner of the telegraph staff of the Great Western Railway was held at the Hotel Cecil on February 13th, and members of the staff attended from all over the system. Mr. E. J. Collier presided and was supported by Mr. E. C. Simpkins, general assistant to the superintendent of the line, Mr. A. D. Aikman, assistant to the chief accountant, and Mr. F. C. Warren, of the chief engineer's department. The loyal toast was proposed by the chairman and that of the Great Western Company by Mr. G. T. Milford, and responded to by Mr. E. C. Simpkins; "The Visitors," by Mr. H. Weaver, and responded to by Mr. Aikman and Mr. Warren. The toast of the chairman was proposed by Mr. Clarke (Birmingham). A musical programme was provided, mainly by members of the telegraph staff.

Revision of Brazilian Duties.—The *Board of Trade Journal* dated February 18th, contains a schedule of revised "consumption duties" embodied in the Brazilian Budget Law for 1926. These duties are to be imposed on many classes of goods formerly exempt, including electrical appliances. The following items are embodied in the list:—Electric lamps, batteries and apparatus; electricity; fans of any kind; and fires and stoves using wood, coke, gas or electricity as fuel.

Trade Announcements.—The Anglo Electric Co., Ltd., announces that "in order to express more accurately the present operations" of the company, it has decided to change its name and will henceforth be known as: Armorduct Cable Co., Ltd. (and reduced).

Mr. W. C. Pincott has resigned his post as chief engineer of the Criterion Restaurant, Piccadilly, and has commenced business in partnership with Mr. A. Taroni, at 23, Denmark Street, Charing Cross Road, W.C.2, as electrical contractors. He wishes to receive catalogues and lists.

Mr. J. H. Stephens, the receiver and manager of H. W. Smith & Co. (1920), Ltd., electrical wire and cable manufacturers, Lydbrook, Glos., states that he has disposed of the undertaking and business to Lydbrook Cables, Ltd. The business will be continued on the same lines at that address.

Mr. Goundry, electrical contractor, of Reigate, has removed his business to larger premises at 34, High Street.

Messrs. John Spencer, Ltd. (Wednesbury), have opened London offices at 176-178, Upper Thames Street, E.C.4, under the management of Mr. P. Spencer. The offices will deal with inquiries and orders for all classes of pipework.

Catalogues and Lists.—Messrs. Stewart Thomson and Patrick, Ltd., 10 and 12, Hart Street, London Road, Liverpool.—A stock list of d.c. and a.c. motors, small lighting sets, starters, &c.

Messrs. Ransomes & Rapier, Ltd., 32, Victoria Street, S.W.1.—An illustrated catalogue describing the company's petrol-electric mobile crane.

Messrs. W. J. Furse & Co., Ltd., Traffic Street, Nottingham.—A series of illustrated pamphlets describing the firm's services to the kinema and theatre industry. They include particulars of lighting dimmers, curtain controls, &c.

Messrs. Young, Osmond & Young, Ltd., Stafford House, Norfolk Street, Strand, W.C.2.—Two illustrated booklets dealing with the "Lightfoot" tubular heating system and its applications

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Pamphlet No. 16D, illustrating and describing "Peebles" polyphase induction motors of medium size (0.75 to 470 h.p.).

The G.W.M. Electrical Co., Ltd., 43, Grafton Street, Tottenham Court Road, W.1.—An illustrated pamphlet advertising battery-charging sets for use upon a.c. and d.c. circuits. Priced.

Newalls Insulation Co., Ltd., 4, Mosley Street, Newcastle-on-Tyne.—Pamphlets advertising the company's magnesia insulation for steam pipes, refrigerator installations, &c.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, W.1.—A list containing particulars and prices of a.c. motors and starters.

Messrs. Marelli & Co., Ltd., 19 and 20, Garlick Hill, Queen Victoria Street, E.C.4.—List No. L/126, illustrating and describing the company's fractional h.p. motors.

Messrs. J. Hopkinson & Co., Ltd., Britannia Works, Huddersfield.—A folder illustrating a large group of high-pressure steam valves which the company has recently supplied to a leading American power station.

Engineering & Lighting Equipment Co., Ltd., Sphere Works, St. Albans, Herts.—Three illustrated folders dealing respectively with "Lunax" lighting units, "S.L.R." standard industrial reflectors, and "Interzone" shop-window reflectors.

Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.C.—A blotter advertising the "Adnil" press button switch; and List L.A. 2/26, an abridged price list of electrical supplies.

The British Resistor Co., Ltd., 32, Clare Road, Halifax.—A booklet dealing with the "Globar" heating element and its applications.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A leaflet advertising the company's "Elasta" electric lamps.

Messrs. Royles, Ltd., Irlam, near Manchester.—An illustrated brochure dealing with "Milletherm" feed water heaters.

The Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—Publication No. 6,213, containing full details, illustrations and prices of "Igranic" and "Igranic-Pacent" radio apparatus.

The Cambridge Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A mailing card advertising six booklets which the company has published dealing with its instruments.

M. Paul Dieny, 21, Laurence Pountney Lane, E.C.4.—A price list of brown and black bakelite sheet.

Bankruptcy Proceedings.—F. J. Tizzard and N. Tizzard (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 21, Market Street, Dalton-in-Furness.—Last day for proofs for dividend, March 6th. Trustee, Mr. W. G. Pearson, Official Receiver, 16, Cornwallis Street, Barrow-in-Furness.

G. W. Ridley, electrical engineer and contractor, 1, Alfred's Court, Chorley.—Last day for proofs for dividend, March 5th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Street, Preston.

R. Wright (R. Wright & Co.), electrical engineer, 34-36, Oxford Street, W.—Trustee, Mr. R. F. W. Fincham, 3, Warwick Court, Grays Inn, W.C., released February 2nd.

W. T. Ellis and C. A. Hornsby (Ellis & Hornsby), electrical engineers, Gwynfryn, Deganwy Avenue, Llandudno. Trustee, Mr. I. D. Hooson, Official Receiver, St. Peter's Churchyard, The Cross, Chester, released February 8th.

A. Smith (Smith & Gill), electrician, 57, Albion Street, Nelson.—Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston, released February 5th.

J. A. Bosher, electrical engineer and contractor, 33, High Street, Aberdare.—Last day for proofs for dividend, March 2nd. Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff.

G. V. Cooke (Wakefield Welding Co. and the Albion Accumulator Service), oxy-acetylene welder and accumulator charger.—Receiving order made February 13th, on debtor's own petition. First meeting March 1st, at the Official Receiver's Office, 21, King Street, Wakefield. Public examination, March 11th, at the Court House, Wakefield.

H. W. W. Alford, wireless engineer, 13, Goldsmith Street, and 261, High Street, Exeter.—Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter, released February 4th.

J. Burkett, electrical engineer, 185, John Clay Street, and 78, Anderson Street, South Shields.—Trustee, Mr. C. Woollett, Official Receiver, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne, released February 5th, 1926.

E. Downing, lately carrying on business in co-partnership with E. J. Mills, as manufacturers of electrical conduit fittings, late of 143, Butts Road, Walsall.—Trustee, Mr. S. W. Page, Official Receiver, 30, Lichfield Street, Wolverhampton, released February 9th.

W. T. Smith, electrical and mechanical engineer, Victoria Street, and 61, Hampden Street, Bolton.—Last day for proofs for dividend, March 3rd. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Company Liquidations.—Pressland Electric Supplies, Ltd., wholesale electrical and radio factors, Eden Street, Kingston-on-Thames.—A meeting of creditors was held recently at Kingston-on-Thames. The chair was occupied by Mr. W. Bronson, I.A., of 157, Cricklade Avenue, S.W., who had been appointed to act as the liquidator in the voluntary liquidation of the company. An approximate statement of affairs as at December 31st last disclosed ranking liabilities of £10,729 and assets estimated to realise £13,556. From that amount had to be deducted £8,800 due on debentures, leaving net assets of £4,756, or a deficiency as regarded the creditors of £5,973. The company had made advances to another radio company to the extent of £2,134, but at the moment it was not known what amount would be recovered. Mr. Bronson reported that the company was registered on December 6th, 1922, with a nominal capital of £1,100, all of which had been issued for cash. The directors of the company were Messrs. C. Pressland and H. W. Matton, who were also the only shareholders. The company traded successfully up to June, 1924, when it was in need of further capital. Up to that date Mr. Matton had advanced cash to the extent of £3,500, and he then lent a further £2,500, and as security was given debentures over the assets for £6,000. In January the interest on the debentures was in arrears, and Mr. F. W. Stevens was appointed as receiver. It appeared that the company had made advances to another wireless concern, and had received a debenture for £2,800. Between January 1st, 1923, and December 31st last, the total sales of the company amounted to £75,000, but Mr. Bronson said he was of the opinion that the gross profits earned during the period had been exceeded by the overhead expenses, and that there had been a net loss on the trading. In the course of a discussion it was pointed out that debentures had been issued for more than the amount of the company's capital, and it might be that some portion of the debentures could not be regarded as constituting a first charge over the assets. A resolution was proposed in favour of the voluntary liquidation of the company being continued, with Mr. Bronson as liquidator. Mr. Bronson stated that on the proxies lodged his appointment as liquidator was confirmed. A suggestion was made by one creditor that the meeting should be adjourned with a view to a compulsory petition being presented, but this was not agreed to.

Radio Equipment Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by Marconi's Wireless Telegraph Co., Ltd., of Marconi House, Strand, W.C. Creditors will be heard in London on March 2nd.

Radio Works, Ltd.—Winding up voluntarily. Liquidator, Mr. R. L. Tayler, Coventry House, South Place, E.C.2. A meeting of creditors was called for February 25th at the Liquidator's offices.

Erith Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. H. C. Merrit, 41, Finsbury Square, E.C. Meeting of creditors, March 1st, at the Institute of Chartered Accountants, Moorgate Place, E.C. Particulars of claims to the Liquidator by April 1st.

Dissolutions of Partnership.—A. G. Bullen & Co., electricians, 79, West Walls, Carlisle.—Messrs. A. G. Bullen and R. L. Jenkinson have dissolved partnership. Debts will be attended to by Mr. Bullen, who will continue the business under the same style.

Taylor & Anderson, electricians, Talbot Street, Grangemouth.—Messrs. R. Taylor and R. Anderson have dissolved partnership. Mr. Anderson will continue the business.

Deed of Assignment.—W. W. Symper and D. J. Evershed (Symper & Evershed), electrical engineers, 22-24, Greenhill Parade, Harrow-on-the-Hill. Particulars of claims to the Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.2, by March 9th.

Meeting of Creditors.—COLE, MARCHENT & MORLEY, LTD.—A meeting of creditors was held at the offices of the company on February 16th. Mr. A. Greaves, the company's accountant, presented a statement of affairs, which showed liabilities to unsecured creditors of £54,522, along with contingent liabilities of £20,000, and second debentures for £71,000. The assets covered by the first debentures, land, buildings, motive power, &c., were taken at book value, *viz.*, £72,396, leaving a surplus of £57,278. The balance of assets after deducting the second debentures showed a surplus of £55,801, less the amount due to unsecured creditors £54,522, leaving a surplus of £1,279. Mr. Greaves emphasised the fact that the assets taken at book value had recently been valued at a much larger sum on the basis of a going concern, but that the realisable value was problematical, depending entirely upon the mode of realisation. After discussion, the creditors passed a resolution leaving the matter in the hands of the receivers (Messrs. A. Greaves and R. S. Brailsford), and appointed a committee to whom the receivers will report from time to time. The opinion was expressed that it was not advisable in the interest of the creditors for any steps to be taken by any creditor to place the company in liquidation.

Railway Electricians' Dispute Settled.—The threatened strike of electricians employed in the power and sub-stations of the London electric railways has been averted by the concession by the companies of the 6½ per cent. increase which was recently awarded to all electricity supply workers in the London area.

Local Exhibition. — BURNLEY. — The recent exhibition organised by the Electricity Committee produced satisfactory results. It was visited by 21,206 persons, and £108 was received in admission fees. The appliances disposed of were: Cookers, 52; radiators, 56; vacuum cleaners, 21; "Santon" geysers, 12; wash boilers, 10; sewing machines, 8; sundry appliances (irons, kettles, bed-warmers, &c.), 60.

Catalogues Wanted.—MR. T. H. M. SWINBURNE, electrical engineer and merchant, Ellesmere Road, Altrincham, asks for catalogues and price lists of electrical goods of all kinds, with wholesalers' terms.

Wireless Exhibition, Olympia, 1926.—We learn that the Wireless Exhibition to be promoted by the N.A.R.M.A.T. will be held in the new Hall, Olympia, from September 4th to 18th next (both inclusive), and that it will be thrown open to the trade as a whole. It is hoped that such support will be afforded the forthcoming Exhibition as will make it fully representative of the British radio industry.

Contract Conditions.—With reference to the I.E.E. Model Form of General Conditions "A" (Home-With Erection), we learn that Clause 37 (Regulations of Local Authorities) of the edition (revised September, 1921) has been amended by the Council to make it clear that the regulations and by-laws with which the contractor shall conform are those which the local or other authorities are authorised by Statute to make. In Clause 37 of the new edition (revised January, 1926) the words "which they are authorised by Statute to make and" have been inserted after the word "authorities." The new edition in all other respects conforms with the old edition.

A Telephone Directory.—MR. J. C. WHITE (Manchester) has sent his customers a useful desk telephone directory with ample space for memoranda.

Steam Turbines for South America.—The Compania Hispano-Americana de Electricidad has contracted with the International General Electric Company for two 52,500-kW, tandem-compound steam turbine generators as the initial installation for the new generating station to be built at the entrance of the harbour of Buenos Aires. Each generator will be a 50,000-kW, 13,200-V, 1,500-r.p.m. main unit with a 250-V d.c. exciter and a 2,500-kW, 2,300-V service generator with its own d.c. exciter, all mounted on the same shaft. The turbines will operate at an initial steam pressure of 550 lb. gauge and 750 deg. F. total temperature, with full intermediate reheat of the steam between the cylinders.

Swedish Refrigerating Apparatus Development.—According to the papers, the Aktiebolaget Elektrolux has received a communication from America stating that a definite agreement has been concluded with a leading American manufacturer of refrigerating apparatus regarding the exploitation of the remarkable Swedish invention in this branch made by the two young engineers, Messrs. Platen and Munters. Aktiebolaget Elektrolux will receive a sufficient number of shares in the American exploiting company to assure its control over the company, together with a sum in cash and a royalty on production. Companies affiliated to Elektrolux have been founded in Germany and France in order to create markets for the new invention and other products of the company. Factories will be erected or leased in Berlin and Paris for the manufacture of cupboards for refrigerating apparatus, while these will be produced to the largest possible extent in Sweden.—*Reuter's Trade Service* (Stockholm).

The "Electrolux" refrigerator is described elsewhere in this issue. A factory is to be built at Luton for its manufacture.

For Sale.—Newquay Electric Light and Power Co., Ltd., invites offers for two Belliss & Morcom compound non-condensing engines, direct-coupled to two 500-volt d.c. generators, two Stirling boilers with superheaters, and two Weir feed pumps, valves, piping, &c. The Royal Kinema, Tonypandy, has for disposal one 18-h.p. motor generator set. The Palace Pier Co., Brighton, invites offers for two Otis electric passenger lifts. By order of the High Court, Messrs. H. Butcher and Co. invite offers for the nautical and scientific instrument works of Heath & Co., Ltd., Avery Hill Road, New Eltham, comprising freehold land, buildings, plant, machinery, stock-in-trade, &c. (See our advertisement pages to-day.)

Book Notices.—"Weaving and Woven Fabrics." Pp. 710; illustrated. London: Lewenz & Wilkinson, Ltd. Price 41s.—This is Vol. XVI of the Schlomann-Oldenbourg illustrated technical dictionaries, and covers that section of the textile industry which is of chief interest to electrical engineers—namely, the applications of electricity to driving the machinery, and the motors and accessories employed. It is true that the electrical references form but a small part of this volume, which covers a vast number of technical terms and forms a very useful and worthy addition to a series of dictionaries that is without a rival. The book is of a more convenient shape than the earlier volumes, and the six languages covered are provided with separate indexes, instead of being run together alphabetically. We cannot speak too highly of the Schlomann dictionaries, which are indispensable to those who have occasion to translate technical articles and data.

The following pamphlets have been published by the Technical Section of the Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's Square, London, S.W.1, during the present session 1925-26:—"Rolling-Mill Machinery," by R. C. D. Fell; "Foundations," by W. H. Latham; "Perspective Drawing for Draughtsmen," by W. Sellar. Many examples of electrically-driven machines are cited in the publication by Mr. Fell. The price of each publication to the public is 2s.

"Who's Who in Architecture," for 1926. London: The Architectural Press. Price, 25s. net.—The publication of this year's edition has been expressly timed to coincide with the recently concluded amalgamation of the Society of Architects and the Royal Institute of British Architects, and the new volume includes the numerous qualification changes which this most important event has brought in its train. The new issue has been carefully revised, and its biographical notices of the British architects have been compiled with the greatest care under the editorship of Mr. Fredk. Chatterton, F.R.I.B.A.

"Theory and Practice of Alternating Currents," by A. T. Dover. Pp. xv+539; 303 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 18s. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV, February, 1926, No. 350. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

New French Company.—La Société d'Electrification Rurale de Lesuere-Jaoul is the name of a new concern which has lately been formed at Rodez with a capital of 664,700 fr., to establish a hydro-electric station upon Jaoul falls.

A German Merger.—It is reported from Stuttgart that the business of the Eisemann Gesellschaft has been amalgamated with that of the Robert Bosch Gesellschaft of that town. Both concerns are well known as manufacturers of magnetos, sparking plugs and other electrical equipment for motor vehicles.

Swedish Agreements with Russia.—Besides the agreements entered into between the A.E.G. and the Soviet State Electrical Trust (heavy electrical engineering branches), to which reference was recently made, it is now announced that in the matter of light electrical engineering manufactures, a licence and sales agreement has also been concluded for a period of six years between the Swedish Ericsson Company and the Soviet Low Pressure Trust. The latter is said to have been granted the exclusive right of using all the patents of the Swedish company also in Esthonia, Latvia, Lithuania, Persia, Afghanistan and Mongolia. Moreover, the sole right of sales for all the products of the Swedish company is reported to have been granted for the countries in question with the exception of Esthonia, Latvia and Lithuania, and a credit of 3,000,000 kr. with the Swedish company in the case of possible orders given by the Trust. In return, the Swedish company will receive a payment of from 2 to 4 per cent. of the value of all installations carried out by the Trust on the basis of the agreement.

New Italian Companies.—Among the new electricity supply undertakings recently organised in Italy are the Società Idro-Elettrica Sile, of Treviso, capital 100,000 lire, and the Società di Elettricità, of Genoa, capital one million lire.

Irish Free State Electrical Imports.—The imports of electrical goods into the Irish Free State during November last attained a value of £48,166, as compared with £35,434 in the corresponding period of 1924. For the first eleven months of 1925 the returns show a total of £356,181, as against £364,703. It should be noted that the imports of electrical machinery are not included in the above figures.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report February 23rd:—No change in the prices of electrolytic copper.

Messrs. James & Shakespeare report February 23rd:—Copper bars (best selected) sheet and rod, no change; English pig lead, £35 5s., 5s. decrease.

Messrs. Edward Till & Co. report February 23rd:—India-rubber, Para, fine, 2s. 3d., 4d. decrease.

Tramway Extensions in Argentina.—It is reported that the Rosario Municipality is contemplating the extension of its tramway system into outlying districts. The cost is estimated at 2,500,000 pesos (approximately £59,000).

Large Machinery Production in Czecho-Slovakia. — The Skoda Works Co., of Pilsen, has recently completed a 20,000-h.p. steam turbine and dynamo, designed to run at 3,000 r.p.m., for the municipal power station in Prague.

Lighting Propaganda in France.—With the object of encouraging the improvement of lighting throughout France, a number of electricity supply undertakings and makers of electric lamps and other fittings in that country have recently organised the Société pour le Perfectionnement de l'Eclairage, with headquarters at 12, Rue Pelleport, Paris. The new organisation has for its object the collection, co-ordination and broadcasting of information relative to lighting, to train-lighting specialists; to inaugurate a campaign in favour of better lighting; to explain and demonstrate by conferences, leaflets and tests the principles on which modern lighting installations should be based, &c. It is proposed to establish a showroom for modern electric lighting equipment and to establish a journal with the title *Eclairagisme* to deal specially with lighting matters.

Lighting and Power Notes.

Aire and Calder Electricity District.—The conference of local authorities of the West Riding of Yorkshire (Aire and Calder) Electricity District held a meeting on February 17th, at the Bradford town hall, when there were present representatives from Bradford, Halifax, Dewsbury, Huddersfield, Barnsley, Wakefield, Keighley, Batley, Shipley, Ilkley and Hebden Bridge. The present position in relation to the long-deferred proposed Aire and Calder scheme, and the position in regard to supply demands, or proposals in various West Yorkshire districts, were discussed. The conference was again adjourned, to a date to be fixed by the executive committee, and no statement of the proceedings was issued for publication.

Australia.—Sydney (N.S.W.).—According to the *Australasian Electrical Times*, in order to provide for the increase in the demand for electricity for about ten years, approval has been given by the City Council to the laying of underground h.p. cables at a cost of £1,542,000 to replace the existing h.p. overhead mains. The amount is to be expended during the next four years, in the following proportions:—1926, £376,000; 1927, £293,000; 1928, £479,000; 1929, £394,000.

New South Wales.—*Tenders* states that included in the State treasurer's estimates for the forthcoming year are the following items:—Hydro-electric schemes, £85,500; Burrinjuck dam development works, £208,700.

Barnsley.—Loan.—The Town Council is applying for sanction to a loan of £42,000 for the laying of mains and other purposes.

Blackpool.—Electricity Agreement.—The draft agreement with the Corporation for the supply of electricity to Poulton, Carleton and Marton has been revised and the amended document has been forwarded to the Corporation for ratification.

Blyth.—New Power Station.—The Northern Counties Electricity Supply Co., Ltd., is to erect a power station at Newsham, Blyth.

Canada.—Hydro-Electric Development.—Development of the Alexander Falls on the Nipigon River, at an estimated cost of nearly $7,000,000, is to be carried out by the Ontario Hydro-Electric Power Commission, authority for the development having been granted. This development, which has been made necessary through increased demands for power from the industrial interests in the Thunder Bay district, will add 50,000 h.p. to the present supply of 65,000 h.p. available at Cameron Falls, one and a-half miles north of Alexander, and will enable the Government to take ample care of the situation at the head of the lakes until 1930 or 1931. Operation at the new power site will begin in 1928. Its complete power capacity, according to the Premier, has been applied for already. Ontario's investment on the Nipigon represents $12,000,000, which is approximately $1,000,000 less than the amount which was estimated by the Hydro-Electric Commission as required.

Continental.—France.—The French Ministry of Public Works has recently granted a concession to the Société d'Energie Electrique de l'Emblavez of Lavoute-sur-Loire, to establish a hydro-electric station to utilise the water power of the River Loire in the Department of Haute Loire.

The report of the Société Electrique du Nord-Ouest for the past year shows a steady increase in the use of electricity for lighting and power purposes in North-West France, the sales of the company having increased from 80,629,347 kWh in 1924 to 88,283,010 kWh last year. During the year a 90,000-V transmission line was erected between Bully and Gosnay and between Bully and Dainville for the supply of electricity to the Arras district.

Luxembourg.—Plans have been prepared for the construction of two large hydro-electric stations to utilise the water power of the River Our, one at Holzentry and the other near Vinden.

Spain.—The Sociedad de Canalazacion y Fuerzas de Guadalquivir has recently commenced the construction of another dam below the Jandula falls which will supply water to a new hydro-electric station with a capacity of 26,000 h.p.

Cottingham.—Electricity in Bulk.—The Urban District Council has received an offer of a bulk supply of electricity from Hull Corporation, and has appointed a deputation to meet the Corporation with a view to obtaining further information as to the estimated cost.

Cumnock.—Electricity Supply.—The Town Council has accepted the offer of the Ayrshire Electricity Board for an electricity supply and is to allow overhead cables to be installed.

Dartford.—Loan.—The Electricity Committee has recommended to the Urban District Council that application be made for sanction to a loan of £33,480 for electricity extensions.

Edinburgh.—Street Lighting.—The Corporation Lighting Committee has recommended that provision be made for improved street lighting. The scheme includes the provision of 800 new electric lamps, while a number of the old lamps are to be fitted with Holophane glassware. The wattage of lamps in side streets in various districts is to be increased.

Epping.—Electricity Supply.—The Urban District Council has consented to the application of the North Metropolitan Electric Power Supply Co. for a Special Order to supply electricity in the district. No overhead wires are to be erected in the town, and the maximum charges are to be 10d. per kWh for lighting and 1½d. per kWh for heating.

Glasgow.—Progress during January.—The manager of the Corporation electricity undertaking reports that 104 houses were wired in January, making the total to date 1813, and that the number of applications for the hire of domestic appliances was 216, making the total to date 9,819.

Heywood.—New Plant.—The Town Council is to install a 750-kW rotary converter at the power station, and application is being made for sanction to a loan of £4,600 to cover the cost of the plant.

Holmfirth.—Extension of Supply.—The Urban District Council has approved a scheme for electricity extensions, and application is being made for sanction to borrow £5,000.

Hornsey.—Loans.—The Electricity Committee has recommended that application be made for sanction to loans of £1,000 for extensions and £9,000 for services.

Ipswich.—Electricity Extensions.—The Town Council has adopted a report submitted by the Electric Supply and Transport Committee on electricity extensions. Two 2,000-kW rotary converters are to be installed at an estimated cost of £16,000, and additional d.c. feeders are to be laid from the power station to Stoke Bridge, Major's Corner, and Barrack Corner at a cost of £15,700.

Irish Free State.—Ballina (Co. Mayo).—A scheme for supplying electricity for public and private lighting in the town is about to be undertaken by Mr. T. J. Reid, of the Gas Works, Ballina, who has applied to the Ministry of Industry and Commerce for a Special Order to enable him to carry the proposed scheme into effect.

Howth (Co. Dublin).—The Urban District Council proposes to have the electric lighting system extended and to introduce facilities for domestic lighting.

Kent.—Electricity Scheme.—The *Evening News* states that Messrs. Pearson & Dorman Long, Ltd., are to spend £2,000,000 on the development of the Kentish coalfield, and it is reported that plans have been prepared for the generation of electricity and for its transmission to London.

Leominster.—Electricity in Bulk.—The Electricity Commissioners have approved the supplementary agreement of the Hereford Corporation for a supply of electricity in bulk to the Leominster Electric Supply Co., Ltd.

Lichfield.—Loan Sanctioned.—The Town Council has received sanction to a loan of £28,700 in connection with the electricity scheme.

London.—Bermondsey.—The Electricity Committee has received sanction to the borrowing of £21,500 for mains, meters, and domestic apparatus.

Maidstone.—Extension of Supply.—The Corporation is to extend its cables from the Snodland Paper Mills to a new cement factory at Holborough. It is stated that this will mean an additional supply of electricity from Maidstone of about 6,000,000 kWh per annum.

Mansfield.—New Sub-Station.—The Town Council has received an application for a supply of electricity to a factory in course of erection in Sutton Road, and is to provide a sub-station at a cost of £1,000 for the supply of electricity in that district.

Nottingham.—Electricity Charges.—The Electricity Committee has agreed to place arc projectors and generators in kinemas on the power rate of 2¼d. per kWh, instead of the present rate of 5½d. per kWh.

Padiham.—Electricity Supply.—The Lancashire Electric Power Co. has erected overhead cables from Accrington electricity works to the new power station at Padiham, and is now taking electricity from Accrington to supply certain areas in Padiham district, pending the completion of the new Padiham station. Electricity is transmitted at 10,000 V.

Preesal.—Loan.—Application is being made by the Urban District Council for sanction to a loan of £1,000 for the purchase of domestic apparatus to be let out on hire.

Preston.—LOAN.—The Electricity Committee has recommended that application be made for sanction to the borrowing of £10,000 for the purchase of cookers, &c., to be let out on hire.

Portsmouth.—ELECTRICITY CHARGES.—The Electric Lighting Committee has revised the scale of charges for lighting as follows:—Within the borough: First 5,000 kWh per annum, 5½d. per kWh; from 5,000 to 10,000 kWh, 5d.; 10,000 to 20,000 kWh, 4d.; 20,000 to 30,000 kWh, 3½d.; 30,000 to 40,000 kWh, 3d.; 40,000 to 50,000 kWh, 2d.; any quantity above 50,000 kWh per annum, 1½d. per kWh. Outside the borough, 2d. per kWh extra in each case.

Rothesay.—NEW POWER STATION.—The Town Council proposes to erect its own power station for the supply of electricity in the town. Electricity is at present obtained from the Rothesay Tramway Co., Ltd.

Rugeley.—ELECTRICITY SUPPLY.—It has been reported to the Urban District Council that Major Prescott-Westcar has decided not to proceed further with his application for a Special Order, but that the Power Development Co., of London, is considering the question of making an application in association with Messrs. Rooper & Chalmers. The Council has decided to ask the Power Development Co. for particulars of its scheme.

Sittingbourne.—ELECTRICITY SUPPLY.—The Urban District Council has been informed by the Kent Electric Power Co. of its inability to supply electricity to the town at present. Messrs. E. Lloyd, Ltd., who had also been approached on the matter, have replied that they cannot give a supply, and the Sheerness Electric Power Co. has now been approached with a view to obtaining a supply from its works.

South-East Lancashire.—ELECTRICITY ADVISORY BOARD.—The Board has intimated to Alderley Edge Urban District Council that it is considering supplying electricity in bulk through the Alderley and Wilmslow Electricity Supply Co., and also the attitude to adopt in any action initiated by local authorities with the object of securing a reduction in the charge of 10d. per kWh at present made by the company.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Richmond (Yorks.) Town Council to supply electricity in the borough and rural district of Richmond.

Application has been made by Mr. R. F. Winder for a Special Order to supply electricity in Boroughbridge (Yorks.) and district.

The Minister of Transport has confirmed Special Orders made by the Electricity Commissioners authorising the Birmingham Corporation to supply electricity in the rural district of Solihull and part of the rural district of Meriden, and the St. Helens Corporation to supply in part of the rural district of Whiston.

Stanhope (Co. Durham).—ELECTRICITY SCHEME.—In connection with the Urban District Council's scheme for the electrification of the whole of Weardale, the engineer has submitted a report based on obtaining a bulk supply from the Cleveland and Durham County Electric Power Co. at Peases West, Crook, and transmitting it at a pressure of 19,000 V to Wolsingham, from which centre it would be distributed to all parts of Weardale, a total distance of 21 miles. The preliminary estimates show the cost to be about £33,000.

Thornaby-on-Tees.—STREET LIGHTING.—The Corporation is of opinion that it might encourage private consumers to take a supply of electricity if the service were adopted for street lighting, and it was agreed to obtain from the Cleveland and Durham County Electric Power Co. an estimate of the cost of laying mains for lighting certain streets by electricity.

United States.—ELECTRICAL DEVELOPMENTS.—According to *Power*, the improvement and extension programme of the Columbus Railway Power & Light Co., Columbus, Ohio, involving an expenditure of $11,000,000, will be completed by the company this year. Some of this work has been in hand for two years. Other work expected to cost $3,000,000 will be started this year. The new Pickaway power plant, erected about 11 miles south of Columbus in Pickaway County, at a cost of $7,000,000, with provision for more than doubling its capacity at a total cost of over $16,000,000, is being erected. This plant will have a capacity of 60,000 kW when it is placed in service this year. Additional units will be installed as needed to bring its total capacity to 150,000 kW.

An application for a preliminary permit covering the Cove Creek site on Clinch and Powell rivers in the Tennessee Valley, has been filed with the Federal Power Commission by the Union Carbide Co., of Richmond, Va., a subsidiary of the Union Carbide & Carbon Co., of New York. The Company's plans call for a maximum development of this important site. It is proposed to build four dams and power houses. The installation proposed at the power houses is 30,000 h.p., 50,000 h.p., 13,000 h.p., and 200,000 h.p.

Whaley Bridge.—ELECTRICITY SCHEME.—The Urban Council has referred to the South-East Lancashire Electricity Advisory Board a letter from the Power Development Company, London, asking for the Council's support to an application for an Order to supply electricity in the rural district of Chapel-en-le-Frith and the urban district of Whaley Bridge.

Worsborough.—WIRING OF SMALL HOUSES.—The Urban District Council has received a report from the Electrical Distribution of Yorkshire, Ltd., on the wiring of 40 houses on the Back End site. The company states that the cost of connecting these houses with the sub-station would be £1,350, and it suggests levying a charge of £2 per house for the service connection. The charge through quarterly meters would be 6½d. per kWh and through slot meters, 7½d. per kWh.

Tramway and Railway Notes.

Bradford.—NEW TRAMCAR DESIGN.—The Tramways Committee has authorised Mr. R. H. Wilkinson (general manager) to proceed with the construction of a single-deck saloon tramcar, divided into smoking and non-smoking compartments, which will be entirely new to Bradford. The cost will be about £2,000, the seating capacity 40, and the speed capacity appreciably greater than that of the existing double-deck cars. The car, which is to Mr. Wilkinson's own design, will run on two four-wheel bogeys. The conductor will be in the middle of the saloon, at a central entrance, and there will be no screen between driver and passengers.

Continental.—SPAIN.—The Spanish Department of Communications has recently placed the contract for the supply of the electrical energy for the electrified railway between Ripoll and Aix-les-Thermes in the Pyrennees, with the Sociedad Energia Electrica de Catalune, of Barcelona.

FRANCE.—Contracts have been placed for the construction of two new sections of the Paris underground electric railways.

Good progress is being made with the electrification of the Culoz-Modane Section of the Paris, Lyons and Mediterranean railway. The transformer stations at Aix-les-Bains, Chambery, Saint Pierre-d'Albigny and Saint Jean de Maurienne have already been completed, and the erection of the 45,000-V line between Venihon and Chambery to feed these stations is well in hand. The third rail has been laid between Chambery and St. Pierre-d'Albigny, and electric locomotives are now running on the Chambery-Montmelian section, current being drawn from the Chambery transformer station which is being temporarily supplied from the Departmental electricity transmission system.

Greenock.—ELECTRICITY ACCOUNTS DISPUTE.—The *Greenock Telegraph* states that a difference of opinion has arisen between the Corporation and the Greenock and Port Glasgow Tramway Co. regarding the payment of electricity accounts. Under the arbiters' award the Corporation is satisfied that a minimum payment of £5,000 per annum was fixed, but this is disputed by the Company. The Electricity Committee has recommended that the Corporation should insist upon full payment of the amount specified in the award and for recovery of arrears.

London.—L.C.C. TRAMWAY IMPROVEMENTS.—Double-deck L.C.C. tramcars are to replace single-deck cars on the Chelsea Bridge to Lavender Hill route in a few weeks' time. The road is being lowered by 18 inches underneath the Southern Railway arches near Queen's Road station to allow the larger cars to pass.

TRAMCAR IMPROVEMENTS.—A tramway-car reconstructed with special consideration for the comfort of passengers has been put into service on the Enfield to Euston route of the Metropolitan Electric Tramways, Ltd. It has been fitted with the latest type of cross seating, well-sprung seats being arranged with reversible backs, so that passengers may always face the direction in which the car is proceeding. In place of the usual slatted floor, the lower saloon floor has been covered with rubber. Six cars are being reconstructed in a similar manner for service on various routes.

Madagascar.—RAILWAY ELECTRIFICATION.—A *Reuter* message from Paris states that the Governor-General of Madagascar intends to submit to the French Government an important programme for the further development of Madagascar, which includes the electrification of the Antananarivo-Tamatave railway and the construction of an electric railway linking up the densely-populated Betsileo district with the east coast.

Preston.—TRAMWAY IMPROVEMENTS.—The Tramways Committee has recommended permanent-way renewals at a cost of £4,900, and car renewals at a cost of £3,920.

Salford.—THROUGH-RUNNING.—The *Electric Railway and Tramway Journal* states that, following upon the establishment of the tramway service between Victoria Bridge and Bury, the Tramways Committee has had under consideration means of making further extensions to its services. The latest suggestion is that a service shall be run from Salford to Walkden. The present traffic in Walkden is under the control of the Lancashire United Tramway Co., and the Tramways Committee has decided to open negotiations with that company, the object in view being an interchange of services similar to that which now exists between Salford and Bury. At a later date the Committee hopes to proceed with the establishment of a similar service between Salford and Bolton.

Telegraph and Telephone Notes.

China.—Cable Rates Increased.—The Chinese Telegraph Administration at Harbin recently increased by 20 per cent. the cable charges on telegrams to foreign countries. Charges are payable in local paper dollars.

Czecho-Slovakia.—Long-distance Telephony.—The Ministry of Posts and Telegraphs has arrived at an agreement with the French and German telegraph authorities for the installation of a direct telephone service between Prague and Paris. The project is to be carried into effect this summer. The *Financial Times* thinks it probable that as soon as the service is inaugurated the charge for a three minutes' conversation will be reduced from 10 to 8.60 fr., as the expenses now involved by the use of the relaying station at Frankfurt will no longer be incurred.

Dominica.—Telephone System.—The Municipal Council of Santiago, Dominican Republic, has sanctioned a proposal for the establishment in Santiago of a modern telephone system for a minimum of 500 subscribers.—*Reuter's Trade Service* (Port-au-Prince).

France.—International Telegraph and Telephone Rates.—As from February 16th the standard international telegraph and telephone rates will be multiplied by 5.2, as compared with 5.1, the figure fixed on January 16th. The rate is still lower than that which came into force on January 6th, when a figure of 5.3 was established, as compared with 5 in December, 1925.—*Reuter* (Paris).

Honduras.—Telephone System.—The Government of Honduras has entered into a contract for the construction of a telephone line, 175 miles in length from the capital (Tegucigalpa) to San Pedro Sula, running along the eastern shore of Lake Yojoa, the contractors undertaking to have the service in working order before the middle of September. The same firm has been granted a concession to construct a line from Tegucigalpa to Yorro, with branches at Trujillo, Olanchito, La Ceiba, &c.—*Reuter's Trade Service* (Tegucigalpa).

Hull Telephone Service.—Relief of Rates.—Hull Corporation Telephone Committee has decided to give a sum of about £1,700, representing one-half per cent. of the undertaking's liquid loans, in the relief of the city rates. The chairman said it would be advisable, in view of the difficulty of estimating the year's developments in expenditure, for the undertaking to be abundantly safe. It might be, too, that at the end of the year the Government would take over the undertaking.

Iraq.—Telephone Service.—The telephone service in Iraq is still in its infancy. There are no long-distance lines, and the only cities having telephone systems are Baghdad, Mosul, and Basra. Baghdad, a city of 250,000 population, has about 400 subscribers, and the annual rate is 440 rupees (nearly £35). In Mosul, a city of about 60,000 people, the use of the telephone is limited almost entirely to the British military and Iraq Government Services. The Basra automatic system was installed by the British army of occupation, and gives ample facilities. The rates (now about 400 rupees) will probably be decreased shortly in order to attract subscribers.

Marine Radio Operators.—Strike Settled.—The marine wireless operators' strike was settled at the Ministry of Labour on February 18th, and work was to be resumed immediately. The strike began on November 26th last, when the men declared that the employers failed to consider certain questions raised by the men's association on which satisfaction was desired before negotiating with regard to a proposal by the shipowners to reduce wages by 22s. 6d. a month. The resumption of work was to take place on the new rates of pay, at the reduction of 22s. 6d. a month demanded by the employers. The whole of the matters in dispute, including wages, are to be the subject of negotiation after the resumption of work, and if no settlement is reached the questions in dispute are to be referred to arbitration.

Radio-Telegraph Convention.—New Members.—It is announced that the Côte Français des Somalis and the Republic of Honduras have become members of the Radio-Telegraph Convention.

Radio Notes.

Broadcasting Committee.—Report.—The Broadcasting Committee, appointed by the Government under the chairmanship of the Earl of Crawford, was to meet at the House of Commons this week to frame its recommendations. Its report is expected to be in the hands of the Postmaster-General early next month.

Czecho-Slovakia.—Growth of Broadcasting.—The *Gazette de Prague* says that the first radio missions in Czecho-Slovakia were made in 1923, when trials were carried out in the spring at Kbely with 1-kW transmitting plant. On June 7th of that year the Radiojournal Company was created, with a capital of 500,000 crowns, of which the Radioslavia concern subscribed 255,000 crowns. At first operations were difficult as the only broadcasting station available (at Kbely) was constructed for telegraphy, and certain alterations had to be made. The first six concessions for receiving stations were granted on October 10th, 1923; on December 31st of that year 47 licences had been issued, at the end of 1924 the number was 1,564, and at present there are 32,000 listeners in Czecho-Slovakia. Since the inauguration of the Strasnice broadcasting station the number of listeners has increased considerably, and it is thought that the figure of 50,000 will be exceeded at the beginning of March.—*Reuter's Trade Service* (Prague).

Paraguay.—New Station.—A radio-broadcasting station, erected under the auspices of the Military School at Asuncion, has been completed and a trial programme instituted.—*Reuter's Trade Service* (Asuncion).

United States.—G.E.C. Research.—There are now nine transmitters working on nine different wave-lengths from Schenectady, and during some periods seven may be "on the air" at the same time, not all broadcasting, however. Within three miles of the city the General Electric Co., of America, has constructed a transmitter development station; eight transmitters have been erected, each having its independent antenna system, which are constantly undergoing changes, and all transmitters are constructed on wooden frames so that they may be quickly dismantled as new methods are devised. The company is indebted to listeners who have reported on the various tests, notably the 50-kW broadcast tests and the programmes broadcast alternately from vertical and horizontal antennæ on superpower. Reports from volunteer listeners are supplemented by observations made by a corps of field engineers who are detailed to various parts of the country. Investigations at the South Schenectady station include short and long wave-lengths, code and broadcast signals, with various degrees of power input and a variety of antenna structures. Experimental broadcasting on special wave-lengths is finding increasing favour; Captain Calvin H. Burkhead, post signal officer, at Fort Leavenworth, Kansas, U.S.A., states that the 41.88-metre signals of WGY are received on a master receiver, and after amplification the signals are sent over 15 miles of wire to loud speakers in 162 homes. Development work on the 1,560-metre wave-length has shown that it is the "ideal" wave-length for reliable and consistent relay service over distances up to 300 miles.

Popularity of Radio.—A nation-wide survey of the radio industry made by Mr. Arthur Williams, vice-president of the New York Edison Co., shows that one of every three families in New York City and one of every five families in the rest of the United States owns a radio set. Radio sales have increased from 5,000,000 dollars to over 300,000,000 dollars in the last five years, and nearly 15,000,000 dollars were spent on broadcasting programmes last year. There are 22 broadcasting stations in the metropolitan area, and a total of 563 broadcasting stations throughout the United States.—*Reuter's Trade Service* (New York).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—Sydney.—March 31st. New South Wales Government Railways. One air compressor for Zarra Street power house.

April 21st. Four motor-generator sets and four switch-operating batteries for Hornsby and St. Leonards sub-station. Specifications from Chief Electrical Engineer, 61, Hunter Street, Sydney.

Melbourne.—April 7th. City Electrical Department. One 2,000-kW rotary converter, with transformer and accessories,* d.c. switchgear and accessories, and one a.c. control panel.*

April 7th. Victorian Government Railways. One hydraulic plate-bending press.* April 21st. Eight electric overhead travelling cranes.*

Bedford.—March 3rd. Electricity Department. E.h.p., h.p., and l.p. underground cables for 12 months. (February 19th.)

Belgium.—March 9th. Municipal authorities of Ixelles, Brussels. 6,000-kW steam turbo-generator set. Particulars for 3 fr. from Hotel Communal.

March 2nd. L.p. armoured cables and d.c. electricity meters. Particulars for 3 fr. from Hotel Communal.

March 4th. Municipal authorities of Schaerbeek, Brussels. 250-kVA transformer. Particulars for 5 fr. from Bureau du Service de l'Electricité, Hotel Communal, Schaerbeek.

Birmingham.—March 6th. Tramways Committee. Traction motors, power wiring, &c., for 30 tramcars. Form of tender from Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street.

Bridlington. — March 10th. Electricity Department. Stores for 12 months, including electrical sundries, lamps, cables, &c. (See this issue.)

Cardiff.—March 8th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. (February 5th.)

Dundee.—Town Council. Tramway rails, tie-bars, fish-plate bolts and nuts. Specifications, &c., from Mr. Geo. Baxter, city engineer.

East Ham.—March 15th. Electric Lighting and Tramways Department. Cable, bifurcating boxes, and joint boxes. (See this issue.)

Eccles.—March 6th. Health Committee. Installation of electric lighting, including wiring and fittings, for houses being erected in Anson Street, Monton. Form of tender from Borough Electrical Engineer, Electricity Works, Cawdor Street.

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or alternatively, one 20,000-kW turbo-alternator with condensing plant. (February 5th.)

March 9th. Tramways Department. 1,200 tons of steel tramway rails. Specifications, &c., from Tramway Manager, 2, St. James' Square.

Hull.—Corporation Electricity Committee. Automatic table telephones and bell sets. (February 19th.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (See this issue.)

April 13th. 23 electric passenger locomotives. (See this issue.)

Kettering.—March 9th. Electricity Department. E.h.p. and l.p. cables. (See this issue.)

March 23rd. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary converter equipment, and one steam turbo-boiler feed pump. (See this issue.)

Leeds.—March 2nd. Tramways and Transport Department. Stores for year ending March 31st, 1927, including electrical sundries. Particulars from Mr. W. Chamberlain, general manager, 1, Swinegate.

Leicester.—Electricity Department. One 18,750-kW, 3-phase turbo-alternator, with condensing plant. (February 12th.)

Leytonstone.—West Ham Union. Alterations to the electric lighting station and the installation of a steam-driven generating set, &c., at the Central Home, Leytonstone. (February 19th.)

London.—ST. PANCRAS.—March 2nd. Electricity Department. E.h.p. switchgear at the Grafton Road sub-station. (February 5th.)

HOLBORN.—March 10th. Board of Guardians. Electrical fittings for six months. Forms of tender from Mr. C. J. Cross, Clerk to the Guardians, 53, Clerkenwell Road, E.C.1.

STEPNEY.—March 4th. Board of Guardians. Electrical fittings for six months. Mr. S. McClelland, clerk to the Guardians, Raine Street, Old Gravel Lane, E.1.

Manchester.—March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)

March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (See this issue.)

Newark-upon-Trent.—March 16th. Electricity Department. Medium and l.p. switchgear and accessories. (See this issue.)

New Zealand.—WELLINGTON.—April 23rd. Public Works Department. 11,000-V metering equipment and switchgear for the Arupuni electric power scheme.*

Oldham.—March 2nd. Electric lighting fittings at Bardsley Conservative Club. Particulars from Mr. E. W. Robins, secretary.

March 8th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to Board of Guardians, Union Offices.

Portsmouth.—Electricity Supply Department. Erection of a steel-frame turbine house. (February 19th.)

Preston.—March 12th. Electricity Department. 4,200 yd. (approx.) e.h.p. cable and four sets of e.h.p., 3-phase transformers. (See this issue.)

Rochdale.—March 16th. Gas and Electricity Committee. One 1,250-kW (or alternatively 1,500-kW) rotary-converter equipment, including transformer and switchgear. (See this issue.)

Town Council. Electric lighting and power installation, 34 houses, Clarke's Lane housing estate. Particulars from borough surveyor.

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)

CAPE TOWN.—March 17th. Electricity Department. Electric cables, electric light poles, cross arms, insulators, &c.

MOOREESBURG.—March 20th. Municipal Council. Engine-room equipment, including oil engines and tanks, main generators, motor booster, pumps and air compressor, travelling crane, switchboard, battery and connections, distribution system, instruments, meters, &c.; and house service connections.*

Tynemouth.—March 15th. Electricity Department. One 250-kVA transformer. (See this issue.)

Warrington.—March 15th. Electricity and Tramways Committee. Motors and transformers. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Billericay.—Board of Guardians. Accepted:—
Installing electric lighting at the new infirmary buildings (£682).—Ellis and Ward.

Calne.—Town Council. Accepted:—
Switchboard (£176).—Crompton & Co., Ltd.

Deal.—War Memorial Hospital Committee. Accepted:—
Installation of a wireless set (£131), including a steel mast and spare h.p. batteries.—C. O. Clark.

Egypt.—Egyptian Ministry of the Interior. Accepted:—
H.p. underground and l.p. overhead distribution system (£9,886), for the municipality of Zifta; one 240-kVA and two 120 kVA alternators, with h.p. and l.p. switchgear, &c. (£5,307), for the municipality of Minieh; and one 25-kVA alternator, with Willans Diesel engine; one 160-kVA rotary-converter, with h.p. and l.p. switchgear, &c. (£7,101).—British Thomson-Houston & Co., Ltd.

Edmonton.—
Electrical work at the Education Offices.—Ridout & Ratcliff, Ltd.

Glasgow.—Tramways Committee. Accepted:—
Trolley feeder cable.—Siemens Bros. & Co., Ltd.
Lead-covered cable.—Standard Telephones & Cables, Ltd.
Dust exhaust plant.—James Keith & Blackman & Co., Ltd.

Water Committee. Accepted:—
Electric lighting fittings, &c., at Glengyll House (£353).—Allan Arthur and Ure.

Health Committee. Recommended:—
Electric lighting work at Bellefield Sanatorium (£1,215).—Haddow & Co.

Electricity Committee. Recommended:—
1,500-kW rotary-converter (£5,622).—British Thomson-Houston Co., Ltd.

Government Contracts.—The undermentioned Government contracts were placed during January, 1926:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Accumulators.—Chloride Electrical Storage Co., Ltd.
Turbo-alternators.—C. A. Parsons & Co., Ltd.
Batteries.—Premier Accumulator Co., Ltd.
Cells and accumulators.—London Battery & Cable Co., Ltd.
Cells.—Fuller's United Electric Works, Ltd.; Edison Swan Electric Co., Ltd.
Air compressors.—P. Brotherhood, Ltd.
Electrically-driven compressors.—Belliss & Morcom, Ltd.
Electrodes.—Alloy Welding Processes, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.; Siemens & English Electric Lamp Co., Ltd.
Overhead electric traveller.—T. Smith & Sons (Rodley), Ltd.

WAR OFFICE.

Aluminium ingot.—British Aluminium Co., Ltd.
Generating sets.—W. H. Dorman & Co., Ltd.
Switchgear and switchboard.—Johnson & Phillips, Ltd.
Transformers.—Newton Bros., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.

AIR MINISTRY.

Alternators and switch panels (Kidbrooke).—Electric Construction Co., Ltd.
Conversion of single-phase supply (Cardington).—G. E. Taylor & Co.
Engines and generators (North Weald and Upper Heyford.)—Blackstone and Co.
Generating sets (Waddington).—W. H. Allen, Sons & Co.
Internal wiring (Heyford).—Lea, Son & Co., Ltd.
Oil-engine generating sets (Karachi).—Babcock & Wilcox, Ltd.
Control resistance and voltmeter.—Pyne Mfg. Co., Ltd.
Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.
Generators and spares.—Mortley, Sprague & Co., Ltd.; Small Electric Motors, Ltd.
Repair of transmitters.—Gambrell Bros., Ltd.
W./t. valves.—Edison Swan Electric Co., Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; General Electric Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Telegraph Condenser Co., Ltd.
Testing protective apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Reliable Engineering Co., Ltd.
Battery stores.—Alton Battery Co., Ltd.; D. P. Battery Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Telephone cords.—British Insulated Cables, Ltd.; London Electric Wire Co. & Smiths, Ltd.; Standard Telephones & Cables, Ltd.
Lamps.—A. C. Cossor, Ltd.
Tumbler switches.—J. A. Crabtree & Co., Ltd.
Earth plates, rod stays, stay swivels.—Bullers, Ltd.
Enamelled wire.—London Electric Wire Co., Ltd.
Batteries (Manchester telephone trunk exchange).—Alton Wire Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Sheffield-Rotherham: British Insulated Cables, Ltd. Leicester (Rothley)-Loughborough: Siemens Bros. & Co., Ltd.
Manufacture, supply, drawing-in, &c., cable and installing loading coil cases.—London-Canterbury: Standard Telephones & Cables, Ltd.
Electric lift (Manchester, superintending engineer's office).—J. Bennie, Ltd.
Telephone exchange equipment.—Marton, Wimbledon, Southall, Waterloo: Automatic Telephone Mfg. Co., Ltd. Douglas (Glasgow), Birmingham (Midland), Jesmond (Newcastle-on-Tyne), Paddington: Standard Telephones & Cables, Ltd. Western (London): Siemens Bros. & Co., Ltd. Sub-contractors: Hart Accumulator Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for machines. Wakefield: Siemens Bros. & Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. Sandal (Wakefield), Grimsby, Letchworth: Siemens Bros. & Co., Ltd. Keighley: General Electric Co., Ltd. Sub-contractors: Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Mansfield: General Electric Co., Ltd. Newcastle-on-Tyne (Central): British L. M. Ericsson Mfg. Co., Ltd. Sub-contractors for batteries: Tudor Accumulator Co., Ltd.; for ringing machines: Crompton and Co., Ltd.
Private branch exchange telephone equipment.—Birmingham Chamber of Commerce; A. W. Bain & Sons (Leeds); Kendal, Milne & Co. (Harrods), Ltd., Manchester. Bristol Docks Committee: Stewart, Thompson & Co., Ltd. (Manchester); Blake & Co., Ltd. (Liverpool). Lambeth Borough Council; Bradford (Yorks.) Royal Infirmary; Eastbourne Corporation: Relay Automatic Telephone Co., Ltd.
Telephone repeater station (voltage control board).—Fenny Stratford: Newton Bros. (Derby), Ltd.

H.M. OFFICE OF WORKS.

Wiring Ministry of Pensions Hospital, Leeds.—A. Innes.
Wiring Montague House, S.W.—R. Langston-Jones & Co.

CROWN AGENTS FOR THE COLONIES.

Electric cable, &c.—W. T. Henley's Telegraph Works Co., Ltd.
Diesel engine and generator.—English Electric Co., Ltd.
Electric equipment.—J. Stone & Co., Ltd.
Flood alarm cabinets, &c.—General Electric Co., Ltd.
Insulated cables.—St. Helens Cable & Rubber Co., Ltd.
Train-lighting cells.—D. P. Battery Co., Ltd.
Telegraph instruments, &c.—Walter's Electrical Mfg. Co., Ltd.
Telegraph ironwork, &c.—Bullers, Ltd.
Telephone exchanges.—Peel-Conner Telephone Works.
Telephones and switchboards.—Standard Telephones & Cables, Ltd.
Copper wire, &c.—F. Smith & Co.; Shropshire Iron Co., Ltd.
Stannos wire, &c.—Siemens Bros. & Co., Ltd.

Irish Free State.—DUBLIN.—The following contracts were placed by the Commissioners of Public Works during the month of January :—

Installation of electric lighting at Irish Land Commission offices, Upper Merrion Street, Dublin.—Handley & Robinson, Ltd.
Installation of electric lighting at Munster Institute, Cork.—Brooks, Thomás & Co., Ltd.—*Irish Builder and Engineer.*

Lamp Contracts.—The Southern Railway has placed contracts for six months for the supply of electric lamps with the British Thomson-Houston Co., Ltd., the Siemens and English Electric Lamp Co., Ltd., and the Edison Swan Electric Co., Ltd.

Letchworth.—

Electrical work for the new abattoir.—Ridout & Ratcliff, Ltd.

London. — ISLINGTON. — Electricity Committee. Recommended :—

Commutator and motor (£75).—John Phillips & Co.

South Africa.—According to the *Evening News*, a contract for a 10,000-h.p. motor-driven winder for a gold mine in South Africa has been placed with Messrs. Fullerton, Hodgart and Barclay, Ltd.

Sowerby Bridge.—Urban District Council. Accepted:—

Electrician's work in connection with the erection of a further 25 houses, Willow Street site.—Oakley, Green & Wilson, Halifax.

Walthamstow.—Urban Council. Accepted:—

Boiler-house plant for the electricity works (between £17,000 and £18,000). —Babcock & Wilcox, Ltd.
Economiser (£3,800).—E. Green & Son.

Willesden.—Electricity Committee. Recommended:—

H.p. cable for 12 months.—British Insulated Cables, Ltd.
L.p. cables for 12 months.—Pirelli-General Cables, Ltd.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

DUOLITE lamps.
EXPRESS electric urns.
DAINTY vacuum cleaners.

Forthcoming Events.

Physical Society of London.—Friday, February 26th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary Scientific Meeting.

Institution of Production Engineers.—Friday, February 26th. At 83, Pall Mall, S.W. Debate on "Payment by Results," to be opened by Mr. R. H. Hutchinson.

Birmingham Electric Club.—Friday, February 26th. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Discussion on "Power Factor," to be opened by Messrs. F. R. Unwin and F. C. Hall.

Institute of Transport.—Monday, March 1st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Paper on "State-ownership of Waterways," by Mr. H. D. Dickinson.

Glasgow Corporation Electricity Department Engineering Society.—Monday, March 1st. At the Welfare Hall, St. Andrew's Cross Works. At 7.45 p.m. Papers on "The Varying Length of Night with Latitude," by Mr. H. J. McEwen; on "Design and Detail," by Mr. J. Elliott; and on "Section Pillars and Mains Fittings," by Mr. A. Rutledge.

Society of Engineers.—Monday, March 1st. At Burlington House, W. At 5.30 p.m. Paper on "Tidal Power on the River Severn—Some Notes and Suggestions on its Utilisation," by Mr. W. M. Beckett.

Roentgen Society.—Tuesday, March 2nd. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Tuesday, March 2nd. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Paper on "Electricity Supply," by Mr. A. Kirk.

Ideal Home Exhibition.—At Olympia, W. From March 2nd to 27th.

Electrical Society of Glasgow.—Tuesday, March 2nd. At Glasgow. Paper on "Industrial Heating Appliances," by Mr. P. J. Sims.

Royal Society of Arts.—Wednesday, March 3rd. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "Science in the Cable Industry," by Mr. P. Dunsheath.

Monday, March 1st. At 8 p.m. Cantor Lecture on "The Production and Measurement of High Vacua," by Dr. G. W. C. Kaye. (Lecture III.)

Institution of Heating and Ventilating Engineers.—Wednesday, March 3rd. At Caxton Hall, Westminster, S.W. At 7 p.m. Paper on "The Design and Application of Electric Motors Relating to Heating and Ventilating Installations," by Mr. J. Meech.

Edinburgh Electrical Society.—Wednesday, March 3rd. At the Royal Society of Art, 117, George Street. At 8 p.m. Paper on "Hydro-Electric Plant," by Mr. A. Arthur.

Institution of Electrical Engineers.—Thursday, March 4th. At the Institution, Victoria Embankment, W.C. At 5 p.m. Paper on "Electro-Farming, or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(Wireless Section).—Wednesday, March 3rd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Papers on "The Directional Recording of Atmospherics," by Mr. R. A. Watson Watt; and on "An Instantaneous Direct Reading Radiogoniometer," by Mr. R. A. Watson Watt and Mr. J. F. Herd.

(North-Western Centre).—Tuesday, March 2nd. At the Engineers' Club, Manchester. At 7 p.m. Paper, "Notes on the Testing of Static Transformers," by Mr. J. L. Thompson and Mr. H. Walmsley.

(Western Centre).—Monday, March 1st. At the South Wales Institute of Engineers, Cardiff. At 6 p.m. Lecture on "The Engineer: His Due and His Duty in Life," by Mr. T. Carter.

(East-Midland Sub-Centre).—Tuesday, March 2nd. At the Technical College, Derby. At 6.45 p.m. Paper on "Steam Pipes for Extra-High-Pressures and Temperatures," by J. A. Aiton.

(Sheffield Sub-Centre).—Wednesday, March 3rd. At the Royal Victoria Hotel, Sheffield. At 7.45 p.m. Ordinary general meeting and smoking concert. Address by the president, Mr. R. A. Chattock.

Royal Institution.—Thursday, March 4th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Atom of Light and the Atom of Electricity," by Dr. C. D. Ellis.

Electrical Power Engineers' Association (Southern Division).—Friday, March 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C.2. At 7 p.m. Lecture on "A 50,000-kW Parsons Reaction Turbine," by Mr. C. D. Gibb.

Junior Institution of Engineers.—Friday, March 5th. At the Engineers' Club, Waterloo Street, Birmingham. At 7.30 p.m. Paper on "Hoisting Appliances," by Mr. C. H. Woodfield.

Friday, March 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper, "Tendencies in Modern Electric Practice," by Mr. J. M. Seddon.

(North-Western Section).—Monday, March 1st. Paper on the "Behaviour of Metals Under Stress," by Mr. W. E. W. Millington.

Joint Delegation Dinner.—Friday, March 5th. At the Great Northern Hotel, Leeds. At 6.30 p.m. Dinner of the Joint Delegation of the Local (Yorkshire) Associations of the Engineering Institutions.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, March 6th. At 62, Wind Street, Swansea. Discussion on "D.c. *versus* A.c. for Colliery Practice," to be opened by Messrs. G. W. Walton and H. Thomas.

Notes.

The Optical Convention, 1926.—We have received a copy of the particulars of the above Convention which is to be held at the Imperial College of Science and Technology, South Kensington, from April 12th to 17th inclusive. The programme of the Convention is set out and the privileges and subscriptions of membership are also given.

Decimal Coinage.—In accordance with the decision of the Grand Council of the Federation of British Industries, a letter was sent to the Treasury asking for an inquiry into the scheme suggested by Mr. Harry Allcock for decimalising the shilling. As a reply was received to the effect that in the view of the Treasury the new suggestion did not differ in any material particular from the scheme propounded by Lord Southwark and rejected by the majority of the Royal Commission in 1920, a further letter was submitted pointing out the ways in which the new suggestions differed from that scheme. The Treasury, however, again gave an unfavourable reply.

E.P.E.A. Dinner.—The North of Ireland Section of the Electrical Power Engineers' Association held its third annual dinner in Thompson's Restaurant, Belfast, on February 14th, when Mr. R. P. Watson (chairman) presided. The guests included the High Sheriff (Alderman Oswald Jamison), Councillor Major Hall-Thompson, Mr. J. F. Gordon, M.P., Mr. A. S. Ostler (president of the Association), and others. Mr. J. F. Gordon, in proposing "The Electrical Power Engineers' Association," said repeated statements had been made that some measures must be taken to reduce the disparity between the amount of electricity consumed for industrial, commercial, and domestic purposes by the people of Northern Ireland and their competitors in the world markets. The consumption per head of population in Great Britain was 200, Tasmania 500, Canada 900, and in some areas in the United States over 1,000 kWh. In Northern Ireland the average figure was 50.3 kWh, and there was considerable scope for further development. With the remarkable improvements which had been made in the last ten years in the generating practice in coal-fired stations, very little margin of benefit was left to the hydro-electric station, although in an undertaking of the latter type there were no recurring fuel costs. The Commission on the Development of the Natural and Industrial Resources had under examination the possibility of utilising in a comprehensive scheme the existing and potential sources of supply such as at Belfast, Londonderry, Coalisland, Lower Bann (Carnroe), and Strangford Lough, and thereby turning the natural resources into material benefits. It had been suggested that the electricity requirements of what might be termed the industrial area of Northern Ireland could be adequately met by the erection of a ring main system embracing the more important and densely populated towns circling Lough Neagh, with possible extensions at a later date to include the other important urban centres in Northern Ireland.

Local Society.—The second lecture of the session of the Sheffield Illumination Society was delivered by Mr. W. T. Wardale, on February 18th, on "How Electricity is Supplied to the Tramcars." The lecturer dealt with the generation and transmission of energy for tramway purposes.

Appointments Vacant.—Telegraph foremen (£400), for the Government of the Gold Coast. Switchboard attendant for Epsom U.D.C. Electric Light Department. Car shed superintendent (£338) for the Rawtenstall Corporation Electricity Department. Shift charge engineer, for the Kirkcaldy Corporation Electricity Works. Clerk of works, for the Borough of Newark Electricity Department. Junior assistant to the borough electrical engineer, for the Corporation of Ealing Electricity Department. (See our advertisement pages to-day.)

The Electrical Trades Benevolent Institution.—It is interesting to learn that Henley's Dramatic Club has promised to give in aid of the Institution a performance of the play "If Four Walls Told"—a village tale in three acts, by Edward Percy—at King George's Hall, Caroline Street, London, on Thursday, March 4th, at 8 p.m. Tickets, at prices from 10s. 6d. to 3s., all numbered and reserved, can be obtained from the assistant hon. secretary, Mr. E. J. King, at 98, Grosvenor Road, S.W.1. The well-known ability of the members of the club, and the desire to help the E.T.B.I., ought to ensure a full house.

London Traffic. — Lecturing on "Traffic Reform" on Sunday last, Sir Henry Maybury, chairman of the London Traffic Advisory Committee, said that the remedy for the traffic congestion was co-ordination—the pooling of resources and receipts, the elimination of waste, extension of tubes, and the electrification of the suburban railways. He looked forward to the early production of a scheme embodying all those features. Referring to the increased patronage of the omnibuses, at the expense of other forms of transport, Sir Henry said his Committee was unanimous in holding the opinion that tramways were essential to the movement of people in London.

Explosives in Coal Mines.—The Secretary for Mines announces that he has issued an Order, in pursuance of Section 61 of the Coal Mines Act, 1911, varying the list of "permitted explosives" used in certain classes of coal mines. Certain definitions of explosives have been amended, and others have been removed from the "permitted list." The Order may be purchased from H.M. Stationery Office, price 2d.

Very High-pressure Turbines.—It is reported that two large turbines, each 79 ft. long and weighing over 400 tons, working with steam at 600 lb. per sq. in., which is claimed to be the highest steam pressure now in commercial use in the United States, were recently put into commission at the new steam station of the Columbia Gas and Electric Company at Columbia Park, Ohio, at a cost of $20,000,000. The machines are of the tandem type, and are each rated at 45,000 kW. The steam is reheated to its original temperature, 725 deg. F., between the high and low-pressure sections. Fourteen stages accommodate the high-pressure and 12 the low-pressure sections. Steam is bled from the turbines, after partial expansion, for feed-water heating. The estimated daily coal consumption of the two machines is about 1,000 tons, and, for each ton of coal, from 400 to 450 tons of water. Provision is made in the station for eight turbines.

The Electrode Capacity and Resistance of Electrolytes.—It has long been known that a capacity effect exists at the surface of an electrode placed in an electrolytic solution, and it is in consequence of this effect that, when measuring the resistance of such a solution by means of a Wheatstone bridge, with a telephone as indicator, one never obtains complete silence. Wien showed, in 1896, that, in addition to a capacity effect, there is also an extra resistance effect introduced by the electrodes. Various attempts have been made to arrive at the law connecting this extra resistance with the frequency of the current employed to measure it, but conflicting results have been obtained. The work described by Mr. B. B. Baneiji in his recent Faraday Society paper, entitled "The Electrode Capacity and Resistance of Electrolytes for a Wide Range of Frequencies," was undertaken with a view to clearing up the uncertainty that obtains, and a number of electrolytes have been examined to find the variation of polarisation capacity and resistance over a wide range of frequencies. The simplest combination of resistance and condenser behaves, unless one of them is either too high or too low, as a condenser whose capacity is a function of the frequency. In the case of an electrolytic cell, there is the further complication that the resistance is composed primarily of the electrolytic resistance, and secondarily of the electrode values, while the capacity effect is a purely electrode effect. Consequently, more was likely to be learnt if attention was directed towards the capacity of the cells, and that was the basis of the present work.

The method employed was that of the Wheatstone bridge for alternating current, the source of current being a triode valve generator. Reference must be made to the paper for full particulars of the experimental arrangements. The electrodes used were silver in silver nitrate, cadmium in cadmium sulphate, and nickel in nickel sulphate. The results show that over a wide range of frequencies up to 2,500 per second, the capacity may be represented by a hyperbola when plotted against the square of the frequencies. The inference is made that the phenomena at the electrodes may be very closely represented as due to two condensers, one of them leaking very heavily and the other only slightly. The interpretation of this hypothesis is based on the existence of the Helmholtz double layer, which would necessarily be accompanied by a capacity effect. If, further, the space between the layers be supposed large enough to enable a few charged particles to move at random between them, the case will be that of a leaky condenser, analogous to what would happen if two plates were placed in a gas containing a few ionised particles. This explains the presence of one leaky condenser. The other may be expected as a result of transport phenomena. When a small current passes through an electrolytic cell, there will be a change of concentration tending to establish an e.m.f. opposing the current proportional to the change in concentration, which change will itself be proportional to the quantity of electricity that has entered the cell. The effect will therefore be similar to that produced by a capacity, and diffusion will produce an effect similar to a small leak. From the values of the capacities measured, the thickness of the double layer can be calculated, and it is found to be consistent with the value found by other methods.

Improved Lighting Scheme.—As the result of a recent lighting scheme of the St. Marylebone Electricity Department, the illumination of Baker Street and Orchard Street has been greatly improved. Wembley lanterns, manufactured by the General Electric Co., Ltd., fitted with 750-W gasfilled lamps, have been adopted throughout the scheme and the accompanying illustration shows the double-fitting unit outside the Metropolitan Railway station. The body of the lantern is constructed of heavy-gauge sheet copper, and is suitably ventilated. A special protected focusing device enables the lamp to be adjusted inside the prismatic refractor and varied to give any required light distribution; adjustments can be made from the outside with extreme accuracy. The lantern has been subjected to many stringent tests, and fully complies, it is claimed, with all the indispensable requirements for a street lighting unit.



Wembley Lanterns in Baker Street.

Mines Report. — We have received a copy of the preliminary statement of the number of deaths caused by accidents in and about the mines and quarries of Great Britain during 1925. In all there were 1,140 separate fatal accidents, which resulted in 1,228 deaths, against 1,294 deaths for the previous year, when there were 1,224 fatal accidents. Of the total deaths 1,129 occurred at mines under the Coal Mines Act, and eight of these are attributed to the use of electricity, three under and five above ground. The number of deaths reported at mines under the Metalliferous Mines Regulation is shown as 23, and that reported at quarries, more than 20 ft. deep, under the Quarries Act, is recorded as 76. No deaths are attributed to the use of electricity under the last two sections. In addition, eight deaths at quarries 20 ft. or less deep were reported.

Research at Birmingham.—The Joint Standing Committee for Research, at the University of Birmingham, in the annual report just issued, states that in the Department of Electrical Engineering research work has been carried out on the conduction of currents by electrolytes; the testing of alternating-current machines by means of direct current; the behaviour of litho stone, and other semi-conductors; and the transmission of power at high frequencies.

Tramways and Light Railways Association.—ANNUAL CONGRESS.—As most of the available hotel accommodation at Bristol and Bath has already been bespoken by two other public bodies for the week selected by the Association and the week following, the Council has decided, after consideration, to hold the Congress at Torquay on June 24th and 25th instead of at Bristol.

Low-Temperature Carbonisation.—In a paper read by Mr. David Brownlie, B.Sc., before the Institution of Mining Engineers, he expressed the opinion that the next stage of evolution in steam power-station operation would be the combination of the low-temperature carbonisation of raw coal with the separation of the tar or crude oils and, if necessary, ammonia, and the combustion under the steam boilers of the residual gas, along with the smokeless low-temperature fuel, either in a pulverised condition or in the solid form, using travelling-grate stokers. He stated that it was impossible to go on burning 8,000,000 tons of raw coal per annum in the power stations of Great Britain. If carbonisation as part of the boiler plant operation was adopted, it would give every year about 20,000,000 gallons of motor spirit, 120,000,000 gallons of low-temperature tar, and 53,000 tons of sulphate of ammonia, while requiring 9,600,000 tons of coal instead of 8,000,000 tons for the same steam output. Many super-power stations to-day were burning 1,000 tons of raw coal per 24 hours, and it was not much of a step to carbonise this coal, which already had to be crushed, conveyed, and stored in overhead bunkers. The same remarks applied to other large furnaces, such as those used in the iron and steel, ceramic, glass and chemical industries. He urged the colliery industry in Great Britain to co-operate and study on scientific and practical lines the whole subject of low-temperature carbonisation; over 100 processes were available, and in many cases smokeless fuel and by-products could be sold to much better advantage than raw coal, while low-grade refuse fuels also were available for utilisation.

North Wales Dam Disaster.—The Government, in furtherance of its decision, as announced in the House of Commons on December 21st last, to make further investigations of a technical character into the design and construction both of the Dolgarrog dam which failed, and the other local dams under the control of the Aluminium Corporation and the North Wales Power Co., has, according to the *Financial News*, appointed the firm of Sir Alexander Gibb & Partners, chartered and consulting civil engineers, of Westminster, to hold a full investigation and report thereon.

Ships' Wireless.—The m.v. *Asturias*, which displaces 35,390 tons and was built at Belfast for the Royal Mail Steam Packet Co., is to sail from Southampton to-day (February 26th) on her maiden voyage to South America. She has been equipped by the Marconi International Marine Communication Co., Ltd., with a very complete wireless installation. The main telegraph installation consists of a 1½-kW quenched-spark transmitter, with emergency apparatus, and also a long-range valve transmitter. The receiving equipment consists of the standard long-range receiver embodying a four-electrode valve amplifier, with the addition of an extra-high-frequency amplifier, which makes the tuning extremely sensitive and very selective. Direction-finding equipment is carried as an aid to navigation. The aerials of this installation are mounted in an open teak framework 8½ ft. in height fixed rigidly to the deck, which method dispenses with the large aerial system hitherto employed. In addition, two of the lifeboats also carry Marconi ¼-kW transmitters of the quenched-spark type, the power supply being obtained from petrol-driven generators. Valve receivers, which also incorporate alternative crystal reception, are used in the lifeboats. A Marconi band repeater has been installed in the *Asturias*, and six loud-speakers can be used in any of a dozen selected places in various parts of the vessel in order that music played by either the ship's orchestra, reproduced from a gramophone, or received by wireless, may be reproduced in any part of the vessel. The apparatus includes an amplifier, a generator with the necessary controlling apparatus, a control unit to change from microphone to gramophone, and a gramophone without sound box and horn. The amplifier station also includes a small loud-speaker to act as a pilot to the operator, thus keeping him informed as to what is going on at the various reproducing positions. The introduction of a small motor generator has made it unnecessary to include accumulator batteries with their attendant maintenance difficulties. The generator is driven by power from the ship's electric mains, and supplies the energy required both for the filament and anodes of the valves in the amplifier. In reproducing gramophone music, the scratching of the needle has been eliminated by the replacement of the sound box by an electrical device of the Marconi Co., by which the indentations of the gramophone record are converted directly into a varying electric current, which is amplified and passed on to the loud-speaker. In this way distortionless reproduction of the original music, or speech, on the gramophone record is claimed to be obtained, and the volume of music produced can be controlled through wide limits.

A Smoke Washer.—Organised by the Smoke Abolition Co., of Manchester, a demonstration of a smoke-washing device, capable of adaptation to works chimneys, &c., was given at Manchester on February 9th. Mr. H. M. Sidebottom, the inventor, conducted smoke from a boiler to a box enclosing a wheel that is bladed on the circumference. Water was played on to the blades, causing the wheel to revolve and the water to be sprayed in the smoke stream. The effect of this is to "increase the draught" and to facilitate the passage of the washed smoke. The discharged water laden with dirt from the smoke is filtered and the residue reclaimed. We are informed that the residuum can be put back on the fire and burned, thus extracting its latent potentiality of heat. It was explained that what otherwise would be waste contains valuable by-products.

Accumulator Manufacturers' Association.—The annual dinner of the Association was held at the Connaught Rooms, London, on Monday last, and was a very successful function. Our report will appear next week.

Gallium-in-Quartz High-temperature Thermometer.—A thermometer similar in appearance to the usual mercury-in-glass one, but capable of registering a temperature of more than 1,800 deg. F., has been developed in the Thomson Research Laboratory of the General Electric Co., of America, at Lynn, Mass., U.S.A. Instead of glass, which would melt at far lower temperatures, the thermometer bulb and stem are made of clear, fused quartz; and instead of mercury, which would boil and cause the thermometer to explode at such a temperature, gallium, one of the rarer metals, is used. A temperature of 1,000 deg. F. is the maximum with the mercury-in-glass thermometer, and such thermometers are inaccurate at high temperatures. By the use of mercury-in-quartz, German scientists attained a previously maximum temperature of about 1,300 deg. F.

The development of a method for the commercial production of clear fused quartz as tubing was the first development in the Thomson research laboratory that made the new instruments possible. Gallium is similar to mercury in appearance, but is much lighter in weight. It melts at a temperature of 100 deg. F., but can be cooled to about 40 deg. before solidifying. Gallium boils at about 3,600 deg., so that it is not necessary to have it under pressure in the thermometer.

Motor Vehicle Parade.—The 20th annual London parade of commercial motor vehicles, organised by the Commercial Motor Users' Association (Incorporated), will take place in Lincoln's Inn Fields, on March 27th, under the patronage of His Majesty the King. The British Electrical Development Association (Inc.) is co-operating with the C.M.U.A. in connection with the electric-vehicle class of the parade, and special prizes will be awarded to the drivers of the winning vehicles in this class.

London's Postal Tube.—An account of the expenditure in respect of the London Post Office Tube railway has been issued as a White Paper. It is shown that the total expended to March 31st last was £1,100,000, which is the full amount authorised. The heaviest item is tunnelling cost, which aggregates £780,007, while permanent way, &c., involves £165,381. Preliminary expenses and professional fees are returned at £44,512.

Institution Notes.

Institution of Electrical Engineers.—The semi-jubilee of the Scottish Centre of the Institution of Electrical Engineers was celebrated on February 17th, when about 300 members and friends met in the Grosvenor Restaurant, Gordon Street, Glasgow. The function took the form of a dinner, whist drive, and dance, and Prof. Magnus MacLean, D.Sc., chairman of the Centre, presided. Representatives from all branches of the electrical industry in the West of Scotland were present. Music by Mr. J. Meredith Kay's Orchestra added to the pleasure of the evening, and the Committee responsible was congratulated on the successful way in which the arrangements were carried through.

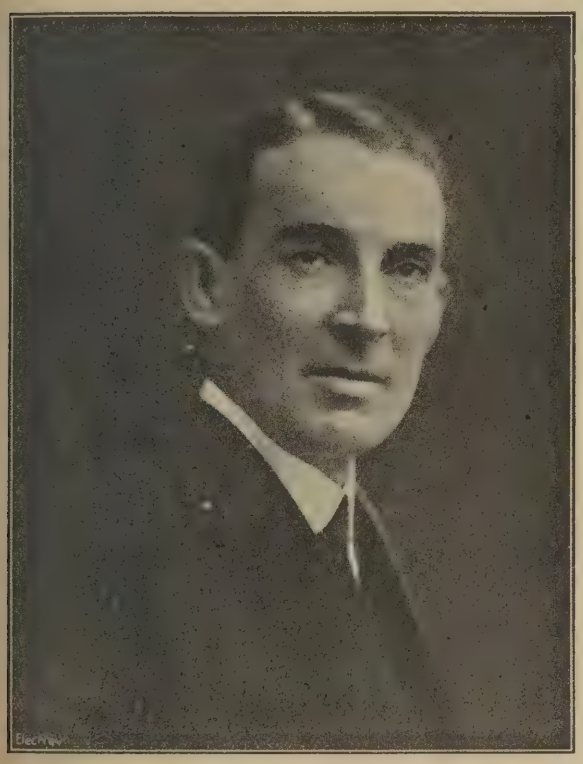
Institution of Fuel Economy Engineers.—The second Council meeting of the Institution of Fuel Economy Engineers was held in London on Friday, February 12th, when four additional members were elected to the Council, making the total now 16. Thirteen new members were elected. It was decided that for associate members the annual subscription would be £2 2s., and for students £1 1s. It was also decided that preferential terms should be given to full members who are full members of other leading institutions, which reduces the fee in such cases from £3 3s. to £2 2s. Amongst the members of Council are Messrs. John Bruce, A.M.I.E.E., A. W. A. Chivers, M.Inst.T., L. M. Jockel, A.M.I.E.E., E. W. L. Nicol, A.M.I.E.E., A. Hugh Seabrook, M.I.E.E., W. Alderson Smith, F.C.I.S., Charles P. Sparks, C.B.E., M.I.E.E., John D. Troup, M.I.Mech.E., and Prof. R. V. Wheeler, D.Sc. The scope of the Institution covers every phase of fuel technology; its main objects are: To promote the science and practice of fuel economy engineering in all its branches, and to facilitate the interchange of ideas respecting improvements in the various branches of fuel technology. The next Council meeting will be held in London on March 19th, and the temporary office is at 29, Sherwin Road, Lenton, Nottingham (Mr. H. L. Pirie, secretary).

Diesel Engine Users' Association.—At the February meeting of the Association Mr. Geoffrey Porter read a paper on "Heavy-Oil Engine Installations; Choice of Site and Lay-out of Plant," pointing out that importance had to be attached to the avoidance of vibration, and in this connection the most favourable type of sub-soil was one that was dry and consisted of closely compacted particles capable of small relative movement. In deciding upon the number and individual capacity of generating sets for a given total capacity, the primary consideration to be borne in mind was the running plant load factor; the range of capacity should be such that no engine would be required under normal circumstances to operate at light loads, a light load being estimated as one below 50 per cent. of the maximum continuous rating of the engine.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

On February 13th, the staff of the Grimsby Corporation Electricity Works gave a complimentary dinner to Lieut.-Col. W. A. VIGNOLES, D.S.O., at the Oberon Hotel, to celebrate the 25th anniversary of the starting of supply on February 13th, 1901. Mr. Vignoles was engineer-in-charge of the erection of the plant at that date and he was placed in charge of the undertaking in the following April. Mr. A. S. Channon presided. Mr. Vignoles was presented with a gentleman's wardrob and Mrs. Vignoles with a combined silver cake-dish and casserole. About 80 sat down to dinner, the only guests in the number being Councillors W. H. Thickett and W. E. Fletcher (chairman and vice-chairman of the Electricity Committee). An appropriate and humorous menu had been prepared by Mr. S. S. Russell, a member of the staff. Mr. Channon, in making the presentation, said that Mr. Vignoles was a gentleman



Lt.-Col. W. A. Vignoles, D.S.O.
Borough Electrical Engineer of Grimsby.

in every sense of the word and that the undertaking had been successful largely because of the manner in which he had conducted its affairs. Mr. Vignoles, in responding, referred to the loyalty of the staff and the excellent way in which they all pulled together. Mr. J. Magee proposed the toast of the Chairman and Vice-Chairman of the Corporation Electricity Committee, and both gentlemen replied.

Mr. F. R. GIBSON, station superintendent to the Portsmouth Corporation tramways, who is shortly retiring under the superannuation scheme after a service of 25 years, was last week presented by the staff of the Engineer's Department with a barometer, cigars and an illuminated address, and an umbrella for Mrs. Gibson. Mr. Lironi, the chief engineer, made the presentation in the power station engine room.

The Exeter Electricity Committee has recommended the City Council to increase the salary of Mr. MUNRO, the electrical engineer, to £790, which is the recognised minimum.

Mr. R. S. J. NEVE has been appointed to succeed Mr. C. Batt as superintendent of Post Office Telegraphs at Bournemouth. He has been in the telegraph service for 41 years.

Of 23 applicants for the post of tramway manager at Portsmouth, at a commencing salary of £1,000 a year, Mr. BEN HALL, tramway manager of Halifax, is recommended for appointment by the Town Council.

Mr. A. GOODWIN, of Messrs. C. A. Vandervell & Co., Ltd., is taking a prolonged rest from business, which it is hoped will completely restore him to health.

A presentation is to be made to-day, Friday (4 p.m.), at the Institution of Electrical Engineers to Mr. HARRY BOOTH, O.B.E., on behalf of his many friends in all branches of the electricity supply industry. Sir Harry Renwick is to make the presentation and speeches will be made by representative leaders of the industry.

Obituary.—MR. A. E. GIFFEN.—The death is announced, at the age of 55 years, of Mr. Alexander Ewing Giffen, A.M.I.E.E., of Stoke-on-Trent, who was for a number of years sectional engineer for the Post Office Telephones and Telegraphs in the Hanley Section. He had been associated with the P.O. Engineering Department since 1897.

MR. H. B. HORNE.—The death took place on February 7th, of Mr. Henry Balfour Horne, chief draughtsman to the Yorkshire Electric Power Co., Ltd. He had been with the company for 17 years, and was stationed at Dewsbury prior to the transfer of the staff to Leeds about a year ago.

MR. B. CUDE.—The death occurred on February 6th, as the result of injuries sustained whilst motor-cycling, of Mr. Bert Cude, who was a member of the engineering staff of the Leatherhead Electricity Works. He was 24 years of age.

MR. H. HOWARD.—The death occurred, suddenly, on February 14th, of Mr. Henry Howard, who was electrical engineer to Lord Norbury, of Greenwood, Withyham, Sussex. He was 40 years of age.

MR. A. P. LUNDBERG.—We regret to learn, at the moment of going to press, that Mr. A. P. Lundberg, M.I.E.E., passed away on February 22nd, after a long illness, in his 95th year.

PROF. H. K. ONNES.—We regret to record the death of Prof. Heike Kamerlingh Onnes, Emeritus Professor and Director of the Physical Laboratory at Leyden University. He was born at Groningen in 1853, and became Professor of Experimental Physics in 1882 at Leyden, where he carried out researches on gases at high pressures and low temperatures, which culminated in the liquefaction of helium in 1908 at 4.5 degrees on the absolute scale. Later, he attained a temperature of about one degree above absolute zero, and he proved that, as had long been anticipated, the electrical resistance of metals practically disappeared in the neighbourhood of the absolute zero of temperature. He was awarded the Nobel prize for physics in 1913, and the Rumford medal of the Royal Society in 1916, besides receiving many other distinctions.

MR. MARTIN F. ROBERTS.—We learn with deep regret that Mr. Martin Fenn Roberts, M.Inst.C.E., M.I.E.E., F.C.S., passed away suddenly on February 22nd, at Brandshatch Place, Fawkham, Kent, at the age of 72 years. Mr. Roberts was a director of W. T. Henley's Telegraph Works Co., Ltd. He was formerly assistant engineer-in-chief to the General Post Office.

Will.—The late SIR G. S. GIBB left £46,501 gross and £40,815 net personalty.

New Companies Registered.

Shipton Automatic Telephone System, Ltd. (211,744).—Private company. Registered February 15th. Capital, £100 in £1 shares. Objects:—To carry on the business of telephone, telegraph, electrical, mechanical, and general engineers, manufacturers of, and dealers in, importers and exporters of, and dealers in instruments, accessories, components, and installations used in connection therewith, &c. The directors are:—E. Shipton, A.M.I.E.E., 2, Belgrade Road, Stoke Newington, N.16 (managing and permanent director); E. J. Baker, 4, Oxford Road, Snakes Lane, Woodford; V. A. P. Stokes, Frog Hall, Wokingham. Solicitors: Rubenstein, Nash & Co., 5 and 6, Raymond Buildings, Gray's Inn, W.C. Registered office: 37, Tothill Street, Westminster.

Elpar, Ltd. (211,715).—Private company. Registered February 13th. Capital, £2,000 in 500 6 per cent. cumulative preference and 1,500 ordinary shares of £1 each. Objects:—To adopt an agreement with A. C. Chapple and to carry on and turn to account the business of an electrical, mechanical, and radio engineer carried on by him at 20, Eltham Road, Lee Green, Kent. The directors are:—A. C. Chapple, 39, Woodside Crescent, Sidcup, Kent; A. T. K. Moir, 46, Wisteria Road, Lewisham, S.E.13, electrical engineer; V. W. Cunis, 40, Hampden Avenue, Beckenham, Kent, engineer. Remuneration as fixed by the company. Secretary: A. C. Chapple, 20, Eltham Road, Lee Green, Kent. Solicitors: Lendon & Carpenter, 31, Budge Row, E.C.4. Registered office: 20, Eltham Road, Lee Green, Kent.

Siemens and General Electric Railway Signal Co., Ltd. (211,382).—Registered as a "private" company on January 28th (delayed at Somerset House), with a nominal capital of £20,000 in £1 shares (10,000 "A" and 10,000 "B"). The "A" and "B" shares rank *pari passu* as a single class, except that they confer certain rights of appointing directors. The objects are to acquire the goodwill, stock, and assets referred to in an agreement between the General Electric Co., Ltd., of the first part, Siemens Bros. & Co., Ltd., of the second part, and this company of the third part, to design, manufacture, and deal in railway signalling installations and apparatus, to construct and carry out railway, electrical, and other works and conveniences, &c. The first directors are:—Max J. Railing, "Whiteknights," Reading (director of General Electric Co., Ltd.); Sydney D. White, "Arundel," Upper Brighton Road, Surbiton, Surrey (director of General Electric Co., Ltd.); Francis Hird, Lanark House, Fairfield Road, Old Charlton, S.E. (director, Siemens Bros. & Co., Ltd.); Dr. Hy. R. Wright, 51, Westcombe Park Road, Blackheath, S.E.3 (general manager, Siemens Bros. & Co., Ltd.). The first two named represent the "A" and the last two named the "B" shareholders. No qualification required. Remuneration as fixed by the company. Secretary: A. M. Hicks. Solicitors: Wild, Collins & Crosse, Kennan's House, Crown Court, Cheapside, E.C.2. The registered office is at Caxton House, Tothill Street, S.W.1.

E. A. Wilson & Co., Ltd. (211,770).—Private company. Registered February 16th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of a manufacturer of wireless components, engineer and brass founder carried on by E. J. C. Liney (formerly carried on by E. A. Wilson), at 88, Shadwell Street, Birmingham, as "E. A. Wilson & Co." The permanent directors are:—E. J. C. Liney, 164, Orphanage Road, Erdington, Birmingham; and E. A. Wilson, 13, Woodall Road, Witton, Birmingham. Qualification, 100 shares. Solicitors: A. C. Jaques, 102, Colmore Road, Birmingham. Registered office: 88, Shadwell Street, Birmingham.

Fountain Bros., Ltd. (211,790).—Private company. Registered February 17th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of, dealers in and agents for all kinds of ironmongery and builders' materials, electrical machinery, plant, switchgear, apparatus and supplies, cables, &c. The subscribers (each with one share) are:—H. J. Fellowes, 56, Rathcoole Gardens, Hornsey, N.8, solicitor's clerk; W. C. Paske, 31, Amerland Road, Wandsworth, S.W.18, solicitor's clerk. The first directors are: H. J. Fountain and P. G. Fountain. Solicitors: P. S. Solomon, Archer & Co., 110, Cannon Street, E.C.4.

Anodon, Ltd. (211,864).—Private company. Registered February 19th. Capital, £15,001 in 10,000 "A" and 5,000 "B" shares and 1 arbitrator's share of £1 each. The arbitrator's share shall not confer upon the holder any right to participate in the profits, but shall rank for repayment of capital *pari passu* with the "A" and "B" shares. Objects:—To adopt an agreement with I. Knowles and F. J. Knowles, and to carry on the business of manufacturers of, agents for, and dealers in wireless and electrical instruments and accessories, &c. The subscribers are:—**H. T. Phillips, 247, Evering Road, Clapton, E.5, confectioner, 1 "B" share; I. Knowles, "Stonyhurst," Chalfont St. Peter, merchant, 1 "A" share.** The above subscribers shall be two of the first directors and shall be permanent. There may from time to time be appointed in respect of the company an arbitrator director. Solicitors: Horner & Horner, Fitzalan House, Arundel Street, W.C.2.

Ballycastle Electric Light and Power Co., Ltd. (B.I.304).—Private company. Registered in Belfast on February 3rd. Capital, £7,000 in £1 shares. Objects:—To carry on the business indicated by the title. The directors are:—J. McKavanagh, 26, Ballyholme Esplanade, Bangor, gentleman; J. Dobbin, 136, Manor Street, Belfast, electrical engineer; W. McPeake, 136, Manor Street, Belfast, electrical engineer; J. Smyth, 65, North Street, Newtownards, electrical engineer. Qualification, 500 shares. Secretary: J. Dobbin. Registered office: 133, Royal Avenue, Belfast.

Rowland's Electrical Accessories, Ltd. (211,738).—Private company. Registered February 13th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of manufacturers, importers, exporters, and repairers of, agents for and dealers in electric light fittings and accessories, general electrical goods, and instruments for use in connection with radio or wireless-telegraphy and telephony, &c. The permanent directors are:—W. R. Hill, "Seaward," The Cliff, Roedean, Brighton; O. R. Hill, 11, Broadfields Road, Erdington, Birmingham. Qualification, 1 share. Secretary: O. R. Hill.

Official Returns of Electrical Companies.

Associated Battery Co., Ltd.—F. W. Pixley, of 58, Coleman Street, E.C.2, ceased to act as receiver or manager on December 31st, 1925.

New Welding Co. (Southern), Ltd.—C. G. Arnold, of 26, Rosebery Avenue, E.C., was appointed receiver and manager on February 9th, 1926, under powers contained in debentures dated November 7th, 1923.

Electrical Insulating Composition Co., Ltd.—J. Lucas, of 26, Birley Street, Blackpool, I.A., ceased to act as receiver or manager on December 31st, 1925.

British Automatic Telephone Installation Co., Ltd.—Debenture dated January 27th, 1926, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. F. O'Hara, 148, Shaftesbury Avenue, W.C.2.

Win-Sum Electric Diffusers, Ltd. — Particulars filed of £1,000 debentures authorised January 27th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Rose Bros. Electrical Co., Ltd. (175,986).—Capital, £20,000 in £1 shares. Return dated October 26th, 1925. 10,002 shares taken up. £2 paid. £10,000 considered as paid. Mortgages and charges, £5,000.

Robin Electric Lamp Co., Ltd. (125,723).—Capital, £75,000 in £1 shares. Return dated October 29th, 1925. 60,352 shares taken up. £10,300 paid. £50,000 considered as paid. £52 in arrears of calls. Mortgages and charges, nil.

Barnsley and District Traction Co., Ltd. (72,962).—Capital, £125,000 in 50,000 preference and 75,000 ordinary shares of £1 each. Return dated June 24th, 1925. 22,000 preference and 60,105 ordinary shares taken up. £62,070 paid on 22,000 preference and 40,070 ordinary shares. £20,035 considered as paid on the remainder. Mortgages and charges, £19,928 4½ per cent. debenture; £29,000 second debenture issued to bankers as collateral security.

Shoreham and District Electric Lighting and Power Co., Ltd. (176,995).—Capital, £27,500 in £1 shares. Return dated December 31st, 1925. 17,329 shares taken up. £10,579 paid. £6,500 considered as paid. £250 in arrears. Mortgages and charges, nil.

Tubes, Ltd. (91,224).—Capital, £150,000 in £1 shares. Return dated October 27th, 1925. All shares taken up. £107,584 paid (being £1 per share on 82,859 and 10s. per share on 49,450 shares. £42,416 considered as paid (being £1 per share on 17,691 and 10s. per share on 49,450 shares). Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd. (189,377).—Capital, £2,000 in £1 shares. Return dated December 31st, 1925. 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges, debentures £662 13s. 4d.

Pirelli, Ltd. (103,068).—Capital, £250,000 in £1 shares. Return dated December 11th, 1925. 200,000 shares taken up. £200,000 paid. Mortgages and charges, nil.

Llangefni Electric Light and Power Co., Ltd. (11,909).—Capital, £3,000 in 2,750 preference and 250 ordinary shares of £1 each. Return dated November 2nd, 1925. 2,566 preference and 250 ordinary shares taken up. £2,566 paid. £250 considered as paid. Mortgages and charges, £2,400.

West India and Panama Telegraph Co., Ltd. (11,116).—Capital, £2,445,630 in 34,563 first preference, 10,000 second preference, and 200,000 ordinary shares of £10 each. Return dated November 4th, 1925. 34,563 first preference, 4,669 second preference, and 88,321 ordinary shares taken up. £1,275,530 considered as paid. Mortgages and charges, £89,100.

Callender's Cable & Construction Co., Ltd. (48,915).—Capital, £1,300,000 in 500,000 ordinary, 400,000 preference, and 400,000 "B" preference shares of £1 each. Return dated June 11th, 1925. All shares taken up. £1,025,000 paid. £275,000 considered as paid. Mortgages and charges, £300,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

The "Underground" Group.

We have received copies of the reports of the companies forming this group which were to be presented at the annual meetings yesterday (Thursday); they are summarised below:—

London Electric Railway Co.—The traffic receipts rose by £52,462 to £1,914,183, while the expenditure decreased by £4,609 to £1,131,814, leaving net receipts of £782,369—an increase of £57,071. The addition of miscellaneous revenue and £74,506 brought forward, gave an available balance of £1,045,331. Interest, rentals, &c., absorbed £452,625; £45,000 has been transferred to reserve (as in 1924); preference dividends required £126,947; a total dividend of 3½ per cent. on the consolidated ordinary stock took £326,478; and a balance of £94,281 is carried forward. During the year the capital expenditure amounted to £949,776, the principal items being £471,513 in respect of the Charing Cross-Kennington extension and £305,143 for rolling stock. It is expected that the extension referred to will be opened for traffic about the middle of this year. A short connecting line is to be constructed between the Piccadilly section and the City and South London Railway at King's Cross. The new joint booking hall at Oxford Circus has been put into service.

Central London Railway Co.—The traffic receipts amounted to £511,346 (£36,621 decrease) and the expenditure to £340,250 (£32,741 decrease), leaving net receipts of £171,096, a fall of £3,880. To this were added miscellaneous receipts (£88,861) and the balance brought forward (£85,885), making £345,842, a decrease of £9,164. After providing for interest, rentals, &c., and preference dividend, transferring £40,000 to reserve (as in 1924), and paying a total dividend of 4 per cent. on the three classes of ordinary stock, a balance of £81,008 is carried forward. The year's capital expenditure was £182,591, of which the installation of escalators accounted for £158,992. The shareholders were to be asked to approve the promotion of a Bill to empower the company to raise additional capital and to carry out new works jointly with the Metropolitan District Railway Co. Considerable progress was made with improvements during the year.

City and South London Railway Co.—The traffic receipts at £539,310 were higher by £226,884, and the expenditure rose by £150,239 to £265,633. The net receipts were thus £273,677, an increase of £76,645. To this were added miscellaneous receipts of £42,877 and £18,766 brought forward, making £335,320. After transferring £25,000 to reserve and providing for interest and dividends (including 3 per cent. on the consolidated ordinary stock), a balance of £25,037 is carried forward. The capital expenditure was £1,466,299, the bulk of which (£1,040,897) was taken by the Clapham Common-Morden extension. It is anticipated that this extension will be ready for service by the middle of the year. The remodelling and improvement of the company's existing stations was continued during the year.

Metropolitan District Railway Co.—The traffic receipts amounted to £1,634,778 and the expenditure to £1,102,085, representing decreases of £14,744 and £39,475 respectively. The net revenue was thus £532,692, an increase of £24,731. To this was added miscellaneous receipts of £184,058 and £69,230 brought forward, making £785,981. The allocations included £45,000 to reserve and a total dividend of 3½ per cent. upon the ordinary stock, and £69,230 is carried forward. The capital expenditure was only £27,331, mainly upon manufacturing and repairing works and plant.

Summary of Results.—We reproduce below a comparative statement of the results of the four companies which, with the London General Omnibus Co., Ltd., participate in the "Common Fund":—

	1925. £	*Increase+ Decrease−* £
Traffic receipts	13,243,652	+473,451
Expenditure	11,088,255	+268,572
Net receipts	2,155,397	+204,879
Miscellaneous receipts (net)	834,144	+ 34,092
Total net income	2,989,541	+238,971
Deduct—		
Interest, rentals and fixed charges	1,320,545	+164,176
Appropriation to reserve for contingencies and renewals	455,000	+ 50,000
Dividends on guaranteed and preference stocks ...	389,477	—
Total deductions ...	2,165,022	+214,176
Balance	824,519	+ 24,795
Add balances from last year's accounts	308,889	− 74,888
Total amount available for dividends on ordinary stocks and shares and for other purposes	1,133,408	− 50,093
Amount paid in dividends on ordinary stocks and shares representing an average rate of 4.09 per cent. in 1925 and 4.43 per cent. in 1924	808,234	− 66,378
Balance carried forward to next year's accounts ...	325,174	+ 16,285

With the exception of the City and South London Railway (for which 1924 was an abnormal year), the railways showed decreased traffic, but the increase in the number of passengers carried by the C. & S.L. Railway caused a net increase in the total. The figures for the four companies were as follows:—

Passengers carried:—	1925.	
Ordinary	217,914,496	+12,033,369
Workmen	51,416,986	+ 5,937,680
Seasons	49,370,358	+ 2,374,708
Total ...	318,701,840	+20,345,757
Number of car-miles run	65,436,713	+ 6,540,634

The total capital of the four railway companies is £53,379,364—a slight increase. In addition, the capital of the Lots Road Power House Joint Committee amounts to £3,175,000.

Metropolitan Railway Co.

Lord Aberconway (the chairman) presided at the annual meeting on February 18th. In moving the adoption of the report and accounts (*vide* our last issue, p. 306) he said that the year 1924 with which those accounts were compared, was an exceptionally good year for the company

owing to the heavy traffic in connection with the British Empire Exhibition, and the strike which occurred in that year among tramway and 'bus employés, which gave the company a large amount of extra traffic. The attendance at Wembley in 1925 was only about half that of the previous year, and the company's receipts were not even half of those obtained in 1924, owing to the reduction in the price of tickets. Therefore, it was not surprising that the revenue for 1925 showed a considerable decrease, but the same dividend was being paid, as the company had considerably strengthened its financial position from the surplus accumulated in 1924; they had not, however, been able to transfer £25,000 to the general reserve fund again. The latter fund now stood at £125,000, and they did not consider it necessary to increase it further. The capital expenditure during the year amounted to £252,844; a number of important works were covered by this figure, some of which were already in use, while others were under construction. The new junction between the Circle and the widened lines to the east of Euston Square was approaching completion. The capital account was overdrawn to the extent of £1,144,000, but they had taken a favourable opportunity of disposing of 750,000 3½ "A" debenture stock, which had reduced the debit by nearly one half. Further stock would be issued to put the account in order.

Turning to the revenue account, the chairman said that they had a very substantial reduction in working expenses as a set-off against the smaller traffic receipts. That was partly due to the special provision made out of the income for 1924, and partly to the economies which had been effected. Referring to the omnibus and other road competition, Lord Aberconway said that assessments to local rates were continually increasing, and a part of the money paid in that way went towards the upkeep of the roads which their competitors were using. They found that their short distance traffic was shrinking in its proportions. The company had a Bill before Parliament which would provide for the extension of the electrified system into the country districts served by the railway. This would lead to the development of those districts, with a subsequent ever-increasing traffic. They would, however, not be in a position to contemplate further extensions north and west of Harrow until some alternative entrance had been provided to Baker Street, and the Circle lines, and the veritable bottle-neck that now existed on the City side of Finchley Road had been done away with. The company's proposal was to make a new railway leaving the present lines by a junction between Kilburn and Willesden Green, joining up with the Circle lines on the west side of their Edgware Road station. By this means a shorter and straighter route would be provided for fast trains, and new ground would be broken, as there would be three stations at convenient points on the Edgware Road, from which considerable traffic could be derived. The report and accounts were adopted.

Yorkshire Electric Power Co.

The annual meeting of this company was held at Leeds, on February 16th. Mr. A. G. Lupton (chairman), who presided, in presenting the report and accounts (Elec. Rev., February 12th, p 266) said that steady progress had been made during the past year, and the additional connections to the company's system were larger than in the preceding year. The recent fall in the cost of coal had enabled them to reduce their charges to consumers. The extensions at the Thornhill power station were completed, and the installation of a further 20,000-kW set had been sanctioned. The construction of the Ferrybridge station had proceeded during the year, and a limited supply was made available in January last. The chairman then reviewed the situation of the company under the Electricity Supply Acts, and stated that the proposal to cut the area of the company into two main portions, had had to be abandoned. This had led to considerable delay in the construction of the Ferrybridge station, and the board had finally decided that further attempts to carry out a scheme for a joint electricity authority could be of no avail, and that the company must proceed with the development of its area on the lines laid down by the Yorkshire Electric Power Act. The Distribution Company's activities, like those of the Power Co. had been checked while the Commissioners were considering the reorganisation schemes. The Distribution Co. had asked for orders permitting it to distribute in practically all the unprovided districts in the Power Co.'s area, but these had not yet been obtained. It was the original purpose of the company to provide electricity on a large scale, to enable small unprofitable stations to be closed down. Very considerable progress had been made, and a number of small stations had been closed down, and supplies were being taken from the Power Co. These had enabled the local authorities to materially reduce the price of electricity. When the Ferrybridge station was running, in the course of next summer, the company would have a total generating capacity of 93,500 kW in its three stations. In addition it would have completed some 50 miles of e.h.p. lines and 700 miles of distributing mains. The company had 340 sub-stations in operation, and in addition to supplying collieries, textile mills, engineering works, &c., the number of distributing undertakings associated with the company was 57. There was a constantly increasing demand from local authorities. The standards of pressure and frequency set by the company in 1901 were the accepted standards for the country, and new undertakings in the company's area had adopted them while old undertakings were gradually converting to them at their own cost. The area of the Yorkshire Power Co. adjoined that of other companies, which also supplied electricity at one standard frequency. The prospects of co-operation had not been overlooked, and when the need arose it could be effected without the establishment of any new organisation. He (the chairman) could not believe that any necessity existed for interfering with the development of supply on the lines which the company had followed for so many years. The opposition which the company had met in the past, from the large municipalities, was changing to a more cordial relationship, and in a few years all outstanding difficulties should be removed, and complete co-operation established. Referring to Mr. Baldwin's electricity proposals, Mr. Lupton said that at present the company could only supply electricity for power purposes. It could not light a person's house, even though the mains ran past his door. The removal of this disability would do much to speed up the use of electricity. Mr. Baldwin's scheme suggested the establishment of a small body to deal with the electrical needs of the country as a whole; he could hardly conceive that such a body would be able to know the needs of the different industrial areas so well as the various boards of directors and power companies which were serving them. Turning to the company's capital, the chairman said that an issue of 500,000 £1 ordinary shares was made last February, and the whole of this was taken up by the shareholders. At last year's meeting, authority was given for the issue of £773,000 of new capital. The directors now proposed to issue 765,000 £1 6 per cent. preference shares to the present holders of ordinary and preference shares. Further capital would be required, and it was proposed to apply to Parliament for an increase in the share capital of the company, to six millions. The report and accounts were adopted, and at a subsequent extraordinary meeting resolutions were passed approving of the application to Parliament for an increase in the company's capital, and sanctioning the donation of £5,000 to the Leeds University Fund.

Tottenham District Light, Heat and Power Co., Ltd.

The annual meeting was held on February 16th under the chairmanship of Mr. H. Woodall. In presenting the report and accounts, the chairman referred to the death of Mr. H. D. Ellis and the appointment of Mr. T. Goulden to fill the vacancy upon the board. Referring to the Government's electricity scheme, Mr. Woodall said that, while he viewed with alarm any incursion of Government into industry, which was much better left in private hands, he recognised that public service companies must be controlled, and the gas legislation had been, on the whole, a model of what such control should be. Coal should be carefully conserved, and it should be remembered that while 80 per cent. of the heat content was recovered in gasworks, in the generation of electricity only 20 per cent. was recovered. There were well-known authorities on electrical matters who were not satisfied as to the advantages of the Government's Electricity Bill. Any powers needed for the cheaper and better production and distribution of electricity could be obtained in the ordinary way, by application to Parliament. The Government proposals were "boosting" the electrical industry, which could be trusted to "boost" itself, with the result that it and allied industries were receiving a valuable advertisement. The electrical industry had been described as one of the bright spots in an otherwise dark picture. It was true that the electrical industry was prosperous, but from a national point of view it would be more true to say that the gas industry was the brighter spot in the picture. The electrical industry was paying large dividends and using coal extravagantly, while the gas industry was paying small dividends, using coal to much greater advantage, and had many schemes for the welfare of its workers, which, he believed, had no counterpart in the electrical industry. In the model Gas Bill discounts were limited to 25 per cent., whereas electricity was charged for, for one purpose, at as much as 10 times the rate as for another in the same dwelling. He thought that the general public would be better served if the price of lighting was considerably reduced even if the price for heating and power was raised. Large users of power could always generate electricity for themselves at a lower price than it could be distributed to them.

Prospectus.

London Power Company Ltd.—The list of applications was to close on or before yesterday, Thursday, in an issue of £3,000,000 five per cent. redeemable debenture stock at £96 per cent. In actual fact, however, so swift was the response, that it closed on Monday a few hours after publication. The company was formed in 1920 as a private company, under the name of the London Electricity Joint Committee (1920) Ltd., to secure the co-operation of the London electricity supply companies in the promotion of a scheme for the better development of the supply of electricity in London and Middlesex, and neighbouring districts. The company became a public company and changed its name on the passing of the London Electricity (No. 2) Act, 1925, and under contracts scheduled to and confirmed by that Act and made with ten London electricity supply companies represented on the board, it has agreed to purchase the freehold of the Willesden and Amberley Road generating stations, and certain transmission lines of the Metropolitan Electric Supply Co., Ltd., and to take on lease the generating stations and main transmission lines of the other constituent companies on terms under which such stations and lines will be acquired by the company on or be-

fore August 25th., 1971. The Act empowers the company by agreement with any constituent company to acquire its station and lines at any earlier date.

The company will operate the generating stations taken over and will supply the constituent companies with the energy required for the purposes of their businesses. Nine of the ten constituent companies have (subject to certain existing contracts for bulk supply) bound themselves by the contracts ratified by the Act of 1925 to take from the company all the electricity they require for supply by them until 1971. The other company (The Metropolitan Electric Supply Co., Ltd.) has bound itself to take from the company for at least ten years all the electricity it may require for its London area of supply.

Each of the ten constituent companies has by such contracts further agreed with the company that if in any year the receipts of the company on revenue account are insufficient to meet the charges payable therefrom (which include interest on the debenture stock and contributions to the sinking funds which the company is required by the Act to establish for amortisation of capital expenditure), such constituent company will provide a part of the deficiency equal to the proportion that the amount paid by it for electricity purchased by it during the year bears to the total amount paid for electricity supplied by the company during that year.

The aggregate number of kWh sold by the ten constituent companies during each of the last three years ended December 31st (excluding inter-company sales) has been as follows:—1923, 190,657,426; 1924, 215,952,957; 1925, 263,113,970.

The proceeds of the present issue are required to provide for the acquisition and extension of certain of the existing generating stations and main transmission lines and to pay off obligations of some of the constituent companies and for the general purposes authorised by the Act of 1925. The share capital of the company is £50,000, divided into 50,000 shares of £1 each, all of which has been issued at par for cash and is fully paid up, and is all held by the constituent companies. The holders of this capital have the exclusive right of nominating directors of the company. Preferential consideration was to be given to applications from debenture holders and shareholders of the ten constituent companies, the representative of which are stated below:—

W. F. Fladgate, M.V.O., Charing Cross Electricity Supply Co., Ltd.
H. R. Beeton, Brompton and Kensington Electricity Supply Co., Ltd.
R. H. Benson, London Electric Supply Corporation, Ltd.
W. R. Davies, Chelsea Electricity Supply Co., Ltd.
A. E. Franklin, Notting Hill Electric Lighting Co., Ltd.
W. Leaf, Central Electric Supply Co., Ltd.
A. W. Tait, C.B.E., Metropolitan Electric Supply Co., Ltd.
F. J. Walker, St. James' and Pall Mall Electric Light Co., Ltd.
Lord Wargrave, Westminster Electric Supply Corporation, Ltd.
C. C. Wyllie, Kensington and Knightsbridge Electric Lighting Co., Ltd.

The engineers are: Sir Alexander Kennedy and Mr. G. W. Partridge.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held on February 18th. Mr. A. H. Geldart (deputy chairman) presided, and in presenting the report and accounts (*vide* our last issue, p. 305), said that in spite of a very small increase in the demand from Northampton's staple trade, the energy sold had risen by 21.7 per cent., and although prices had been reduced, the revenue had exceeded the estimates. The greater output had led to a reduction in the working costs per kWh generated. The shareholders were to be asked to agree to the extension of the capital to £500,000. The programme for the ensuing year included extensions to Towcester, Bletchley and Fenny Stratford, and the completion of the ring mains to Daventry and Wolverton back to Northampton. An extension of 8,000 kW was being made at the Hardingstone Junction power station to cope with the demand. The report was adopted.

At a subsequent meeting a resolution was put forward to empower the board to issue 150,000 additional £1 "B" shares. The chairman said that only £60,000 of this would be issued at present—at the price of 28s. per share—to existing shareholders. It was suggested that the price should be 26s., but the chairman would not accept the amendment. Eventually the resolution was lost, on a show of hands, by a large majority.

Dublin United (Electric) Tramways Co., Ltd.

Mr. Joseph Mooney, chairman, presided at the recent annual meeting, when the report and statement of accounts were adopted and a dividend of 5½ per cent. was declared. The number of passengers carried in 1925 showed a slight increase as compared with 1924, but the revenue from this source decreased, which was attributable to the higher percentage of short-distance passengers. There was a decrease in revenue in the second half of the year which, the chairman said, was believed to be due to a decrease in the spending power of the travelling public. The new motor-'bus services to outlying districts were successful; more 'buses were nearing completion, and it was hoped to open up more routes soon.

Mr. Mooney alluded to the increase in traffic wages, which, he observed, pressed heavily on their resources. There had been some relief under the head of rates for the year, and they looked forward hopefully to a further reduction in these charges. As to the taking over of the Lucan Electric Railway by the company and the extension of their line through the Liffey Valley, terms had been arranged with the Dublin authorities and some of the townships whereby the period of tenure was extended; some townships, however, had not yet come to a decision.

North Metropolitan Electric Power Supply Co.

The report for the year ended December 31st last, records a net revenue of £315,292 (as compared with £272,483 in 1924). The addition of £7,297 brought forward gives an available balance of £322,589. Mortgage, debenture stock interest, &c., is paid, and £150,000 is transferred to reserve, leaving £125,452, which is allocated as follows:—Dividend on the two classes of preference shares, £55,999; final dividend on the ordinary shares, making 10 per cent. for the year, £62,777; carried forward, £6,676. During the year the capital expenditure upon plant, machinery, and mains amounted to £345,123. Approximately 160 miles of trunk and distributing mains have been laid and 35 new sub-stations have been put into service. The company's system is being linked up with the Barking station of the County of London Electric Supply Co., Ltd., and has been connected with the Metropolitan Electric Supply Co., Ltd. Arrangements are being made for the erection of a new generating station at Brimsdown. A supply of electricity was commenced at Potters Bar, Totteridge, Goldings, Hertingfordbury, and Upshire. Charges for supply have been reduced in the majority of the company's districts, and to authorised distributors. The total amount of energy sold was 112 million kWh, as compared with 96½ millions in 1924, an increase of 16 per cent. The number of consumers supplied, directly or indirectly, at the end of the year was 56,500, as against 45,500—an increase of 23 per cent. New showrooms have been opened at Edgware, Harpenden and Southgate. The meeting was held on Tuesday last.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held on February 16th. Mr. G. E. Henderson (chairman), in moving the adoption of the report, said there had not been any improvement in the shipbuilding, engineering, coal and other ancillary industries during the year, but rather the reverse, and as the tramways went through an area principally engaged in those industries, both their ordinary and workmen's traffic had been seriously affected by continued and increasing depression, which accounted for their diminished receipts. Their traffic receipts for the year amounted to £39,105, as against £43,343 for 1924, a decrease of £4,237. The passengers also showed a decrease of 366,582. During the year they had been able to reduce their working expenses by £2,410, so that the gross profit of £4,457 was only £1,753 less than that for 1924. They were not able to pay a dividend on the preference shares for the past year. During the year they had added to their reserve funds £1,650, but they had taken from that fund, so that it stood at £27,027, against £30,372 at the end of 1924.

Scottish Power Co., Ltd.

The net trading profits for 1925 of the undertakings owned and operated by this company amounted to £58,044, of which £10,000 was allocated to the reserves of these undertakings. The balance remaining after meeting expenses and adding £2,503 brought forward is £45,099. After defraying interest, preference dividends, &c., and placing £7,641 to reserve, a dividend at the rate of 8 per cent. is to be paid on the ordinary shares, and £2,702 is carried forward. Transmission and distribution cables have been considerably extended, and additional boiler plant has been installed. It is stated that the services now approach the limits of the company's area of supply. The shareholders may be asked during the current year to sanction an increase in the company's capital. Meeting: To-morrow (Saturday).

Midland Counties Electric Supply Co., Ltd.

The trading profits for 1925 of the companies owned and operated by this concern totalled £171,506, and the balance at credit of profit and loss (including £4,457 brought forward) is £146,727. After meeting debenture interest, interim preference dividend, &c., and transferring £15,000 to reserve, there remains £83,974. A dividend at the rate of 6 per cent. is proposed on the ordinary shares, leaving £4,732 to be carried forward. The company reports a satisfactory increase in the demand which has led to considerable capital expenditure that should be productive in the near future. The traction section failed to contribute in the aggregate to the trading profits. Meeting: March 1st.

Power Securities Corporation, Ltd.

The third annual meeting was held last week, Mr. G. Balfour, M.P., presiding. In the course of his speech, the chairman said that they had proceeded cautiously, and confined their attention to general engineering and electrical development work, and to financial and underwriting business connected with public utility undertakings and public authorities. The electricity supply business in this country had made rapid strides since it was freed from the distraction of legislative proposals, and money was freely found to keep pace with the demand. Referring to the Government's electricity proposals, Mr. Balfour said that he hoped that the Government would confine them to removing and not imposing restrictions. The existing undertakers should be assisted in developing their areas, and private enterprise should be attracted to areas not yet covered. Coming to the company's own affairs, the chairman said that further progress had been made in connection with the Grampian electricity scheme. For the purpose of consolidating the areas, they had acquired two small electricity

undertakings, and were negotiating for two larger undertakings in the area. The volume of work carried out by Balfour, Beattie & Co., Ltd., was well up to that of previous years. Among the contracts being carried out by them was the Lochaber scheme, which would probably continue for another two years. The company's investments stood at £846,793; of this 37 per cent. was invested in electricity supply and allied undertakings, 29½ per cent. in Balfour, Beattie and Co., about 17 per cent. in British Government securities, and 16½ per cent. in industrial securities. The year's gross profit was £96,412, and the net balance £77,965, plus the sum brought forward, making £86,523. £20,000 was transferred to reserve, and the ordinary shares received a dividend of 6½ per cent.

London Electric Supply Corporation, Ltd.

The report for the year ended December 31st last records a profit of £202,426, as compared with £164,863 in 1924. To this is added £32,285 from the last account, and from it is deducted interest of £5,704 on a temporary loan, making £229,007. After providing for interest and sinking fund, there is an available balance of £188,933, which is to be allocated as follows:—Preference dividend, £41,952; ordinary dividend (10 per cent. for the year), £49,950; to reserve, £30,000; to depreciation, £30,000; to contingencies, £5,000; carried forward, £32,031. The sales of energy rose from 61,809,968 kWh to 90,905,284 kWh—an increase of 47 per cent. The average receipts per kWh sold were reduced from 1.56d. to 1.22d. The report makes reference to the developments in connection with the reorganisation of London's electricity supply, and states that the directors are taking the necessary steps to carry out the arrangements embodied in the London Electricity (No. 2) Act, 1925. The meeting is to be held to-day (Friday).

Isle of Thanet Electric Supply Co., Ltd.

The revenue for the year ended December 31st last was £137,990, and the expenditure £85,739, leaving net revenue of £52,251. Debenture interest, &c., absorbs £15,000, and £20,000 is transferred to reserve, and interest of £1,201 and a balance brought forward of £1,403 are added, making a net available balance of £19,854. After paying the preference dividend and one of 2½ per cent. on the ordinary shares, a balance of £3,504 is to be carried forward. Over 750 new consumers were added during the year, and an additional 3,000-kW set was installed to meet the growing demand. To provide capital for cable extensions, &c., the shareholders are to be asked to approve of the increasing of the company's capital by £140,000; £72,000 of this is to be issued forthwith in the form of 6 per cent. cumulative preference shares, which will be offered to shareholders at par, in the proportion of one to five. Meeting: March 1st.

Smithfield Markets Electric Supply Co., Ltd.—The net profit for the past year was £7,670 (after providing for debenture interest, &c., and depreciation); £2,022 brought forward is added, making £9,693. A final dividend at the rate of 5 per cent. is recommended upon the ordinary shares, making 8 per cent. for the year; £2,500 is transferred to general reserve, and £2,393 is carried forward. The output showed a considerable improvement over that of 1924. The report refers to the death of Mr. J. Browne Martin, a director of the company since its inception; it is not proposed to fill the vacancy thus created. The meeting was to be held yesterday (Thursday).

Electrical Distribution of Yorkshire, Ltd.—The accounts for the past year show a net profit of £31,099. To this is added £10,838 brought forward, making £41,937. A dividend at the rate of 7 per cent., free of tax, is paid on the ordinary shares (3½ per cent. was paid in August last); £10,000 is transferred to reserve; and £14,114 is carried forward. A continuous and growing demand is reported, particularly for domestic use. Further Orders have been approved by local authorities, and await the Electricity Commissioners' decision. The issue of 250,000 ordinary shares made last year was considerably oversubscribed by existing shareholders. Meeting: March 2nd.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

Johnson & Phillips.—100,000 ordinary shares of £1 each, fully paid, Nos. 500,001 to 600,000.

Vickers.—12,315,483 ordinary shares of 6s. 8d. each, fully paid, Nos. 1 to 8,190,817 and 8,190,968 to 12,315,633.

General Electric Co.—30,000 ordinary shares of £1 each, fully paid, Nos. 2,111,976 to 2,141,975.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

General Electric Co.—30,000 ordinary shares of £1 each, fully paid, Nos. 2,111,976 to 2,141,975.

Yorkshire Electric Power Co.—765,000 new 6 per cent. cumulative preference shares of £1 each, issued at 21s., partly and fully paid, Nos. 838,001 to 1,603,000.

South Metropolitan Electric Light and Power Co., Ltd.—Final dividend of 10 per cent. on the ordinary shares, making 15 per cent., as in 1924.

Bournemouth and Poole Electricity Supply Co., Ltd.—Final dividend of 5½ per cent., making 10 per cent. for the year, on the ordinary shares, plus a bonus of 4 per cent., free of tax, as in 1924.

Richmond Electric Light and Power Co., Ltd.—A dividend of 10 per cent. has been declared on the old ordinary shares, as in 1924.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Auto Electrical Services, Ltd.
Newcastle and Sunderland Oxy-Electric Welding and Metallurgical Co., Ltd.
Perak Hydro-Electric Power Syndicate, Ltd.
Triumph Electric Manufacturing Co., Ltd.
Vickers (France), Ltd.
World's Electric Co., Ltd.

Companies Struck off the Register.—The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Anode, Ltd.
Boulton Magnetos, Ltd.
British East African Power Development Co., Ltd.
Central Electric (Handsworth), Ltd.
Hightensite, Ltd.
Metallic Electrodes, Ltd.
Scott Electrical Co., Ltd.
Tredelect Dynamos, Ltd.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—To a net income of £39 954 is added £8,219 brought forward, making £48,173. A dividend of 5 per cent. is paid on the ordinary shares; £19,452 is placed to renewals, depreciation and reserve fund; the reinstatement of roads consequent upon the abandonment of tramway routes requires £9,000; and £574 is carried forward. Unrestricted omnibus competition has led to the discontinuance of services on certain routes, and motor 'buses have been substituted. Meeting: to-day (Friday).

Bruce Peebles & Co., Ltd.—The directors recommend the payment of the following dividends in respect of the past year:—On the preference shares, a dividend at the rate of 7½ per cent. per annum, for the half-year ended December 31st, and a further dividend of 2½ per cent. per annum, for the year ended December 31st; on the ordinary shares a dividend for the year at 10 per cent. per annum, together with a bonus of 5 per cent.

Chas. Clifford & Son, Ltd.—There was a net profit of £20,873 for the past year, and the addition of the balance brought forward makes available £50,536. After paying the preference dividend and a total dividend of 10 per cent., and a bonus of 5 per cent., both free of tax, on the ordinary shares, £47,159 is carried forward.

Chelsea Electricity Supply Co., Ltd.—The ordinary shares are to receive a final dividend at the rate of 15 per cent., making 12 per cent. for the year, as in 1924. £17,000 is allocated to depreciation; £15,000 to reserve; and £9,000 is carried forward.

Clontarf and Hill of Howth Tramroad Co.—The general meeting of this company was recently held in Dublin, under the chairmanship of Dr. W. Lombard Murphy. The report and statement of accounts were adopted, and a dividend of 3 per cent. was declared.

Aberdeen Suburban Tramways Co.—The profit for the half year ended January 31st last was £188. With the addition of the sum brought forward there is a balance of £3,318 to the credit of profit and loss account. Meeting: To-day (Friday).

Crossley Bros., Ltd.—The net profit for 1925 was £60,383, and the addition of £19,075 brought forward, makes £79,458 available. The final dividend is paid on the preference shares, and a balance of £51,220 is carried forward.

Barcelona Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1¾ per cent. upon the 7 per cent. non-cumulative participating preference shares.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Final dividend on the ordinary shares, making 7 per cent. for the year, as in 1924.

Direct West India Cable Co., Ltd.—The directors have declared an interim dividend at the rate of 10 per cent., free of tax.

Shawinigan Water and Power Co.—A dividend of $2 per share on the common stock has been declared.

Halifax and Bermudas Cable Co., Ltd.—An interim dividend at the rate of 10 per cent., free of tax, has been declared.

Pennsylvania Water and Power Co.—A dividend of $2 per share has been declared for the quarter ending March 31st.

Stocks and Shares.

MONDAY EVENING.

THE London electricity supply companies have nearly finished the tale of their dividend declarations in respect of the second half of last year, and the distributions in every case have been maintained at those of the previous rates. That is to say, the dividends for 1925 are unaltered from those of 1924, in the London companies. This, while it has created a mild degree of disappointment among people who hoped that the companies would do something dramatic in the way of dividend declarations on the eve of the change-over, is a policy that is claimed as sound by others who contend that the companies are well-advised to strengthen their cash resources at a time like the present.

The effect upon prices of the dividend announcements has been actually nil. The factor that influences quotations at the moment is what is likely to happen when the reorganisations of capital are completed. Nor do all proprietors feel thoroughly happy at the outlook which confronts them, and which, as we have previously observed, is likely to be no worse, to say the least of it, than that which has prevailed during the past few years.

In the circumstances it is natural to look for dullness in the prices of electricity supply shares. St. James's, however, have risen ⅛ to 16¼. Bromptons and Charing Cross are both 1/16 down. The rest of the London list is unchanged. Yorkshire Electrics at 29s. 6d. are quoted ex dividend. Midland Counties are 6d. higher at 24s. 3d. upon the company's report showing an increase in net profit of £18,800 to £142,000. The company has to pay this year on extra capital, but the dividend on the ordinary shares is maintained at 6 per cent., to which it was raised from 5½ per cent. paid in 1923. The issued capital in the latter year was £1,723,519, whereas now it is within a few pounds of 2½ millions sterling. In all companies of this kind the tendency must be, of course, for the capital accounts to expand. As previously mentioned, the shares of these undertakings are in request by people who, recognising the inevitable growth of the concerns, recognise also the likelihood of new issues of shares being made at prices that will provide, in one manner or another, a bonus to the proprietors. The Electrical Distribution of Yorkshire pays its usual dividend of £7 tax free, and the net profit of £31,000 is £5,400 better than that of 1924. The Oxford Electric dividend of 7 per cent. is a rise of 1 per cent. over the previous year's rate. The shares stand at 5¼.

The Metropolitan Electric Supply Co. is promoting a Parliamentary Bill which, if carried in its entirety, will give the company extremely wide powers. The assumption is, however, that the company has gone "all out" for everything, in the hope of getting at least part of its proposals granted. Considerable opposition is set down against the Bill.

The feature in the Home Railway market is the rise to 100 in Underground Electric Income Bonds. These have been in speculative-investment demand for some time past, and the rather disappointing results achieved by the Tubes, as shown by the reports out a week ago, have had no effect in stopping the absorption of these bonds, which are being picked up for American account as well as for local consumption. The company's £10 shares have recovered to 2⅜, and Central London assented ordinary is a little better on balance at 68 x.d. London and Suburban Traction preference strengthened to 5s., London United Tramway debenture remains unchanged at 45.

The Traffic Committee, according to Sir Henry Maybury, is unanimously of opinion that tramways form an essential form of transport in London. His remedy for the present congestion lies in co-ordination of all traffic services, to which end he contends that resources should be pooled. It is with this idea in their mind that speculators have recently been buying London Tramway issues in a manner which is reflected in the prices of London and Suburban preference, and London United Tramway debenture.

A further remarkable rise has occurred in the price of Brazilian Tractions. The price touched 100 before it reacted to 99. Canadian buying is still declared to be the inspiration for the virility of the market, and as we have mentioned on many previous occasions, the Canadian-American interest is declared to be eager to obtain control through purchases of the shares. A curious, slightly humorous, rise occurred in Monterey "C" debenture, the price going from 1-3 to 2-6. Anglo-Argentine Tramways preferences of both classes are a little easier. British Columbia preferred strengthened a trifle.

Wireless shares continue dull, Marconis going back to 23s. 9d., and Radio common to 8½. The latter company's preferred keep tolerably steady at 9⅜. On the other hand, Marconi Marines are better at 18s. 9d. Burndept preferred rose from 13s. 9d. to 15s. bid. Cable stocks are inclined to strengthen, and amongst telephones, Automatics went back to 52s., after being 53s.; they show a small rise on balance.

Iron and steel shares show a fair degree of firmness, the outstanding feature being a rise of 1/16 to 53s. 9d. in Babcock and Wilcox. It is thought that the company is likely to benefit, not only from the Government's proposal to extend electrical development throughout the country, but also from the latest move guaranteeing capital for extension of the Kentish coalfield, in which Dorman Long and Pearsons are intimately interested. The cable equipment shares have moved but little. Speculation in these is subsiding noticeably. Brush and Metropolitan-Vickers ordinary are down to the common level of 27s.; on the other hand, Siemens strengthened to 31s. 3d. Telegraph Constructions maintain their rise at 29.

The London Power Co. achieved immediate success with an offer of three million pounds 5 per cent. redeemable debenture stock. This was eagerly snapped up at 96. The security, backed as it is by ten of the leading electricity supply companies in London, can be regarded as first-class, and the stock is gilt edged. The principal is repayable at par in 1972. The stock will take rank as one of the best of its kind in the eye of the cautious investor who wants permanency as well as safety for his capital.

Rubber shares are a dull and dispirited market, owing to the price of the raw product, which dipped to 2s. 4¾d. per lb. The slump has frightened some of the more nervous amongst rubber shareholders, and the fall in prices, from the best levels reached, is now substantial.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923	Dividend. 1924.	Price Feb. 22, 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	13	14	63/3	—	4 8 7
Brompton Ordinary	1	10	10	1 1/16	−1/16	*5 18 6
Charing Cross Ordinary	1	14½	15	45/9	−1/3	6 11 2
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2⅛	—	5 12 11
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/-	—	5 6 8
County of London	1	15	15	£0/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14¼	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5 5/16	—	5 7 10
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	+6d.	4 19 0
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	24/6	—	5 14 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16¼	+⅛	5 7 8
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 5/16	—	5 6 8
Urban Ordinary	1	4	4	19/6	—	4
do. 6% Pref.	1	6	6	1	—	6 0
Westminster Ordinary	1	15	15	46/3	—	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	—	7 10 0
Yorkshire Elec.	1	8	8	29/6xd.	—	5 8 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68xd.	+½	5 17 8
Metropolitan	,,	4	5	68½	—	7 6 0
do. District	,,	3½	3½	47½	—	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2⅜	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	6	6	100	+1	*6 0 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	1	3	6	52/-	+9d.	2 6 2
Chili Telephone	5	6	5	6½	+1/16	*3 16 11
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	+1	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18¼	—	*5 9 7
do. do. Pref.	10	6	6	11	—	5 8 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	23/9	—1/3	8 8 6
Marconi Marine	1	10	7½	18/9	+1/3	8 0 0
Oriental Telephone Ord.	1	12	12	2⅛	—	*5 12 11
United R. Plate Tel.	5	8	8	7⅛	+1/16	5 1 7
Western Telegraph	10	10	10	17⅛	—	*5 11 11

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3 3/16	—1/16	8 13 6
do. do. 2nd Pref.	5	6	6	3 1/16	—1/16	9 16 0
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	106	—	5 13 2
Brazil Traction	100	4	4	99	+6	4 5 1
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	104	+½	*4 12 4
do. do. Deferred	,,	129/5	129/5	128	—	*5 1 7
do. do. Deb.	,,	4¼	4¼	79	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/-	+6d.	Nil
London United Tram. Deb.	Stock	4	4	45	—	8 17 10
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	64½	—	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	16/3	—1/3	6 3 1

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	2 1/16	+1/16	*4 9 5
British Aluminium Ord.	1	5	10	38/9	—	5 0 2
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3	—1/16	5 0 0
Brush Ord.	1	10	10	27/6	—6d.	7 5 6
Callenders	1	15	15	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	—	5 18 6
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	31/6	—	4 15 3
Henley	1	15	16	3⅝	—	4 8 3
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1½	—	*4 0 0
Johnson & Phillips	1	10	10	2 1/16	—	3 8 3
Met.-Vickers, Ord.	1	8	8	27/-	—6d.	5 18 6
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	31/3	+1/3	4 16 0
Telegraph Construction	12	20	10	29	+½	*4 2 9

*Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in January, 1926.

THE export figures for January are not encouraging; there was a decline of £84,086 as compared with the previous month, while comparison with the corresponding period of last year shows a fall of £364,209. The decline from the December, 1924, total (£84,086) was mainly due to the decreased exports of unenumerated electrical machinery, while submarine telegraph and telephone cable also contributed to a large extent. The increases were greater in number but failed to compenstate for the fall in these two items. The seriousness of the decrease of over £364,000 from the January, 1924, figure is somewhat mitigated by the fact that £259,193 of it was due to a fall in the value of submarine cable exports; this, as we have previously observed, is an item subject to very violent fluctuations, rendering comparisons very difficult and often misleading. Apart from this, however, the decline was certainly a large one—in the neighbourhood of £100,000—and was attributable mainly to the decreased shipments of motors and generators and telegraph and telephone instruments and apparatus.

The fall in the import total, while numerically smaller than in the case of the exports, was proportionally larger, and was, moreover, a general decrease. Only three items rose, the principal increase occurring in telegraph and telephone wires and cable (not submarine). The most noticeable decline occurred in the item "batteries and accumulators," which, by the way, was accompanied by a rise in the exports of these articles. The fall in the imports of insulated wires and cables was also attended by a rise in the export section. In comparison with January, 1924, imports were down by £70,729, telegraph and telephone apparatus and batteries and accumulators being mainly responsible for this. There was a substantial increase in the importation of unenumerated electrical goods.

As compared with the preceding month, re-exports were uninteresting, but the total represented only two-thirds of that of January, 1924. The decrease was well distributed; only glow lamps and batteries and accumulators showed a rise.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.	Electrical imports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.	Electrical re-exports for Jan., 1926.	Inc. or dec. as compared with Dec., 1925.	Inc. or dec. as compared with Jan., 1925.
Electrical goods and apparatus (unenumerated)	£167,811	+ £11,335	+ £11,488	£125,374	— £5,451	+ £24,923	£6,980	+ £1,338	— £3,882
Insulated wires and cables ...	268,560	+ 15,146	+ 31,747	47,693	— 26,466	— 7,560	237	— 424	— 776
Glow lamps	42,381	+ 2,092	— 1,341	44,606	+ 7,665	+ 8,430	2,261	+ 1,836	+ 2,034
Arc lamps and parts	2,187	+ 1,184	+ 1,947	330	— 1,188	— 1,109	2	— 10	— 151
Batteries and accumulators ...	85,806	+ 10,669	+ 8,654	24,556	— 25,972	— 43,088	1,274	+ 730	+ 750
Meters and instruments ...	22,300	— 5,928	+ 4,645	20,395	— 2,372	+ 411	728	— 971	— 2,059
Carbons	2,499	+ 1,379	— 1,581	4,268	— 4,994	— 3,339	106	— 348	— 99
Electrical Machinery—									
Electrical machinery (unenumerated)	224,318	— 76,717	— 15,974	84,198	— 18,108	+ 20,219	5,764	— 2,041	— 946
Railway and tramway motors	45,405	— 345	— 26,751	—	—	—	—	—	—
Other motors and generators ...	203,847	+ 6,214	— 54,983	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4,929	— 4,171	— 2,361	257	+ 32	+ 182	—	— 30	— 924
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	68,590	+ 5,796	— 15,624	34,664	+ 20,099	+ 18,061	17	— 47	— 89
Submarine telegraph and telephone cable	14,323	— 43,914	— 259,193	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	210,370	— 6,826	— 44,882	50,853	— 20,083	— 77,859	4,438	— 974	— 4,710
Totals	£1,363,326	— £84,086	— £364,209	£437,194	— £76,838	— £70,729	£21,807	— £941	— £10,852

An Extra-High-Pressure Cable.

Some Constructional Details and Test Results of the New Pirelli Cable.

THE rapid growth in the demand for electrical energy, and the concentration of generating plant in large power stations, has made the use of very high-pressure transmission lines a necessity. Hitherto, transmission at 11,000 and 22,000 volts has answered the purpose; 33,000 volts has now become standard practice, and many miles of underground cable are working satisfactorily at this pressure. It is, however, not sufficient for the transmission engineer, who sometimes requires voltages very much higher for his purpose; and in consequence pressures above 35,000 volts have had to be dealt with by overhead lines. The dangers and objections which beset overhead transmission, however, are many, but for the time being there is little or no alternative. The problems which confront cable makers in competing with overhead work are difficult, and considerable amounts of time and money are being spent in research work to develop cables of suitable design and construction to meet the situation. In the meantime the developments in connection with the new H.p. cable, made by Messrs. Pirelli, Milan, are being closely watched, and it is interesting to learn that the makers have built and installed underground cables which have been operating successfully for a considerable time on 3-phase systems, at pressures higher than 35,000 V. In Barcelona 6½ km of cable (19.5 km. of single core) is working at 50,000 volts, between phases. In the Gothard Tunnel, power at 60,000 volts single phase is carried over 22 miles of cable; and, as reported by Mr. Emanueli, at the "Conference Internationale des Grands Reseaux Electriques" in Paris, an experimental line of three single-core cables, each 600 metres long, has been laid in conjunction with an overhead line, and has been operating at 130,000 volts without interruption for the past two years. This cable was briefly described in the ELECTRICAL REVIEW, May 1st, 1925, and we have received from Messrs. Pirelli-General some further particulars concerning its construction.

There are several novel features in the design of this cable, many of which are covered by patent rights, and in some cases the processes used are not available for publication. The conductor is made hollow, as shown in fig. 1 (full size), and the necessary number of copper wires are laid up on the outer surface of a galvanised iron or h.d. copper spiral, which provides sufficient support to maintain the tubular formation, and at the same time, being elastic, is able to accommodate itself to movements due to handling.

The insulation is of paper and is applied in the usual manner, but it is graded, according to its permeability, so as to present a dielectric strength proportional to the pressure gradient at all points from the conductor to the lead covering. Graded paper insulation, as regards thickness of paper, has been used by manufacturers for some years past, but in 1919 Mr. Emanueli discovered that a relation existed between the porosity of the paper and its dielectric strength. Graduation, therefore, is determined not by the thickness of the paper, but by the degree of its permeability to fluid. This quality

is measured by means of a suitable apparatus, in which the paper to be tested is traversed under a certain pressure P by a fluid, which may be air, and then, by measuring the time t, required for a determined volume s of the fluid in question to penetrate the thickness of the paper, a coefficient A, strictly related to the permeability, can be obtained by a suitable manipulation of the quantities t, s and P, together with the coefficient of viscosity n of the fluid, $A=f(t, s, P, n)$.



Fig. 1.—Section of e.h.p. Cable.

The dielectric strength may be determined by any of the well-known means.

The principal conclusion drawn from researches made in this direction is that, the impregnating compound being constant, the dielectric strength is, up to a certain point, greatest in the least permeable paper. For example, a paper of A = 50,000 dried and impregnated is perforated at 15,000 volts/mm., whereas a paper of A=370,000, similarly treated, requires a pressure of 37,000 volts/mm., before it can be perforated. However, no further increase of dielectric strength is obtained with papers of a higher A (see fig. 2). In order, therefore, to obtain a high resistance to perforation in cables for conveying very high-pressure electrical energy it would be necessary to use only paper possessing a very high degree of impermeability, or at least not below a certain limit (A = 400,000).

Layers of highly impervious paper (50 kV/mm.) are applied next to the conductor—and it would appear to be an extremely simple matter to build very high-pressure cables by continuing the use of this paper throughout, but practical difficulties arise, as the density of this paper prevents the thorough impregnation of the core, consequently successive outer layers are composed of papers of gradually decreasing density—that next to the lead having a dielectric strength of 30 kV/mm. The highest stresses are, therefore, met by the insulation of greatest density, and the lower stresses by insulation of corresponding lesser densities. In this way highly efficient insulation is obtained, and the over-all diameter of the cable reduced, without, however, in any way reducing its factor of safety. The very unusual practice is adopted of lead-covering this type of cable before, instead of after, drying and impregnating. Dry air is passed through the hollow centre, and by application of electrical tests the process of drying is watched throughout, and the required result obtained with certainty. Impregnation also takes place from the centre of the cable, to which a vacuum is directly applied. Better results are found to be secured by producing, within the cable itself, a higher degree of vacuum than can be obtained when employing the usual method of tank impregnation.

In the installation of this cable the central cavity is maintained through the joints. At the terminal ends and intermediate points it is connected with tanks placed at suitable heights, and the whole is filled with a light insulating oil. By this means oil is kept in the hollow core under pressure and in immediate contact with the insulation throughout the whole length of the cable, and expansion and contraction of the oil, due to temperature rise or fall, is accommodated in the reservoirs.

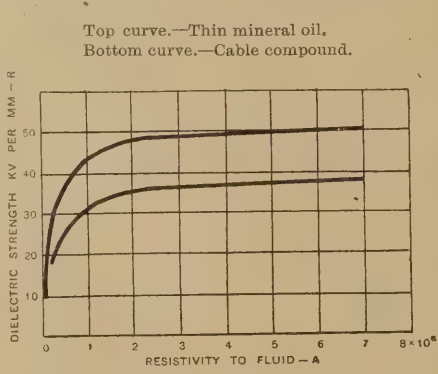


Fig. 2.—Dielectric Strength and Resistivity.

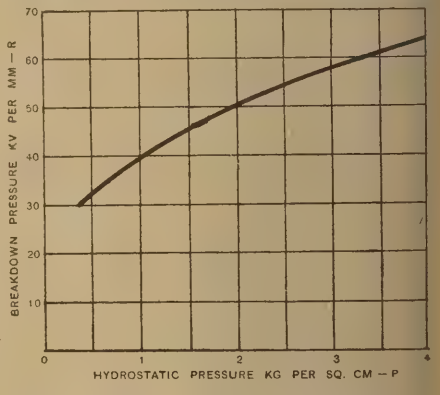


Fig. 3.—Dielectric Strength and Fluid Pressure.

It is interesting to note the effect of increasing the pressure on the dielectric strength of the cable paper impregnated with this thin oil. Fig. 3 shows that an increase of pressure from 1 to 4 kg./cm.² is sufficient to double the breakdown voltage.

This design overcomes many of the difficulties that are met with in the usual form of cable; the use of three separate lead-covered cores eliminates the dangers set up by tangential stresses which assume serious proportions in very high-pressure 3-phase cables. The hollow construction, and the use of the thin oil, ensure that the cable is full of oil at all conditions of load; the expansion tanks supply oil when required, or receive excess oil and store it, to suit the changing conditions. Thus no voids or gas spaces are formed in the cable, and no deterioration takes place.

The joints are made by using a copper tube, upon which the conductor wires are laid and soldered, thus maintaining the tubular passage. The insulation of the cable, having been tapered down from the lead to the conductor (the tapered portion extending over a considerable length on both sides of the joint), is built up with strips of impregnated paper. Here, as at the terminals, the perfect impregnation which is obtained, due to the hollow design, considerably assists in eliminating the serious disadvantages which arise from the presence of gas pockets; consequently the over-all diameter of the joint is little more than that of the cable itself. To prevent the joint absorbing moisture whilst the insulating tape is being applied, hot dry air is blown on the joint during the whole of the process. The joint is then impregnated, and to ensure this being thoroughly done, a vacuum is produced in the hollow centre of the cable, and sufficient current passed through the conductor to warm up the cable, and to make the compound more fluid to penetrate the insulation and to drive out all traces of humidity. The insulation over the joint is then covered with metal foil, contact being made with the lead sheath on both sides, in order that the stresses due to the sheathing may be continued, without interruption, throughout the length of the cable. At the terminals the lead sheath is bell-mouthed to a specified shape, so that the stresses parallel with the paper insulation are constant from the point where the sheath ceases to be in contact with the insulation to that where the insulating material increases in thickness.

These cables are laid direct in a trench, approximately 30 in. deep by 20 in. wide. They are, of course, unarmoured, but the lead sheaths are protected by layers of suitable waterproofing material. They are laid with 6 in. between centres, separated from each other by a line of bricks, and protected by brick covers. All the sections constituting the line in Italy were tested before leaving the works, with 150,000 volts for 15 minutes, then with 175,000 volts and 200,000 volts for one minute. A short length was tested with 275,000 volts for two minutes, and then 150,000 volts for 24 hours, without sign of hot spots. When the cable was laid, jointed and connected to its special terminal ends, the system was tested up to 180,000 volts, 3-phase, this being the highest available pressure. Dielectric loss/voltage (fig. 4) and dielectric loss/temperature curves (fig. 5) show the remarkably good results obtained with this method of construction.

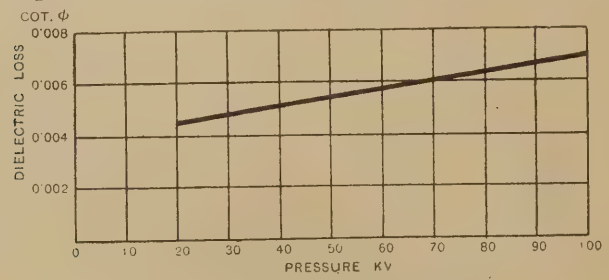


Fig. 4.—Dielectric Loss and Pressure.

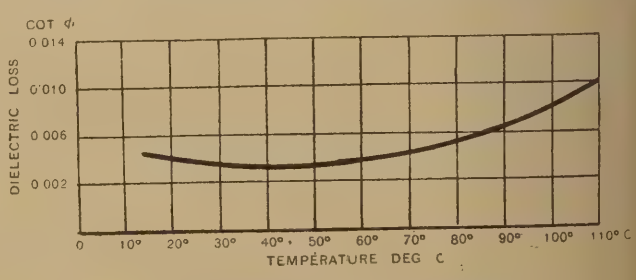


Fig. 5.—Dielectric Loss and Temperature.

It will be recalled that a special design of pothead is used for terminating this cable, and the construction of it was described and ilustrated in the issue of the ELECTRICAL REVIEW already referred to.

It is interesting to note that the N.Y. Edison Co. has ordered a cable of the above type for 132,000-V transmission, and that a similar cable for 140,000-V working is to be supplied to Chicago.

The London Telephone Service.

Developments and Progress during the Year 1925.

A STATEMENT of progress in 1925, signed by Mr. W. A. Valentine, controller of the London telephone service, and Mr. R. McIlroy, superintending engineer of the London Engineering District, shows that the London telephone area covers approximately 750 sq. miles, and extends from Reigate in the south to Waltham Cross in the north, and from Tilbury in the east to Hayes in the west. The requirements of this area are at present met by 107 exchanges, including the trunk (long-distance) exchange, which handles traffic to the more distant provincial exchanges, the Irish Free State, and the Continent, and the toll exchange, which deals with traffic to the nearer provincial exchanges. They vary in size from 100 to 10,000 lines, and the number of exchange lines connected at the end of 1924 was 244,342; at the end of 1925 the net increase was 25,459, or about 10.4 per cent.

There is an increasing demand for private wires; the increase during the year was 1,200, and the total number is now 15,000. The total number of telephones (exchange and private) at the end of 1925 was 476,813, a net increase of 37,590. Private branch exchanges (p.b.x.) total 21,000; of this number, 62 are automatic. At the request of subscribers, approximately 28,000 removals and alteration of apparatus were effected. Call offices working at the end of 1925 numbered 4,403, the increase for the year being 260. Kiosks, at which a day and night service is provided in the streets, numbered 212. Multi-coin boxes for call offices, which permit the use of shillings and sixpences for long-distance calls, as well as pence for short-distance calls, meet the public need, and extensive development is contemplated.

Four new exchanges were opened to serve new areas, Albert Dock, Franklin, Mill Hill, and Sloane, providing an increased capacity of 5,600 lines. Six new exchanges were provided to replace exchanges already existing at Enfield, Grangewood (formerly East Ham), Malden, Palmer's Green, Pinner, and Tilbury; in addition, the equipment of 47 existing exchanges was extended and provide (with the new exchanges mentioned) additional capacity of approximately 24,000 lines. Work in hand includes ten new exchanges and the extension of 27 existing exchanges, to provide increased capacity of 36,440 lines; new exchanges and extensions projected for the present year will provide a further 30,000 lines. If the anticipated rate of telephone growth is maintained, it will be necessary during the next eight years to open 71 automatic exchanges within 10 miles from Oxford Circus and 33 manual exchanges outside that radius, but within the London Telephone area, which will provide for the replacement of worn-out plant as well as for growth.

During the past year an extension of the toll exchange was completed, increasing its capacity by 25 per cent. A new toll exchange of approximately twice the capacity of the present exchange, and designed to work in conjunction with it, is expected to be completed in 1926. New underground cable has been provided between London and Glasgow, and five new direct lines have been brought into use between these cities. Work has commenced on additional cables to carry trunk and toll circuits from London to Farningham, Tonbridge, Sutton, Stanmore, Leatherhead, Cambridge, and Derby, most of which cables have been brought into use. There are 14 new exchange buildings under construction, and sites for 21 additional exchanges have been secured, but considerable difficulty is experienced in acquiring sites for exchanges in suitable situations.

There has been a rapid increase of line plant during the year: The total mileage of single wire provided for subscribers' lines and local junctions is now 1,800,000, an increase during the year of 131,000 miles; the total mileage on December 1st, 1918, was 1,100,000. The great majority are underground, of which there are 7,000 miles, each cable containing from 20 to 2,000 wires; the weight of copper in these cables is over 10,000 tons, and 40,000 tons of lead has been used to sheath them. Earthenware ducts and iron pipes increased during the year by 693 miles to 6,450 miles. The total length of pole line in London is 5,280 miles, and the mileage of single wire carried on them is 63,294. The amount of "open" wire shows a tendency to decrease, as the increasing telephone density in some areas renders it economical to use underground cables. In some of the more important streets in the City area it has been necessary to resort to tunnelling. The automatic installations in hand represent a capacity of about 45,000 lines, and those projected about 147,000 lines—about 192,000 lines in all in the section of the automatic programme which has been commenced. Progress has been made with the "tandem" exchange, the purpose of which is to facilitate calls to and from subscribers connected to exchanges between which there is not sufficient traffic to justify the provision of direct groups of junctions; about 8,800 junction lines will be connected to the tanden exchange.

During the year the largest private automatic branch exchange in the country (that serving the Port of London Authority and its various sub-departments) was opened. Automatic exchanges have also been provided at the following docks:—London and St. Katherine, India and Millwall, Victoria and Albert, Surrey Commercial, and Tilbury; the initial equipment caters for 740 extensions, but provision has been made for extension to 1,370 ultimately. During 1925 orders were taken for 26 private automatic branch exchanges, as compared with a total of 52 such orders in the preceding three years.

At present London subscribers originate, on the average, 1,667,000 calls per working day, or about 478,600,000 calls per year, an increase of about 7.5 per cent. as compared with the previous year; of the average daily traffic, about 256,000 calls are made during the busy hour of the morning, so that about 15 per cent. of the 24 hours' traffic is handled in a single hour. Day and night service is given at all exchanges, and on the average about 61,000 calls are originated daily between 8 p.m. and 8 a.m. About 80 per cent. of the total calls originated are made to subscribers on other exchanges, and to accommodate this inter-exchange traffic over 29,000 junction lines have been provided, an increase of about 9 per cent. on last year's total. The number of calls outgoing from London daily at the trunk and toll exchanges is about 26,500, an increase of about 7.2 per cent. over the preceding 12 months.

For the Anglo-Continental traffic, additional lines have been provided to Amsterdam and Rotterdam, and the traffic has risen appreciably. The service is available between all British and Dutch exchanges; there is also direct service to Antwerp, Brussels, and Ostend open to all Belgian towns. Taking the Continental traffic as a whole, 50 per cent. is to France, 24 per cent. to Holland, 21 per cent. to Belgium, and 5 per cent. to Switzerland.

The Phonogram room at the Central Telegraph Office, for the reception and transmission of telegraph messages direct from and to telephone subscribers, has 380 junction circuits to 68 telephone exchanges in the London area, while facilities have been provided for the employment of 220 telephonists to receive and transmit telegraph messages, and an extension to accommodate an additional staff of 72 is now in hand. The number of phonograms dealt with during 1925 was 1,423,781, the increase being about 12.3 per cent. From the public point of view the phonogram service is rapidly increasing in attractiveness. On Christmas Eve no fewer than 19,000 telegrams were forwarded and received by telephone.

The operating staff employed in the exchanges of the London telephone service numbers about 8,200 telephonists and supervisors. Over 1,200 new entrants to the service passed through the Clerkenwell operating school during the year and, in addition, seventy telephonists employed by subscribers for their private branch exchange work were trained in standard methods of operating. Eight telephone officials from other countries visited the school to study the methods employed in training the staff. Over 70,000 engineering workmen are employed, about two-thirds of them on construction and development work and the remainder on maintenance.

The operating of over 100,000 calls was observed, and statistics indicate that the average time of answer to the subscribers' calling signals for the year was 5.4 seconds, 89.4 per cent. of the calls being answered within 10 seconds, or less. Complaints from subscribers regarding local call charges are decreasing. The electrophone exchange was closed on June 30th, 1925. The number of subscribers reached 2,080 in January, 1923, but the introduction of wireless broadcasting resulted in a gradual diminution. At the G.P.O. South, apparatus is to be used for amplifying speech received over long trunk lines, and a set already installed has given satisfactory results. The introduction of this apparatus will appreciably extend the range of speech, as the attenuation due to the use of long lines can be corrected by means of valve amplifiers.

The City Smoke Problem.—In an address delivered before the Circle of Scientific, Technical and Trade Journalists, on February 16th, Dr. John S. Owens, B.A., A.M.Inst.C.E., pointed out that the pollution of the air by smoke resulting from the growth in size of cities had grown so gradually that the magnitude of the evil was not fully recognised. He divided the problem of obtaining clean air into two parts: First, the production of an active desire on the part of the community to keep the air clean; without this, the second, or technical, part of the problem, namely, the finding of the means, would not be likely to be solved. The smoke problem was essentially a public one; the evil effects were rarely felt by the smoke producer himself, but by his neighbours. The contrast between the care taken to keep water and food supplies pure and unpolluted and the little attention given to the provision of pure air was indicated; the economic cost to the country was also mentioned, and it was stated that smoke cost, in London, about 24s. per head of the population per annum, when all its effects were taken into account. In Manchester the cost was about 30s. per head, and in other cities it was doubtless much higher. There was thus a colossal waste which was largely avoidable. The keynote of Dr. Owen's address was the part the Press had to play in bringing about improvement, by removing the public apathy and producing a desire for such improvement, without which there would be little progress.

The Electric Propulsion of Ships.

Some Details of the Equipment of a 17,000-h.p. Twin-screw Liner.

(*Abstract of Paper read before the* North-East Coast Institution of Engineers and Shipbuilders.)

At a well-attended meeting of the N.E. Coast Institution at Newcastle-on-Tyne recently a paper on the above-named subject was read by Mr. W. J. Belsey (of the British Thomson-Houston Co., Ltd.), in the absence of its author (Mr. Eskil Berg, of the General Electric Co., of America). Sir William J. Noble, past president, occupied the chair, and the reading of the paper, which is abstracted below, was followed by a discussion.

The paper contends that the electric propulsion of ships can no longer be considered in the experimental stage. Its use by the United States Navy during the last ten years, and its application to a few rather large cargo steamers as well as several other types of ships, have proved this method successful, reliable, economical, and the upkeep of the electrical apparatus has been practically nil.

For large powers where steam is considered, the steam turbine must be used on account of its high efficiency, as compared with any other steam prime mover; in order to obtain the best efficiency, the machine must be designed for relatively high speed (r.p.m.), which makes it necessary to interpose either mechanical speed reduction or electrical transmission between the turbine and propeller shafts. Mechanical gears for large powers require a multitude of turbines and pinions, complicated steam piping and cross-over connections between the various turbines, as well as a multitude of turbine gland packings. Reversing turbines are a source of great loss, not only friction loss, but, as they necessarily make the turbine longer (which makes the distance between bearings greater) a larger diameter shaft for the same deflection is involved, thus increasing the packing losses as well as bearing losses. With mechanical gears, the turbines adopted have generally to be of lower speed (r.p.m.) than that which would give the most economical design for the horse-power required. This item is important, as, in almost every case, the lower-speed turbine with the features mentioned above will involve a loss in turbine economy that is a great deal more than the total electrical transmission loss; in some cases, it may be more than double the electrical losses.

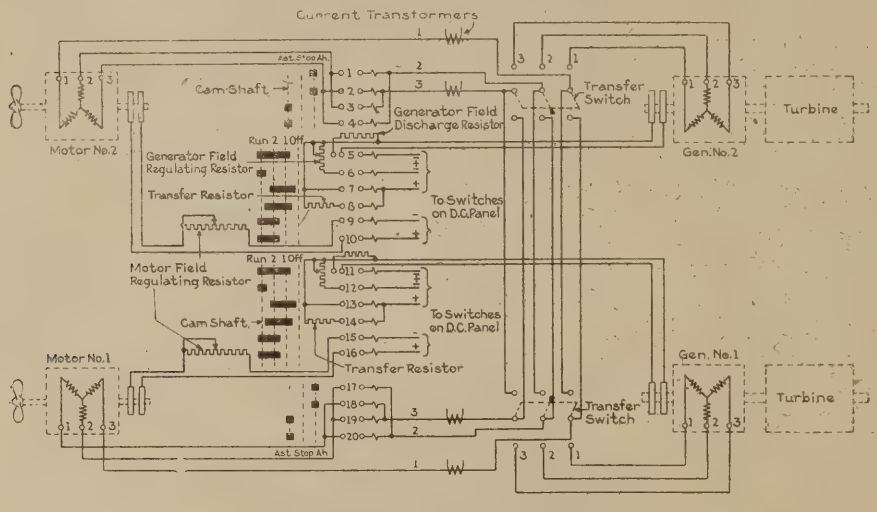


Fig. 1.—Diagram of Electrical Connections.

In electric ships full advantage can always be taken of new improvements in turbine design which develop in the enormous field of turbo-generators for central station use; in other words, the very latest turbine designs can always be used. The enormous advantage in economy by the use of high steam pressure, steam temperature, steam extraction for heating boiler feed water, &c., can be secured in the electric ship without any complication and with practically no special divergence from standard modern steam station practice. Many stations are successfully using 550 lb. boiler pressure and a steam temperature of 725 deg., which produce 1 kWh at the switchboard with about one pound of coal of 14,500 B.th.u. This is not a record of a few hours' operation, but is a weekly record, and includes the whole power plant, taking into consideration load factor, cleaning boilers, &c. What this means on board ship may be illustrated by the fact that a large luxurious liner using 50,000 h.p. can be operated with a total fuel consumption of less than 300 tons of fuel oil per day, including everything on board the ship.

Recently the International Mercantile Marine has closed a contract with the Newport News Shipbuilding Co. for an electrically-driven, twin-screw, passenger-cargo liner having 17,000 h.p. The propelling machinery is to be built by the General Electric Co. of the United States of America, and the dimensions and particulars of the ships will be as follows:—Length, 600 ft.; beam, 80 ft.; draught, 30 ft.; displacement, 22,000 tons; propeller speed, 120 r.p.m.; horse-power, 17,000; speed, 18 knots; propellers, 18 ft. 6 in. in diameter, 17 ft. 3 in. pitch. The steam pressure at the throttle will be 250 lb.; superheat at throttle, 100 deg. F.; vacuum, 28½ in. The 12 Babcock & Wilcox oil-burning marine boilers will have each 4,600 sq. ft. of heating surface and 1,344 sq. ft. of superheating surface. The two turbine-driven alternating-current generators will have a rating of ATB 2—6,600 kW, 2,888 r.p.m., 4,000 volts. The two main synchronous induction motors for direct connection to the propeller shafts will have a rating ATI 48—6,600 kW, 120 r.p.m., 4,000 volts. There will also be four 500-kW direct-current generating sets.

In this case no attempt has been made to reduce the weight of the apparatus from that used for land purposes:—

The weight of the two turbo-generators, including all accessories, tools, &c., will be ...	306,000 lb.
The two main propelling motors will weigh ...	338,000 lb.
Complete control equipment, including cables	17,000 lb.
Total ...	661,000 lb.

Weight per shaft horse-power, 39 lb.

Electric propelling machinery has also been laid out for a light cruiser having 120,000 h.p. In this case the weight is of the greatest importance and the equipment would weigh 18 lb. per shaft horse-power.

The price of the electrical propelling equipment complete in this case is substantially the same as the geared-turbine equipment proposed for this ship, but on account of simplier and less costly foundations, piping, oiling system, &c., it was found to be cheaper than any other method of propulsion proposed.

The control apparatus will consist of contactors for closing the electrical circuits between the generators and motors; it will be operated by means of four levers (two for each motor). In addition, there will be two small levers for regulating the speed of the main turbines. The two main levers for each propulsion motor will consist of: One for regulation the excitation of the generator and the motor; the other is the reversing lever, which will have three positions, "ahead," stop," "astern." The field lever will have four definite positions, "off," "1," "2," "Run." On position "1" double excitation will be applied to the generator alone; in this position, with the reverse lever on either "ahead" or "astern," the propelling motor will be started or reversed as a pure squirrel-cage induction motor. In position "2" normal excitation will be applied to the rotor field, leaving double excitation on the generator; in this position the motor will phase in and become a synchronous motor. Position "run" reduces the excitation of the generator to normal.

Speed variation of the propeller revolutions in either direction will be obtained by varying the turbine speed, controlled by the operator from the small lever on the control board. Normally both turbo-generators will be in operation. Should, however, it be desired at any time to operate the ship at three-fourths speed (or lower) for a considerable length of time, only one generating unit need be used and both propelling motors can be operated from the control board exactly in the same way as when both units are running. This feature should prove most economical should the ship be used for cruises during the slack season, as in this case almost 15 knots can be obtained.

The motors and the generators are designed to give the necessary torque to reverse the propellers from 120 r.p.m. ahead to 120 astern in 20 seconds; quicker reversal can be had, but is not considered advisable. Fig. 1 is a diagram of connections of the electrical circuits and fig. 2 shows the arrangement of the machinery in the ship, but is subject to slight changes at the present time.

The steam consumption per s.h.p. delivered to the propeller shaft (including all losses in generators, motors, cables, &c.), will be 9.5 lb. when delivering 17,000 h.p. to the propeller shaft at 120 r.p.m.; when delivering 13,500 h.p. at 110 r.p.m. under the same steam conditions the consumption will be 9.9 lb., and considerable margin is included in these figures to take care of sea conditions and inaccuracy of tests. If electrically-driven auxiliaries are used, the fuel consumption per s.h.p. hour, including everything on the ship, at 17,000 h.p., will be 0.85 lb., and at 13,500 h.p. 0.90 lb.; in these calculations slightly over 1,000 kW direct-current load has been assumed in both cases. This ship will be operated with only 100 deg. F. superheat. The design of the turbine is, however, made to use efficiently and safely 300 deg. should it at a later date be desired to increase the superheat, or if new additional ships

should be built. The fuel saving by going to 200 deg. over 100 deg. is 5 per cent. and to 300 deg. over 100 deg. is 9 per cent. Electric propulsion is particularly well adapted to high steam temperatures, as all the reversing is done electrically and no undue heat stresses, or temperature changes, take place in the turbine itself—as is the case when mechanical gears are used.

At 17,000 h.p. load and 120 r.p.m. of the propellers, the generator will have an efficiency of 96.75 per cent., excluding excitation which, in this case, will be 32 kilowatts per generator, or less than ½ per cent. The motors will have an efficiency of 97.5 per cent., excluding excitation, which amounts to 45 kW per motor, or 0.68 per cent. The loss in cables and control will amount to 0.04 per cent. The total transmission loss will be, therefore, excluding excitation, about 5.7 per cent., or, if excitation is included about 6.75 per cent.

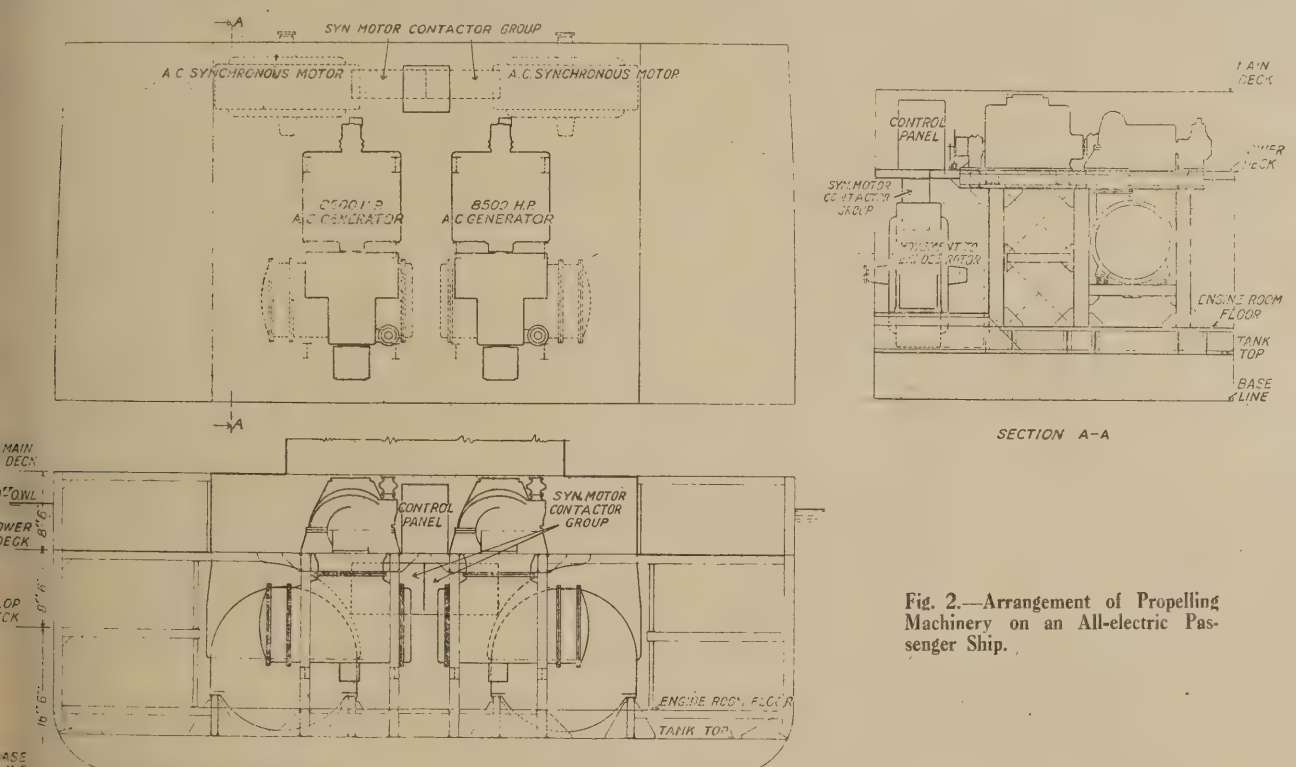
At reduced speed of the vessel the efficiency of the generator and motors will remain practically constant, as the voltage is then reduced in about the proportion of the square root of the horse-power, so that at three-quarters speed the voltage is reduced from 4,000 to about 3,000 volts, and the transmission loss is only increased from 6.75 per cent. to 7.4 per cent., although the load is reduced from 17,000 h.p. to about 7,000 h.p. The loss in gear efficiency, under similar conditions, would be about 2 per cent.

The advantages of electrically driving a large liner are simple means of speed reduction between the turbine and propeller in almost any ratio which may be desired. It affords means of reversal by simple change of electrical connections, without changing the direction of rotation of the turbine. Any desired reversing torque up to the full power of the turbine can be obtained without affecting the efficiency of the equipment in the forward direction. Reversal is obtained with a minimum amount of steam drawn from the boilers, as the full inertia of the turbo-generator is first used in the act of reversal; in fact, in most cases actual reversal is obtained without drawing any steam from the boilers, and steam is only used from the boilers to accelerate the propeller speed in reverse rotation. Electrically-driven vessels can be made noiseless.

Electric drive makes it possible to obtain accurate data, either by instantaneous readings, or by recording instruments, of the load on the propeller shaft under various conditions of sea and wind; to have a real check between fuel consumption and horse-power-hours developed means a constant check on economy. Maintenance experience with the electrically-driven ships by the General Electric Co. and the British Thomson-Houston Co. has shown that the upkeep of the electrical machinery has been practically nil so far.

The tendency lately is to put some of the large and medium size liners on winter, or other, cruises when the season is slack. With electric drive about three-quarters speed can be obtained by the use of only one of the two power units, which means a very large saving in fuel and attention; the steam consumption per s.h.p. will be practically the same as that at maximum speed. In the design of the generators and motors special precaution has been taken so that, should damage occur to any part of the windings, it can quickly be repaired, or temporary quick repairs can be made, so that the ship can proceed at slightly reduced speed. Multiple circuits are used in the generators and motors so that in many cases (for instance if a coil is damaged) it can simply be cut in two with a hack saw, the ends insulated, and the loss in power will be only the ratio of this one circuit to the total number of circuits in multiple; for instance, if the motor has 10 circuits in multiple, and one circuit is cut out, the power is reduced only 1/10th, which will be practically unnnoticed, and the repair should take only a few minutes. If several coils are damaged a jumper can be connected across the damaged coils and the vessel can proceed. Electrical repairs are always easily made when fully understood. Electric drive in many cases may afford important advantage because the generating unit, or units, can be placed in any convenient place near the boilers; they can be mounted at any height desired, the condensers can be put directly under the turbines, thus reducing the steam and the exhaust piping to a minimum. Chances of air leaks, which are so detrimental to obtaining good vacuum, are reduced to a minimum. The propelling motors can, in many instances, be put near to the propellers, eliminating long, expensive, shafting and the bearing losses incident thereto. Shaft alleys can be eliminated, thus saving hold space and making cargo handling much easier and convenient.

The turbine for electric transmission can be built more efficient; no reversing wheels are required, thus the turbine becomes shorter with a smaller shaft, less diaphragm packing leakage, packing and bearing losses. Since there is no heat distortion during reversal, smaller clearances can be used with the same factor of safety, all of which goes toward greater economy. Full advantage can be taken of the economy derived from high steam pressure and super-heat; as the turbine is never reversed, it cannot be subject to extreme temperature changes.



SECTION A-A

Fig. 2.—Arrangement of Propelling Machinery on an All-electric Passenger Ship.

Diesel-Electric Drive.—Since the adoption of Diesel-electric propulsion for the beam trawler *Mariner*, which was put in operation early in 1920, there has been marked progress in the application of this type of propulsion over a wide range of vessels—there now being some forty-five ships using this type of drive in operation, or under construction, including tug, ferry, and cargo boats, oil tankers, dredgers, and coast guard cutters. The largest Diesel-electric equipment installed at present in any single ship is of 2,500 shaft horse-power and it would not be surprising if, in the near future, someone went ahead with this form of propulsion in larger capacities.

The most promising field at present, however, seems to be in the smaller craft, especially where a large percentage of the installed horse-power is required for driving auxiliaries, for the same prime mover can furnish the power for both auxiliaries and propulsion; it is admitted that this form of propulsion has its limitations, but operators who have Diesel-electric driven ships seem very well pleased with the results obtained.

The paper includes a list of electrically-propelled ships built and on order to date, the number of such ships being 49 and the total shaft horse-power 561,615. Of these 21 are Diesel-electric ships, aggregating 14,815 s.h.p.. This list shows that great headway has been made in the application of electricity for the propulsion of ships. With the advent of high steam pressure, superheat, steam extraction for feed heating, as well as possible reheating between stages, electric propulsion makes the simplest ideal installation, and results can be obtained equal to, or better than, the best Diesel when total fuel consumption of the whole ship is taken into consideration. Electric propulsion is also ideal for the mercury turbine should this be considered for ship propulsion. Results so far obtained on land prove conclusively that this type of prime mover is more economical than the best of Diesel engines produced so far.

Railway Electrification in France.

Some Particulars of a Section of the Orleans Railway.

By H. PARODI.

(*Abstract of a Paper read before a joint meeting of the* Institution of Electrical Engineers *and the* British Section of the Societe des Ingenieurs Civils.)

This paper does not describe in detail the important electrification scheme now being carried out by the Orleans Railway Company, but merely outlines those features which show how the scheme fits into the general electrification programme of France. In the first part of the paper, the author has outlined the main factors which have dominated the whole of the investigation regarding the scheme of electrification in France and the development and economical use of the country's water power. The second part of the paper is devoted to a brief description of the electrical equipment installed, or being installed, by the Orléans Company.

Part I.

The electrification of the Orléans Railway is of particular interest, not only on account of the importance of the scheme, but also owing to the magnitude of the problems arising in carrying out the work. It was a question not merely of substituting electric traction for steam traction on a line having a dense traffic, but also of providing a large distribution system of which the power plants and transmission lines could

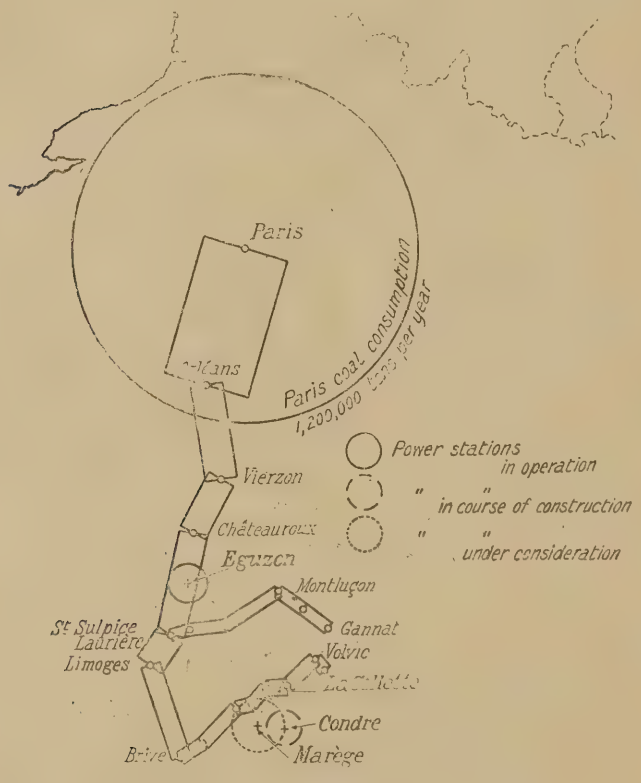


Fig. 1.—Coal Consumption in Electrified Areas.

be utilised for a supply of electric power in all the districts through which the railway passes.

The policy adopted in France in connection with the electrification of the railways is substantially different from that followed in other countries. The substitution of electric power for steam on the railways is considered in France to be one stage of a more comprehensive scheme, whereas in Germany, Switzerland, Austria, Sweden, Norway and other countries, the electrification of the railways is considered independently of the problem of a general supply of electric power. The railways in all the countries mentioned belong to the State, and special power stations and transmission lines have been installed for the generation and utilisation of single-phase current at low frequencies. Two entirely separate and independent systems are thus being developed side by side, the power supply to the industrial system being by three-phase current at 50 periods, and the State power-supply system for electric traction being single-phase current at a frequency of $16\frac{2}{3}$ periods. The only indication of a desire to establish at a later date an electrical connection between the traction and industrial systems, with a view to an exchange of power between them, is that the ratio between the frequencies of the two systems is a whole number, namely $50 \div 16\frac{2}{3}$, *i.e.*, 3.

In Great Britain, France, Belgium, Holland, Spain, Africa (Morocco, Algeria and Natal), as well as in South America (Chile, Argentine, &c.), electric power for traction will be generated and transmitted in three-phase form at 50 periods (60 periods in South America).

Other countries which have followed the policy of interconnecting the traction and industrial power systems have adopted high-pressure direct current at 1,500 to 4,000 volts as their standard for traction. Such current can, of course, be obtained whatever the frequency of the supply. It should, however, be pointed out that in certain countries, such as Italy and Hungary, very interesting tests are at present being made with a view to using for single-phase or three-phase traction three-phase current of a frequency such as is employed for the industrial supply. In Italy three-phase locomotives, having gears and connecting-rods and using current at the industrial frequency, have been tested on the Mont Cenis lines; and single-phase and three-phase 50-period locomotives fitted with synchronous converters on De Kando's system are under test in Hungary on a suburban line near Budapest.

This development, which is taking place in countries where low-frequency alternating-current traction has been in operation for a long time, proves, more conclusively than any theoretical considerations, the practical advantages to be obtained by standardising the various systems adopted for the generation and transmission of electric power.

As the main flow of traffic always follows the same direction whatever the form of transport, it would seem that the general direction of the main power-transmission lines should practically coincide with that of the railway lines which have a very dense traffic, and such railway lines are, as a matter of fact, those where the question of electrification is of most interest. For instance, the railway from Paris to Toulouse through Orléans, Limoges and Brive, is the route of the power transmission line which would allow of an exchange of power between the large steam-driven power stations of the Paris district and the hydro-electric stations of the Central Plateau and the Pyrenees.

It will therefore be understood why the French Government had, even before the war, brought pressure to bear upon the large railway companies supplying districts rich in water power to electrify their systems so as to prepare the way for a still more extensive electrification.

The total coal consumption in France now reaches about 70 million tonnes per year, 75 per cent. of which is obtained from the country's mines and 25 per cent. from English, Belgian and German mines. The whole of the French railways do not consume more than 9 million tonnes, *i.e.*, about 13 per cent. of the total. In order to obtain an appreciable reduction in the amount of coal purchased abroad, which forms a serious item in the trade balance, it is necessary to transmit electrical energy obtained from water power to large cities like Paris, Lyons, Bordeaux and Toulouse, where the coal bill in connection with the generation of the electrical energy required for industry, namely, motive power and lighting, is far bigger than that for traction purposes.

Fig. 1 clearly shows this condition. On each railway line where the electrification is complete or nearly so a rectangle has been drawn having its area proportional to the 1913 consumption of coal for traction on railways. In this connection it should be remembered that the traffic figures for 1913 are now exceeded on all the railways. The circle round the Paris area represents, to the same scale, the fuel consumption in the steam-driven power plants of the Paris district which supply the industrial requirements for electric power and lighting. The amount of coal thus consumed in Paris (1,200,000 tonnes in 1924) is more than three times greater than the coal consumption for steam haulage of all the trains of the Orléans Company between Paris and Brive. By the end of 1935 the consumption of electrical energy in Paris will reach 2,000 million kWh, whereas requirements for electric traction on the Orléans system (the lines from Paris to Brive, from Saint Sulpice to Gannat, and from Brive to Clermont) will very probably not be higher than 400 million kWh. The maximum demand in Paris will be about 1 million kW, whereas the traction demand will not exceed 80,000 kW. The whole problem of the electrification of the Orléans Railway has been dominated by the desire to transmit electrical power from the Central Plateau to Paris without burdening the railway electrification with capital charges which are out of proportion to the present traction requirements. The solution of this problem has been found in the systematic use of transmission lines at as high a voltage as possible.

The use of very high voltages presents considerable advantages from an electrical point of view, particularly in connection with the great strength of such lines and their almost complete immunity from atmospheric phenomena. Economically the advantages are not less important, and they become more evident when, bearing in mind that the amount of power which can be transmitted to a given distance varies as the square of the voltage, it is found that the first cost increases practically only as the voltage.

Owing to the increase in the transmission voltage, a saving is certain to result if we transmit over the same line a long hour load such as traction (say, 4,000 to 5,000 hours per annum), and a shorter-hour industrial load (2,000 to 2,500 hours per annum).

With the pressure of 150 kV now used, it is possible to transmit economically 40,000 to 50,000 kW from the Central Plateau to Paris, a distance of about 280 miles. By increasing the pressure to 220 kV, however, it would be possible to double (*i.e.*, $220^2/150^2$) the amount of power transmitted, and to superimpose on a traction load of 30,000 to 40,000 kW a power load of 60,000 to 70,000 kW, which could be used for industrial power and lighting.

The high-pressure system of the Orléans Company now includes a 150-kV line which can later be converted for use at 220 kV by the addition of a few units and a shield to the present chain insulators. The sizes of the aluminium conductors with their steel cores (293 mm² total section), and also the dimensions of the towers, have been based on the ultimate adoption of the higher pressure. In fact, the normal distance between the conductors (about 25 ft. 6 in.), and that between the conductors and the main supports (about 10 ft.) are larger than those actually employed on the 220-kV lines in operation in California.

In countries like Great Britain where electric energy can be obtained only by burning coal, and in countries possessing waterfalls fed from water sources all of the same type, as in Switzerland, the problem of the generation of electricity is almost exclusively a technical one, particularly when, as is the case in both the countries mentioned, the coal resources in one and the water-power resources in the other are very much larger than the national requirements.

The problem becomes, however, much more complicated in countries like France, where important coal resources and considerable water power are both available at the same time, although the amount of water power varies throughout the year. The coal resources of France are estimated at 22,000 million tonnes*, taking into consideration only those deposits which can be worked with the appliances at present available. With the present output of 40 to 60 million tonnes per annum, coal will thus be available in France for between 400 and 500 years. The water-power resources, which are renewed every year by solar heat, are estimated to represent normally about 5 million kW, of which about 3.3 million kW is in the form of waterfalls fed by glaciers, and 1.7 million kW is in waterfalls depending for their water-supply on rain. Of this total, only 0.67 million kW was being utilised on January 1st, 1925, whilst 0.28 million kW was in course of development at the same date.

The present consumption of electrical energy in France is about 7,500 million kWh, of which about 4,500 million kWh are generated by steam plants, the output of which represents 2,000 hours' use per annum, and 3,000 million kWh are obtained from water power, representing 4,300 hours' use. The combined load of the inter-connected electric distributing systems represents about 2,500 hours' use per annum, *i.e.*, a load factor of about 28 per cent.

The French Government is at the present time considering in close co-operation with the manufacturers, a programme of gradual equipment and of progressive linking-up of the various distribution systems, rather than Government control of electricity generation. The problem is too important, from the point of view of the country as a whole, for the Government not to try to outline the method of generation to be followed; and it is also too complicated, owing to the various opposing interests, to admit of the laying down of a hard-and-fast technical solution.

From the point of view of the rapid utilisation of the waterfalls, decentralised efforts are perhaps desirable, but as regards the operation of the plant and its efficiency, unity of control is essential.

Fig. 2 shows the relative variation in the number of kWh generated and consumed per month, compared with the number generated and consumed per year. The left-hand side of the figure shows the percentage variation in the number of kWh generated by the flow of water in the case of a plant depending on rain for its supply (Central Plateau stations), and also of a plant where the water comes from glaciers (Alpine stations). The right-hand side gives the monthly variations in load of an electric railway system and of an industrial system supplying power and lighting.

As the ouput curves of water-power plants depending on the rainfall are approximately of the same shape as the consumption curves of industrial systems, we can see at once the advantage which there would be in supplying electric power to Paris from the water power of the Central Plateau, it being particularly easy in this case so to adapt the power available that it will meet the demand.

This was realised by the Government when it authorised the Orléans Company to form, with the help of the Société l'Union d'Electricité, the Société l'Union Hydro-Electrique, in order to install the Eguzon water-power plant on the River Creuse.

The fact that this plant has a dam allows the storage of a sufficient quantity of water to form a weekly reserve, without the possibility of seasonal regulation. Owing to the working in parallel of the Eguzon plant (50,000 kW installed) and the large steam power-stations of the Paris district, it will be possible to utilise to the fullest extent the power available from the River Creuse.

In the first stage of the electrification of the Orléans system, the Eguzon plant will represent in the system of power stations of the Société l'Union d'Electricité the equivalent of a 50,000-kW set located at a distance of 300 km (186 miles). This set will be started when water power is available from the Creuse, and it will be stopped when there is no water; but the existence of the weekly reservoir will allow, on the other hand, this power to be used at any time during the 24 hours when this reserve will be most advantageous from the point of view of either economy or reliability.

In the second stage of the electrification of the Orléans system, use will be made of power generated by the hydro-electric plants of the Haute-Dordogne. The equipment of the waterfalls will include for the most important power plants the construction up-stream of a reservoir, in order that the adaptation of the available power to the demand may be secured by the use of this reservoir and by the exchange of power with a neighbouring system having water power-plant of a type complementary to the Central Plateau plants.

Owing to this combination and the policy of mutual assistance, the electric traction service of the Orléans Company will be operated under exceptionally reliable conditions, without the average demand for additional steam power being more than 10 per cent. of the total power. Should, in the future, large amounts of hydro-electric power be transmitted from the Central Plauteau to Paris, the lines of the Orléans Company could be easily adapted for this transmission.

In superimposing the industrial load on the traction load of the various 90-kV and 220-kV lines, it would be possible to transmit economically 100,000 kW a distance of 450 km (280 miles). The author thought it advisable to emphasise this question of electric power production in a complex system, because on its more or less favourable solution depends the success of the electrification, not only of the railway, but also of the whole country it supplies.

If in a country possessing an abundant supply of coal such as Great Britain considerable attention is given to the most economical methods for the generation and distribution of power, it can readily be understood how in France this problem is becoming very important and urgent.

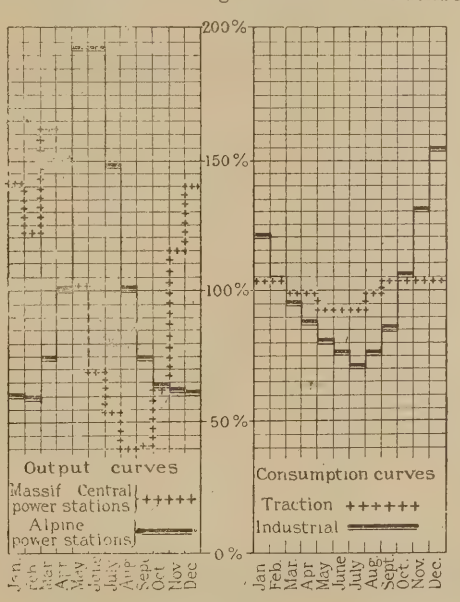


Fig. 2.

(To be concluded.)

*Metric tons.

Discussion in London.

Mr. ROGER T. SMITH opened the discussion by thanking the Institution of Electrical Engineers, as a member of the British Section of the French Society of Civil Engineers, for the facilities afforded to Mr. Parodi for the delivery of his paper in London; and, on behalf of the I.E.E., he thanked Mr. Parodi for coming to this country and giving such an excellent paper. France, he said, was the only country which was working its railway electrification in with a national supply scheme. A great advantage to be reaped by the electrification of the main railways was the speed increase of goods traffic. If distance and time curves were plotted for both goods and passenger traffic, electrification resulted in the two lines or sets of lines becoming nearly parallel—the ideal case—and an average speed of 40 m.p.h. could be easily obtained. This resulted in the opposite to the present conditions, where slow-speed trains were employed, of increased traffic on congested lines. He referred to the excellent conditions of load balance brought about by the opposite seasonal variation in the two French water-power sources for the Central Plateau and the Alpine stations, which had their maximum and minimum outputs at different periods. He thought that interconnection between the two supply centres was essential to the French problem: there was nothing between Paris and Brive except Orleans. The theory was held by some in this country that advantage would be gained by linking up the large centres with h.p. interconnecting lines. He doubted whether such a scheme would be practicable, or whether economy would ever result from it.

Col. O'BRIEN paid a tribute to Mr. Parodi and other French engineers who had conceived the vast electrification scheme. He said it would be interesting to know if the tonne-km. per km. referred to in the paper represented gross or net values. He also asked what precautions were taken in connection with

the very h.p. feeders with regard to the communication circuits. He thought that the type of locomotive without connecting rods would be the most successful, and that the 2D2 type would prove the best. He would be interested to know the anticipated cost of energy; many people had the impression that water power was cheap compared with coal. He criticised the French third rail; it appeared to be expensive and complicated compared with the other patterns. On the whole the paper demonstrated the superiority of electricity over steam, and he thought the paper should be read before the other engineering institutions.

Mr. F. Lydall said the Institution was to be congratulated on having a paper with such a wide range read before it. He thought the principal consideration in connection with main-line electrification was whether the railways should generate their own supply or depend on other concerns. Many railway engineers felt that the question of security of supply was of the first importance. There were undoubted advantages in taking the supply from the general system, but in such a case the general and financial position of the supply undertaking should be beyond reproach. He felt that the circumstances in France were peculiar, and did not apply in this country. A mistake was the tendency to regard railway electrification as something to be "nibbled" at. The sections which were often electrified as commencing stages were too small to show any advantages, and the Paris-Orleans line was an example of how electrification should be dealt with. He advocated the large supply system for railway electrification. On a badly intermittent railway 3,000 kW might be thrown on or off; this would be serious if the supply was from a small station, but on a large system such fluctuations were not important. In a case he had in mind the average load was 9,500 kW, the sustained load 17,000 kW, and the peak load (two minutes) 25,000 kW. He thought too much attention was paid to the question of weight of the locomotive; in some cases it was necessary to increase the weight.

Mr. F. W. Carter said that the outstanding feature of the paper was that it dealt with the electrification of an ordinary railway. Most electrification schemes were the outcome of special problems such as fuel shortage or dense urban traffic such as that around London. In some cases drainage problems or the question of long tunnels brought about schemes for electrifying the lines. The Paris-Orleans railway was a plain line, and if the undertaking proved successful it would show that the programme could be applied to all normal railways. The principal difficulty in the problem of main-line electrification in this country was the question of capital outlay.

Major A. M. Taylor said that in extending the electrification scheme to meet the industrial load in Paris the French Government had done very well. If it paid the French people to transmit a heavy load over a 280-mile line, would it not pay in this country with the present generating costs? The success of the transmission of heavy loads no doubt rested in the question of increasing the transmission pressure. Engineers were not bold enough when preparing schemes of power transmission. Estimates were prepared for loads of 20,000 or 30,000 kW, and did not prove economical; really large loads and high pressures would give better results. On a 100-mile line transmitting 125,000 kW with a 33 per cent. load factor, the sinking-fund and repair charges would be about 0.025d. per kWh, and the loss charge would amount to about 0.017d. per kWh resulting in a figure for the total charges as low as, say, 0.045d. per kWh. In America the transmission of 100,000 kW at 220,000 V was effected with a steam station at each end and a synchronous apparatus at the middle of the line.

Mr. E. M. Malek said the French authorities had grasped the essentials of railway electrification in co-operating with the industrial interests. The paper dealt only with one of the three main French schemes, and it would be interesting to know the results of the whole programme. The capital outlay for electrification on a large scale was enormous because of the distribution lines.

In reply, Mr. Parodi said, *inter alia*, that better results were hoped for as the load on the transmission lines increased. Electrification had resulted in maintaining full speed up the severe gradients, where with steam it had only been possible to result in ¼ speed at the top. The tonne-km. per km. referred to did not include the locomotive. He regretted that comparative energy costs were not available except that in the case of Eguzon the water-power cost was only half of that for steam power—but the ratio was not general. The French railways preferred to use the plant of the supply companies.

Combating Electrical Fires.

The "Lux" Liquid CO_2 System for Power Stations.

The very serious consequences of electrical faults in large power stations which involve a fire risk have emphasised the need for means of combating conflagration of an electrical origin. The usual chemical extinguishers afford excellent first aid protection, provided the seat of the fire can be reached easily in the very early stages, but a fire in a large enclosed generating set cannot be dealt with by such means; or, again, should an oil switch explode in a large switch room it may speedily become quite impossible to cope with the fire that may result from the spreading of the burning oil, which, in turn, may involve other switches and lead to very serious damage and dislocation of supply.

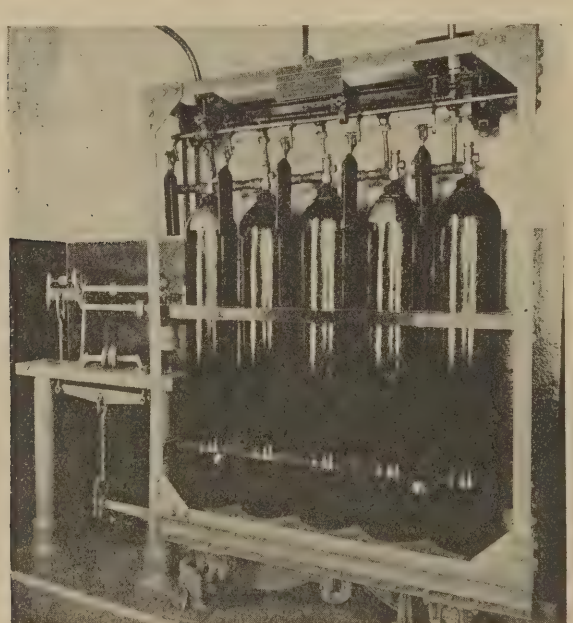


Fig. 1.—CO_2 Cylinders on Scale Balance.

It was to meet this state of affairs that the "Lux" method of fire extinction was developed. This system was first used to deal with ship fires in cargo holds, oil-fired boiler rooms, tankers, &c., and it has been applied to the electrical field, having been installed by Walter Kidde & Co. (Inc.), in power stations in America and other countries.

Carbon dioxide in a pure liquid state is stored in steel cylinders of the usual commercial type, but provided with special valve gear which makes it possible to release in a few seconds very large quantities of the liquid through small-bore pipe lines into the atmosphere surrounding the electrical gear to be protected. The liquid CO_2 at once expands into gas, producing an inert atmosphere in which no fire can live; the

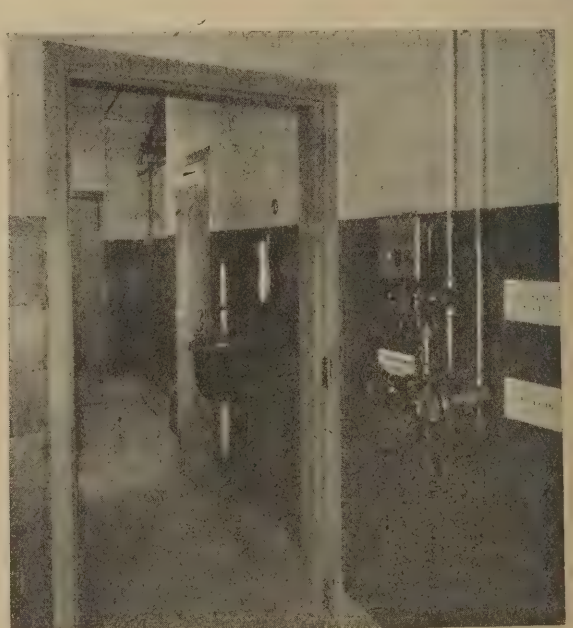


Fig. 2.—Hand-operated Direction Valves and Remote Electrical Release Gear.

very considerable refrigerating action (due to the rapid expansion) produces a chilling effect at the seat of the fire. Carbon dioxide gas has no effect upon insulation, or metals, and its dielectric strength is greater than that of air; thus it can be employed with safety on live high-voltage installations.

The "Lux" system as applied to, say, a number of oil-switch rooms would consist of cylinders of liquid CO_2, fitted with quick-release valves which prevent the liquid freezing before it reaches the fire, manifolded together and connected through distributing valves to piping running to the various switch rooms where the pipes terminate in nozzles arranged to totally flood the whole of the room involved. All the valves can be arranged to be operated either electrically, from any position remote from the switch room, or manually. It is claimed that a room of any size can be completely flooded with CO_2 in a period of from 30 to 40 seconds after operating the quick-release valves, thus extinguishing a fire of any magnitude and at any height in the room, within from 5 to 40 seconds.

This rapid action is one of the secrets of the success of the system, as it gives the fire no time to remove the gas by ventilation, even though a door or window be open. The gas gradually becomes dissipated by ventilation until, after a time varying from ¼ to ¾ hour, no CO_2 remains; thus, a protecting blanket of gas remains for a sufficient time to allow the heated apparatus, oil, &c., to cool. No damage is done by the gas, it is claimed, and there is no moisture or residue to clear up afterwards. Transformer cubicles can be protected in the same way, and the system is particularly adapted for dealing with fires in cable trenches.

Where a batery of cylinders is installed for totally flooding a room, it is advisable to provide a length of hose terminating in a hand nozzle and mounted on a reel, which provides a ready means of dealing by hand with fires in their initial stages. A still smaller, portable, hand apparatus connected to one gas cylinder only has been developed to deal with switchboard fires, and many thousands have been supplied to the telephone companies in America for this purpose.

Success in dealing with a generator fire depends, first, upon extinguishing it within a few seconds of ignition, and, secondly, upon limiting smouldering and preventing re-ignition during the period in which the generator is coming to rest, and for a reasonable time afterwards. In the case of a totally-enclosed machine with a water-cooled ventilating system, two banks of gas cylinders are used: The first contains enough CO_2 to give the whole ventilating system a high enough gas content to extinguish flame within from 10 to 20 seconds of injection. The valve gear is operated electrically by a solenoid actuated by the differential relay of the generator, or it can be arranged for push button control. At the same time that this charge of gas is injected, the turbine throttle would be tripped and the machine would commence to come to rest; meanwhile, due to leakage in the ventilating system enclosure, fresh air would enter the machine and might cause re-ignition, or serious smouldering. The amount of air leakage as discovered by CO_2 gas analysis tests on a number of machines is usually more than is realised, amounting to as much as from 10 to 15 per cent. of the ventilating system volume per minute at normal speeds.

Therefore, the contents of the second bank are injected into the ventilating systems one cylinder at a time by means of delay-action mechanism, so that the CO_2 concentration rises rather than drops, for the whole period that the machine is coming to rest. Hence, the fire can be definitely prevented from spreading round the coils and damage can be confined to the one or two turns which originally broke down.

When machines of the closed type, but with open ventilating systems and air filters are to be protected, special shutters must be provided to convert the machine into a closed type in the event of fire. A number of machines may be protected by means of one cylinder outfit, simply by providing electrically-operated distribution valves and the necessary piping. The action throughout is entirely automatic, and, as will be seen from fig. 1, the battery of cylinders may be mounted on a scale balance to indicate loss of gas by weight. The cylinders are under moderate pressure (744 lb. per sq. in. at 60 deg. F.) and provided with safety valves. Figs. 1 and 2 are views of the installation which protects the oil switches and transformer vaults in the East End sub-station of the Duquesne Light & Power Co., Pittsburgh, Pa., U.S.A. The "Lux" system is understood to be of Swedish origin; it has been developed in America, and is now available in England.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electric Lamps in Mines.—On February 16th, Mr. W. PALING asked the Secretary for Mines the number of pits in Great Britain where electric lamps were used underground.

Colonel LANE-FOX said that at the end of 1924 there were 356,817 electric safety lamps in use, practically all of them underground, at 1,012 mines.

Imperial Wireless Communication.—On February 16th, Mr. DAY asked the Postmaster-General the present position with regard to the Imperial wireless chain; and what had been the results of the tests made from the Imperial wireless station at Rugby.

Sir W. MITCHELL-THOMSON said that the contractors hoped to complete the Bodmin and Bridgwater stations, which were to be used for the Canadian and South African services early in April, and the Grimsby and Skegness stations which were to be used for the Indian and Australian services, in August next. The corresponding stations in the Dominions and India would, it was understood, be completed at about the same time as the English stations. The tests of the Rugby station showed that it could be received in all parts of the world. The station had been used regularly for the official wireless news service since January 1st and for the transmission of long-distance radio telegrams to ships since January 31st. Owing to its world-wide range, messages could be sent from Rugby to ships at any point on the high seas, however remote; and considerable use was being made of the new facilities thus afforded. The question of operating other services from Rugby was under consideration.

On February 16th, Sir H. BRITTAIN asked the Postmaster-General with which parts of the Empire his department was now in direct wireless communication; and whether any further developments were in contemplation during the current year.

Sir W. MITCHELL-THOMSON said that there was at present no two-way communication by Government wireless between this country and the Dominions, though it was hoped to open such a service during the current year with Canada, South Africa, India and Australia, by means of the beam stations, now under construction here and in those countries. As regarded one-way communication, there had for some years been a regular Press service between Leafield and Halifax, Nova Scotia, and the opening of the Rugby station had now made it possible to broadcast messages for reception in any part of the Empire. At present official news messages were sent out from Rugby thrice daily and good reception of these was reported from places as far distant as New Zealand. In addition private messages for ships anywhere in the world were now regularly transmitted from Rugby and reception appeared to be satisfactory.

Broadcasting.—On February 18th, on a Supplementary Vote for £847,000 for salaries and expenses of the Post Office, including telegraphs and telephones, Lord Wolmer, Assistant Postmaster-General, said that the estimate included £223,000 for radio broadcasting. All the moneys collected for licences had to be surrendered by the Postmaster-General to the Exchequer, and the authority of Parliament had to be obtained before the Treasury could pay out its share to the British Broadcasting Company. It was estimated that the number of licences would entitle the B.B.C. to the sum of £350,000; as a matter of fact it had been paid £573,000. Therefore the supplementary estimate was necessary, but it had not cost the country a single farthing. The item of £190,000 for engineering materials was due to expenditure on a greater purchase of ducts and cables for telephone development than had been estimated last year, and also to quicker work on the part of the contractors.

Mr. AMMON thought that further information should be given as to the expenditure of the B.B.C., a body which was financed by Parliament and was placed in a specially privileged position. A feeling was entertained in certain quarters that the business of the company was being run extravagantly.

Lt.-Commander KENWORTHY contended that the sum of 2s. 6d. charged by the Postmaster-General for issuing a 10s. licence was preposterous. The Post Office must be making an enormous profit. He had been told that the book-keeping charges for similar work by commercial firms worked out at less than 1s. per cent. The Postmaster-General might say that he relayed the programmes over his telephone wires. But this was done at a time when the wires were not in much use, and the relaying was bad. That position would have to be faced presently if the Postmaster-General was to give value for money; he must lay down special telephone wires.

Sir W. MITCHELL-THOMSON, the Postmaster-General, said that at present the question of the future development of broadcasting was being considered by Lord Colwyn's Committee, which hoped to present a report at the beginning of March. It was probable that legislation would be required as a result of this report. As to the suggestion that the Post Office had been guilty of faulty relaying, he had received no complaints from the B.B.C. on that score.

The London Power Company Bill.—On February 22nd, on the order for the second reading of the London Power Company Bill, Mr. ATTLEE, on behalf of the Labour party, moved the rejection of the Bill, the introduction of which, he said, was entirely premature, and which was in direct contravention of the policy of the Government and of the House. The Joint Electricity Authority for London and the Home Counties, which was only established in November, was already considering a technical scheme for bringing the electricity supply of London up to date. The present Bill sought power to set up a capital station in the West London area before any report had been made on that technical scheme. The Joint Electricity Authority was already very forward with plans for a generating station, and was actually in negotiation for a site for it. The site selected by the company was not the best one available.

In the course of further debate, Mr. HANNON pointed out that the Joint Electricity Authority would not be in a position to supply electricity for four years, and the London Power Company had a scheme already elaborated.

Col. ASHLEY, the Minister of Transport, said that, candidly, he was sorry that the Bill had not been held back until the

electricity proposals of the Government had been brought forward. The House would then be better able to pass judgment on such a scheme. At the present stage he must take an absolutely impartial and non-committal attitude. He would advise the House, however, that before the Bill left its control, Section 11 of the Electricity Act of 1919 should be inserted. That would mean that the Electricity Commissioners would have to decide whether the station referred to in the Bill should be built by the London Power Company or by the Joint Electricity Authority. He would also suggest that there should be inserted in the Bill a clause giving an option of purchase to the Joint Electricity Authority if the Electricity Commissioners decided that that Authority and not the Power Company was the body to build the station, He hoped that before the third reading of the Bill was taken, the Government proposals would be before the House, and they could judge what reception they should give to the measure.

The Bill was eventually rejected by 137 votes to 110.

Legal.

Attorney-General (St. Pancras Borough Council) v. County of London Electric Supply Co., Ltd.

Mr. Justice Tomlin gave judgment in the Chancery Division on February 19th in this action. The point at issue was whether the defendant company or the St. Pancras Borough Council were entitled to supply electricity to the new buildings erected by Messrs. Hulton in Gray's Inn Road, W.C. His Lordship said that the boundary line between the borough of Holborn and the borough of St. Pancras formerly ran east and west through this property. By an Order in Council dated May 15th, 1900, the boundary was moved further south, bringing the whole of the property within the boundary of St. Pancras. The relators (the St. Pancras Borough Council) were and had been at all material times authorised under the St. Pancras Electric Lighting Order, 1883, to supply electricity within an area that comprised the southern boundary of the property in question. The defendant company had, since 1897, under the County of London Northern Extension Electric Lighting Order, 1897, been authorised to supply electricity in an area corresponding with the borough of Holborn. The area of supply of the St. Pancras Council extended southward only to the old boundary of the borough of St. Pancras, and included the northern part, but not the southern part, of the property, while the area of supply of the defendant company extended northward as far as the old boundary and included the southern part, but did not include the northern part of the property. Messrs. Hulton, having completed part of their proposed building, approached the St. Pancras Council to negotiate terms for a supply of electricity, the St. Pancras Council being then erroneously under the belief that its area of supply included that portion of the borough that had been transferred from the borough of Holborn. Ultimately these negotiations were broken off, and Messrs. Hulton entered into a contract with the defendants for a supply of electricity. The amount of electricity being consumed at present upon the land south of the old boundary was trivial compared with that being consumed on the land north of the boundary. The St. Pancras Council claimed that electricity was being illegally supplied by the defendants outside their area of supply. Defendants contended that the supply given by them to Messrs. Hulton was given within their area of supply. His Lordship found that a substantial part of Messrs. Hulton's property was within the area of supply of the defendants, and that only a small quantity of electricity was at the moment being consumed on that part, but that there was reasonable ground to anticipate an increased user in the near future. He also found that the ends of the lines belonging to Messrs. Hulton on which electricity was passed to them from the service lines of defendants were within the area of supply of the defendants, and that the consumers' terminals of supply were in substance and fact within defendants' area of supply. Throughout the relevant Acts and Orders he thought a distinction was drawn between supply and use or consumption; that point was illustrated by the phraseology of the definition of consumers' terminals in Section 2 of the Order, as the ends of the service lines on which the supply was delivered, and by the terms of the prohibition in Section 18 of the Act of 1882 against any interference by the undertakers with the manner in which any electricity supplied by them was used. He found that the obligation to supply and the power to supply were not necessarily co-terminous, and even if no supply could be demanded except in respect of and for premises wholly within the area, no argument was thereby afforded for limiting the power of supply if, apart from that contention, such power appeared on construction to be wider. The obligations and powers of the undertakers in relation to the supply to a particular consumer were, speaking broadly, confined to their own side of the consumers' terminals, and it was upon the undertakers' side of, or at the consumers' terminals, that the amount of the supply had to be measured and its pressure ascertained. The method of user of the supply, unless, at any rate, it resulted in interference with the efficient supply by the undertakers to other people, did not concern the undertakers at all or give them any right of inspection on the consumers' side of the terminals or right to cut off the supply. Section 5 of the Electric Lighting Act, 1909, and Section 8 of the London Electricity Supply Act, 1908, did not, in his judgment, afford sufficient ground for displacing the conclusion which otherwise he had arrived at. Section 5 of the 1909 Act seemed to draw a clear distinction between supply and use. Finally, he held that supply did not mean supply for use or consumption, but supply in the sense of delivery at the consumers' terminals. There was nothing in the language of Section 5 or 6 of the Order or in Section 23 of the Act of 1909 to render illegal that which, upon the facts as he had found them, the defendants were doing. It followed that the action failed and must be dismissed, with costs.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Government Electricity Scheme.

I trust you will allow me to reply to Mr. Allcock.

Perhaps I did not make myself clear, but the 3d. was the price of the current received at our works. If Mr. Allcock can distribute it at 6d., 2d. and 1d. and show a profit, I should be glad to hear how to do it.

In conclusion, even if I could buy in bulk at 3d. a unit at the switchboard here, I maintain that it is sheer folly and absolutely uneconomic to sell at any price less than 3d.

It would be interesting to have the opinions of some of our large commercial houses on this point. I cannot see Barker's or Whiteley's buying large stocks of apples at 3d. a lb. and selling at 1d. in the hope that someone will buy oranges at 6d. on which they may have a good profit.

C. Culmer Hodges.

Dawlish, *February 15th*, 1926.

The Cost of Living in Cyprus.

I should be very glad if you could give me, or refer me to someone who can, some details as to the cost of living, and general conditions, in Cyprus.

Cyprus.

February 15th, 1926.

The All-Electric House.

In his letter in your current issue, Mr. E. W. Dickinson states that I am at fault in quoting from the figures in his article "Fuel Economy and the All-Electric House."

He clearly gave gas 12½ per cent. of the 100 per cent. of the c.v. of the coal. In this connection the points in my letter will be clear enough.

But if it is now claimed that gas offers 37½ per cent. of the c.v. of the coal, alongside of 17 per cent. for electricity, what becomes of the miserable 30 per cent. for gas *plus* coke mentioned in the article?

I like Mr. Dickinson's good intentions to "make our industry absolutely impregnable." He can safely amuse himself by handing out scaling ladders to the assailants to prove it so.

February 19th, 1926. **Invictus.**

The Testing of Transformers.

We note in your issue of February 19th, 1926, page 289, a short article on "The Testing of Transformers; Some Observations on a Method of Ratio Testing," by Mr. D. Pedley.

While we have read Mr. Pedley's article with interest, we must submit that his criticism is unjust in that it refers to a diagram, fig. 2, drawn up by himself, which is obviously wrong, and will not function correctly.

Mr. Pedley has been misled by the abstract printed in your issue of January 29th. The full text reads as follows:—

"The low-tension winding is connected in opposition across a part of the resistance R, also tapped through suitable dial switches to a sensitive wattmeter movement to show the balance of the two circuits, the field coils of which are excited off the h.t. supply."

The wattmeter movement shown in our diagram has the field coils specially wound for the a.c. supply, and the moving coil is of low resistance.

Our diagram is only intended to show a general arrangement, and allows of several modifications depending on the type of transformer to be tested. We have had experience of three such instruments of different ranges for a considerable period, and find them of great service and accuracy. In one of these instruments the wattmeter field coils are specially wound to go across the supply of 220 volts, and the other two are arranged with a small transformer to step down from the supply to give the correct current for the wattmeter field coils.

The wattmeter is a polarised instrument, and is usually a centre-zero instrument; thus it can be marked to indicate + or − ratio error.

J. Lindley Thompson, M.Sc., M.I.E.E.
H. Walmsley.

Newcastle-on-Tyne, *February 22nd*, 1926.

North-West Midlands Electricity District.

Electricity Commission's Inquiry at Stoke-on-Trent.

On Wednesday, February 17th, an inquiry was held at the Town Hall, Stoke-on-Trent, by the Electricity Commissioners, Sir Harry Haward and Mr. S. L. Pearce, with Mr. J. C. Walton (legal adviser) and Mr. D. S. Cumberlege, with reference to the area to be included in the North-West Midlands Electricity District and to consider a scheme for improving the existing organisation for the supply of electricity and for the formation of a Joint Electricity Authority. The promoters were all the authorised undertakers within the district which had been delimited by the Commissioners, namely, the City of Stoke-on-Trent, the Borough of Newcastle-under-Lyme, the Urban District Council of Leek, and the Market Drayton Electric Light & Power Co., Ltd. They were represented by Mr. Craig Henderson, K.C. There were also present Alderman H. Keese and Mr. H. H. Battle, chairman and secretary, respectively, of the Conference of Authorised Undertakers promoting the scheme, and officials of the bodies concerned.

Mr. CRAIG HENDERSON said the area of the district was 636 square miles and the population was estimated at 530,703. The bulk of the population was gathered into industrial centres, but the greater part of the area was rural and agricultural. Provision was made for the erection of a new station when justified by the demand (on what was considered to be the most suitable site) at Barlaston, midway between Stoke and Stafford. The two main stations, at Stoke and Stafford, were capable of considerable extension; by bringing them up to a capacity of 31,000 kW and linking them with high-pressure mains, with further links to outlying places, immediate requirements would be fully met. Leek had its own station, but would soon want a supply from Stoke, and so a link from Stoke to Leek was proposed. Congleton was anxious to have a supply; it had none to-day, and a station of its own was not justified, so that provision had also been made for a link from Stoke to Congleton which would be connected also with Leek. At some date in the future Leek would be linked with Uttoxeter, and Uttoxeter with Stafford. Uttoxeter could not justify a station of its own, and Newcastle-under-Lyme was already linked with Stoke. When the territory in the south-west developed, Market Drayton could be linked through Newcastle and also directly with Stoke.

Sir HARRY HAWARD asked whether it was the idea that Congleton and Uttoxeter should obtain Special Orders to enable them to distribute electricity, the supply being taken in bulk from the Joint Authority.

Mr. O. W. WHITTER, Mayor of Congleton, said the Borough desired to have its own Order and become the distributing authority.

Mr. CRAIG HENDERSON stated that the Conference had no objection to the municipal bodies taking the course they thought best. The Council of Stone was applying for its Order, which would probably be a precedent for the others. The position to-day was that Stoke had the "chief power house," which had 17,000 kW of plant; there were two smaller stations with about 1,000 kW each which would be used as sub-stations for distribution purposes.

Ald. HARRY LEESE said he had been chairman of the Stoke-on-Trent Electricity Committee for 15 years and was also chairman of the Conference of Authorised Undertakers promoting this scheme. With regard to the administrative part, they were prepared to take as the general text the Order made for the West Midlands District. The Conference was unanimous that the time had not come to erect a new generating station; by extending the stations at Stoke and Stafford the demand would be fully met for a considerable number of years. His Council was prepared to transfer the Stoke station to a Joint Electricity Authority, as the pooling of resources could not be done effectively unless that Authority had control of the whole of the supply.

Sir HARRY HAWARD: Have you considered the possible bearing which the Government's new electricity proposals may have upon this scheme? The Witness replied that they seemed quite nebulous. If a main transmission line passed through the area within easy distance of Stoke and Stafford it might be they would not require to build the Barlaston station, but, so far as the immediate supply was concerned, it would not have much effect. Their difficulty was not one of generation, but of distribution, and a cheap supply in bulk would not appeal to them unless it was cheaper than they could generate it for themselves.

Mr. ARTHUR ELLIS, M.Inst.C.E., M.I.E.E., M.I.Mech.E., said he had acted as advisory engineer to the North-West Midlands Conference. For the erection of a new station Barlaston was the best available site; there was, however, no need for a new station at present. During the last four or five years the demand had increased at the rate of 1,000 kW per year, but in his calculations he had assumed an annual increase of 2,000 kW during the next ten years. Extensions of 10,000 kW at Stoke and 5,000 kW at Stafford would meet the whole requirements, and the buildings for that plant were already available. Both stations could go up to 31,000 kW, and if necessary (by putting in larger sets) Stoke could be extended to 46,000 kW; by linking them together, the spare plant at one would be capable of meeting the requirements of both. The main link was a double circuit of 0.2 sq. in. operating at 33,000 volts, which would be extended, first, to Leek, and then come back, through Uttoxeter, to Stafford. The demand in Market Drayton did not justify a 33,000-volt line, and it was proposed to provide an intermediate system of transmission at 11,000 volts. He did not think the scheme could be dispensed with by taking a supply from a main transmission line passing through the district, if the Government proposals were developed in that direction. It would be a question of the terms at which supplies could be delivered, compared with the price at which they could produce their own. He did not contemplate that such transmitted supplies would be available in the next two or three years, and extensions must be made at Stoke or Stafford within that period. The extensions would cheapen production; they were now paying 16s. and 17s. per ton for coal. During the winter they had installed at Stoke four larger boilers of higher steam capacity and a 5,000-kW turbo-alternator, and the Stoke engineer was contemplating the possibility of raising steam from a cheaper grade of fuel, costing 14s. to 15s. per ton of less, and with the new plant in regular service the steam consumption would be something like 10½ lb. per kWh as compared with 13 or 14 lb. with the older plant. The same thing applied at Stafford, where new plant had been installed within the last 12 months.

Sir HARRY HAWARD asked what economies would be effected by linking the two stations and pooling their resources. In Mr. Ellis's opinion the economies to be effected would enable supplies to be available at the bus-bars at 0.675d. per kWh, after taking into account capital charges. There were five separate stations operating in the district, and the peak loads on all of them coincided; there was no diversity of load. The summer load was practically half the winter load and one station (under a proper arrangement) could supply the whole of the district.

Sir HARRY HAWARD: But you are not going to connect all these stations for 15 years? Mr. ELLIS replied that they wished to connect Stafford and Stoke immediately. The station at Leek could serve a useful purpose, but if the demand there required additional plant it would be cheaper to take a transmission main to Leek and give a bulk supply. Newcastle was already linked and taking the greater part of its supplies in bulk from Stoke. That left out Market Drayton, which was very remote. The demand at present was 120 kW, and a transmission main would cost something like £17,000. Taking a period of 10 years, during which extensions of 10,000 kW at Stoke and 5,000 kW at Stafford would be sufficient, he estimated that a kWh could be delivered at the bus-bars of the various distribution authorities at a cost of 0.608d., including all charges.

In reply to Mr. HERBERT, the witness said he did not know anything about the condition of the tramway generating stations. If the figures given him regarding the tramway requirements were correct (5,000,000 kWh, maximum demand 1,622 kW, load factor at one station from 34 to 37 and at the other from 38 to 42), it would be to the advantage of the Joint Authority to take the load. In the scheme under consideration he was working on the footing of a load factor of 30; his experience was that the tramway load overlapped the lighting load at the most awkward period of the day. If the tramway load could be fitted in between off periods, the Joint Authority would quote appropriate terms, but to do that it would be necessary to shut down the tramways during part of the day.

Answering Mr. PEARCE, the witness said the maximum demand for the year ending March 31st, 1925, was 12,907 kW. During the present winter the combined maximum demand had been 14,096 kW. According to his schedule the maximum potential demand in the district was 50,000 kW, divided between four different classes of supply. A difficulty arose from the fact that most of the collieries, which might be looked upon as potential customers, had their own blast-furnace plant and utilised their waste gases to provide their own supplies, but he did not think any works which had their own plant had been omitted in arriving at the total of 50,000 kW. It represented the ultimate possible demand at the time the figures were taken out. A very important manufacturing firm was proposing to establish works at Stoke, and negotiations were proceeding regarding the supply of electricity to that firm. An ultimate demand of some 10,000 kW of load was anticipated with a load factor of 50. This was not included in the 50,000 kW, which figure might be further increased by the introduction of new industries. His estimates of coal consumption showed that in 1930, the present average of 2.796 lb. being reduced to 2.25 lb., there would be a saving of 17,000 tons of coal, representing £12,000. The scheme set out what, to his mind, was the only way in which the rural areas could be opened out. Under existing conditions they could not develop a 33,000-volt transmission system to a place which had a maximum demand not exceeding 315 kVA. Of course, if the district developed at an

extraordinary rate, a cheaper line might be run. In a national scheme he assumed the pressure of transmission would be in the neighbourhood of from 110,000 to 120,000 volts. It would be better to have a Joint Authority representing a large area than five different authorities negotiating separately for supplies.

Mr. Pearce was surprised that there was no diversity factor. Was there no difference between Stoke and Stafford?

Mr. Ellis replied that they pretty well coincided, but he was not going to say that that would continue.

Mr. Herbert asked that provision be made that if the Potteries Electric Traction Co. took a bulk supply, the company should not be required to pay more than it would cost to generate the supply itself.

Ald. G. P. Dean, for the employés' side of the National Joint Industrial Council, suggested that the workers be allowed to have two representatives upon the Authority. Mr. W. A. Jones asked that there be one representative of the employés' side of the Joint Industrial Council and one representative of the employés' side of the District Joint Board.

Mr. Craig Henderson replied that at present the number of workers at the five stations did not exceed 60. When they got high-pressure main transmission and so on the number might go up to something like 100. One representative was sufficient. There was no objection to the working together of the two bodies representing the staff workers and the manual workers. The proposal put forward by the Potteries Electric Traction Co. amounted to asking that the amortisation charges for its present generating plant shall be borne by the Joint Electricity Authority.

The inquiry was then closed.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 17th :—

E.M.S. (lettering and design). No. 456,534. Class 6. Mechanical signs for advertising purposes. No. 456,535. Class 8. Electric batteries (not medical). No. 456,536. Class 13. Electric lamps (ordinary).—Electrical Name and Numerical Sign Co., Ltd., 30, Little Newport Street, Charing Cross Road, W.C.2.

Orion. No. 465,918. Class 6. Electric vacuum cleaning machines.—Electrical and Manufacturing Co., 7-13, Clavering Place, Newcastle-on-Tyne.

Radio Palaba, P.S.P.S. No. 465,906. Class 8. Instruments and apparatus for use in radio-telephony.—Pala. A. Spal, Slany, Czecho-Slovakia. (British representatives: E. R. Royston & Co., Tower Building, Water Street, Liverpool.)

Banbat. No. 465,586. Class 8. Radio-telephonic and telegraphic apparatus.—Prima Co., Ltd., 12, Commercial Street, Birmingham.

Onyx. No. 465,919. Class 8. Electric discharge tubes for radio and wired telegraphy and telephony, X-ray tubes, not employed for medical or surgical purposes, and rectifying tubes.—Mullard Radio Valve Co., Ltd., 45, Nightingale Lane, Balham, S.W.12.

Wandem. No. 466,247. All goods in Class 8.—Wainwright Manufacturing Co., Ltd., 531, Forest Road, Walthamstow, E.17.

G.P. (lettering and design). No. 462,607. Class 13. Electrical switches, contacts and terminals, electric-lighting fittings and accessories, fusible cut-outs, electric bells, junction boxes, ignition plugs, &c.—Gilbert Productions, Ltd., King's Road, Hay Mills, Birmingham.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

17,913. "Telegraphic signal amplification." K. L. Wood and Eastern Telegraph Co., Ltd. July 26th, 1924. (246,531.)

17,997. "Radio receiving stations." Dr. E. Asser. July 28th, 1923. (219,711.)

20,583. "Electrical transformers." Igranic Electric Co., Ltd., A. H. Curtis, S. R. Wright, and E. J. Brunning. September 1st, 1924. (Addition to 205,013.) (246,535.)

22,951. "Electrical discharge lamps." W. R. Bullimore. September 29th, 1924. (246,538.)

22,988. "Party-line telephones." E. F. Hastings. September 28th, 1923. (222,517.)

23,005. "Method of and means for composing and igniting the charges in internal-combustion engines." Daimler-Motoren Ges. September 28th, 1923. (222,519.)

23,910. "Inductance coil for electrical purposes, including wireless apparatus." L. E. L. Kelly. July 6th, 1925. (246,541.)

24,265. "Electrolysing fused baths." R. J. McNitt. October 30th, 1924. (246,542.)

25,021. "Two-way transmission systems, with repeaters, particularly for telephone lines." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.) October 21st, 1924. (246,544.)

23,032. "High-voltage electric transformers." S. Z. De Ferranti and Ferranti, Ltd. October 21st, 1924. (246,545.)

25,047. "Acoustic amplifiers." W. A. Darrah. October 21st, 1924. (246,546.)

25,297. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.) October 23rd, 1924. (246,550.)

25,552. "Telephone receivers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman.) October 27th, 1924. (246,556.)

25,559. "Electrical structures." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier.) October 27th, 1924. (246,557.)

25,569. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (246,558.)

25,570. "Electrical condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (A. Nyman). October 27th, 1924. (246,559.)

25,574. "Variable electric condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.). (W. Dubilier). October 27th, 1924. (246,560.)

25,634. "Magneto-electric machines." Fabrica Italiana Magneti Marelli. February 13th, 1924. (229,257.)

25,661. "Arc-welding process. E. Schroder. October 28th, 1924. (246,565.)

25,718. "Electrically-operated governors for controlling prime movers." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. October 28th, 1924. (246,572.)

25,766. "Relays for electric motor control and other purposes." Sir J. B. Henderson. October 29th, 1924. (246,573.)

25,776. "Headphones for wireless and other telegraphy and telephony." F. R. Johnston. October 29th, 1924. (246,574.)

25,839. "Electric switches." Simplex Conduits, Ltd., and H. F. McLoughlin. October 30th, 1924. (Cognate application 19,294/25.) (246,578.)

26,100. "Wireless systems." J. Robinson and N. Cox-Walker. November 1st, 1924. (246,592.)

26,249. "Electric switches." J. B. Tucker. November 4th, 1924. (246,595.)

26,528. "Electric-lamp holders and like couplings." J. C. White. November 6th, 1924. (Patent of addition not granted.) (246,599.)

27,211. "Electric-heating elements, particularly applicable to cooking apparatus." Falkirk Iron Co., Ltd., and J. Millar. November 14th, 1924. (246,604.)

27,270. "Battery chargers or rectifiers." Fansteel Products Co., Inc. March 27th, 1924. (231,423.)

27,308. "Rotary electric quick-release switches." Appareillage Gardy Soc. Anon. November 22nd, 1923. (225,209.)

27,698. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,614.)

27,701. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,615.)

28,213. "Electrical terminals." W. H. Bowling. November 25th, 1924. (246,619.)

28,719. "Package or carton applicable for packing thermionic valves or like articles having contact terminals." Radions, Ltd., H. J. Osborn, and G. D. G. Leadbetter. December 1st, 1924. (246,623.)

29,021. "Charging of electric storage batteries." Crypto Electrical Co., Ltd., and H. G. Sharp. December 3rd, 1924. (246,624.)

29,144. "Terminal caps for the carbon electrodes of dry batteries." A. H. Sheppard and Ever-Ready Co. (Great Britain), Ltd. December 4th, 1924. (246,625.)

29,607. "Electromagaetic sound-reproducing devices for telephony and like applications." S. Calamatianos. December 10th, 1924. (246,630.)

29,820. "Acoustic amplifiers or radiators." E. A. Graham. December 11th, 1924. (246,634.)

30,992. "Methods of cooling electric machines." A. W. Smith. December 24th, 1923. (226,831.)

31,379. "Apparatus for recording telephone messages." A. E. O'dell (Naamlooze Vennootschap Financieele Maatschappij Driebergen). December 31st, 1924. (246,646.)

1925.

612. "Connections or terminals for wireless and other electrical apparatus." E. A. Wood. January 8th, 1925. (Cognate application 3,734/25.) (246,648.)

1,025. "Electric motors." A. E. Alexander (Zobell Electric Motor Corporation). January 13th, 1925. (246,651.)

1,831. "Electric terminals." G. Edmonds, Ltd., and H. Edmonds. January 21st, 1925. (246,660.)

2,180. "Insulated electrical conductors and the like." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd. (Western Electric Co., Inc.). January 24th, 1925. (246,663.)

3,035. "Plug switches." S. M. Hale. February 3rd, 1925. (246,669.)

6,209. "Electromagnet clocks." Soc. Anon. Etablissements L. Hatot. October 24th, 1924. (241,856.)

6,287. "Wireless telegraphy and telephony apparatus." J. Millet. March 7th, 1925. (246,686.)

7,745. "Telephone protector and disinfector." J. Cooney, Jun., and J. Cooney, Sen. March 23rd, 1925. (246,691.)

8,562. "Grips or glands for sheathed electric cables." A. Kirk and W. G. R. Ball. March 31st, 1925. (246,694.)

8,696. "Dynamo-electric machinery." A. Parkinson and Parkinson, Ltd., F. & A. April 1st, 1925. (246,695.)

9,143. "Electric steam generation." T. H. Noll. April 6th, 1925. (246,697.)

10,096. "Terminals of the plug-and-socket type." A. W. Whistlecroft. April 17th, 1925. (246,700.)

10,716. "Manufacture of electro-ionic discharge tubes." Edison Swan Electric Co., Ltd. April 28th, 1924. (232,978.)

11,132. "Contact device for electric illuminated advertising." H. O. Frederiksen and L. E. Rasmussen. April 29th, 1925. (246,702.)

13,312. "Illuminated signs." Patent-Treujand-Ges. für Elektrische Gluhlampen. June 16th, 1924. (235,544.)

13,650. "Automatic electric signalling apparatus for double-track railways." J. Kremenezky (firm of) and L. Wimberger. May 28th, 1924. (234,810.)

14,286. "Operating means for variable electric condensers, variometers, and like instruments." G. A. Laughton and F. J. Curry. June 2nd, 1925. (246,713.)

14,685. "Closing means for electrical-instrument cases." Soc. Génévoise d'Instruments de Physique. June 28th, 1924. (236,188.)

14,839. "Commutator brushes." R. L. Henry. June 8th, 1925. (246,716.)

16,780. "X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 6th, 1925. (246,723.)

17,749. "Electrical measuring instruments." Metropolitan-Vickers Electrical Co., Ltd. August 9th, 1924. (238,201.)

18,526. "Electrostatic telephones." Tri-Ergon Akt.-Ges. April 7th, 1925. (246,728.)

19,229. "Construction of electric switch." G. Marr. July 29th, 1925. (246,732.)

20,278. "Luminous signal circuits, particularly for railways." Siemens and Halske Akt.-Ges. and Dr. J. Arndt. August 12th, 1925. (246,739.)

20,285. "Portable electric safety lamps." J. G. Barber and I. R. Van Wart. August 12th, 1925. (246,740.)

21,624. "Electric ignition apparatus." Scintilla. August 28th, 1924. (239,230.)

22,572. "Electric water heaters." E. C. Steere. September 10th, 1925. (246,751.)

23,794. "Electrical precipitation apparatus." Lodge-Cottrell, Ltd., and N. Stallard (Metallbank und Metallurgische Ges. Akt.-Ges.). September 23rd, 1925. (Addition to 176,713.) (246,757.)

26,907. "Synchronous induction motors." British Thomson-Houston Co., Ltd. October 30th, 1924. (242,279.)

27,171. "Electric incandescent-lamp sockets." British Thomson-Houston Co., Ltd. November 3rd, 1924. (242,298.)

30,247. "Electromagnetic devices." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd) (Western Electric Co., Inc.). September 1924. (Divided application on 243,787.) (246,711.)

31,425. "Automatic and semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). October 23rd, 1924. (Divided application on 246,550.) (246,775.)

32,373. "Synchronous telegraph systems." E. C. R. Marks (Morkrum Co.). July 20th, 1924. (Divided application on 245,175.) (246,776.)

1926.

534. "Electrical condensers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.) (A. Nyman). October 27th, 1924 (Divided application on 246,559.) (246,778.)

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Politics and Electricity.

ONCE again electricity measures have been caught in the whirlpool of politics. The London Power Company's Bill enabling it to build a station at Brentford, and the Metropolitan Company's Bill to extend its area, have both been rejected, not on their merits, but because of a fear that they would perhaps prejudice the work of the London Joint Authority, the suspicion of Socialists, and so forth. It is a lamentable thing that electricity development should become the subject of contention between rival political parties, and we sympathise with the Companies which have thus suffered a set-back. But companies, themselves, are not always entirely innocent of countenancing similar tactics; in fact, if our memory serves us, it was the West End Companies that started this particular hare—or if not, at least they joined in, in full cry. Mr. Attlee, in moving the rejection of the London Power Bill, seemed almost to be speaking from the West End Companies' own brief when they opposed the Barking station scheme some years ago, urging that no new station should be built before the Joint Authority's plans were fully matured, and that the site chosen was not a good one. Mr. Attlee said that "the Bill was a misguided attempt to get in first and queer the pitch of the larger scheme." We have an idea that, in substance, that was exactly what the West End Companies said at the Commissioners' inquiry about Barking. But we do not wish to press the point. We mention it merely because it points a moral—one that will be heeded in the future, when all the schemes require to be constantly dovetailed together. The moral is that all electrical parties themselves should deal with all matters on technical and commercial grounds, on their merits, and never invoke political issues or join forces, in a particular case, with political sections, especially when they violate their own principles by doing so.

It is to be regretted that the Metropolitan Electric Supply Company's Bill, which was warmly supported by the Minister of Transport, was not allowed to proceed. We fully recognise the right of the London and Home Counties Joint Electricity Authority to control electrical affairs within its District, but the Minister pointed out that the Company was willing to meet almost all the objections of the Authority, and stated his inten-

tion of taking steps to safeguard the interests of that body if and when the Bill came under the consideration of a Select Committee. As Mr. Harmer showed at the last "Informal Meeting" of the Institution of Electrical Engineers, the Metropolitan Company has made rapid progress in developing its area outside London since the war, and with enlarged powers would have been able to hasten the provision of electric light and power in regions at present inadequately supplied. It was unfortunate, therefore, that the Bill was summarily rejected by a vote which cannot be regarded as representing the considered opinion of the House of Commons.

Incidentally, the rejection of these Bills shows that any comprehensive project has its bad side, and that is, that it can be used actually to frustrate electrical development. Now that there are Joint Authorities, Advisory Committees, and so on, and a National Board in prospect, it seems likely that unless some way out of it is found, any malcontent body can obstruct a new project by playing off one party against another. An instance on a small scale was recorded recently when new Orders for areas uncatered for were objected to on the ground that such areas were in an Electricity District and that it was the duty of the Joint Authority to deal with them. Now, this sort of thing can go on indefinitely. A little more goodwill among the parties is the best remedy, but as we are not over-optimistic as to this, we suggest that the Commissioners should have fuller powers to enable them to deal summarily with such obstructionists. The Commissioners should decide in their own minds what authorities can be trusted to get on with their job, and deal ruthlessly with mere obstructive tactics. Up to the present thick-skinned "authorities, companies, and persons" have simply taken advantage of the unfailing courtesy of the Commissioners. The sooner electricity is out of the hands of politicians the better, and the more scrupulously all electricity authorities keep political weapons out of their armoury the better too.

Spinning Electrons.

The analysis of the infinitesimal has been carried so far by men of science whose fertile imagination seems to be a most efficient substitute for a "double-million magnifyin' gas microscope" that even the atom has yielded up its secrets, and is known to be an organised body of considerable complexity. The electrons, revolving around the nucleus at planetary distances, are exposed to attack, and have been so successfully bombarded that their places in the atomic cosmos have been pretty accurately defined; to them and their orbital changes are due the "quanta" which give rise to radiation, and thus convey to us light and heat, their functions being indispensable to our continued existence. The nucleus is a much harder nut to crack; Prof. Millikan and others have lately identified a radiation of exceedingly short wavelength which appears to be due to nuclear changes, and Dr. Jeans has quickly developed the idea, but the nucleus remains somewhat intractable.

But if we thought the electron had been reduced to its lowest terms, we reckoned without one last possibility. The jumps of electrons from orbit to orbit provide an explanation for many of the lines of the spectrum, thanks largely to the inspired labours of Prof. Niels Bohr, of Copenhagen, but much remains to be done before the spectrum is wholly understood; now, in a letter from Messrs. G. E. Uhlenbeck and S. Goudsmit, of Leyden, to *Nature* of February 20th, we are invited to make a further step—to conceive of the electron itself as spinning on its own axis whilst it revolves around the nucleus. Moreover, the axis of the spinning electron is assumed to be subject to precession. To render the resemblance to the solar system complete, we only need a satellite revolving around the electron!

It is stated by the authors that the hypothesis of a spinning electron sweeps away many of the difficulties still presented by the spectrum, and in a letter commenting on the theory, Prof. Bohr himself gives it a hearty welcome, his enthusiasm growing visibly as he writes.

We do not pretend to understand the details of the theory, which is a matter for specialists, but we wholeheartedly admire the work of these able physicists, who from a few seemingly inadequate clues can thus by sheer force of intellect construct convincing theories for the constitution of giant stars and for the structure of invisible atoms, continually pressing their attack farther into the hidden mysteries of nature and science.

Electricity Supply in Yorkshire.

Elsewhere in this issue, in our series of articles dealing with electricity supply in Great Britain, we reproduce a map showing the present position in the county of Yorkshire—an area covering one-tenth of England and Wales, containing one-tenth of the population of Great Britain, and including some of our most important industrial centres, engaged in the coal mining, textile, and steel industries. The supply of electricity is in the hands of numerous municipalities and a very few companies, amongst the latter, however, being one of the largest and most successful Power Companies.

At the recent annual general meeting, the chairman, Mr. A. G. Lupton, reviewed the recent history of the Yorkshire Electric Power Company, and showed how on three occasions—in 1918, 1921, and 1925—impending legislation had put a brake on the development of electricity supply, which had also been delayed by the protracted negotiations and inquiries involved by the endeavours of the Electricity Commissioners to reorganise the area with the co-operation of the great municipal undertakings. Even when, after three inquiries, an agreed scheme for part of the area was embodied in a Bill which was supported by the Electricity Commission, a Parliamentary Committee rejected it in 1924 and thus destroyed the work of years. Consequently the Company was thrown back upon its own existing statutory powers, and since May last year it has been engaged in developing its area on those lines. The Thornhill power station has been greatly extended, and the new station at Ferrybridge—for which the site was purchased in 1917, *nine years ago*, but which has been held back by the continual uncertainty prevailing with regard to new legislation or reorganisation—will be running next summer, when the Company will have 93,500 kW of generating plant installed, and 340 substations in operation. Where it has been possible, through the medium of the associated Distribution Company, to supply electricity for domestic purposes, in some new centres every house is on the mains; many municipalities have closed their generating stations and take a bulk supply from the Company, whose standards of pressure and frequency, adopted in 1901, are identical with those now accepted as national standards, and are being brought into effect throughout its area. Moreover, Mr. Lupton stated that the Company was on good terms with its neighbours, and was prepared to co-operate with them. In fact, if only it had authority to supply electricity throughout its area for other purposes besides power, it would be able and willing to develop the supply of electricity as efficiently as any Joint Electricity Authority; and we see no reason why it should not be allowed to do so, as the Mersey Power Company has already been permitted to do. The attitude of the Minister of Transport towards the Metropolitan Electric Supply Company's scheme, embodied in the Bill which came to an untimely end last week, seems to imply that the Government is not unfavourably disposed towards such methods, and the Prime Minister's avowed intention to foster private enterprise strengthens that impression. In Yorkshire, at any rate, there seems to be no hope of inducing the big Corporations to merge their individualities in a joint co-operative scheme, and we do not believe that the Government will attempt to exercise compulsion.

ountry House Fires.

No one who loves the countryside can observe without keen regret the frequency with which the fine old mansions bequeathed to us by by-gone genera-ns are destroyed by fire, often accompanied to their d by irreplaceable artistic treasures. There is a ndency to ascribe these catastrophes to "the fusing of electric wire," not because there is a shred of evi-nce to that effect, but merely because the phrase is ndy and there is no evidence to the contrary. There e, however, various alternative solutions to the pro-em, of at least equal probability, and we are by no eans disposed to let judgment go against the electrical stallation by default.

For one thing, these old buildings were usually wired contracting firms of well-earned reputation for the e of sound materials and good workmanship, who tained the work not by cut-throat competition but by commendation, in the more spacious days when the ners of such mansions could afford to pay a fair price r a good job. The proper use of fusible cut-outs was ll understood, and the wiring was generally heavier the time of carbon-filament lamps. Moreover, the ltage was lower than is customary in connection with blic supplies nowadays—50 volts in the smaller build-gs, and seldom over 110 volts in any case—a condi-n further implying the use of heavy conductors, which re commonly enclosed in wood casing.

Such installations, in dry buildings, were as safe as uld be wished, and would remain so even after five d twenty years—so long as they were undisturbed. has been pointed out, however, in a letter to *The Times* Mr. S. G. Castle Russell that after many years the bber insulation is almost certain to have "perished"; that condition it is brittle, and cracks on small pro-cation, so that if the wires are disturbed, the insula-n ceases to be waterproof, and the access of moisture adily causes leakage of electricity which may char the sing and eventually lead to fire. Hence when exten-ns are made on such an installation, the wiring fected ought to be renewed right back to the fuse-ard.

As Mr. Russell rightly states, the owners of houses ntaining valuable pictures and heirlooms should have eir wiring inspected to make sure that it is not a tential danger. In a later letter, Mr. D. L. Solomon, R.I.B.A., supports these views, but also indicates the ngers attendant upon the fixing of modern stoves in d houses, and upon the use of existing flues for central ating systems in such buildings. The great heat ven out by modern heating installations demands the loption of special precautions, even to the extent of ilding entirely new flues.

According to *The Times*, many of the fires reported have occurred in country houses are believed to have iginated in the roof—a circumstance which in itself nstitutes a good alibi for electricity; for who ever ard of the attics of such a building being wired? On e other hand, the flues are there, probably well lined th soot and close to dry old timber. The attics are rely visited, and a fire may get well started there fore anyone suspects its presence.

None of the letters that we have seen points out that ctricity, though it may sometimes be the cause of fire, so provides a remedy. An outbreak of fire can nerally be easily extinguished if it is tackled in-antly; and electrical fire-alarm systems are now so icient that they can be relied upon to give warning fore a fire has made good its hold. The outlay of a w pounds on such systems would in many cases save ns of thousands in material loss, to say nothing of e mental distress consequent upon the destruction of beloved home, and it is strange that the Fire Offices not insist upon such precautions in the case of avily-insured buildings. As Mr. R. J. Moffett sug-sts in our "Correspondence" columns to-day, the ire Offices might well undertake the duty of inspection new installations—and, we would suggest, the old es too; by that course they would stand to gain in e long run.

After the Fair.

From the reports that have reached us from various directions, we judge that electrical exhibitors who took part in the British Industries Fair at Castle Bromwich, Birmingham, have good reason to be satisfied with the result attending and following their efforts. We have heard of gratifying electrical orders that have been placed by Home, Colonial, and foreign buyers. Taking the Birmingham show as a whole, it is stated that there were formal acceptances of invitations by 35,000 buyers, and an actual attendance of 50,000 buyers. The visits and meetings of electrical associations were very successful, and altogether the whole affair has provided the local committee in particular and the trade in general with practical experience which should materially assist them in planning next year's Fair. Electrical manufacturers who had not been able to patronise the show this year owing to the short time left in which to make arrangements, were observed making a tour of the Electrical Section, and probably they have formed resolutions for the future. Individual orders placed include some for considerable numbers of electric motors, and an order for six oil engines booked by one firm, to the value of £4,800; New Zealand and South African electrical buyers were present and placed business, while one of our representatives reports the presence of a party of Germans who were greatly interested in the exhibits of electrical equipment and wireless accessories. Australian, Indian, Spanish, and Argentine buyers placed orders for hardware, while Continental and other visitors made requisitions for tools, pumps, weighing machines, brass steam fittings, and so on. It is said that the orders placed for all classes of British products at Birmingham amounted to £2,000,000 in the twelve days, and inquiries and signs point to many millions of pounds more to follow as a direct consequence of the Fair there. It is small wonder, therefore, that the space booking for next year promises to be much larger than for 1926, and that the Government is to be urged to repeat its £25,000 propaganda contribution as an annual grant. The Birmingham buildings will have to be extended, and there is talk of the Government's being asked to secure the White City permanently for the London Fair.

Porcelain Insulators.

A visit to The Potteries is an event of such interest as to be long remembered with pleasure, for the art and skill of the potter are proverbial; and when such a tour is undertaken by an electrical engineer with the object of inspecting the several factories of one of the largest porcelain insulator manufacturing concerns in this country, he will be particularly well rewarded. Porcelain insulators and fittings for the electrical trades are used as a matter of course, and few of those who are called upon to employ accessories of this kind realise to what dimensions this section of the local industry has grown of late years.

Messrs. Taylor, Tunnicliff & Co., Ltd., have been known for close on 60 years as makers of porcelain, and the fact that they have been producing high-voltage insulators for more than 25 years places them amongst the foremost authorities on such wares. The term "high-voltage" had, however, a somewhat different meaning then from that which is conveyed by the words "high pressure" to-day, and the methods and processes involved in the production of reliable, good-quality insulators have had to be modified accordingly. If the article which is commenced elsewhere in this issue serves to initiate some of our readers into the varied operations connected with, and the degree of modernisation that has been brought about in, this important industry it will not have been written in vain. The changes that have taken place may be gauged, in some degree, by comparing the impressions of our recent visit with those recorded 18 years ago in the Electrical Review of March 6th, 1908.

The Telephone, 1876—1926.

By J. E. KINGSBURY.

On March 7th, 1876, Letters Patent (No. 174,465) were granted by the Government of the United States to Alexander Graham Bell for an invention which was entitled "Improvement in Telegraphy." There were five claims, the last reading: "The method of and apparatus for transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth." The "undulatory electrical current" runs through the specification. The use of, and the methods for producing, such a current are covered by the other claims. They are: a receiver set in vibration by the employment of such currents; the employment of a permanent magnet or other body capable of inductive action; the gradual increasing and diminishing the resistance of the circuit or the gradual increasing and diminishing of the power of the battery.

To reap a reward it is not sufficient to invent: it is also necessary to protect the invention. In March, 1881, eminent patent counsel advised the Bell Company that "the Bell patents cover every apparatus capable of transmitting articulate speech by electricity which has yet been devised, and the more carefully the subject is examined the more certain it appears that no instrument can do it except by copying the method invented by Mr. Bell and patented to him by his patent of March 7th, 1876." They advised well. His invention received the widest protection throughout the patent's life.

On June 25th, 1876, the Bell instruments were submitted to the judges at the Philadelphia Exhibition, of whom one was Lord Kelvin (then Sir William Thomson). To a colleague he said that what yesterday he would have declared impossible he had that day seen realised. But the laconic exclamation of the Emperor of Brazil, who was present as an interested observer, indicates more clearly the contemporary surprise at what had been accomplished. "My God, it talks," said Dom Pedro. Yes, it talked! The transmission of speech hitherto considered impossible had been achieved.

Bell acquired fame, and, with his associates, a certain modicum of wealth. The civilised world acquired a means of communication of so great a value that both the fame of Bell and the wealth of his commercial associates seem but feeble recompense by comparison. In judging to-day what the world has acquired, we must not overlook that the developments have been due to very numerous discoverers and inventors, but these later discoveries and inventions have all been built upon the one foundation. All are consequent upon Bell's "mathematical conception" of the essentials of voice transmission. Bell invented the speaking telephone, and he advocated the adoption of the exchange system, but beyond some further experimental work in the earlier days he did not attempt to pursue any inventive activity in the direction of accessory apparatus. These accessories are immensely important and afford a wide field for admiration—too wide to be more than mentioned now.

The voice of Bell's telephone in 1876 was a still small voice, but it was capable of reinforcement, and has been reinforced. Its range then was short, but capable of expansion. In 1877 twenty miles was regarded as the limit. The expansion has been such that it now overspreads a continent. It may be said that the limits to telephonic transmission are governed by commercial and not scientific conditions. The five thousand five hundred miles so far accomplished can and will be further extended as circumstances require. Whether the distance be five thousand miles or five hundred yards, the value of telephonic communication cannot be adequately appraised as merely the means of conveying information. It is conversation—question and answer—emphasis and inflexion. Commercially or socially it is generally some particular voice that it is desired to hear. The annihilation of space is of value anyway, but when the undulating current transmits a voice one wants to hear, how much more does that trunk call seem worth while?

Fifty years have passed since the world was told how to transmit speech. What has the world profited by it? Perhaps a few approximate figures serve to answer that question in part:—

Telephone exchange stations of the world	... ...	28,000,000
Investment therein	...	£1,200,000,000
Persons employed	...	1,000,000

Of these 28,000,000 stations, more than half have been so designed, constructed, and connected as to permit speech to be interchanged each with the other. "Since the invention of the telephone, it has been the purpose of your company and its predecessor organisations to create and maintain telephone service in any part of the United States for communication with any other parts of the United States." This statement is made to its shareholders by the American Telephone and Telegraph Company, the lineal business descendants of Bell himself, who early adopted this ideal and have steadily pursued it. Parts of Canada are also included within the connecting zone. Geographically and scientifically there is nothing to prevent the telephonic population of the whole American continent being within hearing of each other. It will come some day. The commercial demand will determine when, and I do not propose to hazard a date. But regarding the 7,000,000 in Europe, it ought to be possible to say that intercommunication is already in operation for the principal countries at least. Without doubt the respective administrations will sooner or later throw over "parochial" restrictions, so that any European with a telephone station may talk with any other so provided. I have written in terms of continents, because that is an advance upon the present general tendency (with few exceptions) to consider only national boundaries, but I must guard against giving an impression that I regard the boundaries of continents as any more the limitations of telephone communication than the boundaries of countries. Telephone lines and telephone instruments would make Europe, Asia, and Africa an intercommunicating field, the area and development of which would only be limited by the extent to which such means of communication were economically productive. The early establishment of international telephony through specially-constructed cables to the Continent by the British Post Office was an example of enterprise from the source rather than a concession to public demands.

A new service like that of the telephone exchange had necessarily to go through a period of uncertainty as to the principles upon which it should be conducted. That the public interest would be served by competitive services was imported into the telephone field from prior and dissimilar experience, and a considerable portion of the half century was occupied in demonstrating the fallacy of this view. It is now universally recognised that the public interests are best served by a single organisation regulated by authority.

The development of the service in any locality is much dependent upon the adoption of an enlightened policy by the regulating authority. In many parts of the world development has been retarded by the failure to recognise that an increase in the cost of living without an increase in telephone rates is equivalent to a reduction in those rates, and that failure to increase them must inevitably lead to a situation in which the service ceases to be profitable or may be undertaken even at a loss.

It has long been known and fairly well recognised that the prosperous tradesman gives the most efficient

service to his customer. When D'Artagnan proposed to drink to the prosperity of his host's establishment, the innkeeper was flattered and surprised. "But don't mistake," said D'Artagnan, "there is more selfishness in my toast than perhaps you may think—for it is only in prosperous establishments that one is well received. In hotels that do not flourish, everything is in confusion, and the traveller is a victim to the embarrassments of his host." As a considerable traveller, he wished to see all innkeepers making a fortune.

Public enterprises cannot make fortunes, but that they should pay their way handsomely is much more to the interest of the "consumer" than he imagines. In the telephone service it is especially so because of the considerable and continuous expansion. The addition of new subscribers is of value to those existing by reason of the potential facilities for widened area of communication, but expansion calls for new capital, and new capital cannot be obtained for unprosperous enterprises. The limitation of rates to unremunerative figures, whether by public opinion, by Governments, or public service boards, is fatal to progress. Yet many telephone administrations suffer from this misdirected form of public control which intends the public good, but attains, instead, the public ill, for it is beyond question that the larger the number of telephone stations the more efficiently and economically is the commercial and social work of the community carried on. Retardation from unremunerative rates accounts in some measure for the meagre expansion in some parts of the world where the subscriber "is a victim to the embarrassments" of the suppliers.

But in the half century since the birth of the telephone, we have seen many misunderstandings removed. Where other misunderstandings exist, they will give way sooner or later to the logic of reason and the lessons of experience, so that the widest use may be made of Bell's discovery and invention. This widest use cannot be made without additional investment, and it is to encourage such new investment that prosperity is required.

The figures given above take no account of the employment and investment in manufacturing or wireless uses. Manufacturers of apparatus, wires, and cables will immediately occur to the mind, but in fact scarcely any branch of industry is outside the scope of expenditure of the Telephone Administration and its employés. There are employments and employments, but that which contributes to the welfare of the community, whilst providing a livelihood for the individual, must always be the source of the greatest satisfaction. Is there any public service which gives so great advantages at so small a cost as the telephone?

Whilst the exchange service is the outstanding practical result of the invention, the value of the telephone as a scientific instrument must not be overlooked. It was promptly used as an indicator of weak currents, and thus early led to the discovery by Hughes of the microphone, the most effective instrument for producing the variation of current specified and claimed by Bell, and one of the means of extending the distance of speech transmission. Though indicating the use of a battery with apparatus for varying the resistance, Bell used the "inductive method" in his instruments. Articulation was perfect, power feeble. Battery with microphone prevailed because articulation was good enough and power much greater. The only known place for power then was at the transmitter. It is of interest at this date to note that the wireless demand for the utmost purity of articulation has tended to the production of a transmitter on the "inductive method" Bell originally used, since power can now be added to the circuit apart from the transmitter. The transmitter originates and amplifiers "carry on." In telephonic partnership sound and electricity have made exceptional scientific progress—promptly applied to practical results both in wired telephony and that wireless transmission which is literally as familiar as household words to the world at large.

A word as to the future. The comparison of telephones to population is a familiar one. Not so long ago telephone men talked of the "saturation point," and looked for signs of its being reached. But no such signs are to be seen, and telephone men are now inclined to wonder whether, in some localities at any rate, the population will continue to exceed the number of telephone stations or the stations exceed the population! That, however, is for the distant future to decide. As to the immediate future, there can be little doubt that the 70 per cent. world's increase of the last ten years will be converted into 100 per cent. in the next ten years. In many parts of the world the telephone has penetrated only the top stratum of society. It must go deeper. Its threefold economy of time, labour, and money is too great to be neglected.

On his last brief visit to London, Bell attended a meeting of the Wireless Section of the Institution of Electrical Engineers. None then present will forget his leonine head, his modest mien, his tribute to others who had furthered telephonic enterprise, and his encouragement of those younger members—wireless and others—in whose hands the future lay. Since then he has been gathered to his fathers, but his work lives. It falls to those younger men at a time when the telepone is no longer a novelty, when the halo of romance surrounding it is less observed, to extend in various ways its practical applications until a much larger percentage of the world's inhabitants are in a position to utilise those "electrical undulations similar in form to the vibrations of the air accompanying vocal sounds" described by Alexander Graham Bell in the patent granted to him on March 7th, 1876.

Electricity Supply in Great Britain.—XII.

Yorkshire.

Yorkshire occupies more than one-tenth of the area of England and Wales, and is composed of the three Administrative Counties of the East, North and West Ridings, with their eleven associated County Boroughs, and the City and County Borough of York, which for administrative purposes is regarded as a County of itself and is not connected with the Ridings.

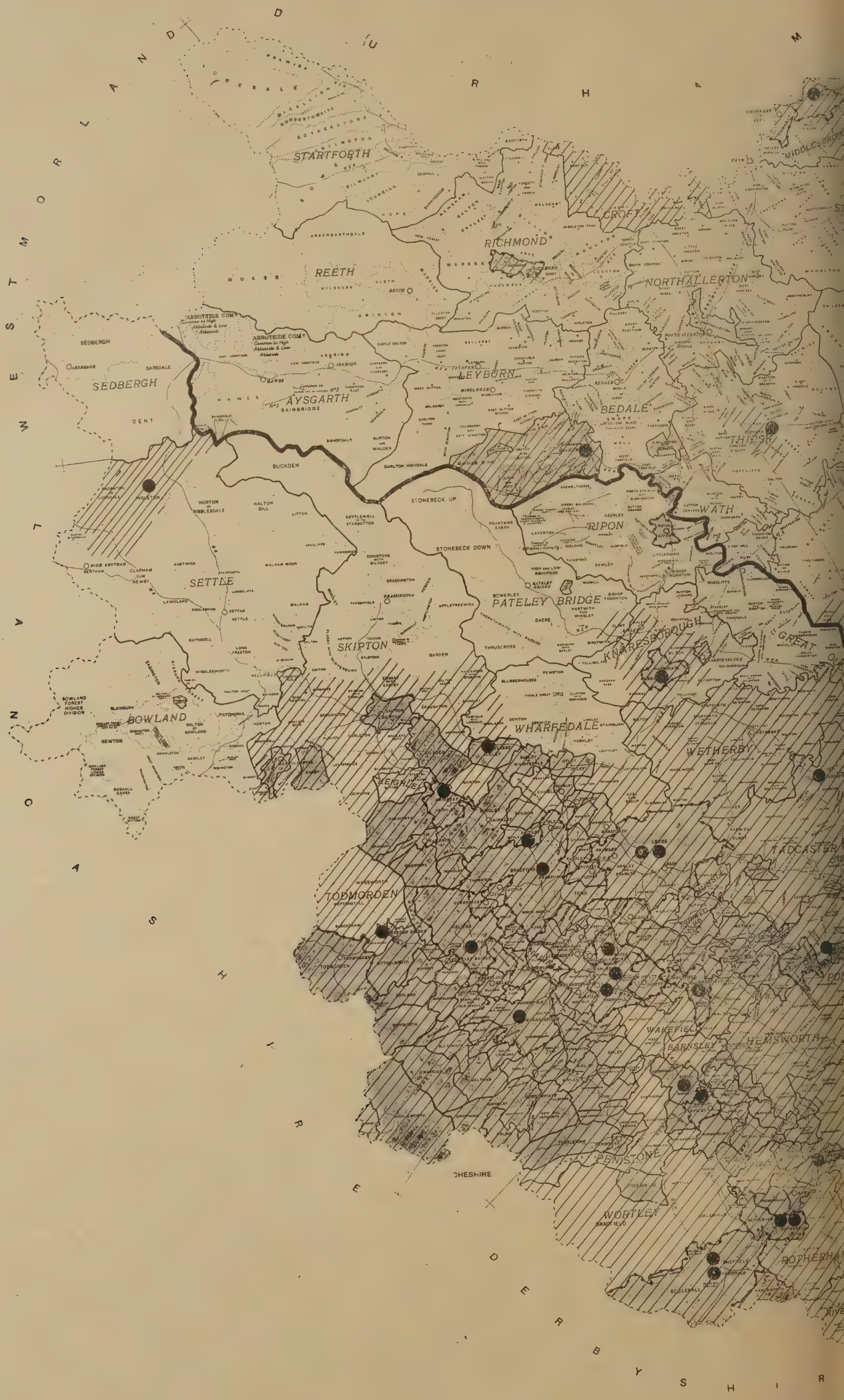
The 1921 Census gives the following figures for each of the Ridings, with their associated County Boroughs, and for the City of York:—

	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
E. Riding ...	750,115	460,880	104,075	7,128
N. Riding ...	1,362,058	456,436	97,859	6,568
W. Riding ...	1,773,529	3,181,174	749,173	54,541
City of York	3,730	84,039	19,020	1,057
Total ...	3,889,432	4,182,529	970,127	69,294

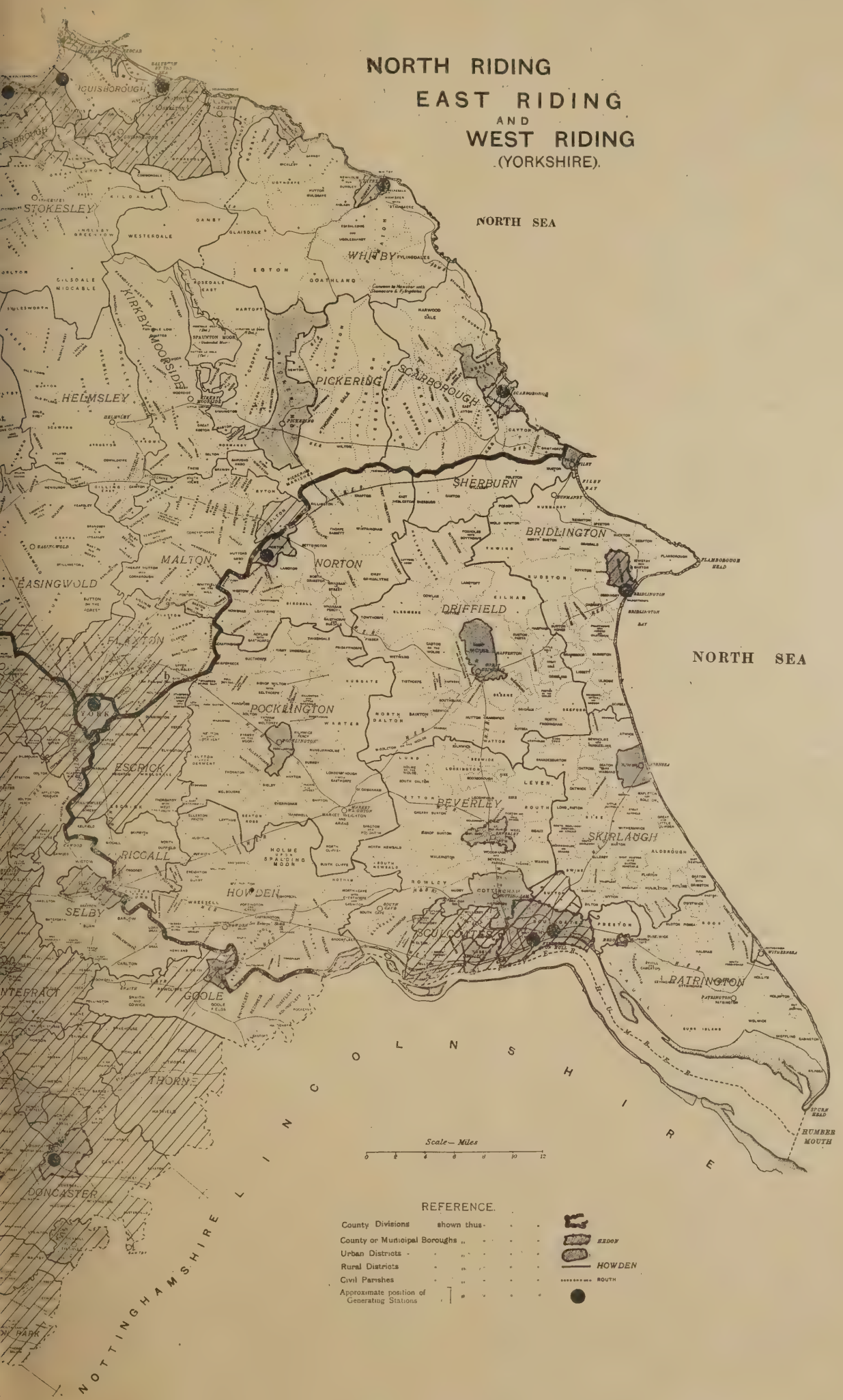
The accompanying map has been hatched to show the occupied and applied-for areas in respect of statutory powers for general supplies of electricity.

The Cleveland and Durham County Electric Power Company's area extends into the North Riding, but this has not been shaded, as the statutory powers do not authorise general supplies. Similarly, the area of the Yorkshire Electric Power Company is not hatched, except where statutory powers for general supplies are held or have been applied for.

Figures for the kWh generated for Yorkshire as a whole are not readily available. The output of the generating stations in the North and East Ridings, together with that of York, Harrogate and the Ingleton E. L. & P. Co., Ltd., is included with the output of the generating stations in the North-East Coast District, which is Area No. 16 of the Electricity Com-



Electricity Supply



of Yorkshire.

missioners' publication, "Generation of Electricity in Great Britain."

The output of the remaining generating stations in the West Riding can be obtained by combining the totals given for Area No. 4 and Area No. 9 in Table 8 of the above-mentioned publication. (It should be noted that the output of the generating stations of Chesterfield and Worksop is also included in Area 9.)

For the sake of comparison, the totals of Area No. 3, which is the South-East Lancashire Electricity District, are also given below:—

Year ending March 31st.	kWh generated. Areas Nos. 4 & 9.	Area No. 3.
1922	458,998,118	536,232,207
1923	559,249,179	647,284,355
1924	656,616,641	741,676,570
1925	691,270,702	838,793,340

It is evident that the rate of increase for the West Riding has not been so fully maintained as in No. 3 Area.

The following is a list of existing authorised undertakers, whose areas are wholly or partly in Yorkshire. The names of two Corporations and five Urban District Councils are shown in heavy type; in these instances it has been decided to dismantle the generating station and take a bulk supply:—

Local Authorities.

Adwick-le-Street Urban District Council.
Baildon Urban District Council.
*Barnsley Corporation.
*Batley Corporation.
Bingley Urban District Council.
*Bradford Corporation.
*Bridlington Corporation.
Brighouse Corporation.
Dearne District Electricity Board.
*Dewsbury Corporation.
*Doncaster Corporation.
Elland Urban District Council.
Eston Urban District Council.
Guisborough Urban District Council.
*Halifax Corporation.
*Harrogate Corporation.
Haworth Urban District Council.
*Hebden Bridge Urban District Council.
Heckmondwike Urban District Council.
Holmfirth Urban District Council.
Honley Urban District Council.
*Huddersfield Corporation.
*Ilkley Urban District Council.
*Keighley Corporation.
*Kingston-on-Hull Corporation.
Knaresborough Urban District Council.
*Leeds Corporation.
*Masham Urban District Council.
*Mexborough Urban District Council.
*Middlesbrough Corporation.
Mirfield Urban District Council.
Morley Corporation.
New Mill Urban District Council.
Normanton Urban District Council.
Ossett Corporation.
Pudsey Corporation.
Redcar Corporation.
*Rotherham Corporation.
Scarborough Corporation.
*Sheffield Corporation.
*Shipley Urban District Council.
Skelton and Brotton Urban District Council.
Skipton Urban District Council.
Slaithwaite Urban District Council.
Spenborough Urban District Council.
*Stalybridge, &c., Electricity Board.
Todmorden Corporation.
*Wakefield Corporation.
*Whitby Urban District Council.
Whitwood Urban District Council.
*York Corporation.

Companies.

Cleveland and Durham County Electric Power Co.
Electrical Distribution of Yorkshire, Ltd.
Ingleton Electric Lighting and Power Co., Ltd.
Northern Counties Electricity Supply Co., Ltd.
Scarborough Electric Supply Co., Ltd.
Tadcaster Electricity Co., Ltd.
Yorkshire Electric Power Co.
Yorkshire (West Riding) Electric Tramways Co., Ltd.

Although the Newcastle-upon-Tyne Electric Supply Company has not been included in the above list of authorised undertakers, it should be noted that the Acts of this company empower it to supply energy, *inter alia*, to the North-Eastern Railway Company.

Applications for Electricity (Extension) Special Orders have been lodged by the following local authorities:—

Bradford Corporation.
Bingley Urban District Council.
Darlington Corporation.
Keighley Corporation.
Leeds Corporation.

Richmond Corporation has applied for a Special Order, and the Electrical Distribution of Yorkshire, Ltd., has nine applications awaiting approval.

The accompanying map was prepared by the Ordnance Survey Department for the 1917 Boundary Commission, and is reproduced by permission of the Controller of H.M. Stationery Office. Since 1917 many alterations to areas, &c., have been made, of which particulars are available if required.

*Local authority undertakers owning generating stations.

Wireless and the Electrical Trader.

By PAUL D. TYERS.

One is frequently told that the electrical trader is somewhat afraid of wireless as an integral part of his business. It seems a little peculiar, perhaps, since wireless is essentially a hundred per cent. electrical that many electrical retailers should approach it in rather a half-hearted way. A little fuller investigation of the subject, however, soon shows us that there has been very good cause for the electrical trader to approach wireless with more than ordinary caution. The inauguration of a regular broadcast service produced chaotic conditions in the wireless industry, if we may term it such at that time. Manufacturers soon began to flood the market with anything and everything that was "wireless," and, moreover, apparatus was to be found in the windows of retailers of almost any class of goods all over the country. It must have been a little disconcerting to the electrical trader to find that a photographer, perhaps, in the same street was filling his windows with wireless goods and obtaining full trade discount.

When the first novelty of broadcasting diminished, the somewhat chaotic conditions began to sort themselves out. The public became more critical, and only the best apparatus found a ready market. To-day, the semi-technically educated public are beginning to find that they cannot expect to obtain intelligent service from the retailer of wireless apparatus unless he happens to be in the electrical trade.

Obviously, then, the wireless trade by its very nature is forcing itself into the hands of the electrical contractor and dealer. That the retailing of wireless components and sets is a profitable undertaking is indisputable, and its successful development will lie in the hand of the electrical retailer.

There may be some who doubt the truth of this statement, but no better indication can be found of the trend which the wireless industry is taking than in the marketing of the General Electric Co.'s radio valves as the "Osram valves." Everybody knows the Osram lamp, and the wireless public are now being made to remember the "Osram valve"; and they will naturally go to the electrical dealer. So far as the sale of ordinary electrical fittings is concerned, the dealer knows that to maintain the support of his customers he must sell them the right article, give them good service, and also be in a position to advise them in their purchase. This, of course, presents no difficulty, since, almost without exception, the retailer thoroughly understands the apparatus which he is selling.

In the case of wireless components and sets, this aspect of the problem is far more difficult, since the technical side of wireless is admittedly more complicated and also strange to the average dealer, unless, of course, he happens to have specialised in wireless as an amateur experimenter. It means, then, that the dealer must exercise considerable care in advising his customers what to buy and how to use it. It is quite conceivable that any haphazard sale of, perhaps, the wrong type of condenser or transformer may arouse the displeasure of one of his best customers, with the result that not only is he likely to lose any further wireless business, but his ordinary electrical trade may also be jeopardised.

It should not be imagined, however, that anything in the nature of a highly technical knowledge is necessary in order thoroughly to understand the selling of wireless apparatus. Experience shows that the queries raised by prospective buyers are almost invariably connected with some few dozen particular points, and it is with these subjects that the trader should become perfectly familiar. By so doing he will gain the confidence of his customers, and soon earn a reputation which should do much to strengthen the foundation of a really good retail wireless business, which happily must sooner or later improve the electrical side still further. With this end in view, it is hoped to discuss in these columns some of the more important technical problems which are likely to arise.

The British Industries Fair.—IV.

Electrical Features and Meetings.

Visit of Contractors and Wholesalers.

On February 24th members of the Electrical Contractors' Association and the Electrical Wholesalers' Federation paid a visit to the British Industries Fair, at Castle Bromwich, Birmingham. The attendance was of a representative character. At the invitation of the Management Committee of the Fair, the party lunched together, and at this function Mr. T. R. Martin, vice-chairman of the Fair Management Committee, said that the organisers had not only got manufacturers to exhibit, but had actively assisted in the bringing of buyers to the Fair. They felt that nothing was more likely to conduce to bigger and better business than to bring producer and buyer once a year into personal contact. The Committee felt that the electrical industry had, for too long, been out of this great movement for the general betterment and world expansion of British trade. They felt confident that having once started they would now go on, year after year, making the electrical section larger and larger until they succeeded in attracting to this country once in every year buyers from all parts of the world. The more rapid its growth, and the greater and more representative its exhibits became, the more quickly would the buyers come, and, for that reason, they hoped that the electrical industry, having once made a serious start, would go on, and that it would take its proper place and share in this movement for making England, for one fortnight in every year, the market of the world. The Fair was now firmly on its feet, and, from the applications and inquiries already received, it was obvious that considerable extensions would be necessary, they were indeed already under consideration for next year's Fair. He expressed the hope that manufacturers, who intended to show next year would give to the Fair Committee an early notification of their space requirements.

Mr. H. H. Berry, in submitting the toast of "The Electrical Industry," said his experience at the present Fair had been most encouraging, and he saw no reason why the concern with which he was identified should not exhibit for some years to come. He looked upon the Exhibition, if it were properly done, as likely to become a milestone in the development of the electrical industry. His hope was that each milestone would become more important; and that support, so far as the Fair was concerned, would be forthcoming from the great and ever-growing electrical industry.

Mr. Alger (president of the E.C.A.), in reply, humorously observed that he was not expected to make a pronouncement against municipal trading, although he considered that anything which tended to destroy private enterprise should be strenuously opposed. As an Association they stood for quality, efficiency, and service; and it was part of their trade policy, as far as possible, to push only British manufactured goods. He congratulated the authorities upon the wonderful exhibition which they had got together; a visitor to the Fair would not believe that Britain was "down and out." If we turned to work seriously in all departments, we need not fear competition from any country.

Mr. A. Holman, president of the E.W.F., said that he felt that the only way of advancing our export trade was by holding these Fairs, year after year, without a break. British manufactured goods were the best, taking everything into account, and he trusted that the Fair would be the means of attracting to London and Birmingham buyers from all parts of the world. As this country depended largely for its existence on export trade, he was satisfied that British manufacturers would manufacture precisely the kind of goods that were wanted overseas; it seemed to him it was only a question of organisation in bringing the Colonial and foreign buyers to this common centre.

Colonel Cole, Director of Exhibitions, Department of Overseas Trade, also replied, observing that that was the seventh occasion on which he had been to Castle Bromwich. He thought they would feel that this Fair movement was only in its infancy. We in this country were slow in taking up new ideas, but this modern type of fair was quite different from the old-time fairs. They of the Board of Trade had a great responsibility in trying to bring to this country as many overseas buyers as possible, and through the various services of the Department they were doing their best to develop export trade. It was not easy to appreciate how rapidly some parts of the British Empire were growing, but it was the desire of the Board of Trade to place its services at the disposal of the business and commercial community. Referring to the recent Exhibition of Decorative Art in Paris, he said that it taught one outstanding lesson: the enormous development in electric lighting. Paris on the occasion to which he referred offered a real object lesson to those engaged in the English electrical industry.

The electrical trade representatives then made a very thorough tour of the electrical section of the Fair.

The Electrical Association for Women.

This Association held a meeting on February 23rd, at the Birmingham Fair, for the purpose of inaugurating a branch in the Midlands. Lady Brooks was in the chair, and Miss Haslett, director of the Association, explained the objects of the organisation, emphasising the need for greater knowledge amongst women of things electrical. Those who were fortunate enough to possess electricity in their homes needed education in electrical "first aid," while for others a demonstration of the value of electrical labour-saving devices was the essential. This instruction would become available to the women of the Midlands if a branch of the Electrical Association for Women was formed there. Miss Haslett emphasised the need for the improvement of the hire system of expensive electrical apparatus, and the value of electrical instruction to girls at school.

Mrs. Lawson, local hon. secretary, announced that it was hoped to hold a large meeting in two or three weeks' time, and as a result of her appeal to those present to become members a large number of local ladies were enrolled during the afternoon.

Mr. Chattock, the city electrical engineer, gave the new branch a very warm welcome, and promised advice and assistance wherever possible. He spoke of the need for an educative movement in the proper use of electricity and the best way of applying it, and said that he wanted the ladies of Birmingham to take an interest in the greater use of electricity for domestic purposes.

Miss Griff, A.M.I.A.E., moved a resolution inaugurating the local branch, and this was seconded by Mrs. Howie, of Walsall. After an open discussion it was decided to call the

branch "The Birmingham and Midland Branch of the Electrical Association for Women."

The meeting concluded with an interesting report from Mr. Dean, on behalf of Mrs. George Cadbury, of an experiment at Bournville. Three houses had been built of the same standard, but fitted, respectively, with (*a*) coal fires, gas cooker, and electric light; (*b*) all-electric fires and lights except in the kitchen, which had a coal range, for cooking and heating water; and (*c*) electricity throughout, no coal fire at all. The last-named was proving rather difficult to dispose of. Careful records were to be kept in these houses for the next 12 months of all expenses connected with heating and lighting (even the cost of chimney sweeping and ceiling painting) so that due comparison could be made.

At the close of the meeting members visited the stands and were then entertained by the Fair authorities to tea; later in the evening members were invited to a reception at the Town Hall, given by the Lord Mayor.

Lady Brooks was elected as president of the branch, Mrs. Lawson as hon. secretary, Mrs. Chattock and Mrs. Beale as vice-presidents, and amongst those elected to the Council were the following:—Mrs. Howie (Walsall), Mrs. S. T. Allen (Wolverhampton), Mrs. Muncaster (Leicester), Mrs. Forrest, Mrs. Garrard, Mrs. Tucker, Mrs. Jennings, Mrs. Martin, Miss M. F. McDonald, Mrs. Collard, Miss C. Griff, Miss E. D. Lockley, Mrs. H. L. Wood, and Mrs. Boyes.

Stands at Castle Bromwich.

We have already reproduced photographs showing examples of the types of stands erected by exhibitors or their contractors in Building C of the Castle Bromwich Aerodrome. As a further guide to prospective participants in future fairs we illustrate herewith four more typical examples. The first (Julius Sax & Co., Ltd.), shows how advantage has been taken of a small space to exhibit a wide range of accessories. The second (Young, Osmond & Young, Ltd.), illustrates the effective use of a large space to show a single idea—the "Lightfoot" tubular heating system. The third example (the Chloride Electrical Storage Co., Ltd.), is a corner stand, and the fourth (Berry's Electric, Ltd.), is a double stand with a room at the rear for demonstrating the effects of electric fires.

Allen-Liversidge, Ltd.

Among a collection of apparatus, examples of "Pontelec" welders and rivet heaters were shown. One of them—the No. 10 spot welder, which was demonstrated, is capable of continuously welding wrought iron or mild steel up to ¼ in. added thickness, or ⅜ in. occasional working, and weldable brass up to 3/22 in. added thickness. It is strongly constructed, fitted with water-cooled electrodes having renewable tips and a swivelling pressure pedal adjustable to any angle up to 30 deg. The heating control provides for eight different degrees of heating for varying thicknesses of material. A trip switch automatically cuts off the current immediately the weld is completed. The machine is rated at 6 kW. A 15-kW rivet heater was shown, and it was demonstrated that the rivet was heated from the core outwards, so that the head was least affected. An 8-heat control plug device is provided, and the machine is provided with three heads, each with its separate operating pedal. Another machine on view was a 30-kW butt welder.

Smith & Paget, Ltd.

A number of washing machines and wringers were exhibited by this company; among them was the "Northern Crown" electric washer and wringer. The clothes container in this machine is a cage of perforated pitch pine operated by a patent reversing motion giving 1½ revolutions in each direction alternately. The wringer provided is of substantial propor-

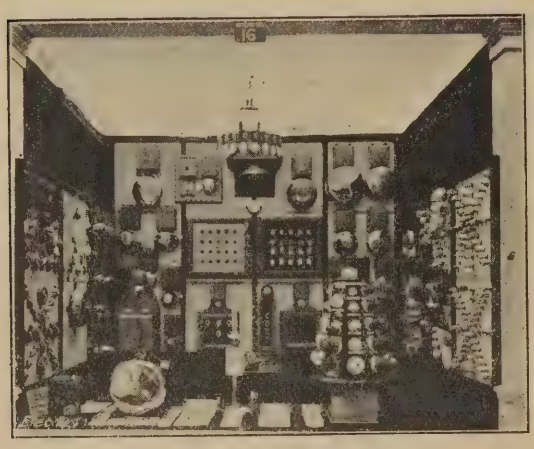


Fig. 15.—Julius Sax & Co., Ltd.

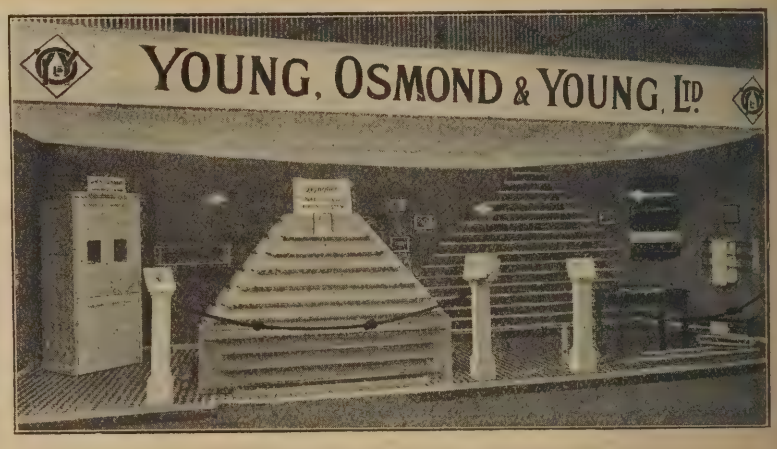


Fig. 16.—Young, Osmond & Young, Ltd.



Fig. 17.—Chloride Electrical Storage Co., Ltd.



Fig. 18.—Berry's Electric, Ltd.

Representative Examples of Stands at Castle Bromwich.

tions, and is driven by guarded chain gears from a small motor which operates the clothes container. Another design of washer was the "Crown Capital" machine, which is of the dolly type, the dolly being operated by a ¼-h.p. motor.

Crossley Bros., Ltd.

A number of running engines were displayed upon this stand. The largest was a 31-b.h.p. horizontal, cold-starting oil engine, designed for operating an electrical generator. It can employ the cheapest grades of fuel oil, but it is also suitable for higher class oils. It has a moderate compression pressure and the fuel consumption is said to be only .45 lb. per b.h.p.-hour at full load when using furnace oil. The fuel admission is on the solid injection principle, the pump delivering oil through a special sprayer nozzle. Another engine shown was the Crossley vertical 2-stroke crude oil engine, with a capacity of 14-b.h.p. normal working load. The special features of this type of engine are an air scavenge pump and a system of forced lubrication to all working parts. The

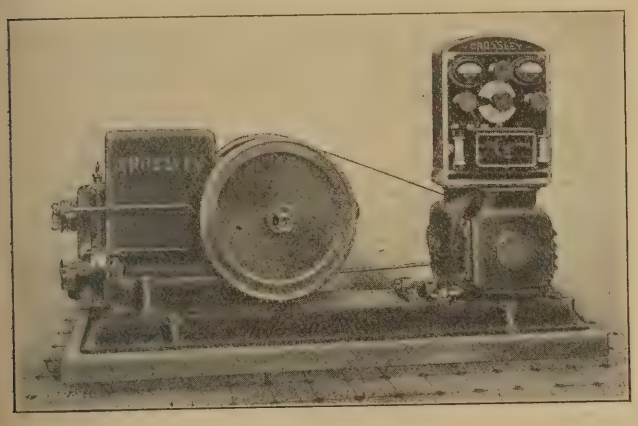


Fig. 19.—A Crossley Lighting Set.

fuel consumption on furnace oil at full load is .57 lb. per b.h.p.-hour. An entirely new production which was shown is the 1½-kW electric lighting set illustrated in fig. 19. This set comprises a 3-b.h.p. horizontal paraffin engine, totally enclosed, with automatic lubrication, belt driving a 50/70-volt dynamo, upon which the switchboard is mounted. The set is erected upon a substantial base, as will be seen from the illustration; this base contains the fuel supply. Water cooling is provided by a fan-cooled radiator attached to the engine water jacket. This set is also made in the following sizes:—¾ kW, 1 kW and 1½ kW. It is arranged for battery charging for country house lighting, etc.

Berry's Electric, Ltd.

The well-known "Magicoal" fires formed the *pièce de résistance* of this exhibit. Upon the stand was a lounge in which several of these in various "period" styles were arranged. At one end of the stand was an "Ironsafe" switchboard which is one of the firm's specialities. Distributed about the stand were examples of "Mulparvo" heaters, which,

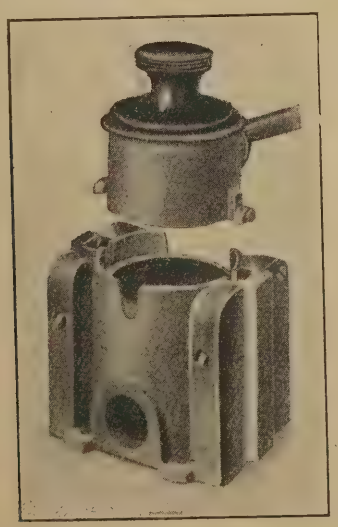


Fig. 20.—The "Konform" Switch-plug.

as their name implies, serve a number of purposes in the heating and cooking direction. Other exhibits were an effective revolving illuminated advertising device and a shaving mirror into which an electric lamp is fitted to direct light upon the face. A recent production exhibited was the "Konform" ironclad switch-plug designed for use with trailing cables, portable tools, &c. This device, which is illustrated in fig. 20, has a quick-make and quick-break switch action which is independent of the operator. It is impossible to make an incorrect sequence of contacts, and there is no separate switch handle to operate. All live parts are enclosed and the contacts submerged when the plug is withdrawn and the operating springs are kept well away from the switch contacts. The latter are of a substantial blade and clip form. Earthing is provided for on both parts.

Upon this stand, also, was a selection of electrical instruments made by Messrs. Nalder Bros. & Thompson, Ltd.

Julius Sax & Co., Ltd.

The principal articles exhibited by the company were "Sax" rubbing contact bells, capable of ringing upon from 2 to 250-V d.c. or a.c., in sizes of from 2 in. to 12 in., and suitable for domestic use, as alarms of various types, for railway signalling, &c. A number of indicators of all kinds were shown, as well as other bell accessories and materials. A very wide range of wall plugs formed another section of the exhibit, which is illustrated in fig. 15, and there was also a candle fitting capable of being adapted to any size of sconce, and numerous lampholders, switches, &c.

Atomised Fuel and Engineering Co., Ltd.

Pulverised fuel is usually considered suitable for large installations only, but this company exhibited a plant which can be suitably employed in situations where the consumption is less than 25 tons per day. The "Atomiser" consists of a complete pulverising and firing equipment, self-contained on a single baseplate. The pulveriser has two stages which successively granulate and pulverise the coal. The coal, which should not be larger than 1¼-in. cube, is delivered into a hopper and is fed by an automatic feeder into a breaking-down chamber, where it is rapidly reduced to a granulated condition by an impact rotor, consisting of beater arms fixed radially to a shaft. When sufficiently granulated, the coal is drawn to the inlet of a grinding rotor, and is discharged through ports on to a grinding ring, where it is ground to a fine powder by grinding balls, which are carried round by the rotor, and kept in contact with the grinding ring by centrifugal force. While these operations are going on, a current

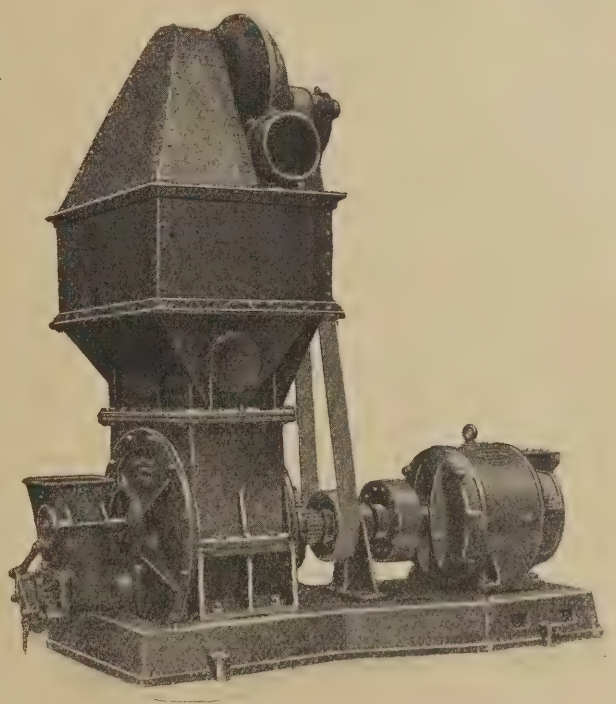


Fig. 21.—The "Atomiser" Pulverised Fuel Equipment.

of air is induced through the machine by a fan. Part of this air enters with the coal, but the major portion enters at an air inlet. As the finely-ground coal leaves the grinding ring it is lifted up by this current of air and is carried into an air-separation chamber; the dust-laden air expands in filling this larger volume and in doing so precipitates the coarser particles, and these fall by gravity through a passage into the machine for re-grinding, whilst the finest product only is carried forward by the fan to the burners. On the discharge side of the fan is fitted a valve, by means of which the air admitted to the machine is controlled, and by this means the fineness of the product can be regulated at will. The equipment is made in three sizes with capacities of 5-10, 20-30, and 30-40 cwt. per hour. The plant is illustrated in fig. 21.

Coley & Swinnerton, Ltd.

Among the appliances shown by this firm were "Electric Perfection" and "Savex" cookers. These are of a fairly light construction and consequently low in price. They are fitted with one, two or three boiling rings as required, and are of ample dimensions for average domestic use. Another exhibit was the "Savex" electric wash boiler consisting of a 10-gallon tank with a 2-heat arrangement, giving 175 W for continuous running and 2,800 W for speedier water heating.

The Hewittic Electric Co., Ltd.

This company's principal exhibit formed part of the special arrangements of the exhibition. This was a mercury-arc rectifier sub-station, comprising eight 100-A units feeding a 3-wire system. The sub-station was fed from the 5,500-V mains of the Birmingham Corporation, the supply being stepped down by two main transformers made by the Hackbridge Electric Construction Co., Ltd. By means of a simple arrangement of three switches, complete isolation may be obtained at any time upon the a.c. or d.c. sides, enabling inspection and repair to be carried out while the other rectifiers in the same bank remain on load. The whole of the gear forming the rectifier proper is enclosed in a sheet steel cubicle, making a compact unit, the instruments, switches, circuit breaker and voltage regulator control being mounted on the front panel. A door is provided in the front, giving access to the fuses, and a lift-off panel at the back facilitates inspection. One of the main advantages of the mercury vapour rectifier over other forms of converter is its relatively high and constant efficiency through a wide variation of load. A view of the sub-station appeared in our last issue (fig. 8, p. 330). The company also showed its "Service Light" system. This employs a tube of incandescent gas 50 in. long and 1 in. in diameter, giving a wide distribution which is claimed to be glareless, and thus there is no need for any form of diffuser. An efficiency of three candles per watt is claimed for this system, as compared with about 1.5 candles per watt for gasfilled lamps. The intrinsic brilliancy is less than 20 candles per square inch as compared with several thousand in the case of the gasfilled lamp. Another one of the firm's manufactures which was shown was the Hewittic-Levick "Ulviarck" lamp, for electro-medical purposes. This gives a light rich in ultra-violet rays and is useful in the sunlight treatment which is coming into extensive use in hospitals, particularly for the treatment of children.

Ruston & Hornsby, Ltd.

Four representative machines of this company's manufacture were shown. The first was a cold-starting horizontal oil engine developing 130 b.h.p. This is designed to run without alteration on a wide range of fuel oils, and it is claimed to start from cold under any conditions. This type is made in sizes from 16 to 340 b.h.p. The engine was shown in operation, as was also a two-stage air compressor of the type used for charging self-starter air receivers, with a working pressure up to 300 lb. per sq. in.; this is water jacketed, self-lubricating, and starts on petrol and continues on paraffin. The other exhibits were stationary—one was a 3-cylinder vertical oil engine (45 b.h.p.). This possesses many of the characteristics of the horizontal type, but has the virtue of occupying less space. It is made in sizes up to 1,000 b.h.p. The Ruston patent "Thermax" boiler which was shown, is a vertical boiler which, by reason of the special arrangement of tubes, is said to give a much higher efficiency than the ordinary vertical cross-tube boiler. The saving of fuel is claimed to be at least 20 per cent., and it is pre-eminently suitable for installation in positions where space is limited.

The "Ceag" Miners' Supply Co., Ltd.

Among the exhibits of this company was a 4-V lamp to provide more than four times the light obtainable from a 2-V lamp, although it is less than twice the weight of the latter. It has been largely adopted by colliery companies for use at the coal face. Another type of miner's lamp on view was an experimental lamp in which the bulb is carried in a swivelling head, and by the use of a scientifically-designed reflector and lens, a very large percentage of the total light is concentrated into a wide-angle beam, which can be directed on to the work. The swivelling arrangement consists of an adaptation of the universal ball joint to enable the light to be shown in any direction without the use of connecting wires. This ball is divided and insulated, and contact is made through the centre of the bulb. Another clever and useful type of lamp which was seen, was a gas-detecting lamp. Upon this is a small oil chamber with a wick ignited by a platinum wire. The wire is carried above the wick by the supporting columns, which perform the double purpose of carrying the chamber and of conducting the current from the accumulator to the platinum wire. The insulating plate in the lamp is divided so that in one position the standard bulb is illuminated, giving light for general use. A turn switches off the light, and a further movement causes the current to flow through the platinum wire, heating it and so lighting the oil lamp. It is said that the oil flame can detect from 1½ to 5 per cent. of gas. A quick-action lid was fitted to a number of these lamps; this enables the electrodes to be readily removed from the accumulator case. Three peculiarly shaped lugs rise out of corresponding recesses in the case when the lid is twisted, so freeing the electrodes. When the lid is pressed on, these lugs drop into position, definitely locating and securing the lid and the case together.

"M. K." Electric, Ltd.

Plugs and sockets and switches of various patterns formed the bulk of this company's exhibit. There was a complete range of 2- and 3-pin plugs and sockets, surface and sunk types embodying the continuous ring spring "Multi-Kontact" sockets, from which the firm derives its name. Foot-press switches for use with radiators were shown; these have largely taken the place of the American rotary types. Combined switch plugs for heating circuits in various types and finishes were displayed, including inter-locking patterns which are foolproof, and conform fully to Home Office regulations and the I.E.E. Rules. Complete control panels for electric cooking and heating installations; teak-cased fuse boards of H.O. design, suitable for 5 to 20-A circuits and a patent double surface safety plug were shown and demonstrated. The last article is a reducing adaptor enabling a fire or other appliance taking a heavy current, to be run from the same point simultaneously with a kettle, iron, or other lighting appliance, the light circuit being protected by a sub-replaceable fuse. Tumbler switches and tumbler switch plugs were shown by the company for the first time. These are rated at from 5 to 7 A. The switch is designed on the same general lines as the well-known foot-press switch. It has a long positive quick-make and quick-break action and the contacts are of phosphor bronze and long and flexible.

Hackbridge Electric Construction Co., Ltd.

The interior of a transformer dominated this stand. The plant is rated at 500 kVA, 3 phase, 50 cycles, 6,600/400 V. It is mesh-star connected and has primary adjustable tappings at plus and minus 2½ and 5 per cent. Samples were shown of bakelite insulation in a number of forms, coil clamping rings, transformer tapping arrangements, 100,000-V bushings, &c.

Gent & Co., Ltd.

This company produces a diversity of equipment, and it required a large stand to display examples of them adequately. One prominent exhibit was an electric turret clock movement, which is capable of driving four 12-in. dials; it is controlled by a master time transmitter. Several patterns of "Pul-syn-etic" clock were shown, including recording apparatus. In addition to these, there was a representative collection of signalling apparatus of various classes, *e.g.*, for mines, on board ship, &c. The telephone apparatus section included several types of intercommunicating telephones and staff locaters, as well as headphones for radio reception. Other radio equipment on view comprised complete receiving sets, loud-speakers, inductance coils, l.f. transformers, &c. An audible as well as visible exhibit was a number of electrically-driven sirens which were occasionally demonstrated.

Waygood-Otis, Ltd.

In addition to a standard electric winding engine (lifting 24 cwt. at a speed of 128 ft. per minute), two hand service lifts, and accessories, this company showed a very handsome working model of an automatic electric passenger lift.

Blackstone & Co., Ltd.

The main exhibit upon this stand was a 100-b.h.p. spring-injection cold-starting oil engine, typical of a range with a maximum output of 900 b.h.p. The "spring-injection" system, it is claimed, ensures a lower fuel consumption, more perfect and prolonged combustion, and the fuel is injected at the same point of the stroke and at the same pressure irrespective of the speed of the engine. This injection mechanism was shown separately. Another engine shown was a new model 5-b.h.p. petrol engine driving a two-stage compressor.

The London Fair.

The General Electric Co., Ltd.

We have already described this company's exhibits at the two sections of the Fair, and a view of its stand at Castle Bromwich has also appeared. In this issue we reproduce a



Fig. 22.—The G.E.C. Stand at the White City.

photograph of the company's stand at the White City, from which it will be seen that the company lent its full support to the Fair.

S. G. Brown, Ltd.

Messrs. S. G. Brown showed a cabinet loud speaker of handsome finish and appearance, having an internal horn of stout

cast aluminium; it is covered by a 12-months' guarantee. In addition there was a display of the company's standard headphones, loud speakers, amplifiers, and other wireless apparatus.

Red Seal Radio Co.

This exhibit consisted entirely of loud speakers, of which two models were shown. These are of simple appearance, free from "freaks"; the cases are sealed, and the instruments are guaranteed without a time limit, provided the seals are not broken. The diaphragms are thicker than usual, and the shape of the horn has been carefully designed.

Eddystone Co.

Besides accessories of all kinds, this company showed short-wave coils for receiving American stations, a 2-valve broadcast receiver for waves from 25 metres upwards, and shock-absorbing feet of Sorbo rubber. All the receiving sets were fitted with front panels of thick glass, and with geared slow-motion condensers.

Gilfillan Bros., Ltd.

The elimination of the battery from radio receivers was the main theme of this firm's exhibit. The Gillan IIx set works directly off the d.c. lighting mains (which, incidentally, also serve the purpose of an aerial within a few miles of the transmitting station). Plate battery pressures from 50 to 160 volts are available when the supply is at 200 volts or more; four filament currents are provided for as well as grid bias from —2 to —10 volts. The battery eliminator unit, which is incorporated in the set above named, can also be obtained separately.

Radio Communication Co., Ltd.

This company had a large exhibit consisting mainly of its marine wireless equipments, rated at 1½, ½, and ¼ kW; a ¼-kW lifeboat set, an automatic call device, and a variety of broadcast receiving apparatus, transmitters, &c., were shown. The 1½-kW ship-and-land station was fitted with continuous wave apparatus, as well as the spark system, and had a daylight range of 800 miles with spark, and 2,000-2,500 miles with c.w. The "Polar Audalion" loud speaker was a notable feature of the exhibit.

Brandes, Ltd.

Amongst the well-known manufactures of this company there were to be seen—and heard—the cone cabinet loud speaker, a neat hornless design; the Brandola; and the little "table-talker," with non-metallic horns. The matched-tone headphones should not be overlooked, and a "distortionless" transformer was shown, with ratios of 5.1 and 3.1.

C.A.C. Radio, Ltd.

Amongst a variety of wireless apparatus, the high-pressure accumulators made by this firm formed a noteworthy feature of the exhibit. The 10-Ah and 1-Ah sizes were shown, each set giving 80 volts; two intermediate sizes are also made. The company is now making its own valves, of several types, which are sold with a three-month guarantee from the date of sale. A portable set having a range of 30 miles on the loud speaker and 50 miles on 'phones, weighing 17 lb., was worthy of note; with an outdoor aerial it has a range of 1,000 miles. Another interesting item was the "Voltometer," a set which takes both h.p. and l.p. supply from the d.c. lighting mains.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The B.E.A.M.A.—The annual luncheon of the British Electrical and Allied Manufacturers' Association will be held at the Connaught Rooms, on March 18th, at 1 o'clock.

Proposed Exhibition at Sydney.—Much work has been done in connection with the proposal to hold an exhibition in Sydney in 1930 to mark the completion of the Harbour Bridge. A committee has been appointed and plans made for a vast gathering, which will also mark the completion of the electrification of the suburban railways and the advancement of Canberra, which should by that time be nearing completion. A proposal, however, has been made that the exhibition be held in Sydney in 1929 instead of in 1930.—*Reuter's Trade Service* (Melbourne).

The Engineering Dispute.—Over 900 men employed by Messrs. R. Hoe & Co., printing machinery manufacturers, have been on strike for some time on the question of the employment of non-union labour. The principal union concerned, the Amalgamated Engineering Union, has refused to recognise the strike, stating that the men should resume work to enable negotiations to be carried on. This action of the union has had no effect, and as a consequence a statement was issued last week by the Engineering Employers' Federation that steps to end the dispute would be taken, to the extent of ordering a national lock-out.

A national lock-out is also threatened by the Federation if unions or district groups attempt to enforce an increase of wages, following upon the abandonment of the national negotiations.

On Friday last the board of management of the Engineering Employers' Federation decided that lock-out notices should be posted in all federated engineering works to-day (Friday), and that they should take effect on Saturday, March 13th. The strike committee of the employés at Messrs. Hoe's works is said to have stated that the threat of a lock-out had no effect upon its determination to abolish non-unionism at the works and to obtain higher wages.

The Swedish Electrical Industry.—*Swedish Export* says that the situation of Sweden's electrical industry greatly improved during 1925. The home market was certainly rather dull, but the demand from abroad improved considerably. Competition was severe, but on the whole Swedish manufacturers were able to retain their position in the export market.

Post Office Engineers' Salaries.—The *Daily Telegraph* reports that the Arbitration Court, which consisted of Mr. Harold Morris (president), Sir Felix Pole, and Mr. J. J. Mallon, have awarded the Post Office engineers new and improved scales of salary. The new basic salary, that is, salary exclusive of the cost of living bonus is to be:—Executive engineers, London, £450-20-550 a year (present scale, £430-20-510); executive engineers, provinces, £420 20 520 (present scale, £400-20-480); assistant engineers, London, £200 240 15 420 (present scale, £220-15-400); assistant engineers, provinces, £180-220 15 400 (present scale, £200-15-380). The lower minima awarded to assistant engineers relate to probationers. The salaries on the adjusted scale will be subject to the current cost of living bonus. The award becomes operative as from January 1st last.

Catalogues Wanted.—MESSRS. ABRAHAM BROS., of 7, Jinkee Road, Shanghai, wish to receive on behalf of the Van Chong Co., electrical engineers, trade catalogues with discounts, also particulars of new electrical accessories and novelties. The Van Chong Co. is Chinese, but the management is British.

New Electricity Company.—The Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Company was incorporated by the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Act, 1925, which received the Royal Assent on December 22nd, 1925. The Act empowers the company to supply electricity within the major portion of the counties of Cambridge and Huntingdon and the Isle of Ely, and in certain districts in the north-eastern portion of the county of Bedford. The provisions in the Bill in connection with the acquisition of land and the erection of a generating station were excluded owing to the Government proposals. Arrangements will therefore be made in the first place with the North Metropolitan Electric Power Supply Company for bulk supply. The directors and officials are as follow:—Directors—Sir James Devonshire (chairman), Viscount St. Davids, Mr. J. S. Austen, Mr. E. Garcke, and Sir Douglas Newton; chief engineer—Mr. J. M. Donaldson, M.I.E.E.; secretary and offices—Mr. Evelyn Boys, F.C.I.S., York Mansion, 94, Petty France, Westminster, S.W.1.

Unemployment.—The number of persons registered at the Employment Exchanges as wholly unemployed on February 15th was 1,139,300, representing a decrease of 25,657 on the week. The total was 100,496 less than that of February 16th, 1925.

Employment During January.—The February *Ministry of Labour Gazette* states that employment in the engineering industry remained bad on the whole during January; there was a slight decline in the electrical engineering section. The detailed statistics show that the total of unemployed in Great Britain and Northern Ireland in the electrical engineering industry was 4,954 (as compared with 3,917 a month earlier), an increase of 1.4 per cent. of the total number employed in the industry (76,720 in July, 1925). The percentage of unemployed in the electrical wiring and contracting industry is given as 9.5 (total insured, July, 1925, 12,660), which is an increase of 2.7 per cent. in the month. There was also an increase in unemployment in the electrical cable and wire and electric lamp manufacturing industries, this amounting to 1.9 per cent., making the proportion of unemployed 7.5 per cent. in a total (as at July, 1925) of 81,350.

Electricity in "Weir" Houses.—The Electrical Trades Union has written to Glasgow Corporation making representations against the employment of unskilled labour on the electrical work in steel houses, and asking the Corporation to refuse to supply electricity to any of the "Weir" housing schemes in the city. Bailie Higgins, who is secretary of the Clyde District Committee of the Union, states that no electricians are employed by Messrs. Weir. Electrical work is being done by girls, he alleges, and the sections are being wired in the factory by a method which is not in accordance with the I.E.E. rules, and which he considers is not safe for dwelling-houses. The Union expects to obtain the assistance of the Electrical Contractors' Association.

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Social Events.—A social evening was held by the Siemens and English Electric Lamp Co., Ltd., on February 19th. The first part of the evening's entertainment consisted of a concert, one item of which was a play in three acts, written by two members of the staff. The cast was entirely composed of members of the staff. Another item was a humorous topical interlude by four outside representatives. The concert was followed by refreshments and a dance, in which approximately 100 people participated.

The first of what it is hoped will be a series of annual dances was held by the staff of the London Electric Wire Co. and Smiths, Ltd., at the Bridge House Hotel, London Bridge, on February 9th. The majority of the company came from the London offices and the Leyton factory, although there were representatives from the Manchester and Liverpool works. Some of the directors attended, and the affair was a thorough success.

Trade Announcements.—Messrs. Pritchett & Gold and E.P.S. Co., Ltd., announce that Messrs. Simpson, Baker and Co. are not now acting on their behalf in the counties of Gloucester, Wilts, Devon, Cornwall, Somerset, and Dorset. The territory, with the exception of Dorset, will be covered by their own representative, Mr. A. G. Foxlee. Dorset will be covered by the company's agents for the Eastern and South-Eastern areas—Messrs. Wood & Ball.

Messrs. Wm. Sanders & Co., of Falcon Electrical Works, Wednesbury, wish to absolutely repudiate rumours that they have disposed of their business. The business is the sole property of Mr. William Preston.

Mr. G. Gordon, late engineer to Messrs. Brown, Stewart, Ltd., has opened premises at 114, Alexandra Parade, Glasgow, as an electrical and mechanical repair shop and contractor. He asks for manufacturers' lists, &c.

The sale of "Redmanol" moulding compound in the English and Continental markets carried on by Mr. A. W. Bishop, Victoria Station House, S.W.1, has been taken over by a newly-formed company—Redmanol, Ltd. The company's specialities are coloured compounds, cements, resins, laminated insulation, compound for silent gears, &c.

Messrs. Ferguson Superheaters, Ltd., 3-4, Clements Inn, London, W.C.2, have been appointed sole selling agents in the London district by Quantameters, Ltd., for its remote tank level and flow indicator, &c.

The Surrey Engineering Co., Ltd., has removed from Surrey Street to 66-67, Shoe Lane, Fleet Street, London, E.C.

Mr. F. Knott (Maxted & Knott, Ltd.) is retiring from active practice after 34 years in the company, and Mr. E. G. Walker, of Westminster, has joined the firm. Messrs. Maxted and Scott, Ltd., will continue their present temporary head offices at Dunstable and their registered offices at 23, Queen Anne's Gate, Westminster, pending the securing of permanent headquarters, and will add to their special branches of engineering structural work, power plant, &c.

Messrs. Ross & Co. (Electric), Ltd., opened new premises at 41 & 43, Robertson Street, Glasgow, C.2, on March 1st.

Mr. H. M. Campbell, A.M.I.E.E., has secured premises at 10, Church Street North, Colchester, where he will open offices and showrooms for electrical products, on the 24th inst.

Messrs. Yates & Lomas, Ltd., electrical engineers, have this week opened new premises at 18 and 20, Chester Square, Ashton-under-Lyne.

Messrs. Alexander Brown & Co. have removed to 113, West Regent Street, Glasgow, C.2.

Mr. E. T. Turner, electrical engineer, of Epsom, has removed to larger premises at 77a, High Street.

Messrs. Edwardes Bros., of Blackfriars Road, London, will be glad if any reader will promptly 'phone to them at "Hop 2115" if anyone claiming to be a representative of the firm asks for advance payments for orders given or received on their behalf.

Holland House Electrical Co., Ltd., has opened an electric fittings, heating and cooking apparatus showroom at 247a, St. Vincent Street, Glasgow.

Mr. H. E. Massingham, electrical and mechanical engineer, 109, Edith Road, West Kensington, London, W.14 (telephone: Western 3129), has taken over the agency for London and district of Vesta, Ltd., Copenhagen, manufacturers of high-grade electrical cooking and heating apparatus.

Catalogues and Lists.—Metro-Vick Supplies, Ltd., Trafford Park, Manchester.—Two well-illustrated and priced catalogues:—Section B, covering electrical accessories and materials; and Section L, dealing with "Cosmos" electric kitchen equipment of all kinds, domestic and commercial.

Tok Switches, Ltd., Granville House, Arundel Street, W.C.2.—A calendar-blotter advertising the company's products.

Mr. A. Hinderlich, 1, Lechmere Road, N.W.2.—A post-card advertising quartz crystals for radio work. Priced.

Mr. L. J. Wolf, 116, Putney Bridge Road, S.W.15.—An illustrated pamphlet dealing with "Hazemeyer" star-delta starters. Priced.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—Publications No. 379c, 413a, and 442, dealing, respectively, with "Sterling" square-law condensers, "Nong-Pong" valve holders, and headphones.

The Ray Manufacturing Co., of 350, Fishponds, Bristol, have sent us one of their "Andy" vest-pocket fuse-wire wallets, of which they recently made a large number for a well-known electrical manufacturing company.

Messrs. Belbin & Bowden, Ltd., 3, Finsbury Square, E.C.2.—A folder, containing prices of "Bow Bells" electric lamps.

Messrs. Ferranti, Ltd., Hollinwood, Lancashire.—Pamphlet Te 151, illustrating and describing "Ferranti" immersed transformers.

Messrs. E. Brook, Ltd., Empress Works, Huddersfield.—A folder, giving prices of the company's single-phase high torque motors up to 11 b.h.p.

Messrs. J. Hopkinson & Co., Ltd., Britannia Works, Huddersfield.—A card, illustrating the "Metacentre" reducing valve, and the company's works.

British Insulated Cables, Ltd., Prescot, Lancashire.—Pamphlet P.197, dealing with braided aerial cables and wire, and Pamphlet P.198, a list of the company's manufactures and branch offices.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester.—Descriptive Section No. 10, illustrating and giving full details of totally-enclosed, ironclad, interlocked, air-break switch- and fuse-gear.

Superlamp, Ltd., 92-94, Paul Street, Great Eastern Street, E.C.2.—February net trade price list of radio components and accessories.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—Catalogue W, containing details and prices of "Exide" radio batteries. The publication contains notes on the care of accumulators, valves, &c.

Bankruptcy Proceedings.—W. C. Rhodes (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham.—Last day for proofs for dividend, March 13th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

W. R. Squire, electrical engineer, 11, Steward Street, Spring Hill, Birmingham.—Last day for proofs for dividend, March 15th. Trustee, Mr. C. Hoult, Official Receiver, Corporation Street, Birmingham.

A. E. Burrow and A. G. L. Prahm (World's Fair Supplies), makers of electrical and mechanical games, Bushy Lodge, Totterdown, Bristol.—Receiving order made February 22nd, on debtors' own petition.

A. F. Kingdom, electrical and mechanical engineer, Tavistock Street, Devonport, Plymouth.—Receiving order made February 22nd, on creditor's petition.

J. E. Byrne, electrical contractor, 3, Wells Yard, Waterworks Street, Kingston-upon-Hull.—Trustee, Mr. J. E. Stickney, Official Receiver, 37, Scale Lane, Hull, released February 18th.

A. C. R. Birkett, electrical engineer, Radio House, 22 & 24, Wheeler Gate, Nottingham.—Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham, released February 22nd.

Company Liquidations.—Pressland Electric Supplies, Ltd., wholesale electrical and radio factors, Eden Street, Kingston-on-Thames.—Mr. William Bronson, I.A., of 1, Cricklade Avenue, Streatham Hill, London, S.W., the liquidator appointed in the voluntary liquidation of the company has issued a circular to the creditors in which he states that the company was incorporated on December 6th, 1922, with a nominal capital being 1,100 shares of £1 each. Mr. Pressland purchased 1,000 of the shares for cash and 98 for a consideration other than cash. Mr. Hamilton, the secretary of the company, holds the remaining two shares. The progress of the company was such that it very quickly outgrew its capital, and it became vitally necessary to obtain further funds. A Mr. A. W. Matton was therefore approached, and was willing to advance certain sums from time to time, and he eventually became a debenture holder for £6,000. There was a sister company, namely, the Woodhall Wireless Manufacturing Co., Ltd., which, in fact, was the manufacturing part of the business. In the early stages of its manufacture the Pressland Company made advances to the Woodhall Co., and for these advances obtained a debenture for £2,000. Later, Mr. Matton did not consider he was sufficiently secured for the moneys which he had advanced, and for the guarantee which he had given the bank, so eventually this debenture was endorsed over to Mr. Matton. In addition to the cash advanced by Mr. Matton, and covered by his debentures, he advanced further sums of £1,000 and £200, so he is therefore an unsecured creditor for £1,200. At December 31st last the interest then due on the debentures had not been paid, and consequently a receiver was appointed on January 15th. There was some dispute with regard to the appointment of the receiver, and thereupon the receiver made application to the Court, and was appointed as an officer of the Court on January 29th. The validity of the debentures had been established. The business was a good one, and if its capital had been sufficient for its needs the present position would not have arisen. At present the receiver is still carrying on the business. The following are creditors:—

	£		£
Albion Manufacturing Co. ...	136	General Radio Co.	
Brandes, Ltd.	114	Hunt, A. H., & Co., Ltd. ...	
Burndept, Ltd.	324	Igranic Electric Co., Ltd. ...	
British Thomson-Houston Co., Ltd.	205	Knapp, Drewett & Sons, Ltd. ...	
Briscoe, W. K.	341	Marconiphone Co., Ltd.	
Bedford Electrical Co.	122	Metro-Vick Supplies, Ltd. ...	
Cossor, A. C., Ltd.	252	Offer, Harry	
Dubilier Condenser Co., Ltd. ...	152	Radio Communication Co., Ltd.	
Graham, A.	100	Stevens, A. J., & Co.	
General Electric Co., Ltd. ...	153	Siemens Bros. & Co., Ltd. ...	
		Vandervell, C. A., Ltd.	

Radio Works, Ltd., 5, Dyers Buildings, Holborn.—A meeting of creditors was held on February 25th, at the offices of Messrs. R. L. Taylor & Co., I.A., South Place, E.C., when the chair was taken by Mr. R. L. Taylor, who had been appointed to act as the liquidator in the voluntary liquidation of

company. A statement of affairs was submitted which disclosed liabilities of £3,173, and net assets of £318, leaving a deficiency of £2,855. The deficiency as regards contributories was £2,955. The company was formed in October, 1923, with a share capital of £100. Mr. Taylor stated that the company had never been conducted at a profit, and the accounts for the year ended December 31st, 1924, showed a loss of £697. For the period to the date of liquidation there had been a further loss of £1,292. The turnover for the former period was £4,951, and for the latter £1,528. No resolution was passed; therefore the voluntary liquidation of the company will be continued with Mr. Taylor as liquidator.

Erith Electrical Co., Ltd., High Street, Erith.—A meeting of creditors was held on March 1st, at the Institute of Chartered Accountants. The chair was occupied by Mr. H. C. Merrett, who had been appointed to act as liquidator. The statement of affairs presented showed liabilities of £1,718, and net assets of £701, leaving a deficiency of £1,017 so far as the creditors were concerned. The issued capital of the company was £576, and as regarded the shareholders there was a deficiency of £1,593. Mr. Merrett reported that the company was registered on April 25th, 1924, with an authorised capital of £2,000. A sum of £400 was borrowed on the security of a debenture. The accounts for the period to March 31st, 1925, disclosed a trading loss of £585. On January 7th last the debenture holder appointed a receiver, who continued to carry on the business for a month. Following the appointment of the receiver several of the larger creditors approached the directors and pointed out that it would be necessary for the company to go into liquidation. He was nominated by the principal creditors, and the shareholders appointed him as liquidator. There was a petition on the file for the compulsory liquidation of the company; it had been adjourned for a month. A resolution was passed confirming the voluntary liquidation of the company with Mr. Merrett as liquidator, with an advisory committee consisting the representatives of the Siemens and English Electric Co., Siemens Bros. & Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd. The following are creditors:—

	£		£
Callender's Cable & Construction Co., Ltd.	51	Metropolitan - Vickers Electrical Co., Ltd.	114
Cable Accessories Co., Ltd. ...	43	Rashleigh Phipps & Co.	23
De Maid, Ltd.	28	Siemens & English Electric Co., Ltd.	523
Falk, Stadelmann & Co., Ltd. ...	42	Siemens Bros. & Co., Ltd. ...	115
Electrical Supplies Co.	54	Young & Wildsmith	30
Foster Engineering Co.	48	London Electric Stores	42
General Electric Co., Ltd. ...	111		

Victoria Electrical (Manchester), Ltd., Oakfield Road, Altrincham.—A meeting of creditors was held recently, at Altrincham, when Mr. R. N. Brookes, C.A., Manchester, submitted a statement of affairs which showed total unsecured liabilities of £6,836. The net assets were only £802, which was insufficient to discharge the sum due to the bank, which held debentures for £2,464. There were, therefore, no assets available to meet the claims of the trade and the other creditors. The liquidator reported that following his appointment he closed down the business, as he was of opinion that it would be useless to carry it on. The creditors decided to confirm the appointment of Mr. Brookes as the liquidator of the company.

Brolt, Ltd.—Winding up voluntarily. Liquidator, Mr. A. V. Jerome, 15, Newhall Street, Birmingham.

Anode Wireless & Scientific Instruments, Ltd.—Trustee, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C., released February 18th.

B.M.A.S., Ltd.—A petition for the winding up of this company has been presented to the Chancery of the County Palatine of Lancaster, Manchester District, by the Chloride Electrical Storage Co., Ltd., of Clifton Junction, near Manchester, creditors, and will be heard at St. George's Hall, Liverpool, on March 8th.

Bishops Castle Electric Light & Power Co., Ltd.—First meetings of creditors and contributories, March 15th, at 2, Offa Street, Hereford.

Park Royal Engineering Works, Ltd.—Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C., released February 23rd.

Dissolutions of Partnership.—Williams Lighting Co., dealers in gas and electric light fittings and accessories and wireless apparatus, 338, Mare Street, Hackney, 2, High Street, Tooting, and 212, High Street, Stoke Newington.—Messrs. P. & W. Lubelsky and N. Ruda have dissolved partnership. Debts will be attended to by Mr. W. Lubelsky and Mr. N. Ruda.

La Rose & Co., wireless and photographic accessories, 9, Stroud Green Road, Finsbury Park, N.—Messrs. L. & B. Phillips and I. Rose have dissolved partnership. Mr. L. Phillips will attend to debts.

For Sale.—Mr. H. J. Shaw will sell by auction on March 17th, at 550-556, Oxford Street, W., about 5,000 accumulators and batteries, h.p. cable, hand lamps, headphones, &c.; and on March 18th, at 13, High Holborn, W.C., a stock of wireless and electrical goods. Hull Corporation Electricity Department invites offers for about 10,800 yd. of scrap cable. (See our advertisement pages to-day.)

Another E.L.M.A. Design Course.—We have received the programme of the eighth illumination design course organised for contractors and others by the Electric Lamp Manufacturers' Association, which is to be held at the Lighting Service Bureau, Savoy Street, W.C.2, from March 23rd to 26th. This synopsis shows that a liberal lighting education is to be imparted in the few days of the course, both scientific and practical aspects of illumination receiving their share of consideration. The programme includes a visit to the Ideal Home Exhibition on March 25th, and concludes with an informal dinner to the "students."

Palestine Contract.—According to the *Daily Mail*, Sir John Jackson, Ltd., the London firm of civil engineering contractors, have recently acquired a part of the concession for water and electricity supply in Jerusalem held by M. Mavromatis, a Greek subject, whose claim against the British Government was upheld by the Permanent Court of International Justice in March, 1925. Mr. Percy Westacott, the managing director of the company, is at present in Palestine.

New French Company.—La Société Dauphinoise d'Accumulateurs is the name of a new company which has lately been formed at Grenoble (5, Rue Ampère) with a capital of 900,000 fr., to manufacture accumulators.

Book Notices.—"Behind the Counter: A Practical Guide for Shop Assistants." By W. H. Beable, F.S.M.A. P. 102. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. Price 3s. 6d. net.—Although this little book does not touch on electrical salesmanship, it may be read with advantage by electrical retail sellers, showroom and demonstration room assistants. Useful food for thought is contained in the recommendation of sympathetic treatment for the customer.

"Science Abstracts" (A & B). Vol. XXIX, Part 2, February 25th, 1926. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Telephone Communication Systems," by R. G. Kloeffler. Pp. vii + 284; figs. 201. London: Macmillan & Co., Ltd. Price 17s. net.

"Superpower, Its Genesis and Future," by W. S. Murray. Pp. ix +237; figs. 25. London: McGraw-Hill Publishing Co., Ltd. Price 15s.

"Radio Press Year Book, 1926." London: Radio Press, Ltd. Price 1s. 6d.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV, No. 2, February, 1926. New York: The Institute. Price $1.

"The *Journal* of the South African Institution of Engineers." Vol. XXIV, No. 7, February, 1926. Price 2s.

Lighting and Power Notes.

Australia.—Sugarloaf Rubicon Scheme.—The Victorian Electricity Commission recently completed the first portion of the Sugarloaf Rubicon Scheme, when the first two cables of the Sugarloaf dam span were carried across a deep gully and creek and strained into position. In the Sugarloaf Rubicon hydro-electric scheme it was necessary to carry the main transmission line, which will eventually carry electricity at a pressure of 66,000 V from Sugarloaf Hill to the foothills on the other side of the weir. The shortest distance possible between the supports on either side was found to be 4,726 ft. and the work was successfully completed.—*Reuter's Trade Service* (Melbourne).

Belgian Congo.—Hydro-Electric Development.—M. van Deuren, Professor at the Belgian Ecole Militaire, has placed before the Union Coloniale a scheme which he has prepared for rendering the lower course of the Congo navigable between Matadi and Kinshasa and at the same time utilising the water power for the generation of electrical energy. The scheme includes the construction of seven dams.

Bexhill.—New Mains.—The Electricity Committee is to provide additional feeder and distribution mains at a cost of £6,500.

Brighton.—Electricity Supply.—The borough electrical engineer recently submitted a report to the Electricity Committee in which he stated that readings taken on the 230-V network during the past Christmas peak loads showed that 11 feeders out of 15 were overloaded and he recommended that some of the existing feeders should be extended and additional feeders laid in various parts of the town. The Town Council is to apply for sanction to a loan of £8,840 for extensions, the work to be carried out during the coming spring and summer.

Burnley.—Price Reductions.—The Corporation Electricity Committee has reduced the charges for lighting from 5d. to 4½d. per kWh. Power charges varying between 2½d. and 1½d. per kWh are to be reduced to 2d. and 1d. respectively. These reductions apply to the borough only.

Bury.—Loan Sanctioned.—The Town Council has received sanction to a loan of £14,291 for the provision of water-cooling towers at the electricity works.

Canada. — Hydro-Electric Development. — Rural hydro-electric development for the past fiscal year has cost the Provincial Government, under its guarantee of 50 per cent. payment of primary and secondary costs of transmission, approximately $335,000, which represents the most active twelve months in the history of rural power extension. Last year's programme of rural construction represents also between 400 and 500 additional miles of service.

A further step in the scheme for the development of between 50,000 and 60,000 h.p. upon the Riviere des Prairies, is marked by the presentation of a Bill in the Quebec Legislature on behalf of the Montreal Island Power Company. The project involves the expenditure of several million dollars. The construction of the dam and power house will probably take

two years. The Island Power Company proposes to dam the "Black River" at a point below Sault aux Recollet and to construct barriers which will form an artificial lake about three miles long

Quebec.—The Toronto correspondent of *The Times* reports that Mr. Taschereau, Premier of Quebec, has introduced a Bill in the Legislature to prohibit the export of hydro-electric power produced in the Province. All future contracts must contain a prohibitive clause, and a like clause must be written into existing contracts and retained in case of the renewal of such contracts. Power developed in Quebec can be exported to other Canadian provinces only on a definite understanding that such power shall not be re-exported to the United States.

Cheadle and Gatley.—Loan.—The Urban District Council has applied for sanction to a loan of £7,576 for carrying out an electricity scheme in the Gatley area.

Cheltenham.—Electricity Supply.—At a recent meeting of the Electricity Committee a letter was read from the Electricity Commissioners stating that in the light of the new Government proposals it was undesirable that any definite decision should be taken at present in regard to the proposed erection of a power station jointly with the Gloucester Corporation, and suggesting that the correct course would be for the two Corporations to inter-connect and to negotiate a short-term bulk supply contract with the West Gloucestershire Power Co. in order to provide for the requirements during the next three or four years.

Electricity Charges.—The Electricity Committee has adopted the following revised charges for electricity:—Lighting: For the first 125 hours' use per quarter of the maximum demand, 6½d. per kWh, and for all additional energy 2½d. per kWh; flat rate, ordinary consumers (other than special supplies), 5½d. per kWh, and large consumers, 4½d. per kWh. Churches, 4½d. per kWh. Kinemas, combined rate of 3d. per kWh. Power (other than special contracts), 1½d. per kWh.

Clayton (Yorks.).—Electricity Supply.—The Urban District Council, on February 24th, decided to apply for an Order constituting the Council as the distributing authority for electricity in the district. The decision is the outcome of the long-standing *impasse* due to rival claims to supply Clayton by the Bradford Corporation and the Electrical Distribution of Yorkshire, Ltd. The Council has opened negotiations with the Yorkshire Electric Power Co., with a view to obtaining terms for a supply in bulk. The Company is laying mains to the Clayton boundary, but the boundary is a considerable distance from the main consuming area.

Continental.—Rumania.—At a recent meeting of the Superior Power Council at the Ministry of Industry and Commerce, the Mayor of Bucarest was authorised to install in the municipal electricity works a 10,000-kW turbo-alternator.

The Mining Industry Company in the Banat has received a concession to erect a 30,000-kW power station at Boccha-Montana. This plant will use exclusively the coal of inferior quality found in the region.—*Reuter's Trade Service* (Bucarest).

France.—The Paris Municipal Council has decided to increase the price of electricity by 15 per cent.

Work is about to be commenced on the laying of an underground electric cable between Lille, Armentieres and Hazebrouck, with eventual extensions to Dunkirk, Calais, and Boulogne. The first section, that between Lille and Armentieres, is expected to be completed this year. The cable will replace an existing overhead cable.

A new hydro-electric station known as the Bonne Inferieure has recently been completed by the Société des Forces Motrices Bonne et Drac. The plant, which is being worked by the Société Hydro-Electrique de Fare et Morge, comprises three 3,500-h.p. generating sets. The output will be utilised in the Mure-Gap districts of the Department of Isere.

Portugal.—The Executive Committee of the Municipal Chamber of Lisbon will shortly discuss the conditions of the competition to be opened for the supply of electricity to the city. The committee has already received from a group of British bankers a request for a copy of the conditions.—*Reuter's Trade Service* (Lisbon).

Upper Silesia.—A *Reuter* message from Berlin states that it is reported from Breslau that an Anglo-American group of financiers is at present negotiating at Warsaw for the acquisition of the Chorzow electricity works. It is intended to enlarge the works so as to supply Polish Upper Silesia, the Dombrova coal district and Cracow industrial undertakings with electricity.

Switzerland.—Work will commence shortly on a new hydro-electric power plant on the Rhine, at Schwörstadt (Canton of Aargau), which is to cost £2,400,000, and is expected to yield 550 million kWh Two other plants will be erected subsequently on the Rhine, at Dogern and Reckingen.

Coventry.—Loan.—The Electricity Committee has recommended to the Town Council that application be made for sanction to a loan of £4,087 for electricity purposes.

Dover.—Loan.—The Electricity Committee is applying for sanction to a loan of £3,500 for electricity services.

East Hagbourne.—Electricity Supply.—The local Council has decided to withdraw its application to the Wallingford Rural District Council for a supply of electricity, and to make direct application for the necessary powers to carry out its own lighting scheme.

Godalming. — Price Reduction. — The Urban Electric Supply Co., Ltd., has reduced the charge for electricity for lighting from 1s. to 10d. per kWh, subject to a minimum charge of 12s. 6d. for the winter quarters, and 8s. 4d. for the summer quarters.

Guildford.—Loans Sanctioned.—The Electricity Committee has received sanction to a loan of £10,000 for mains and meters.

Helsby.—Proposed New Power Station.—The Mersey Power Co., Ltd., is seeking consent from the Cheshire County Council to a scheme for the erection of a power station at Helsby.

Irish Free State.—Leixlip (Co. Kildare).—A memorial petitioning the Dublin United Tramways Co. to extend the tramway service and electricity supply to Leixlip has been approved by the Kildare County Council.

Shannon Scheme.—The power station at Ardnacrusha which has been constructed as a temporary means of supplying electricity for work on the Shannon scheme, is now completed, and was put into operation recently.

Lancaster.—Electricity Supply.—A second h.p. main is to be laid between Ridge Lane sub-station and Morecambe boundary at an estimated cost of £5,000.

Leicester.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer: Mr. T. R. Smith) for the year ended December 31st last, record a total revenue of £294,292, as compared with £300,723 in the preceding year. Working expenses amounted to £158,592, as against £139,696, leaving a gross profit of £135,700 (£161,027). After deducting capital charges, and special expenditure charges to revenue of £14,079, there was a net profit of £544. The reduction in the charges for electricity made in 1924 operated during the full year of 1925, resulting in an approximate decrease in revenue of £51,000. The total capital expenditure during the year was £164,151, and the balance in reserve now stands at £113,293. The sales of electrical energy increased by 5.5 per cent., as compared with the previous year, and the average price per kWh obtained showed a decline of .142d.

Liverpool.—Rate Relief Contributions.—The Corporation Tramways and Electricity Committee has decided to transfer £115,000 from the profits towards the relief of the rates—£50,000 from the tramways and £65,000 from the Electricity Department.

Breakdown Inquiry.—A special sub-committee of the City Council, which has been inquiring into the recent breakdown in electricity supply, has submitted a report, which states that the breakdown on January 28th was due to an accident. After the fullest tests a new motor-generator was switched into operation when some inherent defect developed that had not shown up under the tests that had been applied both by the makers and the staff under all usual conditions. The short circuit wrecked the motor and wrenched off a copper lead some 50 yards away, which was connected to the bus-bars. The finding of the Committee was as follows:—"We wish to place on record that the city electrical engineer and his staff retain our complete confidence."

Mansfield. — Investigation Committee Appointed. — The Town Council has appointed a committee to make a full investigation of the affairs of the electricity undertaking.

Morecambe.—New Feeder Cable.—The Electricity Committee has decided to purchase a second e.h.p. feeder at a cost of £11,600.

Electricity Charges.—The borough electrical engineer has been instructed to prepare alternative schemes for a new scale of charges to become operative from April 1st next based on the principle of a fixed charge, plus a "unit" charge for energy consumed.

New Sub-Station.—The Committee is to obtain a site at White Lund for the erection of a sub-station.

Northern Ireland.—Lurgan (Armagh).—At a recent meeting of the Urban District Council, the report from the consulting electrical engineer was submitted for consideration. This report contained the engineer's new estimate for completion of the electricity scheme in the town. The new estimate amounted to £13,830, and the amount already expended amounted to £4,875. It was decided to apply for sanction to a loan of £20,000 to complete the scheme.

Belfast.—The *Irish Electrician* states that it is understood that the chief engineer, Mr. Johnston Wright, has under consideration the matter of replacing the two 600-kW generators at present in the harbour station by two 1,500-kW generators. There are at present two 1,500-kW sets installed in this station. It is reported that the 1,000-kW turbo-alternator at present installed in the York Street works of the Flax Spinning Company will be shortly replaced by a set of 2,500 kW capacity.

Poulton.—Electricity Supply.—The Urban District Council has asked Blackpool Corporation to proceed with a separate Order for the supplying of electricity to Poulton.

Plymouth.—Price Reductions.—The Electricity Committee has recommended a reduction in the charges for lighting from 4½d. to 4d. per kWh, and a proportionate reduction in the charges for other purposes.

Loans Sanctioned.—The Committee has received sanction to the borrowing of £25,000 for general distributing mains and £6,000 for services in the Lipson Vale and Laira district. Cable extensions have also been approved, at a total estimated cost of £2,821.

Plympton.—TRANSFER OF UNDERTAKING.—Under an Order granted by the Electricity Commissioners, the Plympton Rural District Council is authorised to acquire, as from April 1st, the electricity undertaking at Plympton of Messrs. Hurrell and Heath at an agreed price of £7,000, and to supply electricity obtained in bulk from the Plymouth Corporation throughout its area. Until such time as it is possible to lay a h.p. cable from the Plymouth Corporation's works, the Council will continue to utilise Messrs. Hurrell & Heath's generating plant at Plympton. Work is proceeding for the extension of the supply to the parishes of Compton Gifford and Plymstock.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Keighley Corporation, for the extension of its area of electricity supply so as to include the urban district of Silsden and certain parishes in the rural district of Skipton; the County of London Electric Supply Co., Ltd., and the North Metropolitan Electric Power Supply Co., for the reciprocal supply of electricity in bulk.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Gwynedd Trust, Ltd., to supply in the borough of Pwllheli and the rural district of Lleyn, and the Barry Urban District Council to supply in its area.

Vale of Clwyd.—INQUIRY.—According to the *Manchester Guardian*, the Ministry of Transport has appointed Mr. O. A. Sherrard to hold an inquiry at the offices of the Ministry in London on March 5th with reference to the Denbigh and St. Asaph Electricity Special Order and the objections to its confirmation made by the Rhyl Council. The Order proposes to confer upon the Electricity Distribution of North Wales and District, Ltd., powers of supply in the Vale of Clwyd, including an area in the vicinity of Rhyl in which the Rhyl Council has applied to be the recognised distributor.

West Indies.—GRENADA.—Subject to the approval of the Imperial Colony Crown Agents, the Government will shortly enter into a contract for the erection of a hydro-electric plant at Grand Etang in the interior of the island for lighting St. George's.—*Reuter's Trade Service* (St. George's).

Willesden.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to loans of £8,000 for the extension of the sub-station at Acton Lane, and to £1,580 for a sub-station at Oxgate Lane.

Tramway and Railway Notes.

Colne.—MOTOR OMNIBUSES.—At a meeting of the Town Council, on February 25th, the Town Clerk read a letter from the Ministry of Transport relating to an objection signed by residents in the Laneshawbridge district regarding the proposed abandonment of the light railway. It was decided to forward to the Ministry the observations of the Tramways Committee which had passed a resolution that a service of motor omnibuses should be substituted for the present tramcar service on the reconstruction of the roadway.

Hull.—TRAMWAY IMPROVEMENTS.—The Corporation Tramways Committee has given instructions for the completion of the section of tramway connecting Spring Bank West with Cottingham Road. The cars will run along the Chanterlands Avenue extension. The chairman states that the Beverley Road service has been improved by the addition of two cars. A scheme for relieving congestion in King Edward Street by altering the termini has been referred to the manager for report.

Leeds.—ELECTRICITY SUPPLY FOR TRAMWAY.—The Corporation Cleansing Committee is considering a scheme for the generation of electricity for the tramway by the utilisation of refuse, by means of a new destructor plant at Kidacre Street, expected to be completed in the coming summer, at a cost of £23,000.

London.—LOTS ROAD STATION EXTENSIONS.—The operation of the extension from Charing Cross to Kennington will make further demands on the Lots Road power station and in consequence of this and other transport facilities to be provided in the future the generating plant is being augmented accordingly. The power station at present contains seven turbo-alternators of 6,000-kW each and three of 15,000-kW each. A fourth 15,000-kW machine is under construction, and when this is complete the generating capacity of the power station will be 102,000 kW. The present maximum load on the station is about 70,000 kW, and it is estimated that in five years' time the total demand will be about 100,000 kW. To provide for this additional load further turbo-alternators, which will have a capacity of 15,000 kW, will be installed in place of the existing 6,000-kW machines, and further 50,000-lb. boilers will be substituted for the existing 16,000-lb boilers.

Rawtenstall.—INQUIRY.—Speaking at a Ministry of Transport inquiry at Rawtenstall, on February 24th, regarding the refusal of the Corporation to license a private firm's motor 'buses, Mr. C. L. E. Stewart, tramway manager, said there was a prospect of a loss on the tramway system at the end of the year. On the 'buses there was a profit of 3.595d. per mile, the receipts averaging 16.330d. per 'bus mile. The net surplus last year was £2,396. He estimated the loss of revenue to the Corporation in the event of the Ribble Motor Services being allowed to run a duplicate service, would be £3,000. Last year as a result of the operation of the Ribble Services, there had been a loss of £400 on the Waterfoot section of the tramways. Mr. Wrottesley, K.C., said the Corporation was bound to see that its transport undertaking was not exposed to unnecessary loss. There was already the prospect of a deficit on the tramways and it was only because the 'buses were a success that there was any surplus on the Corporation transport undertakings. It could not continue to provide tramway facilities if competition was allowed.

Southern Railway Electrification.—In the course of his speech at the annual meeting of the Southern Railway Co., on February 25th, Brig.-General Everard Baring stated that with regard to electrification, in April last, electric working was introduced on the old Brighton section from Victoria to Coulsdon and Sutton *via* Croydon, and in July the services from Waterloo to Guildford and Dorking, and on the South Eastern section from Victoria and St. Paul's to Orpington and the Crystal Palace were opened. The results in all these cases have more than exceeded expectations, and the number of passengers carried in these newly-electrified areas shows an increase as compared with the corresponding period of 1924 of 3,200,000, or nearly 12 per cent. The heavy initial cost of introducing the electrical services, involving the training of large numbers of men in new methods, and the testing of the new equipment both on the trains and in the power stations, has been finished with to a large extent, and the extra revenue from electrification is now covering the extra cost of the improved services. Plans and estimates are being considered for the extension of the electrification to complete the whole of the suburban area, and it is expected to make a start with this during the current year. It involves the electrification of the services from London Bridge and Victoria to Sutton and Epsom, Epsom Downs and Purley, with possible extensions to Caterham and Tattenham Corner, and from Crystal Palace to Beckenham.

Electric train services were commenced on February 28th, between Charing Cross, Cannon Street, and London Bridge, and (1) Orpington, *via* Chislehurst, (2) Bromley North, *via* Hither Green, (3) Beckenham Junction, Hayes, and Addiscombe, *via* Lewisham and Ladywell. These routes, totalling eighty-eight track miles, have been electrified at a cost of £1,300,000, and twenty eight-coach trains have been built for the services, comprising 160 vehicles, apart from spare trains. The new services, giving 50 to 100 per cent., improved schedules on Sundays, mid-day on weekdays, and in the evenings after the rush hours, will result in an increased train-mileage of 8,132 miles a week. It is anticipated that all three Dartford routes from Charing Cross and Cannon Street will be completed by June next.

South Shields.—INQUIRY.—An inquiry was conducted by Mr. Alan D. Erskine and Mr. Thomas L. Patterson, inspectors of the Ministry of Transport, on March 26th and 27th, into the application of the Kearney High Speed Tube Railway Co. for an Order to construct a tube under the Tyne between North and South Shields. Mr. Sidney Morse, in stating the case for the promoters, said the present proposal had been before North and South Shields since 1922, and was ultimately withdrawn by the promoters, who undertook to raise the capital, £300,000, in London. The proposed fare for the tube would be 2d. Passengers on the tube would receive a three-minutes' service each way as a maximum, as against twenty to twenty-five minutes now occupied from the centre of one town to the centre of the other, on a ferry journey. South Shields Town Council supported the general principles of the scheme, but Tynemouth Corporation and the River Tyne Commission opposed the application.

St. Helens.—DEVELOPMENTS.—The Corporation Tramways Committee proposes to introduce railless cars on various routes, and application has been made for a Provisional Order. The Committee also proposes to construct a single-line tramway track from Duke Street to Sefton Place.

Telegraph and Telephone Notes.

America.—TELEPHONE USERS.—The fact that the people of the United States were using 16,935,918 telephones at the start of 1926, an increase of 863,160 over a year ago, is shown by figures soon to be published by the American Telephone and Telegraph Co.; for every hundred of population there are 14.7 telephones. The European country in closest competition with the United States in telephone use is Sweden, with 418,318 at the start of 1925, or 6.9 per 100 of population; Switzerland follows with 189,429, or 4.8 per 100 persons; then Germany, with 2,385,177, or 3.9; Great Britain with 1,260,242, or 2.7 per 100; France with 694,937, or 1.7; and Italy with 173,927, or 0.4.—*Reuter* (New York).

Canada.—RADIO OPERATORS.—Canadian Marconi operators have notified the companies concerned that they desire to abrogate the existing contract, with a view to increased wages and improved conditions. The companies in their reply express a desire for a downward wage revision.—*Reuter* (Toronto).

China.—FOREIGN CABLE DUES.—A sidelight on the conditions in China is an intimation from all the foreign cable companies at Shanghai to the effect that, since they have for a long time not received from the Chinese administration any share of the moneys paid by the public to the administration

for the dispatch of telegrams to places abroad, the companies will no longer accept other than Government telegrams from the administrations in the Yangtse Valley provinces unless accompanied by cash.—*Financial News.*

Chile.—Telephone Development. — Having commenced operations 36 years ago, the Chili Telephone Co. may claim to be the pioneer of modern telephone development throughout the Republic. It installed in 1922 an automatic service at Valparaiso, and similar plant is now in course of manufacture at Messrs. Siemens Bros'. factory at Woolwich, London, and will be installed in Santiago. According to the *Chilean Review*, considerable reconstruction work has had to be carried out in the capital in connection with the installation of this up-to-date plant, embracing the laying down of cable ducts and street chambers to which overhead wires can be transferred. Modern switchboards and equipment involving similar reconstruction work are also being installed at Iquique, Antofagasta, and Concepcion, and in several towns of lesser importance underground installations to take the place of overhead wires are being actively proceeded with. The company has about 20,000 subscribers and operates some 14,000 miles of trunk lines throughout the Republic, which are connected to 260 exchanges. The company contemplates an extension of its service in the South of Chile to embrace the important port of Valdivia, and in the North the consolidation of telephone service in the nitrate area. Apart from a few technical officers the staff of the company, at present numbering about 900, is almost entirely Chilean, and the practice has been followed of bringing Chilean youths to England for training at the works of Messrs. Siemens Bros. and various technical schools. The plant and installations are valued at about £1,000,000.

India.—Radio-Telegraph Services.—The annual report on the post and telegraph services for the year 1924-25 shows, says *The Times*, that the number of radio telegrams exchanged with ships at sea by coast stations in India and Burma was nearly 20,000. A number of official telegrams was also exchanged with the British naval station at Matara, Ceylon. The service between Burma and the Malay Peninsula, *via* Rangoon and Penang, continued to work satisfactorily. Communication was also established between Rangoon and Sabang (Sumatra) for meteorological purposes. Wireless communication with Kabul, *via* Peshawar, was maintained, and traffic was passed whenever the condition of the land line necessitated it. The Marconi arc station erected for the Chinese Government at Kashgar continued in operation and exchanged official messages with India *via* Peshawar.

Facilities have been offered by coast stations whereby ships at sea equipped with direction-finding installations can obtain bearings on the coast stations as an aid to navigation. Bearings thus obtained on Diamond Island in unfavourable weather have been particularly valuable, and results elsewhere have been satisfactory. The report further states that the British official Press *communiqués* from the Oxford radio station were received at Jutogh and passed to Reuter's Agency for distribution to subscribing newspapers. As usual, this service was interrupted for some weeks during the hot weather owing to weak signals from Oxford and atmospheric interference.

Bharatpur State Telephones.—Bharatpur was the first Indian State to adopt the automatic telephone system. It is now nearly two years since the Maharajah started to consider the possibilities of providing an automatic service which would cater for the Palace telephones, the State offices, the general public of Bharatpur City, and also give trunk facilities to distant parts of Bharatpur State, and, *via* Agra, to the whole of Northern India. The scheme finally selected consists of a central Relay automatic exchange of the new "Britannic" class connected with the Palace by two miles of underground cable. The circuits are arranged so that an unauthorised person attempting to call up any of His Highness's telephones is at once connected to the inquiry clerk, who completes the call at his discretion. Should the caller not "get through" within twenty seconds of the time when he lifts his receiver, the automatic apparatus will dial the inquiry number itself. The same result will occur should the caller dial a wrong number, or an "out of order" number. Public call offices are to be provided at all the important police chowkies and all effective calls from these telephones will be automatically metered in the central exchange. All the apparatus for the installation has arrived in India and construction work will be commenced immediately under the supervision of one of the Relay Automatic Telephone Company's engineers stationed in India. It is expected that the system will be in working order by April.

International Telephony.—Special Committee.—A determined effort to obtain better international telephone service was initiated, says the *Financial Times*, at a meeting of the special committee appointed by the Brussels Congress of the International Chamber of Commerce. The International Telephone Committee held its first meeting under the chairmanship of Sir Martin Abrahamson, representing Denmark, and Mr. F. Gill, representing England, laid stress on the fact that, technically, there should be no difficulty whatever in any capital in Europe getting into communication with any other capital in from five to fifteen minutes, and for ships in any big port getting into touch with their home office in from 15 to 30 minutes.

Irish Free State.—Telephone Service.—According to an official of the General Post Office in Dublin, there are now up to 24,000 telephones in use in the Irish Free State.

The Telephone Service.—School Installations.—The Willesden Education Committee has recommended that the local elementary schools be equipped with telephones, and an application for a grant for the purpose has been made to the Board of Education. Telephones have been provided in several of the L.C.C. secondary schools, but so far no elementary school has been so favoured. The Willesden precedent, if the Board of Education agrees to the grant, will probably be followed elsewhere.

Monthly Increase.—Sir W. Mitchell-Thomson (Postmaster-General), in a written reply to a question in the House of Commons, states that telephones in this country are at present being installed at the rate of 19,000 a month.

Radio Notes.

Committee of Inquiry.—Result Forecast.—The Committee of Inquiry, presided over by Lord Crawford, that was appointed by the Government to consider the future of broadcasting has completed its report, which is a unanimous one. Contrary to many expectations, says the daily Press, it is gathered that the Committee recommends that a further licence should not be granted to the British Broadcasting Co. to continue in control after the expiry of its existing licence on December 31st next. It will almost certainly be found that the Committee has favoured the creation of a national board, representative of the wireless trade, the public, and the Government, to carry on the work now performed by the B.B.C. The new body would be answerable to Parliament through the Postmaster-General. The financial proposals are designed to prevent any larger sum being taken from the public than is actually required to maintain the organisation.

India.—Increase of Licences.—The annual report on Posts and Telegraphs of India for 1924-25 (Calcutta: Government Press, 4s. 3d.) gives some interesting details of what may be described as the beginning of broadcasting in that country. According to *The Times*, it states that experimental broadcasting by the radio clubs in Calcutta, Bombay, and Madras stimulated public interest and caused an increase in the number of licences for receiving stations. In the last seven months of the year over 1,000 licences were issued in a new form. They are obtainable from certain head post offices and cover the use of receiving sets in British India, except Baluchistan and the North-West Frontier Province. Licences for fixed stations continued to be issued for transmitting and experimental purposes; 81 were renewed, and 220 new licences were granted during the year. In future fixed station licences will not be necessary for receiving stations, owing to the introduction of broadcast receiver licences. The import of wireless apparatus is restricted to those who possess licences for the purpose. At the end of the year 90 such licences were held. There will be, no doubt, a very rapid increase in the number of licences now that broadcasting is to be conducted on a commercial basis by the company, which was recently granted an exclusive contract.

Radio Reception on Trains.—G.W.R. Experiments.—Following the successful experiment of installing wireless receiving apparatus in a moving train and picking up broadcast programmes during a journey from Bristol to Cardiff and back, the Great Western Railway announced that on March 2nd the Cornish Riviera express, which leaves Paddington at 10.30 a.m. for Plymouth, was equipped with a wireless installation similar to that used in the special train which carried out the Bristol-to-Cardiff experiment. Loud-speakers were set up in one of the dining cars, and the compartments of a first-class coach were fitted with headphones. The reception was successful, but was subject to interference from the lighting dynamos under the coaches.

South Africa.—Radio Legislation.—On March 1st the Union House of Assembly read for the first time a comprehensive Bill dealing with all phases of wireless. According to *The Times*, heavy penalties are provided for "piracy," and for illegal broadcasting, while the obstruction of communication, the dispatch of false telegrams, &c., are punishable by a fine of £50 and three months' imprisonment, with or without hard labour. The Bill authorises any competent postal official to enter any premises to inspect the wireless apparatus and makes provision for the zone system of graduating broadcasting fees.

Spain.—New Station.—The new Barcelona broadcasting station (EAJ1) on the top of Tibidabo (1,745 ft. high), the loftiest hill in the vicinity of the Catalonian capital, has just been completed. It will have a wave-length of 325 metres and the station will be the most powerful one in Spain and one of the most powerful in Europe, and its altitude will contribute in its due ratio to the power. The official inauguration took place on February 25th.—*Reuter* (Barcelona).

United States.—Proposed Regulations.—The White Bill for the regulation of broadcasting was approved on February 11th by the House Merchant Marine Committee. The measure grants the Secretary of Commerce authority to issue radio licences, but rejected applicants have the right of appeal to a Federal Radio Commission and to the courts. The Commission would consist of five members appointed by the President from regional zones.—*Reuter's Trade Service* (Washington).

Wave-lengths.—KESTON TESTS.—The B.B.Co.'s Keston (Hayes) receiving station has been again checking some of the European stations' wave-lengths. The Bureau International de Radiophonie at Geneva had previously arranged for certain Continental stations to work on revised wave-lengths, in order further to determine what recommendations should be submitted to the conference which is to take place on March 25th at the Palais des Nations, Geneva. The Continental stations co-operating were the German stations at Munich and Berlin (two), two Austrian stations (Radio-Wien and the new and important Rosenhugel), also Brno, Budapest, Helsingfors, Prague, Zurich, and Sundsvall (Norway). During the test many other stations were picked up, and in this country both Aberdeen and Swansea were detailed to co-operate on specified wave-lengths. To the exactitude preserved by the stations, which had all been allotted wave-lengths differing considerably from their normal, the exception was that of Zurich. Barcelona, working on increased power, jammed Nottingham, and many outside stations, supposed to be working on their normal wave-lengths, wandered sadly beyond their appointed limits; also Morse interference from ships' stations was a constant cause of trouble.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—BUENOS AIRES.—April 12th. Public Works Department. Rock drilling installation, including steam shovel aerial transporters, 170-h.p. electric generating plant, &c.*

Australia.—MELBOURNE.—April 7th. Victorian Government Railways. One hydraulic plate-bending press.* April 21st. Eight electric overhead travelling cranes.*

BRISBANE.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company, Boundary Street, Brisbane.

SYDNEY.—April 21st. New South Wales Government Railways. Four motor-generator sets. Four switch operating batteries.*

Birmingham. — March 6th. Tramways Committee. Traction motors, power wiring, &c., for 30 tramcars. Form of tender from Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street.

Brazil.—RIO GRANDE DO SUL.—April 15th. Port and Bar Management. 10 electrically-operated portal cranes, capacity 2,500 kilos; 2 ditto, 5,000 kilos capacity; and 7 electric winches or capstans.*

Bridlington. — March 10th. Electricity Department. Stores for 12 months, including electrical sundries, lamps, cables, &c. (February 26th.)

Cambridge.—March 6th. Corporation. Twelve months' supply of electric lamps. Forms of tender from the Borough Engineer and surveyor.

Cardiff.—March 8th. Electricity Department. One 10,000-kW turbo-alternator and condensing plant. (February 5th.)

March 22nd. Grit-collecting plant, 100-kW, 400-V alternator, &c. (See this issue.)

Croydon.—March 17th. Board of Guardians. Six months' supply of electrical fittings and sundries. Forms of tender from the Union Offices, Mayday Road, Thornton Heath.

Dublin.—Commissioners of Dublin Union. Electrical fittings for six months. Mr. John P. Condon, clerk of Union, 1, James' Street, Dublin.

East Ham.—March 15th. Electric Lighting and Tramways Department. Cable, bifurcating boxes, and joint boxes. (February 26th.)

Eccles.—March 6th. Health Committee. Installation of electric lighting, including wiring and fittings, for houses being erected in Anson Street, Monton. Form of tender from Borough Electrical Engineer, Electricity Works, Cawdor Street.

Edinburgh.—March 8th. Electricity Supply Department. One 25,000-kW turbo-alternator with condensing plant, or alternatively, one 20,000-kW turbo-alternator with condensing plant. (February 5th.)

March 9th. Tramways Department. 1,200 tons of steel tramway rails. Specifications, &c., from Tramway Manager, 2, St. James' Square.

Six or 12 months' supply of cables, conduits, 604 frames and covers, house-service fuse boxes, electricity supply meters and meter boards. (See this issue.)

Grimsby.—March 29th. Electricity Department. One 2,000-kW converter, one 1,000-kW do., l.p. switchgear, cable work, &c. (See this issue.)

Hamilton.—County of Lanark District of the Middle Ward. Electric lighting installations in 50 houses near Airdrie and 32 houses near Wishaw. Particulars from Mr. P. C. Smith, Housing and Town Planning Department, District Offices, Hamilton.

Hull.—March 18th. Electrictiy Department. Static transformers and motor converters. (See this issue.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (February 26th.)

March 19th. Inert electric cells, "S" pattern. (See this issue.)

April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (See this issue.)

April 13th. 23 electric passenger locomotives. (February 26th.)

Kettering.—March 9th. Electricity Department. E.h.p. and l.p. cables. (February 26th.)

March 23rd. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary-converter equipment, and one steam turbo-boiler feed pump. (February 26th.)

Letterkenny (County Donegal).—Committee of Management of the Tirconaill Mental Hospital. Oil engine, generator, switchboard extension, booster, motors, connections, &c. Dr. J. C. Martin, resident medical superintendent, Mental Hospital, Letterkenny.

London.—HOLBORN.—March 10th. Board of Guardians. Electrical fittings for six months. Forms of tender from Mr. C. J. Cross, Clerk to the Guardians, 53, Clerkenwell Road, E.C.1.

LONDON COUNTY COUNCIL.—March 23rd. Wiring and fittings for electric lighting at St. Paul's Road elementary school, Bow, E. (See this issue.)

SOUTHWARK.—March 11th. Board of Guardians. Six months' supply of electric lamps. Forms of tender from the offices of the Board, Ufford Street, Blackfriars, S.E.

BETHNAL GREEN.—March 16th. Board of Guardians. Installation of electric lighting in the office extension at Bishop's Road, N.E., and rewiring of the existing building. (See this issue.)

METROPOLITAN ASYLUMS BOARD.—March 24th. Installation of electric lighting at the Southern (Lower) Hospital, Dartford. (See this issue.)

ISLINGTON.—March 16th. St. Mary's Board of Guardians. Electrical supplies for six months. Forms of tender from Mr. A. King, Guardians' School, Hornsey Road, N.

Manchester.—March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)

March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (February 26th.)

Menston (Yorkshire).—The Committee of the Wharfedale Isolation Hospital has decided to invite separate tenders for installing electricity at the hospital—one for an electric lighting installation in the various parts of the Institution, and the other for electric power only in the boiler block.

Mountain Ash.—March 22nd. Electricity Department. Two 500-kVA transformers. (See this issue.)

Newark-upon-Trent.—March 16th. Electricity Department. Medium and l.p. switchgear and accessories. (February 26th.)

Newcastle-under-Lyme.—March 16th. Electricity Supply Department. 2,300 yd. single l.p. cable and 800 yd. single l.p. cable. (See this issue.)

New Zealand.—WELLINGTON.—April 23rd. Public Works Department. 11,000-V metering equipment and switchgear for the Arupuni electric power scheme.*

Oldham.—March 8th. Board of Guardians. Electric lamps and fittings. Form of tender from Mr. F. W. Fletcher, clerk to Board of Guardians, Union Offices.

Otley.—March 30th. Wharfedale Isolation Hospital Committee. Electrical installation at the Isolation Hospital, Menston. (See this issue.)

Portsmouth.—March 17th. Board of Guardians. Three months' supply of electrical stores and lamps. Forms of tender from the Guardians offices, St. Michael's Road, Portsmouth.

Electricity Supply Department. Erection of a steel-framed turbine house. (February 19th.)

Preston.—March 12th. Electricity Department. 4,200 yd. (approx.) e.h.p. cable and four sets of e.h.p., 3-phase transformers. (February 26th.)

Pentre, Rhondda.—March 27th. Rhondda U.D.C. Electricity Department. 12 months' supply of house-service a.c. ordinary and prepayment meters, cable, joint boxes, compound, cut-outs, &c. (See this issue.)

Rochdale.—March 16th. Gas and Electricity Committee. One 1,250-kW (or alternatively 1,500-kW) rotary-converter equipment, including transformer and switchgear. (February 26th.)

Roxburgh.—March 15th. Electrician's work required in extension of Grammar School. Schedules from Messrs. Reid and Forbes, architects, 7, Ainslie Place, Edinburgh.

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)

Sutton Coldfield.—March 24th. Electricity Department. E.h.p. underground mains, distributors, feeder, pillars and network fuse boxes. (See this issue.)

Tynemouth.—March 15th. Electricity Department. One 250-kVA transformer. (February 26th.)

Warrington.—March 15th. Electricity and Tramways Committee. Motors and transformers. (February 26th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—Melbourne.—According to the *Sydney Morning Herald*, the City Council Electricity Committee has reconsidered the recommendation to accept the tender of C. A. Parsons & Co., Ltd., for a turbo-generator, and has decided to call for fresh tenders. The original tenders were:—C. A. Parsons & Co., Ltd., £18,953, plus £10,145 duty for a 6,000-kW plant; the Australian firm of Thompson & Co., £24,054 for a 5,000-kW machine, plus £4,152 duty on parts which would have to be imported. The action of the committee in selecting the overseas tender caused several heated debates in the Council, and the notice of motion was referred back to the Committee.

In calling for fresh tenders, it is stated that the Committee, to make the conditions more definite, has decided to provide that the size of the plant be not less than 5,000-kW and not greater than 5,500 kW, with the usual overload.

Tenderers will also be invited to quote for as much of the plant as can be efficiently manufactured in Australia, and to set out particulars of the plant to be manufactured there and the value thereof.

Barking Town.—Housing Committee. Accepted:—
Wiring 59 houses on Eastbury estate (£408).—Jameson & Burrows.

Beckenham.—Electricity Committee. Recommended:—
Water-softening plant (£293).—Vennicott Water Softener Co.

Belgium.—Belgian, German, Austrian, Danish, French, and British (Callender's Cable & Construction Co., Ltd.) firms competed last week for a Belgian State Railway cable and wire contract. Altogether there were 22 lots, for 15 of which Belgian manufacturers submitted the lowest tenders, German concerns being successful as regarded the remaining seven.

Biggleswade.—Urban District Council.
Wiring 41 Townfield 1925 houses:—

Christy Bros.	£9 9 0	per house.
First Garden City, Ltd.	8 9 0	,,
F. Bott & Son	6 10 0	,,
H. Knight & Son. (Recommended.)	**6 9 0**	,,
N. R. Collings & Co.	5 19 0	,,

(Electricity supplied by First Garden City, Ltd.)

Birkenhead.—Electricity Committee. Accepted:—
400-kVA transformer (£363).—English Electric Co., Ltd.
Three miles service cable (£881).—Liverpool Electric Cable Co., Ltd.

Bispham.—
Electrical work at the Lancashire and Cheshire Miners' Home, Bispnam, near Blackpool.—G. Morrison.

Calne.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution.—H. E. Gunning & Sons.

Carnarvon.—Electricity Committee. Accepted:—
Linking-up main (£122).—National Electric Construction Co., Ltd.

Croydon.—Tramways Committee. Recommended:—
12 sets motor equipment, brakes, &c. (£4,825).—British Thomson-Houston Co., Ltd.

Ilford.—Electricity Committee.
Transformer kiosk (£274).—Foster Engineering Co. (Accepted.)
500-kW rotary converter, 500-kVA transformer and other plant for Ganty Hill sub-station (£4,160).—Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)
1,000-kW La Cour converter (£3,000).—Ateliers de Constructions Electriques de Charleroi.
(The recommendation for a 1,000-kW La Cour converter was referred back for the Committee to obtain further tenders.)
2½ miles assorted cable and 24 miles of cable.—Power and Lighting Cables, Ltd. (Accepted.)
1 mile and 4 miles of cable.—Union Cable Co. ((Accepted.)

Lancaster.—Town Council. Accepted:—
L.p. cables for the Bowerham district.—British Insulated Cables, Ltd.

Leeds.—Tramways Committee. Accepted:—
40 partial electric equipments for new rolling stock (£16,120).—General Electric Co., Ltd.
80 drum type controllers (£3,600).—English Electric Co., Ltd.
Special track work (£1,620).—Hadfields, Ltd.
Electricity Committee. Accepted:—
Sub-station switchgear (£740).—West Leeds Engineering Works.
2,000 house cut-out boxes (£812).—Yorkshire Switchgear & Engineering Co., Ltd.
1,000 house cut-out boxes (£425).—Macintosh Cable Co., Ltd.
2,000 house service boxes (£919).—Cole, Marchent & Morley, Ltd.

Leicester.—Baths Committee. Accepted:—
Installation of electric lighting at Bath Lane baths (£332).—J. E. Lester.

Lamp Contracts.—The Southern Railway has placed a contract for "Cosmos" lamps for six months with Metro-Vick Supplies, Ltd. The London, Midland & Scottish Railway, Northern Counties Committee, Belfast, has placed a contract for a 12 months' supply of electric lamps with the General Electric Co., Ltd.

London.—Admiralty.
10,000 inert cells.—Edison Swan Electric Co., Ltd.

General Post Office.—The contract for the battery for the Manchester trunk telephone exchange has been awarded to the Alton Battery Co., Ltd.
14,000 lampholders.—Edison Swan Electric Co., Ltd.

Battersea.—Electricity Committee. Accepted:—
3 h.p. cubicles (£252); e.h.p. busbars (£472).—Ferguson, Pailin, Ltd.
50-ton overhead crane (£2,050).—H. Morris, Ltd.
Belt conveyors (£1,522).—Babcock & Wilcox, Ltd.

Manchester.—Electricity Committee. Accepted:—
Cables.—Standard Telephones & Cables, Ltd.; Siemens Bros. & Co., Ltd.; Hackbridge Cable Co., Ltd.
Converting plant for sub-stations.—Mather & Platt, Ltd., sub-contractors for transformers, Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Bruce Peebles & Co., Ltd.
Wiring for lighting and power, the offices, stores and workshops at High Street depôt.—John Collier & Co. (Electrical Engineers), Ltd.
Electric battery type motor tower wagon.—General Vehicle Co., Ltd. Sub-contractors for body and tower ladder, S. Rawlinson, Ltd.; for Iron-clad battery, Chloride Electrical Storage Co., Ltd.
Tramways Committee. Accepted:—
50 tramcar motors.—General Electric Co., Ltd.
24 pairs maximum traction trucks.—Brush Electrical Engineering Co., Ltd.

Newark.—Town Council. Accepted:—
Mains and accessories (£21,987).—Macintosh Cable Co., Ltd.
Two transformers (£632).—British Thomson-Houston Co., Ltd.
11,000-V switchgear (£1,574).—Ferguson, Pailin, Ltd.

Portland.—Urban District Council. Accepted:—
One 50/75-V dynamo, with switchboard, battery, &c., also electric lighting installation at the main waterworks station (£106).—Smith & Son.

Ripon.—Board of Guardians. Accepted:—
Installing electric lighting at the Institution (£994).—Cox-Walkers and Partners.

Rosyth.—
Electrical installation at the new St. Andrew and St. George Episcopal Church.—R. Bell.

Salford.—Electricity Committee. Accepted:—
4,500 yd. l.p. cable (£1,498).—Nederlandsche Kabelfabriek.

Tynemouth.—Electricity Committee. Accepted:—
Oil separator (£171).—De Laval, Chadburn Co., Ltd.

Forthcoming Events.

Ideal Home Exhibition.—At Olympia, W. March 2nd to March 27th.

Junior Institution of Engineers.—Friday, March 5th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper, "Tendencies in Modern Electric Practice," by Mr. J. M. Seddon. Special meeting of the Institution at the Engineers' Club, Waterloo Street, Birmingham. At 7.30 p.m. Paper by Mr. C. H. Woodfield on "Hoisting Appliances."

Electrical Power Engineers' Association (Southern Division).—Friday, March 5th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "A 50,000-kW Parsons Reaction Turbine," by Mr. C. D. Gibb.

Association of Mining Electrical Engineers (Western District Sub-Branch).—Saturday, March 6th. At 62, Wind Street, Swansea. Debate on "D.c. *versus* A.c. for Colliery Practice," to be opened by Messrs. G. W. Walton and H. Thomas.

(London Branch).—Saturday, March 13th. Visit to Chislett Colliery at the invitation of Mr. J. W. Robinson. Paper, "Some Notes on the Electrical Plant at Chislett Colliery," by Mr. C. Dawson.

Royal Institution—Saturday, March 6th. At 21, Albemarle Street, W. At 3 p.m. Lecture on "The Rare Gases of the Atmosphere," by Sir Ernest Rutherford.
Friday, March 12th. At 9 p.m. Lecture on "Radiation from Electric Discharges," by Sir J. J. Thomson.

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 8th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "A Recent Development in a.c. Apparatus," to be opened by Mr. F. Creedy.

(Scottish Students' Section).—Friday, March 5th. At the Royal Technical College, Glasgow. At 7.30 p.m. Ordinary meeting.

(North-Eastern Centre).—Monday, March 8th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "Electro Farming; or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(North-Western Students' Section).—Tuesday, March 9th. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Ordinary meeting.

(North-Midland Centre).—Tuesday, March 9th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Address by the president, Mr. R. A. Chattock.

(Scottish Centre).—Tuesday, March 9th. At the North British Station Hotel, Edinburgh. At 7 p.m. Paper on "An All-Electric House," by Prof S. P. Smith.

(South-Midland Centre).—Wednesday, March 10th. At the University, Birmingham. At 7 p.m. Paper on "Electro Farming; or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(Dundee Sub-Centre).—Thursday, March 11th. At the University College, Dundee. At 7.30 p.m. Paper on "Cable Troubles," by Mr. A. F. Stevenson.

(Irish Centre) (Dublin).—Thursday, March 11th. At Trinity College, Dublin. At 7.45 p.m. Paper on "Recent Developments in the Production of Synthetic Ammonia," by Dr. J. F. Crowley.

(North-Western Centre).—Tuesday, March 16th. At the Engineers' Club, Manchester. At 7 p.m. Annual general meeting.

Association of Engineering and Shipbuilding Draughtsmen (Birmingham Section).—Wednesday, March 10th. At the Chamber of Commerce, Birmingham. At 7.30 p.m. Lecture on "Boiler House Layout and Management," by Mr. P. S. Wooley.

Institution of Engineers-in-Charge.—Wednesday, March 10th. At St. Bride Institute, Bride Lane, E.C. At 7.30 p.m. Paper on "Modern Laundry Machinery," by Mr. E. A. Alliott.
Saturday, March 6th. Bohemian concert.

Birmingham Electric Club.—Friday, March 12th. At the Grand, Hotel, Birmingham. At 7 p.m. Annual dinner.

Physical Society of London.—Friday, March 12th At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Institution of Automobile Engineers (Wolverhampton Centre).—Tuesday, March 16th. Paper on "Electric Ignition Equipment," by Capt. A. C. Burgoyne.

(London Graduates' Section).—Thursday, March 18th. Paper on Electric Lighting and Starting," by Mr. S. T. Henn.

Porcelain Insulator Manufacture.

Impressions of a Visit to Messrs. Taylor, Tunnicliff & Co.'s Staffordshire Factories.

Founded in 1867 for the production of general porcelain, the firm of Taylor, Tunnicliff & Co., Ltd., has been associated with the production of electrical porcelain ever since the manufacture of electrical plant and accessories became a commercial proposition in this country.

The founder of the Company was Mr. Thomas Taylor, who was chairman and managing director until the day of his death in 1919. The present chairman and managing director is Lt.-Colonel W. J. Kent,



Fig. 1.—The New Factory at Stone.

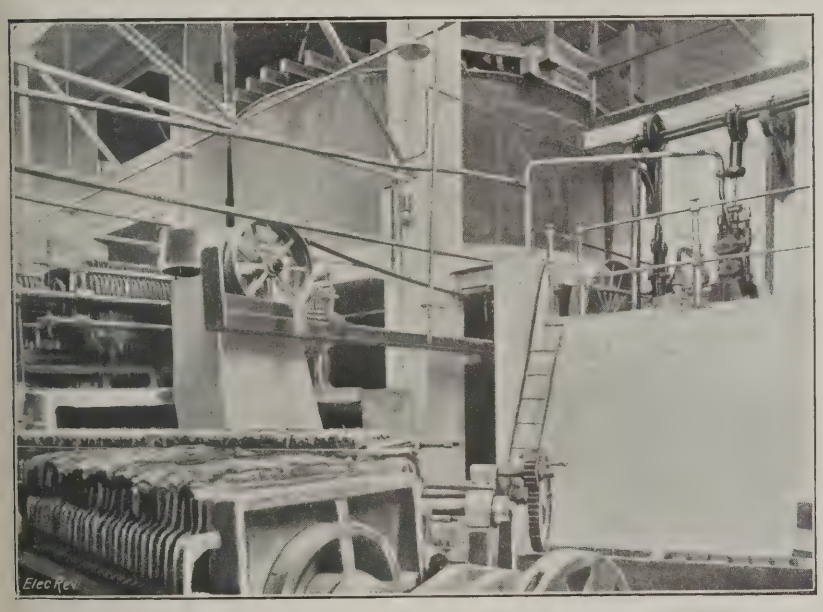


Fig. 2.—Raw Materials Grinding and Mixing Plant, showing some Filter Presses.

with Mr. A. E. Wilbraham as assistant managing director. Mr. M. J. Dark, A.M.I.E.E., is the resident London director, and Mr. P. Cooper is general manager and director. To-day over 90 per cent. of the firm's output is electrical, almost every pattern of insulator being made in its three factories at Longton, Hanley (Stoke-on-Trent) and at Stone, which afford employment for nearly 1,000 people. The last-named works, fig. 1, which are capable of producing 100,000 finished insulators per week, are situated just outside The Potteries. These works are new and are laid out on one floor to facilitate transportation. They are a striking example of the influence that modern equipment (in the form of belt and other conveyors, special machine tools, &c.) has on the reduction of production costs.

The raw materials, canal-borne Cornwall clays and "stones," flints, felspars, &c., from Norway and Sweden, are first crushed and ground exceedingly fine in water. To ensure intimate mixing of the ingredients, the liquid is run into 30-ton underground concrete tanks, and compressed air is circulated through it by means of a system of pipes so arranged that currents and counter currents are formed; this method is quicker and more efficient than the use of mechanical agitators, and the clay being suspended in the water in very small particles does not absorb air, which escapes through the water. On its way to the filter presses, the liquid flows through troughs containing a large number of magnet "combs," which remove particles of iron, &c. The type of pump used to feed the filter presses is interesting in that the vertical ram is cam-lifted and carries a heavy weight at its lower end for the return stroke. As the press becomes filled with clay, the pressure increases and consequently the stroke of the pump decreases in length until the pressure (120 lb. per sq. in.) balances the weight, when the pump automatically ceases to function. The above processes are continuous and result in the production of plastic clay, which is next broken up and undergoes "pugging," an important process that forces the air out of the clay. The material is divided at this stage for the manufacture of accessories and e.h.t. insulators: For instance, porcelain rods and tubes are extruded by means of hydraulic presses at pressures of from 4 to 10 tons.

For casting purposes it is broken up again and then mixed with various chemicals in order that its weight (solid content) may be increased,



Fig. 3.—Part of Insulator Casting Department.

at the same time preserving its fluid state. The resulting liquid flows through the system of piping shown in fig. 3 into plaster of Paris moulds, the air

being driven out as the mould fills. Moisture is absorbed by the plaster mould, and when the required thickness of solidified clay has been deposited, the liquid clay remaining in the centre is run off. When sufficiently set to stand handling, the mould is removed and the formed insulator allowed to dry before being trimmed, glazed, fired, &c.

Another process is to dry and grind the clay in order that it may be used for press work; the plant for this is capable of producing 80 tons of "dust" per week; small articles, such as switch bases, ceiling roses, fuse handles, and the like, being produced by means of hand presses. Fig. 5 is a view of the press shops.

Yet a third method is to use the clay in a plastic condition. In certain cases the clay is first manipulated by hand by a highly skilled potter with the aid of his wheel (see fig. 8), a very fascinating process to watch, the object being to get rid of any air which may still be in the clay; this is of the utmost importance, and the preliminary shaping of the insulator being made is done at the same time. From this stage the articles are passed to another skilled potter to be turned on a lathe (see figs. 4 and 6), and it is this operation which finally shapes the insulator.

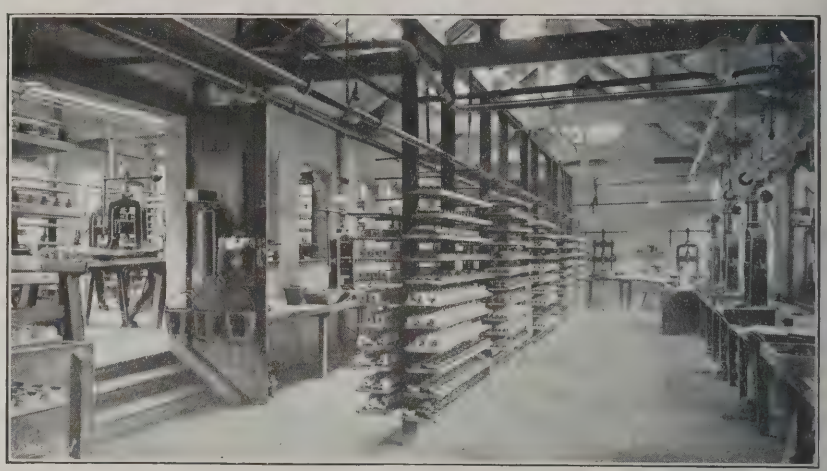


Fig. 5.—A View of the Press Shops.

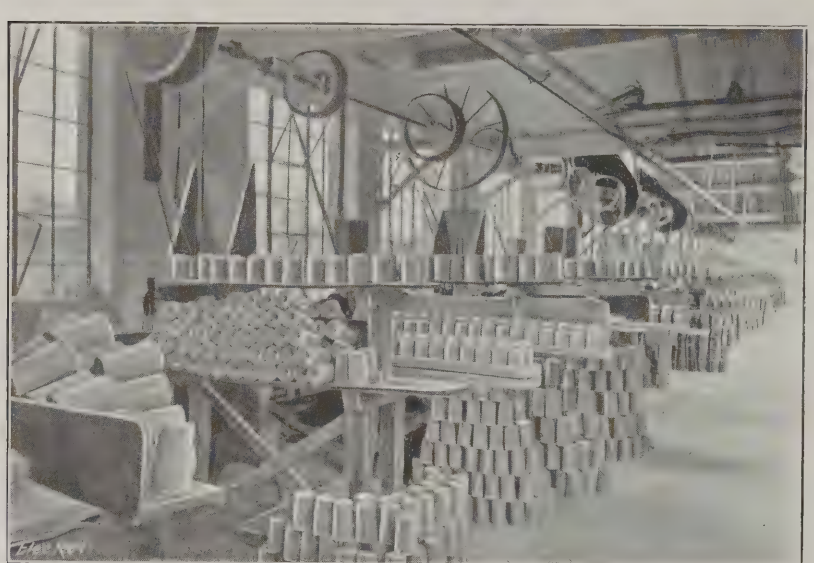


Fig. 4.—One of the Machine Turning Shops.

Another way in which the plastic clay is formed is known as "jollying." This operation may be termed a mechanical one. The clay is put into a plaster mould which revolves and determines the outside shape of the insulator being jollied; a tool of correct form is brought down into the revolving clay mass, impresses it on the side of the mould, and thus shapes the interior and exterior at the same time. In the new factory, however, all these processes are done by machinery.

Particularly in the case of the manufacture of telegraph, telephone, and similar insulators, all the operations of preliminary shaping and the final turning are done by girls, who become quite expert. Many of these machine tools have been specially designed by the Company's staff. Some of the jigs are extremely complicated, alike for lathe turning, drilling, and press work, the cost of which, however is well balanced by the economy and speed of machine production as compared with the older hand method. All the scrap material from the lathes and presses is reclaimed for further use.

It is of interest to note that the turning of the larger products is all done to scale within close limits. The turner works to blue-print drawings, and an article which may weigh 140 lb. may emerge as a finished product weighing only 40 lb. The large bowl-shaped wireless insulators shown in fig. 7 are some of the types made by the Company; to keep them within the fine limits demanded, certain surfaces are ground after firing. A large and well-equipped tool room is maintained, and something like 14,000 pattern numbers are in use, many of them intricate and involving some 50 patents. The drying process which every article has to undergo at more than one stage of its manufacture is carried out in steam-heated and hot-air rooms, and in the case of the larger insulators may last for a number of days, even weeks. Glazing is done by hand, fig. 12, the operator knowing just how long each article should be immersed from experience, according to the weight per pint of the glazing liquid, which may be white, brown, or green, as desired.

The firing process is almost the last operation. This vitrifies the insulator, giving it its insulating properties, the glaze not being depended on for this purpose; it merely gives the article a finished appearance and keeps it clean. Placed in fireclay receptacles, the insulators are stacked in tiers inside the kilns, the tem-



Fig. 6.—Part of the Turning Department.

perature control of which is a very delicate operation. In the older coal-fired kilns the control is obtained visually by watching the degree of melting of strips of clay of various qualities. In the new works, however, fig. 14, the kilns are producer-gas fired; the temperature is controlled by Cambridge pyrometers, the flue exhaust gas temperature being also recorded as well as the in-going gas pressure and quality. The chimney draught is automatically controlled by a very sensitive Arca regulator; it consists of a diaphragm, one side of which is in connection with the kiln side of the flue, the other side of the diaphragm being subjected to water pressure. Should climatic conditions (high winds, &c.) affect the draught, the balance of the diaphragm will be upset, which causes the flue damper to be automatically opened or closed, according to its prior setting. Each kiln, as it is newly filled and sealed, before the gas is turned on to it, is pre-heated to about 700 deg. C. by means of the exhaust gases from the kilns already being fired. After a period, the gas is shut off and the temperature begins to fall; at first fairly rapidly, then it remains steady for a time. At this point the insulator is finished, and in order to save time the kilns are cooled forcibly by the introduction of cold air, the hot air extracted being used for the drying rooms and other heating purposes.



Fig. 7.—Large Wireless Insulators being Ground to Close Limits.

When an article is required to be printed with the maker's name, voltage, &c., an engraved copper plate is made which transfers the pattern to very thin strips of paper. The paper is laid over the insulator and washed off, leaving the pattern on the surface of the insulator; various colours may be used if required. The insulator is then fired a second time, so as to enamel it. This second firing need not be at a high temperature, about 800 deg. C. sufficing. In the older method two firings were necessary—one known as biscuit and the other the glaze. In the majority of cases, however, the modern methods used by Messrs. Taylor, Tunnicliff & Co. necessitate only one firing, which is a consideration in view of the fact that 12 tons of coal are needed per kiln, the firing being an expensive item in the manufacture of electrical porcelain. Firing is quite an art, for the insulators, especially the larger sizes, have to be placed in specially-shaped supports to prevent strains which would lead to distortion being set up while at high temperature that would cause cracking and fracture. Over firing would cause "boiling," which is a cause of porosity.

High-voltage insulators have been made by the Company for a quarter of a century. The development of e.ht. line insulation is naturally of more recent growth, but, once the demand for it materialised, modern equipment was installed and a specialist department created for the production and testing of this class of insulation.

The manufacture of efficient transmission line insulation necessitates close co-operation between the potter and the electrical engineer. The former's business is to control the mixing and firing of clays so as to produce



Fig. 9.—One of the Warehouses, showing Telegraph Insulators.



Fig. 8.—A Potter at his Wheel.



Fig. 10.—Part of the Toolroom.

the requisite "body" for high-voltage work, while the latter designs and arranges the product to give efficient service. The "body" of which the Company's insulators are made, and the methods employed in shaping and firing them, result from long experience. The



Fig. 11.—One of the Drying Rooms.

strength of porcelain may be gauged from the fact that radio-aerial strain insulators are made to withstand a pull of 15 tons. It was a natural development for the pin-type power insulator to follow the telegraph pattern; modern practice is to use the pin-type for working pressures up to 33 kV; the T. & T. range has been standardised up to 66 kV, though there are one or two examples of such insulators functioning satisfactorily on 88-kV lines. The spindles are mild-steel hot-galvanised forgings of two standard strengths and having elastic limits of 1,000 and 2,000 lb. respectively. No cement is used to attach the spindle to the insulator.

To guard against the destructive mechanical stresses which are liable to be set up in insulators composed of three elements, *viz.*, porcelain, metal, and cement, each of which has a different co-efficient of expansion, a resilient medium is inserted between the three materials. The cement used is chiefly Portland, requiring a week or more to set, but a special composition is used in the case of insulators that have to withstand hot oil under pressure.

Metal-hooded suspension and strain insulators are regarded as the standard wherewith to insulate extra-high-tension overhead lines; on a few important systems the interlinked (cementless) type has been em-



Fig. 12.—Part of the Glazing Department.

ployed, but they are in the minority. The number of units per insulator string theoretically increases in more than direct proportion to the voltage, since the units nearest the line carry more of the electric stress than those at the earth end of the line. This effect, however, does not become of any magnitude until, say, six units in series (corresponding to a working voltage of 110 kV) are employed; so at ordinary voltages the number of units per string may be considered to vary in direct proportion to the working voltage. As above-mentioned a resilient medium is used between metal and porcelain to take up the difference in expansion with changing temperature. All modern insulators are designed to flash-over away from the body of the insulator without the aid of arcing horns; nevertheless, under exceptional climatic conditions, the arc may cling to, and destroy, the body, unless horns are provided. Such horns may be used with metal-hooded insulators, but arcing devices for pin insulators are seldom desirable.

Space considerations do not permit of the many and diverse products of Messrs. Taylor, Tunnicliff and Co. being mentioned. They include insulators for wireless, post office telegraphs and telephones, electric railways, and other purposes. It may be noted, however, that electric heater elements are made by the Company which can be safely immersed in water when at a red heat.



Fig. 13.—A Well-stocked Warehouse.

Testing facilities are, of course, an essential feature of such an organisation; they will be illustrated and

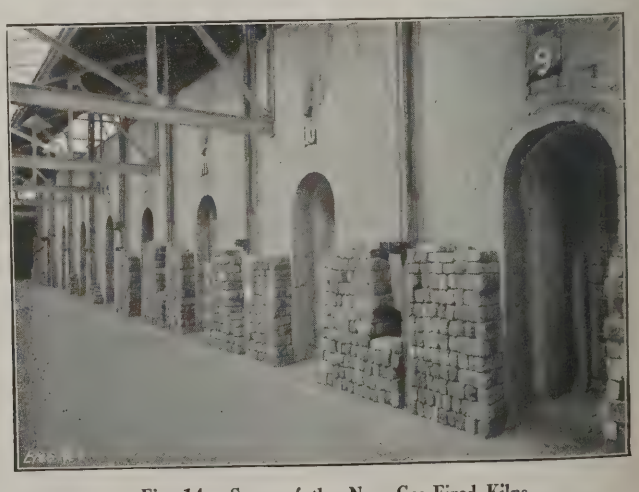


Fig. 14.—Some of the New Gas-Fired Kilns.

referred to fully in a later issue.

(*To be concluded.*)

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

RITEHEAT electric irons.

Resins for soldering purposes (in quantity).

Notes.

Meter Engineers' Association.—We have received a copy of the Rules of the Meter Engineers' Technical Association (ELECTRICAL REVIEW, January 29th, 1926; p. 183). It is proposed eventually to circulate the proceedings of the Association to all members and associate members, and the Council has decided to institute a technical information bureau, through which members may receive unbiased information regarding the apparatus they are called upon to handle.

Local Societies.—EDINBURGH ELECTRICAL SOCIETY.—A lecture was given before the Society on February 17th by Mr. Allan Arthur on hydro-electric plant. Mr. J. G. Burchell, president of the Society, occupied the chair, and the lecture proved to be most interesting.

TRAMWAYS *v.* 'BUSES.—The monthly meeting of the Paisley Association of Electrical Engineers was held on February 23rd, when a very large gathering of members and friends listened to a debate on "Tramways *versus* 'Buses." Mr. W. R. Bruce, of the Glasgow Corporation Tramway Department, upheld the case for tramways, and Mr. Peter Hamilton, jun., of Messrs. Hamilton Brothers, took up the cudgels on behalf of the 'bus proprietors. Mr. Bruce quoted figures and facts in support of tramway travel as against the prevailing fashion to travel by 'bus. Mr. Hamilton gave statistics of costs to show how cheaply 'buses could be managed, as compared with tramways, and pointed out the many advantages of 'buses with regard to comfort, speed, and flexibility which were, he said, all against tramways. After tea a lively discussion was entered into by Messrs. Scott, Coats, Heys, Todd, Young, Hutcheson, and M'Geoch. Mr. Bruce and Mr. Hamilton replied to the discussion ably, and in the general summing up opinion was fairly divided as to the merits of each side.

Electricians' Strike.—Some 80 electricians employed at Devonshire House, London, struck work on March 2nd. The complaint was that work which fitters were doing at the rate of 1s. 3½d. per hour was electricians' work, for which the Union's rate was 1s. 10d. Some 600 other workmen went on strike in sympathy with the electricians.

The I.E.C. and the Electricity Supply Bill.—According to the latest information, the Government's Electricity (National Development) Bill will be circulated to Members of Parliament about the middle of next week, and the second reading will take place on March 23rd. As reported in our issues of January 15th (p. 108) and February 12th (p. 265), the plenary meeting of the International Electrotechnical Commission in New York commences on April 13th and continues until about the 22nd, after which the delegates will embark on a tour of 2,500 miles in the United States and Canada, ending on May 8th. Thus the British delegates will be absent from this country from the beginning of April to the middle of May—the very time when the Bill is before Parliament. Owing to this unfortunate clashing of events, we believe that several of our most prominent electrical engineers who were to have served as official delegates at this exceptionally important meeting of the I.E.C. will be compelled to remain in England, greatly to the detriment of British influence in the I.E.C. discussions.

Presentation to Mr. Harry Booth, O.B.E.—On Friday last, at the Institution of Electrical Engineers, a meeting was held for the purpose of making a presentation to Mr. Harry Booth, on his retirement from the public service last year.

Sir Harry Renwick, K.B.E., presided, and in opening the proceedings, said that they were assembled to show their regard for a much respected public servant who had served his country in general, and the electric supply industry in particular, for over 40 years with unstinted devotion. Mr. Harry Booth entered the public service in 1882, the year which gave birth to the first Electric Lighting Act; Mr. Booth was not responsible for that Act, many clauses of which were so ill-designed, but he had been mainly concerned with it and subsequent Acts throughout his career, and carried on his work as head of the Electricity Department of the Board of Trade all those years practically single-handed. It was in respect of that work that they were honouring him that day. The position had been a most difficult one, having regard to the diverse interests affected, but Mr. Booth had at all times shown a high sense of the responsibilities of his office, and had always been true to the best traditions of public life. He was always tactful, courteous, helpful, and absolutely impartial, and was a splendid type of the Civil Servant of this country, a body of which they were all so justly proud.

Sir Harry then read an address inviting Mr. Booth to accept a piece of plate and the cordial congratulations of the contributors on the completion of 43 years of public service, covering almost the entire history of electricity supply in Great Britain. The address pointed out that his intimate knowledge of the Electricity Acts and Regulations governing electrical enterprise had been of the greatest value and assistance to the electrical industry, and the signatories expressed their deep appreciation of the loyal and painstaking service that he had rendered to the development of the industry.

An album containing the signatures of the 86 contributors to the presentation, including many of the most eminent members of the profession and industry, was handed to Mr. Booth, together with a handsome piece of plate and personal souvenirs.

At the invitation of the chairman, Sir George Hume, M.P., L.C.C., M.I.E.E.; Mr. R. A. Chattock, president I.E.E.; Mr. Alderman Duncan Watson, M.I.E.E.; and Sir Tom Callender, M.I.E.E. paid personal tributes to the merits of Mr. Booth, who then expressed his gratitude for the presentation, the generous terms of the address, and the kind words which had been spoken. It was embarrassing, he said, after 40 years of public service in a position involving adverse decisions, to meet with nothing but eulogy. He had experienced the greatest kindness and consideration from his chiefs and colleagues. He entered the Electricity Supply Department in 1890, and had been closely concerned with the subsequent Acts; the clause of the Act constituting "Fringe Orders" was his invention. He had a horror of red tape, and always administered the law with all the elasticity that was possible; he had "tried to help," and felt that he had had a measure of success.

Mr. Sydney Morse proposed a vote of thanks to the chairman, who was the originator of the movement, the great success of which was due to him. Sir Philip Nash supported the proposal, which was unanimously adopted, and Sir Harry briefly acknowledged the compliment.

Educational.—UNIVERSITY OF MANCHESTER, FACULTY OF TECHNOLOGY.—A scholarship in electrical engineering, of the value of £50 per annum for three years, which has been endowed by the executors of the late Lewis Atkinson, will be offered this year. Forms of nomination and application, returnable by April 1st, may be obtained from the Internal Registrar, The University, Manchester. (See our advertisement pages to-day.)

E.h.p. Rectifying Valves.—Indication of the progress which has recently been made in the application of valves for extra-high-pressure rectifying purposes is given by the production of two new types by the General Electric Co., Ltd., They are known respectively as the Osram valve type-E.H.T.1, and Osram valve type-E.H.T.3. No. 1 is a 2-electrode valve that will withstand a maximum peak reverse pressure of 80,000 volts, equivalent to an input voltage of approximately 28,000 volts r.m.s., or 40,000 volts on a capacity load. The maximum anode current that may be taken from the filament is 200 milliamps. r.m.s., but the manufacturers advise the inclusion of a protective resistance in series with the anode circuit; for cable testing this protective resistance should be approximately 1 megohm. Although this valve is designed primarily for cable-testing purposes, it may be employed to replace mechanical rectifiers in all cases when the rectification of high voltages is desired. The overall length of the valve is 365 mm. and the maximum diameter of the bulb is 160 mm. Its impedance is approximately 1,800 ohms; its maximum filament voltage is 17, and its filament current 10 amperes.

Like the E.H.T.1, the larger valve bearing the numeral 3 is supplied with a plain anode cap, and an Edison screw cap for filament connection. Type 3 is also a 2-electrode valve, built to withstand a maximum peak reverse voltage of 150,000 on a resistance load, or 75,000 volts peak on a capacity load. The maximum anode current that may be taken from the filament is 100 milliamps. peak value, and it is necessary for a protective resistance of the order of 1 megohm to be included in series with the anode circuit. The impedance of the valve is so low, *viz.*, approximately 750 ohms, that there is no visible sign of heating of the anode under normal working conditions; the maximum filament voltage is 8 volts, and the filament current 8 amperes. The valve is 530 mm. overall, 180 mm. in diameter, and its weight only 3 lb.

Dinner.—The dinner of the Ex-British Westinghouse Association takes place to-night (Friday) at the Holborn Restaurant, London.

The Economics of the Electricity Bill.—Sir Arnold Gridley, speaking at the annual dinner of the Preston and District Chamber of Commerce on Thursday last week, referred to the Government's Electricity Bill, and said that what was troubling him and many others was the question how electricity was to be rendered cheaper when it was proposed to set up a new board below the Electricity Commissioners, but above the existing municipal and company authorities, and when a large capital sum would have to be found for the construction of new stations and for the "grids" of interconnecting cables and for the standardisation of frequency.

Association of Mining Electrical Engineers.—IRON-ORE MINES.—At a meeting of the West of Scotland Branch of the Association Mr. Arthur Dixon dealt with the electrification of the Hodbarrow iron-ore mines, prior to which, he remarked, the annual coal consumption was approximately 13,000 tons, representing a cost of about £20,000. It was estimated that the electrified plant would account for 10,000 tons per annum, of which 3,000 tons would be used by the "broken ground" pumps, the approximate saving in coal being 5,000 tons, which represented £6,000 per annum. It was explained that the fuel originally used in the "broken ground" was now providing the complete electrical requirements of the mines, and there was a further saving in boiler attendance and upkeep.

Appointments Vacant. — Assistant electrical engineer (£310+) for the Admiralty service. Practical electrician for the Leeds City Police Fire Brigade. Probationary assistant telegraph engineer for the Government of the Federated Malay States. Senior switchboard attendant for the Borough of Derby Electricity Department. One meter repairer and tester for the Worksop Urban District Council Electricity Works. Relief shift engineer, for the North Metropolitan Electric Power Supply Co. (See our advertisement pages to-day.)

Electricity in Agriculture in Belgium.—With the object of encouraging the use of electricity in connection with farming operations, the Comice Agricole of Mons has recently organised a series of lectures on the subject for farmers and farm workers. The first lecture was given at the Provincial Technical School in Mons, but the subsequent ones are being delivered at different farms where electricity is already in use, so that the students are given practical demonstrations of the use of different classes of electrically-operated agricultural machinery and implements.

Institution Notes.

Institution of Electrical Engineers.—Informal Meeting.—Mr. H. T. Young was in the chair at the informal meeting on Monday, February 22nd, when Mr. A. F. Harmer opened a discussion on "Some Changing Characteristics in the Application of Electricity to Public Supply." This in the main was a description of the development of the supply company with which he is associated, especially emphasising the necessity of economy in distribution costs, and details of some new gear, designed with this object in view, were given. In a brief outline of the history of the Metropolitan Electric Supply Company he described the maze of systems which had been inaugurated at one time or another. At the present time power is only generated at Harlesden, and in the near future all the energy leaving that station will be at 20,000 volts, 3-phase, 50 cycles. The company's western area covers 400 square miles, and in the last few years about 100 miles of 20,000-volt, three-core cable has been laid. To visit the 17 sub-stations, taking the shortest possible route by road, involves a journey of 120 miles. The e.h.p. cables are armoured and laid direct in the ground, and are followed throughout with an armoured cable containing the screened pilots for the Beard-Hunter protective system and two pairs of telephone wires. The centre, or voltage pivot, is Uxbridge, where the voltage is maintained at 20,500 V; this ensures other places getting their correct voltage.

The secondary system of mains is at 6,600 and 3,300 volts; the latter will be raised to the former as soon as convenient. Places like Acton, Brentford, &c., have a network of these mains, stepping down to 415/240 volts either on consumers' premises or in kiosks; this is also in process of being carried out in Paddington. Some of the places supplied take the supply in bulk, and distribute according to local methods. Wherever there is a step down from 20,000 to 6,600 volts, there is a standard metering panel, which is, where necessary, reciprocal; that is, the metering scheme takes care of current either flowing out from, or into, the system.

One of the greatest difficulties supply authorities experience is the lack of depth in going over bridges, whilst other authorities have occupied the greater part of the available space. A 20,000-volt cable has had to be laid direct in the River Thames on this account. In other places, railway embankments have had to be tunnelled under, either in the usual manner or by the use of the thrust borer; this has also been used in town for crossing under tram-lines, &c.

A considerable mileage of the cables is laid in the canal towing paths. More than one burn-out has been due to the bargees driving steel mooring stakes into them, notwithstanding what was thought to be ample protection.

Mr. Harmer stated that public supply authorities should install their own system of telephonic communication, in view of the possibility of serious damage to plant, interruption of supply, and serious risk of loss of life in the event of a breakdown, when instant communication was vital, and said that it was a regrettable fact that few supply authorities had anything but quite feeble methods of telephony, due, no doubt, to the lack of appreciation by heavy engineers of the fact that telephonic apparatus and cables must be of the first order, chosen, installed, and maintained, with the same amount of thought and care as e.h.p. gear: in fact, more so, as 20,000-volt gear gave clear indications when matters were not satisfactory. Mr. Arthur Wright asked for figures of capital cost per kW, and whether the possibility of overhead transmission had been considered. Messrs. H. T. Young, P. Dunsheath, W. E. Rogers, W. A. Erlebach, R. V. Hook, W. Lunn, and M. D. Hart also took part in the discussion.

Association of Consulting Engineers (Inc.).—Annual Dinner.—The annual dinner of the Association was held at St. Stephen's Club, Westminster, on Thursday last week, the chairman of the Committee, Mr. E. W. Monkhouse, M.Inst.C.E., presiding over an attendance of about 150 members and guests. After the loyal toast, Mr. C. G. Du Cane, M.Inst.C.E., proposed the toast of "The British Empire," to which, in the unavoidable absence of Lt.-Col. Wilfrid Ashley, M.P., Sir Henry Slesser, K.C., M.P., responded. He remarked that the prosperity of the British Empire was a matter outside party politics; the Labour Party was as solicitous for the welfare of the Empire as any other party. Sir Joseph Cooke, G.C.M.G., High Commissioner for the Australian Commonwealth, also responded. He referred to a Conference of Dominion representatives, to be held in October next, which he described as a meeting of "political consulting engineers." The time was not yet ripe to establish one common council to prescribe for the Empire in all its ramifications; they could not make a piece of machinery to fit an organism, a corporate body with a soul. He welcomed the development of wireless communication and aviation as shortening the distance between the ends of the Empire.

The toast of "Science" was proposed by Mr. S. C. Lewis, M.Inst.C.E., who said that it was the function of the engineer to apply the findings of the scientist. Sir Ernest Rutherford, O.M., president of the Royal Society, responded, describing physical science as the mother of engineering. The use of the electron, he said, was now a branch of engineering; the same was true of wireless and radiography. Engineering was flourishing, whilst the fruitful mother continued to live in a frugal way. If science had helped engineering, it was true also that engineering had helped science, providing it with better methods and better apparatus for research. He had recently re-visited Australia and New Zealand, and was greatly impressed by the work of the engineers and their courage in designing enormous structures such as the great bridge across Sydney Harbour and the electrical works that were in progress at Arapuni and on the Waikato River. The development of engineering depended on the progress of pure science, and enormous changes had taken place in 30 years, due to the influx of new ideas from University laboratories. Science to-day was more active than ever before; there was a great wave of advance every year, and the problems of the properties of matter and the structure of the atom were being attacked all over the world. The results that would be obtained would have an immense influence on engineering, and he pointed out that the wealthy industries should therefore contribute to the support of the frugal mother.

Mr. A. H. Preece, M.Inst.C.E., proposed the toast of "Law," remarking that law was the "engineering" of human nature. Mr. Justice McCardie responded, pointing out that physical truth was the quest of scientists and engineers, whereas judges sought to discover the truth with regard to facts—a far more difficult problem. He claimed that fearlessness, honesty, and independence were the basis of the English judicial system. Sir Lynden Macassey, K.B.E., K.C., also responded, tracing the origin of engineers and lawyers from a common source. For the benefit of the Bar he recommended that engineers should continue to draw up their own contract clauses.

Mr. W. B. Clode, K.C., proposing "The Association of Consulting Engineers," declared that engineers had done more to develop the civilisation of to-day than any other body of men. The chairman responded, describing the Association as keeping the conscience of the profession, its object being to maintain a uniform standard of professional practice. On behalf of the Committee he tendered warm thanks to the honorary officers, particularly the honorary secretary, Mr. A. H. Dykes.

Electrical Association for Women.—The Glasgow and District Branch of the Association on February 25th visited the Pinkston power station of the Glasgow Corporation Tramways Department and also the tram-car works at Coplawhill.

Junior Institution of Engineers.—Coal-cutting Machinery.—At a meeting of the Institution on February 19th, Mr. S. Reilly delivered a lecture on the subject of "Coal-cutting Machinery," beginning with a general description of the coal face and the methods of machine mining, and showed lantern slides to illustrate the "long-wall" and "heading" methods of working. Mr. Reilly explained that in Scottish mines the long-wall method of working had to be used on account of the small seams of coal, which varied between 9 and 14 in. The height of the roof above the pavement was, therefore, never much more than 2 ft. 6 in., and it would be impossible to work these seams with hand picks. A modern electric disk coal cutter weighed about 2¾ tons and had a motor of about 30 h.p. The disk ran at anything from 16 to 30 r.p.m., and forced lubrication was used. The machine was totally enclosed so as to be flameproof, although it was not necessarily gasproof; under the arduous conditions of working it was impossible to keep all joints absolutely tight. The cost of maintaining a machine was about 1.2d. per ton of coal worked, and the cost of power was about 2.5d. per kWh. The initial cost of the machine was about £700, when installed at the coal face, and its life depended much on the way it was treated. The chief troubles were electrical, and were greatly increased by abuse of the machine; the life of an armature was usually from four to five months. New machines were being made only 12 in. high and were adapted for remote control.

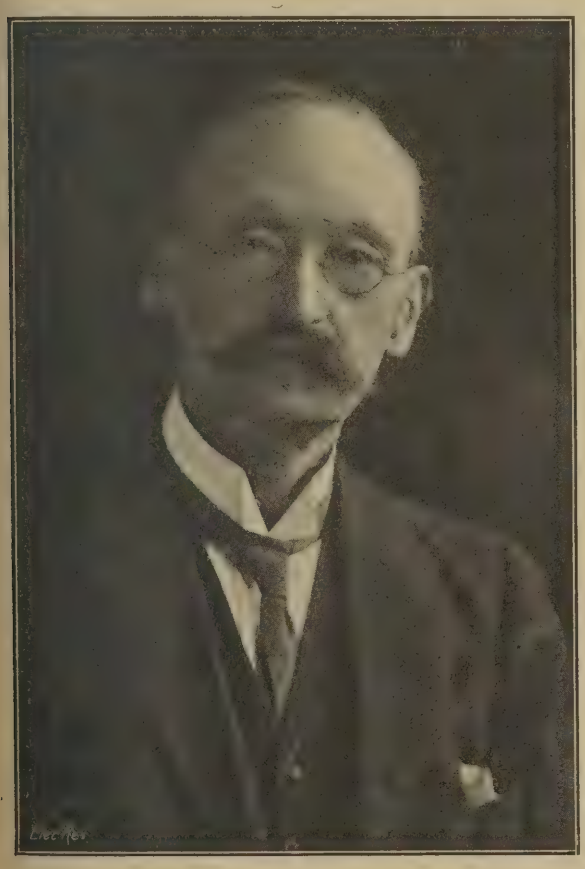
Institution of Public Lighting Engineers.—At a recent meeting of the Council, the programme of the annual meeting, which is to take place at Newcastle on September 14th, 15th and 16th, was considered and approved; it was decided to hold an exhibition on the first day, followed by a reception and a tour of inspection of the public lighting of the city.

On the second day, in addition to the president's address, papers will be read on "Public Lighting from a Motorist's Point of View," by Major Stenson Cook (secretary, Automobile Association); "Improved Lighting of a City," by Mr. J. F. Colquhoun, lighting engineer, City of Sheffield; "Hours of lighting," by Mr. R. Beveridge, City of Edinburgh; and "Electric Public Lighting," by Mr. John Christie, engineer and manager, Brighton Corporation Electricity Works. An excursion will take place on the final day.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. J. E. Kingsbury, M.I.E.E., to whom we are indebted for the very interesting article, "The Telephone—1876-1926," which appears in another part of this issue of the Electrical Review, has been closely identified with telephony during the greater part of his career—indeed, for practically the whole of the 50 years the completion of which is now being celebrated. Yet Mr. Kingsbury's numerous friends in the electrical world are unable to regard him as other than a young man in spite of his 71 years. His practical interest in telephony began in the year 1878, and commercially in 1883, when he started the British branch of the Western Electric Company, to whose interests he devoted his attention until 1910, when he retired from active management, though remaining a director. Recently he has resigned that position, and has limited his telephonic interests to the operating field as a director of several important telephone companies. In 1882 Mr. Kingsbury published a pamphlet entitled "The Telephone in Principle and Practice, its Origin and Development," and many other contributions to the literature of telephony have come from his pen. They have included various papers read before the British Association for the Advancement of Science and the Institution of Electrical Engineers, but his greatest work was the volume published in 1915 entitled "The Telephone and Telephone Exchanges," a book which has become a standard work of reference. He was awarded the Fahie Premium for his paper on Telephone Switchboards in 1895. He has been prominent in the counsels of the Institution of Electrical Engineers, of which body he is a past-vice-president, and a member of Council, and was honorary treasurer from 1915-1919. His close interest in the affairs of the Electro-Harmonic Society, the Electrical Engineers' Ball, and other social organisations of the profession and industry is well known and appreciated.



Mr. J. E. Kingsbury, M.I.E.E.

Mr. R. H. Campion, chief engineer of the Chesterfield Corporation electricity and tramways undertaking, has been appointed manager and engineer of the Torquay tramways, in succession to Mr. H. J. Nisbett, who has retired.

Mr. T. Brighouse has recently resigned his position as chief assistant to Mr. J. A. Robertson, M.I.E.E., M.I.M.E., consulting engineer, in order to take up a position as district representative of the Mitchell Conveyor & Transporter Co., Ltd. His address is St. John Chambers, St. John Street, Deansgate, Manchester.

The Board of Trade has appointed Mr. William Smith Jarratt to be Comptroller-General of Patents, Designs, and Trade Marks, in succession to Mr. W. Temple Franks, C.B., who retires as from March 1st on account of ill-health. Mr. Jarratt has been one of the assistant comptrollers at the Patent Office since 1921.

Mr. L. J. B. Forbes, electrical engineer at Kirk Sandall glassworks (near Wakefield) of Messrs. Pilkington Bros., Ltd., is shortly leaving to take up duty as electrical engineer at the same firm's headquarters' works at St. Helens, Lancashire.

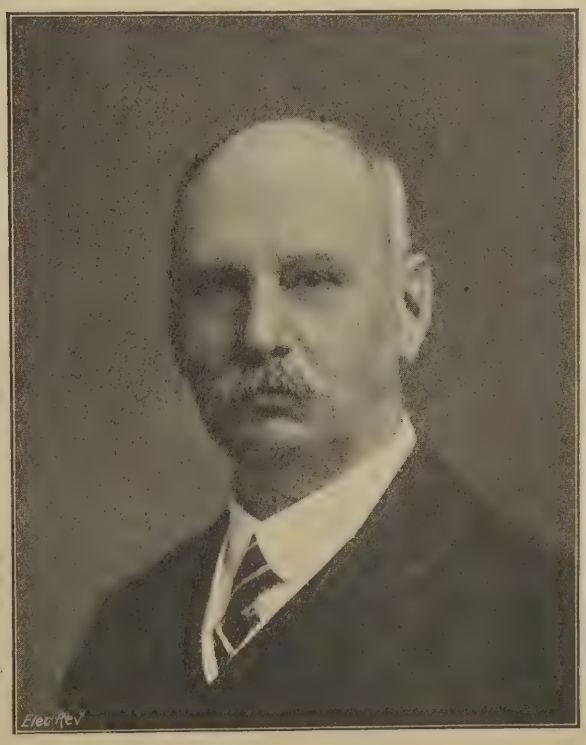
The *Yorkshire Post* states that Mr. T. E. Price Stretche, of Preston, is retiring this month from the position of superintending engineer to the Post Office for the North-Western District of England, which he has held for fifteen years. Mr. Stretche will be succeeded by Mr. J. M. Shackleton, staff engineer of the G.P.O., London.

Mr. H. Burrows has resigned his position with the Liverpool Electric Cable Co., Ltd.

We understand that there is every prospect of Mr. Guy Burney's organising ability and driving power being again placed at the disposal of the electrical industry when a suitable opportunity presents itself. Many of our readers who are familiar with his achievements will welcome such a decision. Our readers will remember Mr. Burney's prominent association with the electrical industry during the past 25 years, especially as the founder and managing director of the Sterling Telephone & Electric Co., Ltd., from which undertaking he resigned in July last, as was stated in our pages at the time.

The International General Electric Company has appointed Mr. A. S. Durrant, formerly manager of the Department of the Americas, to be vice-president. Mr. James C. Ryan, formerly sales manager of the Department of the Far East, has been appointed general sales manager of the company.

Obituary.—Mr. Martin Roberts.—Mr. Martin Roberts, M.Inst.C.E., M.I.E.E., F.C.S., whose death it was our sad duty to record last week, was born at Lichfield toward the end of 1853. He was educated at King's College, London, and entered the Engineering Department of the Post Office in 1871, becoming inspecting engineer in 1873, superintendent of factories in 1880, and assistant engineer-in-chief in 1898. He retired from the Post Office in 1909. While in the Post Office he was responsible for the design of the P.O. factories and power stations. From 1898 onwards until his retirement in 1909, Mr. Roberts, in association with Mr. (afterwards Sir John) Gavey, was responsible for the whole of the engineering work involved in the establishment of the Post Office London Telephone system. The decision to provide the main channels of communication by means of underground plant produced many problems of a novel character, and to the solution of these Mr. Roberts contributed both a sound engineering knowledge, and a degree of foresight which evoked the admiration of all who took part in this pioneer work—the foundation on which the present extensive telephone system in London is based. He was a member of the Engineering Standards Committee, and of the Physical Standards Committee, and had contributed to the Journals of the Institutions of Civil and Electrical Engineers.



Elliott & Fry [*London.*

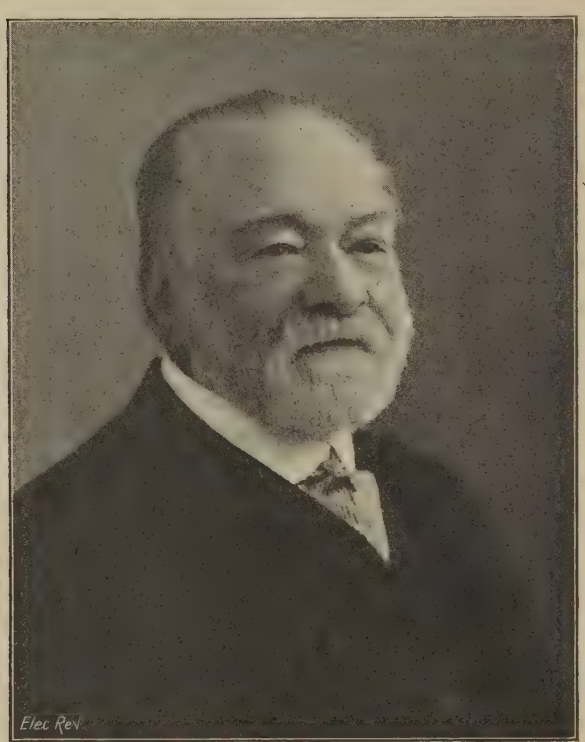
The late Mr. Martin Roberts.

During the war Mr. Roberts gave his services on the Engineering Staff of the Ministry of Munitions, for which he was made a Member of the Order of the British Empire. He was engaged during the Constantinople Exhibition at Olympia in reorganising the mechanical and electrical work of the building, and in designing the lighting of the large stage during the Kiralfy Exhibitions. He was responsible for the mechanical and electrical equipment of the re-built Trocadero.

In the early days of 3-phase alternating currents, he was sent by the Post Office to the Continent to report on the most recent Continental practice in connection with a proposal to provide a central power station for Post Office power and lighting, and was thanked by the Postmaster-General for the value of the report.

He was a man of great vitality and many interests, a keen yachtsman and collector of books, prints and etchings. He was also a prominent Freemason, holding Provincial Grand rank.

Mr. A. P. Lundberg.—Mr. A. P. Lundberg, the news of whose death reached us at the moment of going to press last week, was born at Ringby, Bjorneborgs Bruk, Sweden, in 1831, and had thus reached his 95 year. His early interest lay



Miles Kay] [*London.*

The late Mr. A. P. Lundberg.

in the direction of mathematical instruments ,but in 1855 he spent some time in France and then in Russia and Denmark in various electrical and other pursuits. Later he found employment in London and settled here in the early 'sixties. After working for several instrument firms here he entered the service of Messrs. Siemens at Charlton as foreman of the cable department, subsequently joining the c.s. *Faraday* as assistant engineer for the laying of the first section of the Direct U.S. cable. After other experiences and a return to Sweden he entered the service of Col. R. E. Crompton at Chelmsford, working among other things on the first type of Crompton arc lamp, and he recognised the value of the Colonel's friendship. At the end of three years at Chelmsford Mr. Lundberg, in 1881, started a workshop in Clerkenwell, where a new type of lampholder was made, and subsequently there was developed the large and well-known business of A. P. Lundberg & Sons, which has long made a speciality of the production of switches and all other classes of electrical accessories for lighting, heating, and power. Large numbers of readers are aware of the late gentleman's efforts to assist others to gain electrical knowledge in matters where he himself had experienced difficulty. It will be remembered that with this end in view, he secured the hearty co-operation of the late Mr. W. Perren Maycock and a successful scheme of examination in switching and kindred matters was prepared, which proved very successful and ran continuously for over 10 years. Although withdrawn over two years ago, we understand that several applications for test papers still arrive weekly. Messrs. Lundberg feel that the scheme did something to raise electrical installation matters to a higher level. The snowball effect was so great that inquirers took the scheme as a correspondence course.

Wills.—The late Sir E. E. Pearson, a director of S. Pearson & Sons, contractors, left, so far as can be at present ascertained, £124,525 net and £247,917 gross personalty.

The late Sir Alfred Shuttleworth (Clayton & Shuttleworth, Ltd., Lincoln) left £1,020,808.

Mr. R. T. Brown, late of the West India & Panama Telegraph Co., Ltd., left £11,343 gross and £9,131 net personalty.

New Companies Registered.

Faraday Sound Wave Electric Gramophone, Ltd. (211,922).—Private company. Registered February 22nd. Capital, £100 in 1s. shares. Objects:—To carry on the business of manufacturers of gramophone or other motors, gramophones or their parts, wires, apparatus, electrical appliances, mechanical devices for use in connection with musical instruments, loud-speakers, &c. The first directors are:—A. M. Kinnear, 65, Dalmeny Avenue, S.W.16; A. F. Chappell, 39, Baalbec Road, N.5. Secretary: T. Granville Smith. Registered office: 8, Bridewell Place, E.C.4.

Dodds Flame-Spark Co., Ltd. (14,014).—Private company. Registered in Edinburgh on February 19th. Capital, £2,000 in £1 shares. Objects:—To manufacture and deal in an electrical device to be known as "The Dodds Flame-Spark," used for facilitating the starting of petrol-driven engines, and to acquire the patent rights of the said device, &c. The directors are:—H. J. Gray, 41½, Union Street, Aberdeen, M.A., J.P., advocate; E. M. Dodds, 146, Bon-Accord Street, Aberdeen, university assistant; J. M. Strachan, Culver Lodge, Acton Vale, London, W.3, coachbuilder and engineer. Qualification, 100 shares. Registered office: Crown Mansions, 41½, Union Street, Aberdeen.

Trelleborg Ebonite Works, Ltd. (211,931).—Private company. Registered February 22nd. Capital. £5,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of ebonite, vulcanite, rubber tires and goods made wholly or partly of rubber, to act as merchants, commission agents, carriers, shipowners, &c., in the United Kingdom, Scandinavia, and elsewhere, &c. The subscribers (each with one share) are:—H. Reynolds, 7, Arundel Street, W.C.2, solicitor; E. T. Gorst, 7, Arundel Street, W.C.2, solicitor. The first directors are to be appointed by the subscribers. Remuneration as fixed by the company. Solicitors: Reynolds & Sons, 7, Arundel Street, W.C.2.

Herculean, Ltd. (211,960).—Private company. Registered February 24th. Capital, £12,000 in £1 shares. Objects: To carry on the business of synthetic products manufacturers, manufacturers of electrical insulating moulding powders, laminated cloth and paper, insulating cables, tapes and products of all kinds, manufacturers of synthetic resin, &c. The permanent directors are:—W. A. Jones (managing director), Clifton Street, Miles Platting, Manchester, electrical engineer; and F. L. Jackson, Clifton Street, Miles Platting, Manchester, secretary. Qualification, 500 shares. Remuneration as fixed by the company. Solicitors: H. T. Sales, 44, Kennedy Street, Manchester.

Ellerphones, Ltd. (211,956).—Private company. Registered February 24th. Capital, £5,000 in £1 shares. Objects: To carry on the business of radio engineers and manufacturers of, and dealers in radio apparatus and gramophones, &c. The first directors are:—R. H. Elleray, "Spring Bank," Lyth, Kendal, mechanical and electrical engineer; J. G. A. Kitchen, "Brookfield," Windermere, gent.; and J. K. Thornborough, "Rosemount," Westbourn Terrace, Windermere, electrical engineer. Qualification, 300 shares. Solicitor: W. Todd, 18, Sunt Street, Lancaster.

Julians of Reading, Ltd. (211,993).—Private company. Registered February 25th. Capital, £5,000 in £1 shares. Objects: To carry on the business of electrical engineers, manufacturers of and dealers in motors, motor cars, motor and other cycles, aircraft, radio apparatus and accessories and parts thereof, &c. The first directors are:—H Julian, The Hermitage, Basingstoke, motor engineer; A. A. S. Julian, 46, St. Anne's Road, Caversham, motor engineer; and W. H. Julian, The Hermitage, Basingstoke, motor engineer. Qualification, £100. Remuneration of chairman, £500 per annum; of A. A. S. Julian and W. H. Julian, £350 per annum. Secretary: A. J. Stevens, 96, Basingstoke Road, Reading. Solicitors: Blandy and Blandy, 1, Friar Street, Reading. Registered office: 84, Broad Street, Reading.

Official Returns of Electrical Companies.

Adelaide Electric Supply Co., Ltd.—Acknowledgment of indebtedness dated February 8th, 1926 (supplemental to trust deed dated June 11th, 1918, and deeds supplemental thereto), to secure £250,000 redeemable consolidated debenture stock, making in all £1,000,000 debenture stock secured by the original trust deed, constituting a floating charge on the company's undertaking in Australia (excluding dividend equalisation fund and uncalled capital). Trustees: Electric and General Investment Co., Ltd., Falcon House, Aldersgate Street, E.C.1.

Electron Co., Ltd.—Issue on February 2nd, 1926, of £1,400 debentures, part of a series already registered.

Ayling & Co., Ltd.—C. Currie, of 29g, Ixworth Road, Lewis Estate, Chelsea, S.W., was appointed receiver and manager on February 12th, 1926, under powers contained in debenture dated October 23rd, 1925.

Practical Machines Co. (A. T. Gadsby), Ltd.—R. W. Simmons, of 23, College Hill, Cannon Street, E.C., was appointed receiver and manager on February 13th, 1926, under powers contained in debentures dated April 9th, 1923.

John Richards & Co. (Electrical Engineers), Ltd. (183,000).—Capital, £6,000 in £1 shares. Return dated January 1st, 1920. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

Luminograph Co., Ltd. (185,849).—Capital, £1,000 in £1 shares. Return dated January 14th, 1926. All shares taken up. £1,000 considered as paid. Mortgages and charges, £1,500.

Credenda Conduits Co., Ltd. (126,340).—Capital, £50,000 in £1 shares. Return dated January 14th, 1926. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

Barbados Electric Supply Corporation, Ltd. (104,367).—Capital, £60,000 in 40,000 preferred and participating and 20,000 ordinary shares of £1 each. Return dated December 16th, 1925. 35,172 preferred and 20,000 ordinary shares taken up. £34,672 paid. £20,500 considered as paid. Mortgages and charges, £19,000.

British Automatic Telephone Installation Co., Ltd. (176,608).—Capital, £10,000 in £1 shares. Return dated December 22nd, 1925. 4,500 shares taken up. £4,418 15s. paid (being £1 per share on 4,175 and 15s. per share on 325 shares). Mortgages and charges at date of return, nil. Since registered: Debenture dated January 27th, 1926, to secure £300.

Metalite Co., Ltd. (184,750).—Capital, £100 in £1 shares. Return dated November 5th, 1925. All shares taken up. £100 paid. Mortgages and charges, nil.

Robert W. Blackwell & Co., Ltd. (63,446).—Capital, £50,000 in £1 shares. Return dated January 14th, 1926. All shares taken up. £18,338 paid. £31,662 considered as paid. Mortgages and charges, nil.

Radio Equipment Co., Ltd.—Debenture dated February 10th, 1926, to secure £979 14s. 6d., charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Lighting, Heating and Glass, Ltd., Bilbao House, New Broad Street, E.C.

Rose Bros. Electrical Co., Ltd.—Satisfaction in full on January 29th, 1926, of debenture dated July 16th, 1925, securing £1,000.

Ingleby & Co., Ltd.—R. E. Starkie, of 6, South Parade, Leeds, ceased to act as receiver or manager on February 12th, 1926.

Lydbrook Cables, Ltd.—Debenture dated February 15th, 1926, to secure £37,500, constituting a specific charge on the company's land at English Broknor, Glos., and all other freehold and leasehold property of the company and a floating charge on the company's undertaking and other property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C

Brecknell, Munro & Rogers, Ltd. (79,766).—Capital, £150,000 in 2,200 preference shares of £5 each and 278,000 ordinary shares of 10s. each. Return dated January 28th, 1926. 2,058 preference and 174,829 ordinary shares taken up. £90,673 10s. paid on 2,058 preference and 160,767 ordinary shares. £7,031 considered as paid on 14,062 ordinary shares. Mortgages and charges, nil.

Greenwich Cable Works, Ltd. (74,517). — Capital, £125,000 in 50 000 preference shares of £1 each and 150,000 ordinary shares of 10s. each. Return dated April 1st, 1925 (filed February 3rd, 1926). 14,100 preference and 138,260 ordinary shares taken up. £30,480 paid on 11,350 preference and 38,260 ordinary shares. £52,750 considered as paid on 2,750 preference and 100,000 ordinary shares. Mortgages and charges, £30,000.

Almondsbury and District Electric Supply Co., Ltd. (183,582) —Capital, £3,000 in 1,000 preference and 2,000 ordinary shares of £1 each. Return dated December 10th, 1925. 1,000 preference and 1,115 ordinary shares taken up. £2,115 paid. Mortgages and charges, nil.

Rhayader Electric Light and Power Co., Ltd. (188,604).—Capital, £2,000 in £1 shares.—Return dated January 28th, 1926. 354 shares taken up. £1,770 paid. Mortgages and charges, nil.

Brookhirst Switchgear, Ltd. (175,995).—Capital, £550,000 in £1 shares. Return dated December 29th, 1925. 126,002 shares taken up. £30,502 paid. £95,500 considered as paid. Mortgages and charges, £25,000.

Corwen Electric Light Co., Ltd. (183,842).—Capital, £2,000 in £1 shares. Return dated November 10th, 1925. 1,245 shares taken up. £1,242 10s. paid. £2 10s. in arrears. Mortgages and charges, nil.

W. S. Laycock, Ltd. (in liquidation).—Satisfaction in full (1) on August 28th, 1925, of charge dated May 5th, 1925, securing £106,153 19s. 2d., and (2) on January 26th, 1926, of charge dated August 4th, 1920, securing £23,543 5s. 8d. and £3,171 7s. 7d., together with interest and any other amount or balance owing on current account or any other account. (Filed February 10th, 1920.)

Santon, Ltd. (172,731).—Capital, £4,000 in £1 shares. Return dated November 20th, 1925. 2,000 shares taken up. £2 paid. £1,998 considered as paid. Mortgages and charges, nil.

Electrolines, Ltd.—Debenture dated February 5th, 1926, to secure £450, charged on the company's property, present and future, including uncalled capital. Holder: E. Lewis, "Sonoma," Abbotsleigh, near Bristol.

Mann, Egerton & Co., Ltd.—Satisfaction in full (1) on June 6th, 1913, of mortgage dated April 1st, 1909, securing £2,000; and (2) on June 30th, 1925, of debenture ssecured by trust deed dated April 1st, 1905, securing £10,000.

London Electric Stores, Ltd. (185,651).—Capital, £1,000 in £1 shares. Return dated February 11th (filed November 28th), 1925. 750 shares taken up. £750 considered as paid. Mortgages and charges, nil.

Buss, Webb & Son, Ltd.—Satisfaction in full on December 30th of mortgage dated September 30th, 1925, securing all moneys due or to become due not exceeding £2,500.

Bullers, Ltd. (62,020).—Capital, £400,000 in 20,000 ordinary and 20,000 preference shares of £10 each. Return dated December 23rd, 1925. 15,593 ordinary and 15,000 preference shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £223,950.

Power and Traction Finance Co., Ltd. (181,220).—Capital, £250,000 in £1 shares. Return dated January 1st, 1926. 6,002 shares taken up. £6,002 paid. Mortgages and charges, nil.

Hall Telephone Accessories, Ltd. (175,783).—Capital, £30,000 in £1 shares. Return dated December 31st, 1925. All shares taken up. £6,501 paid (being £1 per share on 2 and 10s. per share on 12,998 shares). £17,000 considered as paid on 17,000 shares. Mortgages and charges, nil.

Wardle Engineering Co., Ltd. (102,714).—Capital, £25,000 in 10,000 preference and 15,000 ordinary shares of £1 each. Return dated January 13th, 1926. 4,432 preference and 7,139 ordinary shares taken up. £10,871 paid £200 considered as paid. £500 in arrears. Mortgages and charges, £4,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

The "Underground" Group.

Speaking at the joint annual meeting of the companies of this group, on February 25th, Lord Ashfield, the chairman, said that although the companies carried no less than 42 per cent. of London's vast traffic, they were unable to secure an adequate margin of income to meet the needs of the capital invested; and other traffic concerns were also in an unsatisfactory condition. He was convinced, however, as the traffic grew in volume, that, given a reasonable measure of co-ordination between the various interests concerned, there could be no question but that, at the existing level of fares, there was sufficient traffic already in existence to support all the facilities which London needed and leave a margin for further developments. They had been unable to work their traffic as efficiently as they desired; in the past four years the car-mileage had increased by 45 per cent., while the number of passengers rose by 41 per cent. The route mileage of the railways had been increased and trains were worked at more frequent intervals. They had been compelled by competition to increase the number of omnibuses until there were enough for a far bigger volume of traffic. To re-establish their financial position they needed a large increase in the number of passengers carried by the railways. All kinds of improvements had been and were being carried out; these had naturally led to some interruptions in the services which, however, would soon be done away with. They had arranged with the Southern Railway for the use of two disused tracks running to Turnham Green; that would enable them to secure a four-track system from Barons Court to beyond Acton Town at a moderate cost, and would permit the projection of the Piccadilly section trains to places west of Hammersmith. A Bill was being promoted to authorise the work. There was a demand for further facilities north and north-east of Finsbury Park. The extension of the Piccadilly section to these districts would involve an expenditure of £4,000,000. Until they were sure of securing an adequate return upon the very large sums already invested, they could not consider such a venture. Referring again to traffic conditions in London, Lord Ashfield said that a pooling scheme, such as they had in operation, was essential, and expressed the companies' willingness to enter into negotiations with other traffic concerns. There were certain favourable omens to be observed; he instanced the growth of traffic on the City and South London Railway and the Edgware extension, the work on which was being fully justified. He considered that the payment of rates by the railways which had no share in the services provided by municipal authorities was anomalous, and that that state of affairs should be corrected. Lord Ashfield then dealt with the past year's accounts, which were reviewed in our last issue, and concluded by saying that the current year showed improvement, and he hoped next year to present an encouraging account of the year's working. The reports and accounts were adopted, and at subsequent meetings of the railway companies the Bill mentioned by Lord Ashfield was approved.

London Electric Supply Corporation, Ltd.

The annual meeting was held on February 26th, Mr. R. H. Benson presiding. In presenting the report and accounts (*vide* our last issue, p. 347), the chairman said that in spite of the reductions which had been made in the charges, the gross revenue had increased by 15.62 per cent. The cost of production had been reduced from 0.97d. to 0.73d. per kWh, and the sales of energy had increased by more than 47 per cent. to 90,905,284 kWh. The demands for energy for all purposes were considerable and were continuing during the current year. The first section of the electrified portion of the South-Eastern and Chatham system had been put into service, and during 1926 the demand on the company's station would be materially increased by the inauguration of further electric services. The extensions at the Deptford station were almost finished, and the capital expended upon them would soon become productive. Referring to the electricity supply reorganisation scheme, the chairman said that it was regretted that the control of the Deptford station was passing out of their hands into those of the London Power Co., Ltd., but the change was essential to the unification of control of supply. He hoped that the Government's electricity measure would put forward a broad and impartial scheme, but he believed that, given the necessary Parliamentary powers, private enterprise was fully able to do all that was necessary to enlarge the use and to lower the cost of electricity in all parts of the Kingdom. The report and accounts were adopted.

Lancashire United Tramways, Ltd.

The report for 1925 shows total receipts of £285,046 and a gross profit of £66,143. The receipts and expenditure both showed increases due to the development of the motor-'bus services, but there was a favourable balance of £4,196. The interest on the prior lien debenture stock is paid, £15,000 is allocated to motor vehicle depreciation, 5 per cent. is paid on the second mortgage debenture stock, and £680 is carried to depreciation account. The depreciation and renewal accounts and the balances carried forward of the combined companies now amount to £218,942.

The annual meeting was held on February 24th. Sir Arthur Stanley, G.B.E., presided, and in the course of his speech, he said that an agreement had been made with the Farnworth Urban Council for an extension of the company's lease for a further 21 years. An understanding had also been reached with the Salford Corporation which would enable the company to run cars over the Salford system right into Manchester. The profit from the sale of electricity (£8,836) was a record; the generating costs had already been reduced by the working of the extensions at the power station. It was proposed to make further additions to the company's omnibus fleet during the current year. The directors intended to re-issue the prior lien debenture stock when it became due for redemption on July 1st, if necessary at a higher rate of interest. The report and accounts were adopted.

North Metropolitan Electric Power Supply Co.

Sir James Devonshire, K.B.E. (chairman and managing director) presided at the annual meeting on February 23rd, and in presenting the report and accounts (*vide* our last issue, p. 346), said that the past year had been one of activity, and the financial results had been satisfactory. The capital expenditure had amounted to £345,000, of which £210,000 was expended on mains and services. At the end of the past year the company had laid over 770 miles of trunk and distributing mains and had 174 sub-stations in service. After referring to the expansion of the supply, the chairman said that the diversity of the demand made upon the company was a factor of safety against depression in any particular trade. To meet undischarged capital commitments the directors had arranged for the sale of 300,020 6 per cent. cumulative preference shares of £1 each ranking *pari passu* with the existing 6 per cent. preference shares. The ordinary shareholders had taken up at a pre-

mium of 5s. per share 199,980 ordinary shares of £1 each. The new station at Brimsdown would consist, in the first instance, of two 20,000-kW turbo-generators with steam-raising equipment of the most modern type; the Electricity Commissioners had expressed their approval of the proposals. The company's area of supply was increased to 632 sq. miles by the Act passed last year, and already mains had been laid to Stevenage and Knebworth in the added area, and it was expected that mains to Royston and Hitchin would be installed during the current year. The average revenue per kWh sold had fallen from 1.60d. in 1924 to 1.52d. in 1925. The chairman said that the company could claim to have anticipated the Government's proposals relating to the pooling of power resources. It had interchanged supplies with adjoining undertakings for many years past.

Westminster Electric Supply Corporation, Ltd. This company's report was reviewed in our issue of February 19th (p. 306). The annual meeting was held on February 24th under the chairmanship of Lord Wargrave, who, during the course of his speech, said that they had been able to maintain the dividend and to add over £80,000 to general reserve and depreciation fund, bringing that fund up to £630,000. While the output had been increased by nearly four million kWh, the total costs had remained stationary. Already during the current year they had increased their output by over a million kWh. The chairman then dealt in some detail with the reorganisation scheme, and stated that they had submitted a schedule of existing assets, and a computation of the standard prices, which were to govern any excess dividend over and above the standard dividend authorised by the Act, to the London County Council, acting on behalf of the Joint Electricity Authority, for approval. Lord Wargrave said that the extension of tenure would enable them to show—what he contended they had shown up to date—that electricity under private enterprise could be supplied to the public at as favourable, if not more favourable, a rate as could be done under municipal enterprise. He deprecated the cry of "cheap and abundant electricity" which ignored the cost of generating plant and distribution mains, and said, in conclusion, that he hoped the Government would not set up another body of persons to supervise the industry, as that would only clog the wheels and prevent that freedom which was essential for the proper development of the industry.

Mather and Platt, Ltd. The net profit for the past year was £260,885, as compared with £275,034 in 1924 and £325,291 in 1923. The dividend, however, remains the same, 10 per cent., plus a bonus of 5 per cent., both free of tax. £40,910 is transferred to the income tax equalisation fund, and £178,281 is carried forward. The meeting was held in Manchester on Friday last. Mr. L. E. Mather, who presided, said that the result of the past year's working was satisfactory in view of the continued depression of trade. The increase in the item "Sundry debtors," was due to their having had to accept deferred payments for goods supplied, particularly to Russia and Central Europe. This policy had been followed for many years prior to the war with uniformly satisfactory results. Their workshops continued to be run smoothly and efficiently and would bear comparison with the best factories in the United States and on the Continent. During the year the home business had maintained its volume. The falling off of the demand for electrical plant and pumps for collieries had been balanced by the expansion of municipal undertakings. As one of the pioneers of the electrical industry in this country, the company welcomed the Government's electricity proposals. Foreign trade had improved on the whole, and he was glad to report that relations had been re-established with Russia which had placed important orders.

Yorkshire (West Riding) Electric Tramways Co., Ltd. Sir Herbert S. Leon, Bart. (chairman), presided at the annual meeting on February 26th, and in moving the adoption of the report and accounts (*vide* our last issue, p. 347), said that the decrease in the revenue was attributable partly to the state of trade in the district but more particularly to omnibus competition. For some years the company had operated under an "Increase of Charges" order, but for some inexplicable reason the Ministry of Transport had made them reduce certain fares in August last, resulting in a loss of at least £7,000. The abandonment of the Normanton, Castleford and Pontefract sections had been enforced by unrestricted omnibus competition. Although the company had given unfailing and satisfactory service in the district for nearly 20 years, its appeal to the authorities for protection had met with no response. The time was fast approaching, however, when traffic services must be strictly licensed and controlled; the company would then reap the reward of its enterprise. Already the West Riding County Council was taking up the matter.

London United Tramways, Ltd. The report for the past year records traffic receipts of £374,284 and an expenditure of £360,551, leaving net receipts of £13,733, to which was added £7,498 miscellaneous receipts, making £21,231. The deduction of interest and payments to local authorities caused a deficiency of £29,149 and this, together with the previous year's deficit (£16,356), has been carried forward. The report also complains of the growing competition of omnibuses, and states that the company will be unable to carry out its statutory obligations if conditions are not mitigated. At the close of the year the amount of £400,000 allotted for reconstruction had been exceeded. The removal of the tramway from Richmond Bridge to London Road, Twickenham, has been completed, and costs in connection with it have been written off. The meeting was called for Wednesday last.

German Companies. The *Sudicatis Telephone Works and Screw Industry Company*, which is owned entirely by the Berliner Telephone Company, reports that the chief departments were satisfactorily employed during 1924-25, and this state of affairs is continuing in the new financial year. The net profits of 14,000 marks for the past year have been carried forward.

The report of the *Telephone Works Company (late Berliner)* of Berlin and Hanover states that activity in 1924-25 prevailed in almost all departments, while the conditions were normal in the case of the branches and subsidiary companies. A reduction only took place in the orders received from the postal authorities for apparatus, but this was compensated for by orders for automatic equipment for the Reich telephone network. The gross profits are given as 310,000 marks and the net profits, which have been carried forward, as 265,000 marks.

Torquay Tramways Co., Ltd.—Mr. H. T. Barnett (chairman) presided at the annual meeting on February 24th, and in reviewing the past year's working said that in the circumstances the results must be considered satisfactory although the traffic revenue had fallen considerably. That decrease of revenue was due to the competition of motor 'buses on the Torquay-Paignton road. In the winter months the services of trams and 'buses were excessive, and were run at a loss. In addition, the company was burdened with the cost of track maintenance and rates, apart from the handicaps of workmen's fares and compulsory stopping places. The chairman condemned the interference of small competitors in the business of public transport. In conclusion, he said that the Devon General Omnibus and Touring Co., whose ordinary capital was held by the company, was proving a valuable asset.

Radio Corporation of America.—According to the *Financial Times*, the net earnings of this corporation during 1925 amounted to only $5,737,206, as compared with $9,503,442 in the preceding year. After providing $700,000 for Federal taxes, $960,145 to reserve amortisation for patents, $524,068 to other reserves and writing off $700,000, there remained a surplus of $2,852,993, equivalent after preferred dividend payments, to $1.27 per share earned on 1,155,400 common shares of no par value, as against $2.90 per share in 1924. For the first nine months of the year earnings applicable to the common shares were only $140,540, or 12 cents a share, so that the company made a marked recovery in the final quarter to bring up the earnings as it did. No dividend is declared on the common shares.

Metropolitan Electric Tramways, Ltd.—There was a further fall in the receipts during the past year, the total being £668,756. The expenditure was £659,586, leaving a balance of £9,170. To this were added £110,000 miscellaneous receipts and £3,396 brought forward, making £122,566. After deducting interest, rentals, and other fixed charges, there was a debit balance of £43,846, which has been carried forward. The decreased receipts are attributed to the growing competition of motor omnibuses, and it is stated that unless relief is promptly secured the company will be unable to fulfil its statutory obligations. The meeting was to be held on Wednesday last.

Liverpool Overhead Railway Co.—The report for the year ended December 31st last states that the gross revenue receipts were £126,134, and the working expenses (including £5,400 transferred to reserves, were £120,687, leaving a surplus of £5,446. The deduction of the debenture interest causes a deficit of £1,309. This is met by the amount of £5,68 brought forward, the balance (£4,380) being carried to the next account. The number of passengers of all classes carried fell from 11,478,735 to 11,418,978. The report mentions the death of Mr. J. U. Hodgson, a director, and the appointment of Col. H. Concanon, O.B.E., to the vacancy thus caused. The meeting was to be held yesterday (Thursday).

Quebec Power Co.—The earnings during 1925 amounted to $1,046,943, an increase of $138,473, and the operating expenses to $236,444. Interest absorbed $300,000, depreciation $60,000, preferred dividends $207,665, and common dividends $198,607. The surplus was $44,225, making the total a credit of profit and loss $80,232. The assets are valued at $13,175,416, as compared with $11,710,331 a year earlier.

Dividends of $1¼ per share on the common shares, and of $1¾ per share on the cumulative preferred shares have been declared in respect of the quarter ending March 31st.

Hendon Electric Supply Co., Ltd.—After meeting debenture interest, preference and interim ordinary dividends, &c., a balance of £32,591 remains from the receipts from the past year's working. It is proposed to place £8 300 to the repair and renewals fund, to write off duty on the increase of capital and the cost of issue (£1,012), and to pay a final dividend of 2s. per share, free of tax, on the ordinary shares. After additional remuneration to directors is deducted, a balance of £1,853 is carried forward. The meeting is to be held to-day (Friday).

New Issues.—According to *The Times*, the business of *Messrs. J. Hopkinson & Co., Ltd.*, of Huddersfield, is to be converted into a public company, with a capital of £700,000, and £350,000 7 per cent. cum. preference shares are to be offered at par early next week.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—The directors are publicly inviting applications for £400,000 five per cent. first mortgage debentures to bearer repayable at £100 per debenture on March 25th, 1936, in debentures of £100 each at £93 per debenture. The money is required solely for the repayment of existing debentures for the same amount falling due March 25th this year. Each holder of existing debenture who exercises his preferential rights will be entitled to receive in exchange for each existing £100 debenture a new £100 debenture and a payment of £7 in cash.

London and Suburban Traction Co., Ltd.—The total receipts during 1925 fell by £1,819 to £47,551, and the expenditure amounted to £43,189, leaving a balance of £4,362. This, together with the balance brought forward (£12,704), is carried forward. The report refers to the detrimental effect of motor-'bus competition, and states that, although a certain measure of protection was granted, it came too late to be of much advantage. The meeting was to be held on Wednesday.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted :—

Yorkshire Electric Power Co.—500,000 ordinary shares of £1 each, fully-paid, Nos. 1,103,001 to 1,603,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

North Metropolitan Electric Power Supply Co.—300,020 new 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 599,981 to 900,000.

Telegraph Construction and Maintenance Co., Ltd.—The report for 1925 shows a net profit of £110,631, to which was added £114,861 brought forward, making £225,492. It was proposed to pay a final dividend of 7½ per cent., free of tax, making 10 per cent. for the year, to transfer £30,000 to the supplement reserve fund (making £300,000), and to carry forward £105,852. The meeting was to be held yesterday (Thursday).

South Metropolitan Electric Tramways and Lighting Co., Ltd.—The company's accounts for 1925 show a balance on working of £60,626 and a net income of £48,248, to which is added £5,809 brought forward, making £54,057. After deducting interest, &c., and making provision for renewals (£15,000), a dividend of 5 per cent. is paid on the ordinary shares and £10,244 is carried forward. The meeting was to be held on Wednesday last.

Electro Bleach and By-Products, Ltd.—The balance from working for the past year, after providing for depreciation, repairs, employés' bonus, &c., was £39,202, to which is added £1,781 brought forward, making £40,983. After meeting the preference dividend, a final dividend of 13 per cent., making 20 per cent. for the year, is paid on the ordinary shares, and £983 is carried forward. Meeting : March 9th.

Uxbridge and District Electric Supply Co., Ltd.—The report for the past year shows a profit of £39,745, to which is added £1,589 brought forward, making £41,334. A dividend of 8 per cent. is paid (as in 1924), £15,000 is allotted to depreciation, £1,200 to debenture stock redemption fund, and £1,385 is carried forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors recommend a balance dividend of 10s. per share, less tax, on the ordinary shares for the half-year ended December 31st, 1925, making 15 per cent. for the year.

Dubilier Condenser Co. (1925), Ltd.—The first accounts of this company are to be closed on March 31st, and the first annual meeting will be held as soon after this date as possible.

Clyde Valley Electrical Power Co.—A final dividend of 5 per cent. has been declared on the ordinary shares, making 8 per cent. for the year, as in 1924.

Metropolitan Electric Supply Co., Ltd.—A final dividend at the rate of 16 per cent. is recommended, making 11 per cent. for the year, as in 1924.

Stocks and Shares.

Monday Evening.

The financial air is lively with talk of a possible reduction in the Bank Rate on Thursday in this week. Monetary considerations flatter the possibility, and the Government's evident desire to do everything possible towards the fostering of trade and industry may serve as an additional lever, if one were wanted, to induce the Bank Court to lower the 5 per cent. minimum set up on December 3rd last year. Money in plenty is available for investment.

The recent issue of London Power 5 per cent. debenture stock at 96 was largely over-subscribed. Those who had the right to preferential treatment in the allotment, that is, the share and debenture holders of the constituent companies, received about 45 per cent. of their applications, while the general public got only 15 per cent. The price of the stock started, oddly enough, at a small discount, which suggested that the stag had noted the security as being sound, but there was very soon sufficient demand for the price to be lifted to ¼ premium. The Southern Railway has opened fresh electrical extensions this week, and it is thought that these are likely to involve further issues of capital. Heartily maligned as it is, the Southern Railway is certainly doing well for its shareholders; its stocks, alone in the list of the grouped railways, show rises in to-day's prices as compared with those of three years ago, when the grouping system came into force.

The Isle of Thanet Electric Supply enters the dividend list with a modest 2½ per cent. for last year. Nothing was paid in the previous twelvemonth. The price is a shade better at 17s.

The London Electric Supply Corporation, it was announced at the meeting the other day, will provide the Southern Railway with current in the present year, and at a rate considerably greater than that of a year ago. As soon as the company's Deptford power station is finished, however, it will pass over to the London Power Company under the arrangement recently announced. The price of the shares has strengthened to 32s. 6d. The Kensington Company has declared the same dividend as before on its ordinary, namely, 15 per cent. for last year, and the yield at the present price of the shares is 5¼ per cent. Richmond (Surrey)—shares in which were recently distributed to Bournemouth & Poole proprietors—declares the same dividend as before, namely, 10 per cent. less tax, while the Bournemouth dividend is to be 10 per cent., together with 4 per cent. bonus, the latter tax free. These results are the same as those for 1924. The South Metropolitan Electric again pays 15 per cent. for the year. Price changes in prices on the week are insignificant. Bournemouth and Poole went back to 62s.; St. James's lost ½ which they gained a week ago, the price now being 16½. Changes in the prices of the preference shares are few and insignificant.

Hendon Electric Supply has declared a final dividend of 2s. tax free, and the shares keep firm at 53s. The Clyde Valley's 5 per cent., final, makes 8 per cent. for the year, as before, and the shares remain at 30s.

The Home Railway market is quiet again. Lord Ashfield was complaining last week, at the meeting of the Underground Companies, of the way in which independent 'buses had increased, as compared with the reduction in the London General omnibuses under the Traffic Act. He pleaded for a wide scheme in regard to London traffic, a scheme that should embrace both a common financial enterprise and a common management. Within the past few days, developments have occurred which should have the effect of reducing the number of 'buses and of encouraging traffic on the trams. London United Tramways debenture at 48 is 3 higher. The company's report shows a deficiency of £29,000, which has been added to the £16,000 deficit of the previous year and carried forward. London & Suburban Traction preference are 6d. better at 5s. 6d. The Metropolitan Electric Tramways showed a deficiency of £43,800 for last year, and this amount will be carried forward into the current year. The London & Suburban Traction has £17,000 to go forward on the right side, but is paying, of course, no dividends. Underground Incomes, quoted 3 per cent. ex dividend on Monday in this week, are unchanged, allowing for the deductions. There is no premium, this time, on the coupons.

Cable equipment shares are steady, with Babcocks holding their price at 53s. 9d. The prospect of an engineers' strike, coupled with the possibility of other labour disturbances in the near future, are having a deterrent effect upon business in markets concerned with iron, steel and similar shares. Nor is it expected that other companies could avoid being damaged, to some extent, if there were to be any serious stoppage of work. General Electrics are a little better at 32s., Metropolitan-Vickers preference improved to 2 7/16. Cromptons are on the dull side at 16s. 3d. The Telegraph Construction Company has made a net profit of £110,600, which is about £700 less than that for 1924; the company pays the usual 10 per cent. tax free dividend for the year, and the price of the shares maintains its recent advance, at 29. Were the shares to be divided from their present cumbersome denomination of £12, into new shares of £1 each, a freer market would be assured.

Marconi Marines have risen to £1, and are the firmest member of the wireless division. New York has been selling Radio common, the price of which is lower at 7¾, though the preferred keep steady at 9⅜. Cable stocks and shares exhibit no striking movement. Globe preference lost ⅛, going back to 10⅞. Chile Telephones are slightly harder. The Direct West India Cable Company's dividend is again 5s. tax free, this being the interim distribution.

The excitement in Brazilian Tractions has partially subsided, and the price of the shares drooped to 97. Stock Exchange brokers have many selling limits at 100, and until these orders are cleared out of the way, the price of the shares may cling closely under par. Montreal Light, Heat & Power lost a point or so at 226½. British Columbia Electrics are dull. Anglo-Argentine Tramway second preference, officially quoted at 3 middle, can be bought below that figure, shares having come to market of late. Proprietors are probably feeling disappointed with the company's traffic returns. Nothing fresh has happened in the Mexican Utility issues.

Rubber, the produce, fell to 2s. 1d. per lb., and rallied to 2s. 3d. Loud cheers greeted the recovery when the figures were posted in the Stock Exchange rubber market. Share values promptly improved, and the market took on a cheerfuller aspect than it has displayed of late. There is a considerable bear account in some of the principal shares.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1923	Dividend. 1924.	Price Mar. 1, 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	13	14	62/-	—1/16	4 10
Brompton Ordinary	1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	1	14½	15	45/9	—	6 11 2
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2 1/8	—	5 12 11
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	30/-	—	5 6 8
County of London	1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/-	—6d.	5 9 1
Edmundson's Ordinary	1	7	7	24/-	—	5 16 8
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14½	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/6	+6d.	6 3 0
do. do. 6% Pref.	5	6	6	5 9/16	—	5 7 10
Metropolitan	1	10	11	3 /6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	23/3	—1/-	5 3 3
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	+6d.	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16½	—½	5 8
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	1 5/16	—	5 6 8
Urban Ordinary				19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	46/3	—	6 9 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	+3d.	7 8 2
Yorkshire Elec.	1	8	8	29/-	—6d.	5 10

Home Rails.

Central London Ord. Assented	Stock	4	4	68xd.	—	5 17 8
Metropolitan	,,	4	5	68½	—	7 6 0
do. District	,,	3½	3½	47½	—	7 7 4
Underground Electric Ordinary	10	Nil	Nil	2 1/8	—	Nil
do. do. "A"	1/-	Nil	Nil	7/6	—	Nil
do. do. Income	Bonds	6	6	97xd.	—	*6 3 9

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23 1/16	—	6 6 4
Automatic Telephone	1	3	6	52/-	—	2 6 2
Chili Telephone	5	6	5	6 2/16	+1/16	*3 16 2
Cuba Sub. Ord.	10	5	5	6 1/4	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18¼	—	*5 9 7
do. do. Pref.	10	6	6	10½	—⅛	5 10 4
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	23/9	—	8 6
Marconi Marine	1	10	7½	20/-	+1/3	7 10 0
Oriental Telephone Ord.	1	12	12	2 1/8	—	*5 12 11
United R. Plate Tel.	5	8	8	7 1/8	—	5 1 7
Western Telegraph	10	10	10	17 1/8	—	*5 11 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3 3/16	—	8 12 6
do. do. 2nd Pref.	5	6	6	3	—1/16	10 0 0
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,	6	6	106	—	5 13 2
Brazil Traction	100	4	4	57	—2	5 3 1
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	103½	—½	*4 11 9
do. do. Deferred	,,	129/5	129/5	127	—1	*5 2 7
do. do. Deb.	,,	4¼	4¼	79	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	+6d.	Nil
London United Tram. Deb.	Stock	4	4	48	+3	8 6 8
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	64½	—	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	15/-	—1/3	6 13 4

Manufacturing Companies.

Babcock & Wilcox	1	12	12	2 11/16	—	*4 9 5
British Aluminium Ord.	1	5	10	38/9	—	5 0 2
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3	—	5 0 0
Brush Ord.	1	10	10	27/6	—6d.	7 5 6
Callenders	1	15	15	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/3	—6d.	... ...
Edison-Swan	4/-	10	10	9/-	—	4 8 11
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	33/9	—	5 18 6
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	20/3	—	4 18 9
do. do. Pref.	1	6	6	20/6	—	5 17 1
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
,, Ord.	1	5	7½	32/-	+6d.	4 13 9
Henley	1	15	16	3 3/8	—	4 8 3
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1¼	—	*4 0 0
Johnson & Phillips	1	10	10	2 1/16	—	3 8 3
Met.-Vickers, Ord.	1	8	8	27/-	—	5 18 6
do. Pref.	2	8	8	2 7/16	+1/16	6 11 3
Siemens Ord.	1	—	7½	31/3	—	4 16 0
Telegraph Construction	12	20	10	29	—	*4 2 9

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price March 2nd.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5 3/4d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4 1/2d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3 3/4d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	..
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£264	£8 inc.
Grade II	,, ,,	£186	£5 inc.
Grade III	,, ,,	£102	£2 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9 3/16d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0 1/4	...
c ,, Wire, basis	,,	10 1/2d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£66 5s.	25/- dec.
d ,, ,, Sheets	,,	£14 10s.	...
d ,, ,, Wire Rods	,,	£77 5s.	5/- dec.
d ,, ,, H.C. Wire	per lb.	9 1/16d.	½d. dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/4	3d. dec.
i Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£33 10s.	£2 dec.
g Mercury	per bot.	£14 15s. to £15	...
e Mica (in original cases) small	per lb.	3d. to 8/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/-	½d. dec.
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£292 15s. to £293 15s.	£6 15s. dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Exterior Lighting Scheme.—An exterior lighting schem was employed for the illumination of St. Patrick's Cathedra Dundalk, on the occasion of the recent visit of the Mos Rev. Dr. O'Donnell. Over 300 20-W Osram lamps wer employed, 94 on the stone screen fronting the Cathedral, 10 on the building itself, and 102 on the belfry and clock towe The belfry interior was lighted by two 500-W lamps. Th scheme was designed by Mr. P. A. Spalding, A.M.I.C.E.

The Classification of Insulating Materials.—The atter tion of the British Electrical and Allied Industries Researc Association has been called to the possibility of confusio arising through the use in its reports of letters of the alphabe for the classification of certain insulating materials accordin to properties, uses, &c., because of the fact that the Britis Engineering Standards Association has adopted a classifica tion of insulating materials used in electrical machinery an apparatus by letters of the alphabet according to the workin temperatures for which they are suitable.

In consultation with the B.E.S.A., it has been decided th the B.E.A.I.R.A. shall in future use Roman numerals fo its classifications, and thus avoid any clashing with the class fications of the B.E.S.A. The following reports already issue are affected by this alteration:—Ref. A/S3, pressboard; Re A/S5, insulating papers; Ref. A/S10, non-ignitable board In all the above documents, where the classification is Cla A, Class B, Class C, &c., the designation in future will b Class I, Class II, Class III, &c.

Railway Electrification in France.

Some Particulars of a Section of the Orleans Railway.

By H. PARODI.

(Abstract of a Paper read before a joint meeting of the Institution of Electrical Engineers *and the* British Section of the Societe des Ingenieurs Civils.)

(Concluded from page 355.)

PART 2.

Of the railway lines from the Central Plateau to Paris, those which the Orléans Company proposes to electrify first are the ones having the greatest density of traffic and, consequently, the biggest consumption of coal. It can easily be shown that the greater the coal consumption per mile of line, the more favourable will be the financial results of electrification. For this reason and others the company, after having investigated with the Government the question of commencing the electrification by converting to electric traction the lines in the neighbourhood of the waterfalls of the Central Plateau, eventually decided to carry out the electrification in the following order (see fig. 1):—Paris to Brive, 312 miles, four track and double track; Brétigny to Dourdan, 17 miles of double track; Saint-Sulpice to Gannat, 118 miles of single track; Brive to Clermont, 123 miles of single track. These make a total of about 980 miles of main-line track, excluding switching tracks, sidings, and sorting and shunting stations. On these lines electric traction will replace steam traction for the whole of the passenger, goods, and shunting services.

The scheme has been drawn up with a view to making provision for the following traffic per year:—40 million tonne-km on the Paris-Orléans section, 20 million tonne-km on the Orléans-Vierzon section, and 12 million tonne-km on the Brétigny-Dourdan section, although, as a matter of fact, the traffic in 1923 only reached 22, 12, and 3½ million tonne-kilometres per kilometre respectively on these sections.

Fig. 3 shows the average yearly traffic on the Paris-Orléans section from 1895 to 1923, and clearly indicates the necessity

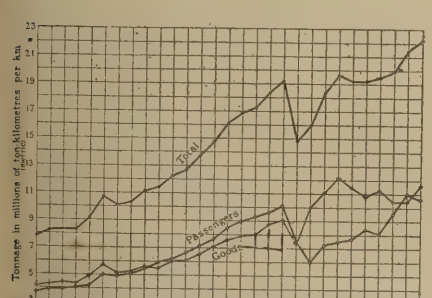


Fig. 3.—Paris-Orleans Traffic.

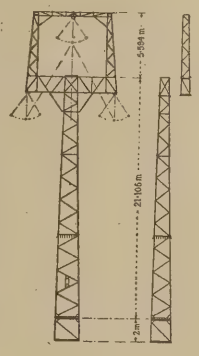


Fig. 4.—E.H.P. Transmission Tower.

of providing, as has been done, for increased requirements in the future, so as to avoid changing the plant materially during the next 15 years at least.

The orders for the Paris-Vierzon and Brétigny-Dourdan electrification, involving the equipment of over 600 km (370 miles) of main-line track, have all been placed since 1923. Already a number of electric trains are running from Paris (Quai d'Orsay) to Etampes and from Brétigny to Dourdan, a total length of 96 km (59½ miles) of route, and the electric service will be extended as far as Orléans and Vierzon before the end of 1926.

The electrical energy for the Paris-Vierzon section is generated in a system of three-phase power stations comprising, at present, the steam-power stations of the Paris district, the water-power plant of Eguzon on the River Creuse, and a group of water-power stations forming part of the concession granted by the State to the Orléans Company.

The unavoidable fluctuations in the output of the water-power stations will be completely compensated, in the case of the plants on the River Creuse, by the exchange of energy between the Eguzon water-power plant and the Gennevilliers steam plant; and in the case of the Haute-Dordogne plant by means of the Chavanon reservoir and by the exchange of energy with the Alpine hydro-electric stations. The energy generated in the various hydro-electric and steam-power stations will be transmitted as follows:—At 13.5 kV by three three-phase cables, at 60 kV by three groups of single-phase cables, at 90 kV by two three-phase overhead lines, at 150/220 kV through an overhead line connecting four transformer sub-stations, and at 120 kV through a line connecting the power stations of the Central Plateau to the Alpine stations.

Fig. 4 shows the general arrangement of the 90 kV and 150 kV towers.

The transmission lines at 60 kV, 90 kV, 120 kV and 150 kV, will be interconnected through five transformer sub-stations situated respectively at Chevilly, Chaingy, Eguzon, Vernéjoux and Commentry.

Three-phase energy at 50 periods is transformed to d.c. at 1,500 volts at 11 sub-stations, representing a total capacity of 54,000 kW for the sections, Paris to Vierzon (200 km, or 124 miles) and Brétigny to Dourdan (27 km, or about 17 miles). The plant consists of twenty-seven 2,000-kW sets of exactly similar type, each comprising two 1,000-kW, 750-volt rotary converters connected in series.

On the suburban section from Orsay to Brétigny a third rail, used also as a feeder, is provided in addition to the overhead line; the shape and method of support of this rail are shown in fig. 5. Beyond Brétigny the carrying capacity of the catenary line is increased by means of a copper feeder of 240 sq. mm. section.

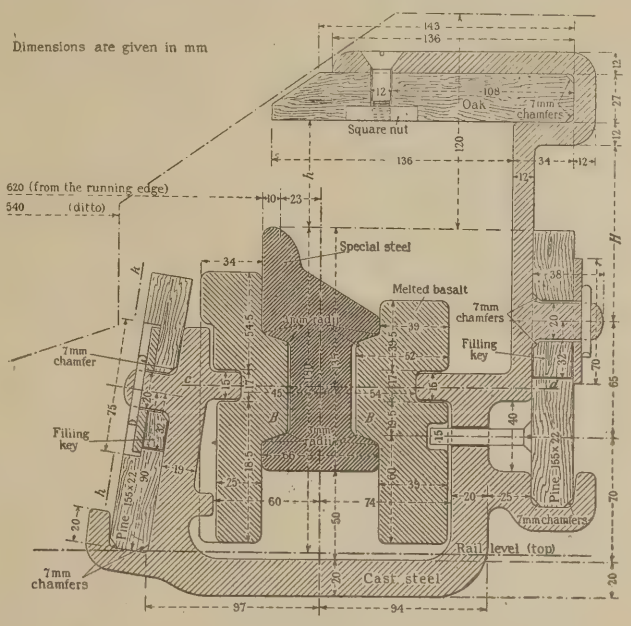


Fig. 5.—Contact Rail.

The suburban trains consist of motor coaches and trailers, whilst the main-line trains, both passenger and goods, are made up of the ordinary rolling stock hauled by electric locomotives.

Each motor-coach multiple-unit train consists of one, two or three driving units, each comprising an electric motor coach, weighing 65 tonnes, and two bogie-type trailers, each weighing 34 tonnes, the total weight of the train therefore being 133 tonnes. Each motor coach is fitted with two independent bogies, each carrying two 250-h.p., 750-V motors which are permanently connected in series. An order has been placed for 80 motor coaches, from which 25 multiple-unit trains of three units each will be formed for the suburban service. At present eight motor coaches are in service, some at 1,500 V and others temporarily at 600 V on the old electric traction system.

Goods and passenger trains, rated for speeds lower than 75 km per hour, are hauled by double locomotives comprising two units. Each unit, or half-locomotive, is supported on two bogies, and each bogie carries two 1,500-volt motors with forced ventilation. Each motor has, depending on the type, a one-hour rating of from 375 to 430 h.p. and a continuous rating of from 300 to 375 h.p.; the unit is designated by the symbol "BB+BB." Two hundred half-locomotives have been ordered, and more than 50 of these have been delivered and are under test or in operation on the electrified lines.

Trains with a nominal speed higher than 65 or 70 km per hour are hauled by special locomotives of slightly greater power than the double goods locomotives; these are of lighter construction and are specially designed for attaining high speeds.

Five experimental locomotives have been ordered, three of which have been delivered and are under test and adjustment. One is a gearless locomotive of the type "2C + C2," having a one-hour rating of 2,700 h.p. Two of the locomotives are of the type "2D2" with connecting-rod drive; these have a one-hour rating of 4,000 h.p. and a continuous rating of 3,500 h.p. One of these is fitted with "hyperstatic" connecting-rods and motors of the usual type, whilst the other has "isostatic" connecting-rods, flexible couplings, and fully-compensated motors. The other two locomotives are of the type "2D2" with outside gear-drive and small connecting-rods, and have a one-hour rating of 3,600 h.p. and a continuous rating of 3,000 h.p. One of these locomotives is provided with standard running gear and motors, and the other with adjustable articulated running gear and fully compensated motors arranged for regeneration.

Fig. 6 shows the curve of maximum sustained output for a locomotive of the Mikado type and the drawbar pull and motor characteristic curves for the BB 101-180 locomotives.

It will be seen that curve C, representing the tractive effort which can be sustained indefinitely without undue heating of the motors, passes very close to the point of intersection of the characteristic for the BB locomotive at full field and that of the Mikado locomotive. For speeds ranging from 50 to 70 km per hour the electric locomotive will thus be able to develop indefinitely a drawbar pull greater than that which can be obtained for a considerable period from a steam engine. By decreasing the gear ratio it would be possible to increase the power available at high speeds from the electric locomotive and to show a still greater superiority over the steam locomotive.

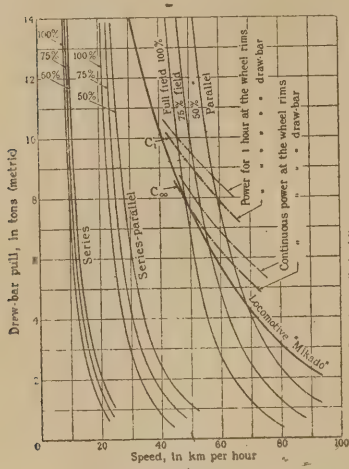


Fig. 6.—Mikado and BB 101-180 Curve.

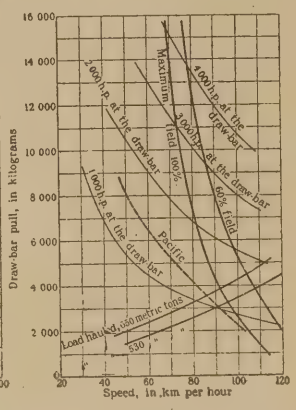


Fig. 7.—Electric and Steam Drawbar Pulls.

Fig. 7 shows the running characteristics of locomotives of the type 2D2 of 3,500 h.p. continuous output with maximum field (100 per cent.) and reduced field (60 per cent.).

In the same figure has been drawn, for comparison, the curve representing approximately the maximum tractive effort at the drawbar hook of the tender of a Pacific engine of the Orléans Company weighing (including its tender) approximately the same as the connecting-rod electric locomotives of the type 2D2.

The comparison of these characteristic curves shows that for all speeds from 90 to 110 km. per hour the useful power obtainable continuously at the drawbar hook of the electric locomotive is about 2.5 times greater than that obtainable at the drawbar hook of the tender of the steam engine.

Discussion in Birmingham.

Dr. C. C. Garrard said he approached the paper primarily from the point of view of how it reflected on the future of electric supply in this country. Referring to the passage in the paper, "the greater the coal consumption per mile of line, the more favourable will be the financial results of electrification," he assumed that the density of traffic and hence the coal consumption per mile on British railways were as great as, or greater than, anywhere in the world, hence Mr. Parodi's conclusion applied with increased force to British conditions. He hoped that the view of the French Government in regarding the substitution of electrical energy for steam on railways as one stage in a more comprehensive scheme would find favour in the discussions on the Electricity Bill about to be introduced into Parliament.

The load factor of the French electricity supply was given as 28 per cent., but it was shown how the addition of railway load would improve the load factor. As one of the chief hopes for cheaper supply under the British Government's proposals was based upon the securing of an improved load factor, this showed how important it was to include railways in the electrification scheme. The difficulty in his view was the conservatism of the railway directors, and the railway amalgamations had rendered the railway companies more powerful and less likely to make innovations.

If the Institution wished to help forward railway electrification in this country, it would have to enlist public opinion on its side. The public did not realise what a wretched transport service the British railways rendered, and he wished to emphasise that it was not possible to secure greater comfort and convenience for the travelling public unless electric traction was adopted.

The majority of the terminal stations in London and our large cities were a disgrace, but it was very difficult indeed to do anything with them with the steam system.

Mr. F. J. Moffett said Mr. Parodi's paper was very timely, as at the present time our principal railway companies were devoting attention to the question of electrification. As the Prime Minister pointed out in his speech at Birmingham on January 15th, one most important desideration for a cheap and abundant supply of electrical energy was a good load factor, and it was generally recognised by all electrical engineers that the readiest means of improving the load factor of our large generating stations was to provide an electric-railway load.

Electrical engineers were agreed that there were no insoluble technical problems to be overcome and that the chief obstacle appeared to be lack of capital. It would appear that it was just as feasible for the Government to provide loan facilities for this purpose as for the interconnecting trunk lines and standardisation of frequency provided for under the new State electricity scheme.

Major A. M. Taylor said that the fact that the energy was obtained from water power at the one centre, whereas at the other centre it was obtained from steam power generated largely by foreign-bought coal, no doubt explained why it was decided to transmit over such a great distance.

In Great Britain all our energy was produced from coal, and the only question we had to consider was whether the costs of power at two centres would sufficiently differ to warrant transmission from one to the other.

He felt that on the question of long-distance transmission, engineers in this country had lost sight of three important points: (1) unless *very* large amounts of energy were transmitted the interest, sinking fund and repair charges produced the impression that it only paid to transmit over comparatively short distances; (2) the charges for transmission at pressures below 220 kV due to energy losses were higher than the fixed charges; (3) it was only by the employment of the very highest pressure that the capital outlay on a long line could be reduced so as to bring things into the realm of commercial possibility.

Prof. W. Cramp said that the great success with which the generating stations had been arranged to co-operate was a striking tribute to the spirit which animated the French electrical undertakings; it would be of interest to know something about the Government machinery by which such co-operation had been rendered possible. It was interesting to note that the highest voltage adopted on any cable was 60 kV, and that single-phase cables were used. Did the author mean single-phase concentric, or single-core? If the latter, it would be very interesting to know whether the cables were sheathed with lead, armour, or both, and whether the cores were hollow. The general principle enunciated in the paper were of universal importance, and were, he believed, stated for the first time. The benefit accruing from the combination of the railways with the industrial load was mentioned but not proved. It seemed as though the industrial load factor in France was higher than in England. For an industrial load without tramways, 28 per cent. was a high figure, except in a colliery district or in a region where there were large steel works. With respect to the motor coaches, it seemed that the goods locomotives had 1,500-volt motors, but for passenger trains it was considered advisable to use two 750-volt motors in series. The power, however, of the goods motors was greater than that for the passenger coaches, so that it would seem that the disadvantageous series arrangement was due to difficulties of commutation at high speed. There must have been some good reason to lead to an arrangement which permanently reduced the efficiency of control. The presence of a hydro-electric station would seem to make the load factor worse for the steam station, and since the former took the cream of the load the latter should be paid more per kWh supplied. He noticed that the elaborate guarding of overhead lines, which would be required in this country, was conspicuous by its absence. The expense of this addition must not be forgotten when comparing the capital costs of distribution with those which would obtain in England.

Dr. F. W. Carter said that the contact rail appeared to be a good mechanical job, but he had not hitherto met with a rail of the section shown. The contact tip being of small area would tend to cut the shoe in grooves, and he presumed the explanation of its use was that the shoe was able to keep the rail clear of ice. He noted that some of the locomotives were equipped for regeneration: from the appearance of the gradient profile he would not have thought the advantage of regeneration worth the complication. The freight locomotives were of the 2-bogie type, having all the weight on the driving wheels; this type was tending to become standard for the class of work in question.

Mr. J. D. Carlmark said the author stated that "the greater the coal consumption per mile of line the more favourable will be the financial results of the electrification." This would always be the case whether the supply was derived from water or steam power, as after electrification the railway should be worked more cheaply. Would not the density of traffic also reduce the capital and working cost per ton mile? as with very little increase in the cost of line and transmission equipment much greater earning capacity would result, and the station and other staff could deal more economically with the heavier traffic. He would like to know if the power transmission lines followed the railways, or if they were run more for the convenience of industrial load than for traction; if the transmission followed the railway, had there been or was there likely to be any electrical interference with telephone or telegraph circuits through the 150/220-kV power circuits, or electrolysis from the d.c. distribution, and, if so, had a successful cure been found? It was noticeable that France had departed from the Continental practice of providing power stations for the railway requirements only, and that they would take care of the industrial load as well; this, he thought, was a step in the right direction.

Mr. E. H. Croft believed he was correct in saying that a regenerative locomotive had been built for the Paris-Orleans by the Oerlikon Co. on the well-known system in which a stabilising resistance was used. In order to get latter regenerative curves, and simpler and safer operation when coming in on the line with regeneration, the Oerlikon Co. had introduced a system whereby the main starting resistances were continuously in service on certain notches of regeneration. It was agreed, of course, that the loss of energy was of no great importance, and regeneration was not put on locomotives with the prime object of saving energy, but rather for the important additional safety which it introduced. One type of high-speed locomotive was of the gearless type. In his opinion the low centre of gravity on this type of locomotive was an entirely retrograde step for high speeds. In addition, this type of locomotive would appear to have considerable un-sprung weight, which was also an undesirable feature, quite apart from the difficult design of the motor. A reasonably high centre of gravity was required, and the preponderance of mass should be towards the centre of the locomotive longitudinally. The driving ends should be provided with suitable bogies or trucks. In Switzerland and on the Paris-Orleans, he believed, the rail joints were not staggered, whereas in America the joints were always staggered. This had a great deal to do with the question of satisfactory high-speed running. There appeared to be certain points in favour of the unsymmetrical wheel arrangement, where the locomotives ran over staggered joints. The track of the Paris-Orleans was in no way equal to the track of British railways. Some time ago, when a high-speed locomotive was designed by a British firm, the question of the necessity of equalisation of the wheels was fully entered into, and it was decided that on British track ordinary springing was adequate, and that equalisation was not necessary. On American railways it was almost standard practice to equalise all wheels.

The Accumulator Makers' Association.

First Annual Dinner.

It does not seem to be generally realised, even in the electrical trade, what an important section of the industry the manufacture of accumulators has become. The above-named Association was formed some 14 years ago to stabilise the business, and consists of the six largest makers of stationary batteries in England.

Under the chairmanship of Mr. B. M. Drake, nearly 200 members and guests attended the first annual dinner of the Association at the Connaught Rooms, London, on Monday night, February 22nd.

Following the loyal toast, Mr. Ll. B. Atkinson proposed "The Association," remarking that manufacturers' associations, not trusts or combinations of manufacturers, had immense advantages, and allowed also that individualism combined with concerted action which was so dear to the Englishman's heart. To any industry an association of the right type was vital for its well-being, but no association was free from internal friction, the only means of overcoming which was personal contact of its members, of an association should, accordingly, not be too large. That the small man's business was just as important as that of the large man was one of the key-notes of success and harmony in any association. Such a body must also satisfy its customers, and not think that its interests were solely bound up in profits; its functions should be to eliminate wasteful competition, encourage standardisation, which was appreciated by the buyer, and carry out that concerted propaganda which was so very necessary. He was, however, not so satisfied that they were co-operating as they should do with the Research Association, and he asked for more help in that direction.

Mr. B. M. Drake, in responding, said that he had been asked to take the chair as he was amongst the earliest manufacturers of accumulators, having started some 43 years ago. After relating early experiences, he referred to the conditions which led to the formation of the Association. He realised that it was useless trying to shake the Electricity Commissioners' faith in alternating current. It had supplanted d.c. because of its superiority from the transmission point of view, but it had done so at the expense of reliability; lamps did not last so long and accidents were more frequent than when d.c. was in more general use. Interlinking would improve reliability, but for outlying districts a d.c. supply was undoubtedly more reliable.

With regard to the Government scheme, conditions would probably have been different if the intention had been to provide a net-work which would supply the whole country, irrespective of whether it paid or not, but the Government had backed out of that proposition. It was bound by predecessors' promises and statements that electricity was the cure for all ills. When the expense of such a scheme was realised the Government funked it, and the proposal now was to make supplies available in only such places where it would pay, but meanwhile country house and isolated village schemes, &c., were being held up. A statement regarding just how far the Government intended to go would avoid considerable delay and enable battery makers to get on with their schemes. The power engineers' aim was to obtain a high load factor, and Sir John Snell had himself admitted that fact, but the power rate was not available for accumulator charging if the energy so stored was to be used afterwards for lighting. That was a wrong policy, for a very good way of improving load factor would be to charge batteries in private houses, &c., by means of time switches at night, and if such a procedure was allowed it would result in at least 50 per cent. more electricity being sold by those who generated it. A good case could also be made out for double conversion in order to cope with the peak load, the batteries being charged at night when the station load was small. For the supply of villages also, the cost of the cable system was very much greater than that of the plant needed to give the supply; by using crude-oil engines with batteries, energy could be produced at well under 1d. per kWh. If such cases could be substantiated, and calculations he had made showed that they could, he thought battery makers would be prepared to reconsider some modified form of maintenance contract. He therefore appealed to the Commissioners to "live and let live," where they could do so without harming themselves in any way, especially in view of the facts that d.c. was more favoured by the public and also that it was not so dangerous in the case of shock.

"The Electrical Industry and the Guests" was proposed by Mr. D. P. Dunne. In acknowledging the debt which battery makers owed to other branches of the electrical industry, he remarked that that gathering was somewhat like the entertainment of the rich relatives by the poor ones, but in this case the poor relatives were of some use, and he appealed to the rich relatives to make use of them. When pig lead cost £18 per ton the purchaser was obtaining his accumulator, complete and charged, for £18 a ton, which fact was the highest tribute that could be paid to any industry. He had heard it said that it did not matter who got an order for batteries, because all the makers got something out of it. That was quite wrong, and he wished to stress the point that each maker obtained his own orders and he did not pay anyone anything out of the price he got for it.

In responding, Sir Hugo Hirst recalled some of his early experiences with the E.P.S.Co. In those days England led industrially. He was known to have welcomed the Government Electricity Bill; some of them, including himself, had had privileged information. The Bill was being amended from day to day, and he asked all to keep their powder dry until they knew what was going to happen. Mr. S. Baldwin's speech was a statesman's statement. The intention was to make electricity accessible to all, and with the co-operation of the user results would follow which would revolutionise the electrical industry. When one was spring cleaning, the house had first to be upset before it could be put in order again. The proposed Board would simply regulate matters; it did not wish to interfere with a single station, and the Bill was not a vote-catching device. The Government did not need that sort of thing; it was too strong, and it did not wish for nationalisation. It was giving the electrical industry a very great opportunity; "for goodness sake let us all take it."

Mr. R. A. Chattock also responded, saying that Sir Hugo's reply had covered the ground so admirably that he need do no more than follow the precedent which had been set and be reminiscent of the early days. His undertaking probably used more batteries than any other in this country. In spite of shortcomings, they were useful things to buy and use, but he thought that research might point the way to something even better in the future.

"Kindred Associations" was proposed by Mr. W. Peto, and in reply thereto Mr. T. E. Alger referred to the spirit of sympathy which was abroad that evening. If a little more adjustment could be made in price, no doubt the contractor would be able to get that "little bit on the extras" to which Mr. Peto had referred. That goodwill existed between contractors and accumulator manufacturers was evident from the fact that the two interests had recently met to improve their relationship, and although they had not met for two years previously, the meeting only lasted two hours.

During the dinner the Band of the Royal Regiment of Artillery rendered a selection of music, and between the speeches Mr. Thorpe Bates' songs were very much appreciated. John Henry was also in great form, and the organisers of the function are to be congratulated on the success of the evening.

The Electrical Industry and the Architect.

The Fifth E.D.A. Conference.

Mr. Walter Riggs presided at the fifth E.D.A. Conference of the session at Caxton Hall, Westminster, on February 19th. The subject was "The Electrical Industry and the Architect," a paper on which was read by Mr. G. Blair Imrie, of Messrs. Imrie & Angell, architects.

Mr. Imrie confined himself to the relations between the electrical industry and an architect specialising in houses. He said that his experience with the supply companies had been unfortunate. Broadly speaking, they did nothing whatever to advance or create demand, and no encouragement was given by them to those who were willing to spend money in developing estates. Exorbitant prices were charged for services, and some companies were extremely unbusinesslike in connecting up. Supply undertakings did not take sufficient trouble to get into touch with architects. The companies could do a great deal to stimulate demand by letting the architect know early that they were prepared to charge a low rate for a reasonable cooking and heating load. The speaker appealed for tariffs which the architect could understand, and quoted an example of the complicated nature of some tariffs. Passing to contractors, Mr. Imrie said that the contractor who would do a good job without worrying the architect with detail and without friction with the builder or other contractors, was likely to get repeat orders. Contractors did not always help the industry as a whole, inasmuch as when asked to estimate for wiring and to suggest a schedule they were inclined to cut the schedule to a minimum to keep the price down. It would be much better to give a very full schedule and to mention what could be saved by omissions. When sending in an estimate for electrical work to an architect the contractor did not always include information such as the name and address of the local supply company, the voltage, rates, &c. In the actual execution of work there was not nearly enough intelligent supervision by the contractors. If wiring rules could be simplified it would be to everyone's advantage; the safety of ordinary methods was ample, and it hardly seemed necessary to make regulations which increased the cost. Referring to fittings, Mr. Imrie said that the architect preferred a flush switch, and the nearer a cheap switch was to the flush pattern, and the smaller it was, the better. Power plugs were his pet abomination; why must they be so big? With regard to lighting fittings, he said that there were more people than was imagined who would pay more for good fittings if they could see them displayed under good conditions. His chief complaint against the makers of electric cookers and many other electrical appliances, however, was that the architect heard so little about them, although he was sent much literature about gas appliances. He looked forward to a time when the house which was not really "all electric" would be out of date. He was aware of the good work that the E.D.A. was doing, but thought that its scope should be enormously increased if results were to be obtained quickly.

Discussion.

Mr. W. R. Rawlings agreed that the electrical industry was checked by the methods of some of the supply authorities; there had been cases in which his own firm, as contractors, had guaranteed a minimum sum to the supply authority in order to get the work done. As regards methods of charging, he had seen very bad instances, but he thought that the one quoted was a joke. The wiring rules were necessary for sound work. Architects should endeavour to establish some standard of work. The obvious course was for them to go to a good firm for their electrical work. He hoped that professional men requiring the services of electrical contractors would only employ those who were registered. A great deal of valuable work was being done in standardising flush fittings and plugs, work in which the manufacturers and the British Engineering Standards Association were taking part, and in a very short time there would be standards for all those fittings. Every effort was being made by manufacturers to make plugs as small as possible consistent with satisfactory operation. Architects should so frame their agreements that the electrical contractor was not left at the mercy of the builder if he should go into bankruptcy, as occasionally happened.

Mr. F. C. Raphael said that a consulting engineer would not make an electrical contractor a sub-contractor to the builder. Speaking of architects in general, Mr. Raphael said that some of them were so conservative that they did not give the electrical industry a chance to get in. In numerous cases, too, the architect designed his building without any regard to where the cables for electric lighting and power were to go. He hoped there were not many cases in which such a complicated tariff as that mentioned by the author existed, but he had come across one nearly as bad supplied by a London supply company. The electrical contractor should not be expected to prepare a schedule for the architect when a consulting engineer was not employed. That was the work of the architect, as the purchaser's representative. If it were left to the contractor, who had to compete with others, it was not surprising if he cut the schedule down as low as possible in order to get the job. The architect should specify what type of plug he wanted. As regarded fittings, it often saved a great deal of trouble to make a rough sketch of what was wanted and get the fittings made specially. This cost very little more and was much better than making a selection in a showroom.

Mr. F. Selly (Marylebone) said that he did not consider that the picture given by the author of the attitude of supply authorities should be accepted as representing the position generally. His own authority did not charge for putting in the service, and in many cases a connection had been made the day following a telephone message. Electricity was now being supplied in Marylebone at about 33½ per cent. below the pre-war rate, and every possible assistance was given to the architect. He tried to get at the architect before any work was done, and the Marylebone Supply Department had been very successful in this respect.

Mr. Pulver (Messrs. Duncan, Watson & Co.) said that Mr. Raphael had suggested leaving chases for the cables before putting in concrete partitions, but it was questionable whether it was the cheaper way.

Mr. L. Gaster said the difficulty in some cases was that supply companies had no money to make extensions, and therefore were not in a position to push development. On the whole, however, he felt that the author, having had one unfortunate experience, had been misled by that into thinking that all supply authorities were the same. The architect should call in the consulting electrical engineer to help him. Designers of fittings should understand that the thing desired was good lighting.

Mr. F. T. Hall (Tottenham) said that there were very few supply authorities who did not want new business, and when difficult cases were investigated it would probably be found that there was a reason for the trouble. He had known cases in which architects would not answer letters or take the slightest notice of the supply authority desiring to put in the supply.

Mr. Grierson said that until recently the position of the companies had been insecure, and as a consequence they had not felt justified in pursuing a forward policy; that position would be altered by the Government's Bill. The question of tariffs had been discussed for years, and architects must realise that supply companies could not run long lengths of cable for nothing in order to get a nominal revenue. A two-part tariff must be introduced to get over that difficulty. There should be no complaint regarding the size of plugs, although they should be of the minimum size to give reliability. The average electrical contractor only looked at the matter from the point of view of the amount of money he could get for the installation. A schedule could be prepared for £250, and on the same job another schedule could be prepared for £50, and the £50 man usually got the order. He could never understand why the architect made the electrical contractor a sub-contractor to the builder, and he agreed that it was a doubtful advantage to cut the chase before the building was completed. It was not to be expected that architects would understand the wiring rules, but they cut out the "jerry" wireman.

Mr. H. Simon thought that architects were inclined to look too much upon the æsthetic point of view, rather than the utilitarian. Something of the æsthetic must be sacrificed if efficient lighting was desired. With Mr. Rawlings, he expressed the hope that architects would deal only with registered electrical contractors. Referring to tariffs, the speaker said that he knew of a London company which had quoted similar arrangement to that mentioned in the paper. That simply hindered progress, and in the case in question his client had abandoned his idea to have electric cooking, &c.

Mr. Strange (Tunbridge Wells) agreed that the quoted tariff was complicated, but it worked out extraordinarily cheap.

Mr. J. W. Beauchamp said that it was not only desirable to put in more outlets in buildings; heavier cable should be used to make the sale of apparatus later on still more easy. Architects should allow generous accommodation for sub-stations in big buildings, for they saved space elsewhere when electricity was used. So far as plugs were concerned he did not think the objection was so much to their large diameter as to the fact that too many of them projected such a long way from the wall. As to tariffs, a simple two part system was the ideal.

Mr. Imrie, replying to the discussion, said that as regarded the wiring rules, all that was required was by-laws to prevent the bad workman doing bad work. In some contracts he had as many as 12 sub-contractors; he would not like to have to deal with 12 consulting engineers. His own method was to put himself absolutely in the hands of a reliable contractor. He always saw to that the sub-contractor was paid, because it was very necessary, apart from other considerations, in the interests of the client. His small experience of electrical consulting engineers had shown that they were of great assistance, but as regarded other branches of building work he would rather be without consulting engineers. The question of cutting chases during building was an expensive matter, and 50 per cent. might easily be added to the cost. As to the schedules, he did not mean a detailed specification, but

price per point. For private house work he was convinced that it was a mistake to try and plan the points during building, as the client or his wife would come along afterwards and alter all the positions. He claimed that the tariff which he had mentioned was a fair sample of the tariffs of the supply companies which he had met in the course of his work. He would avail himself of the suggestion to bring such cases to the notice of Mr. Beauchamp, and as to the point that it did not pay supply companies to lay mains when the revenue might only be 12s. 6d. a quarter, his quarrel was that the supply companies did nothing to induce the consumer to increase it to £12 10s.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Refrigerator.

A recent production of the International G.E.C. of New York, is an electric refrigerator, fig. 1, the mechanism of which, it is claimed, is totally enclosed and practically silent in operation, requiring no attention as regards lubrication. The motor and compressor are mounted vertically on the same shaft and all the moving parts are contained in the refrigerant case; the cylinder pressures are equalised by a valve device, allowing the motor to commence on no-load.

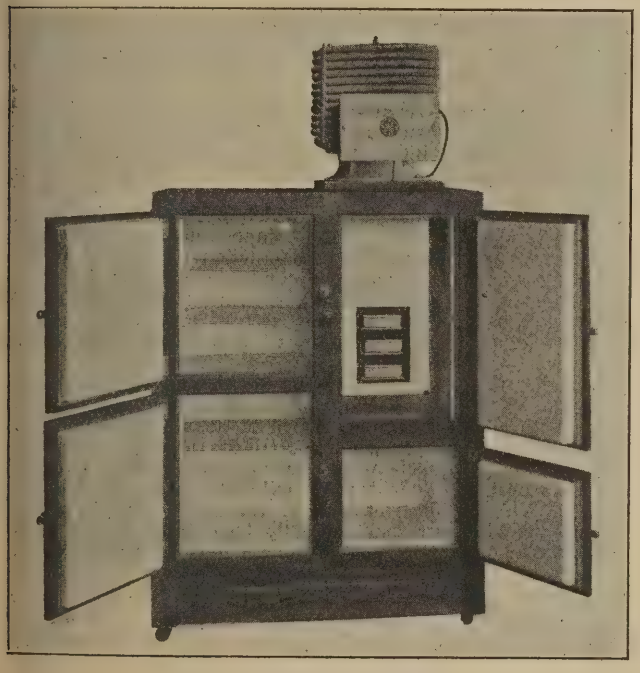


Fig. 1.—Electric Refrigerator.

The principle of operation is the evaporation of a liquid refrigerant (sulphur diozide) in coils submerged in brine. Heat is transferred to the brine tank from the surrounding air, and then to the refrigerant during evaporation. A low pressure is maintained in the coil by means of suction from the compressor. The gas is then passed through a condenser coil and chilled and liquified under a relatively high pressure. The condensed liquid is collected in a float chamber and passed again into the evaporator.

Complete thermostatic and electrical control are provided by means of suitable gear contained in a box on the front of the unit. The automatic control is so adjusted that the temperature of the brine tank is maintained between 16 degrees and 24 deg. F.

Investigations made by the producers show that a temperature range of from 40 to 50 deg. F., depending on the room temperature, is best adapted for food preservation, and the area of the brine tank is claimed to be suitable to maintain that range in the food compartment.

A New Watertight Plug and Switch.

The accompanying illustration, fig. 2, shows a new watertight plug and switch combination, a production of Messrs. James Scott & Co., 340, Royal Liver Buildings, Liverpool, which is designed primarily for use in connection with the lighting of ships during loading and unloading operations; but it should prove useful in outdoor and wet places where a plug control for electric circuits is necessary. The switch and plug are housed in a suitable metal case and the plug is inserted from the bottom. The latter is locked when in position so that it cannot be pulled out by means of the cable; it can also be put in the "off" position without removing it entirely from the case, by virtue of the pin and slot connection between the plug barrel and the case projection. The plug contacts are arranged concentrically, and are accommodated in split sprung terminal sockets suitably mounted and insulated in the case. The top socket, or "inner" connection moves vertically up and down, and is pressed downwards by a spiral spring wound about a sliding

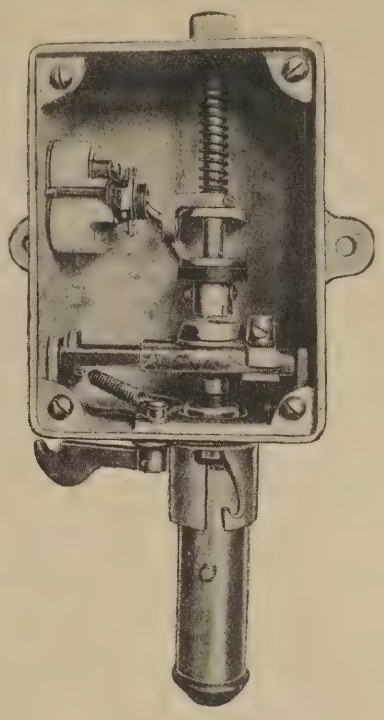


Fig. 2.—Watertight Plug-Switch.

projecting spindle. Attached to this is an eyed angle piece which accommodates the knob of an ordinary Crabtree switch and is so placed that the switch is put "on" or "off" before the plug is connected or disconnected, thus preventing arcing at the plug terminals. A metal flap, under the influence of a spring, closes the aperture in the case, internally, immediately the plug is withdrawn, and it is removed again to admit the plug by means of a small handle under the case. The device is shown with the cover removed.

A Low-C.P. Lamp.

We have received from Messrs. Philips Lamps, Ltd., of 60, Wilson Street, London, E.C.2, a sample of their "Savelite" lamp, which is intended for use wherever a lamp of low consumption and candle power is required. It is intended for use on alternating-current circuits only, and appears to contain in the base a tiny transformer. The lamp has an opal bulb, and gives about 1½ candle power. It is claimed that with it one can obtain 50 hours of light for one penny. It is a very convenient little device.

An Improved Battery Charger.

Fig. 3 shows one of a range of Hobart constant-potential battery chargers, designed for short-period, heavy-current charges, which is being marketed in this country by Mr.

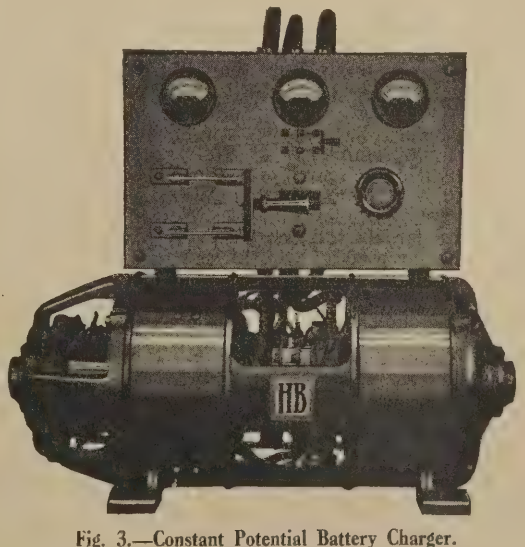


Fig. 3.—Constant Potential Battery Charger.

F. J. Gordon, 91, Moorgate, London, E.C.2. The machine and the control board are arranged as one unit. The motor is fitted with ball bearings, and is wound for non-reversing voltage regulation. The current is automatically rapidly reduced, it is claimed, as the battery becomes nearly charged, thus reducing the heating and gassing. The range covers up to 500 A outfits.

Road Transport and its Possible Developments.

(Abstracts of Addresses delivered at a Joint Meeting of the Institutions of Civil, Mechanical and Electrical Engineers.)

The annual joint meeting of the Institution of Civil Engineers (Birmingham and District Association), the Institution of Mechanical Engineers (Midland Branch), and the Institution of Electrical Engineers (South Midland Centre) was held at the Council House, Birmingham, on Friday, February 12th, when addresses on the above subject were read by Major F. C. Cook, D.S.O., M.C. (Civil Engineers), Sir John Thornycroft, K.B.E. (Mechanical Engineers), and Mr. C. Owen Silvers (Electrical Engineers).

Major F. C. Cook dealt with the administration of the highways, their design and construction, and the effects of heavy traffic upon them. He said: "The essentials of the road for the development of road transport can be briefly put as follows:—(*a*) It must be so sited as to provide the most direct route between the termini, whilst providing easy means of communication with intermediate centres of population. (*b*) It must be constructed with due regard to economy, so that all traffic likely to come upon it can proceed at its maximum economic speed, without damage to the track or vehicle and with safety to other road users."

Sir John Thornycroft's subjects were the types of vehicle employed, and the economics of road transport. Referring to passenger services, he said: "For work in large cities, where they are used to deal with very dense traffic, the double-decker as used in London for carrying about 50 people has a legitimate place, but by far the greatest field seems to exist for single-deck types carrying either 20 or about 30 passengers. A 20-seat vehicle can be built to weigh under 50 cwt. and not to exceed dimensions which make it handy enough to traverse by-roads without interfering with other traffic. If built within this limit of weight it has the additional advantage that it is not restricted as regards speed to a greater extent than any motor car, under the Ministry of Transport's proposed new regulations.

"In considering the economics of transport by road, one must obviously take into account both the cost of the transport services, made up of the running costs of the vehicle, depreciation, &c., and also the costs connected with the roads on which they run, but I do not think anyone has, as yet, discovered a method of correctly applying the road costs, and the most we can do at the present time is to arrive at some general conclusions. . . . The wear and tear of roads is dependent both upon the travelling load and the speed at which it is moved. The speed is in the hands of the driver of the vehicle, but the travelling load, being made up of the weight of the vehicle and what it carries, is dependent on the skill of the engineers who produce them. It would appear from what politicians are saying that it is being taken for granted by them that the heavier goods-carrying vehicles are responsible for the greater part of the road damage. No doubt heavy axle loads on unsuitable roads are responsible for an undue proportion of damage, but engineers, I think, will agree with me that the total of the ton miles applicable to the different types of vehicle, qualified in some way by the speed, is the correct way of arriving at their share of responsibility."

Mr. C. Owen Silvers dealt with the electrical aspect of the subject, the following being an abstract of his remarks:—

For moving large bodies of people safely, swiftly, comfortably and economically in large cities and industrial areas, it would be impossible to substitute motor omnibuses or trolley vehicles and still carry passengers at the low fares now charged on the tramcars. The modern tramcar is constructed to seat up to 84 passengers and with the proposed restriction of size and weight of motor omnibuses and trolley omnibuses, it will be impossible to seat many more than 50 passengers in a railless vehicle. A fair method of cost comparison is based on the average seating capacity of the vehicles and the following figures show the cost per 100 seat miles for tramways, trolley vehicles and motor omnibuses at Wolverhampton and Edinburgh for 1924-25:—Tramways: Wolverhampton, 39.56d.; Edinburgh, 30.69d. Motor 'buses: Wolverhampton, 44.56d.; Edinburgh, 55.24d. Trolley vehicles: Wolverhampton, 37.34d.

The costs are largely influenced by the seating capacity of the vehicle and large 80-seater vehicles can only be employed when the number of passengers is sufficient reasonably to fill those vehicles and at the same time warrant a frequent service which will sufficiently employ the expensive permanent way. Tramways suffer under certain statutory disabilities, and in many ways have not equal opportunity and obligations with motor omnibus competition. With the provision of wide arterial roads, sleeper tracks and tramway sub-ways, the tramcar is likely to hold its own in the transport world for many years to come. Roads to-day should be built to carry the ordinary mechanical traction of the district and the modern trolley vehicle comes within this category; there are innumerable instances where the electrically operated mobile trolley vehicle can be applied more successfully than either the tramcar or the motor omnibus. The pioneers of the electrical trolley vehicle first operated vehicles in this country in 1911 and 1912, and a new lease of life was given to it in 1922, when Birmingham, followed shortly afterwards by Wolverhampton, decided to scrap some worn-out single tramway track and substitute up-to-date trolley vehicles. Both these experiments were very successful and in the Wolverhampton case the traffic on the route increased by 33 per cent. The rate of acceleration of the trolley vehicle has been found to be about 2½ miles per hour per second, without undue stress on the vehicle, tires, or the road. Fifteen or sixteen authorities are now running trolley vehicles in this country, and many others have trolley vehicle routes under construction.

It appears that the battery vehicle is not holding its own. I believe that this is due to unfortunate circumstances and that the potential field for the utilisation of electricity for this purpose is enormous. The more extensive use of these vehicles in the past has, in my opinion, been prevented by, among other things, the lack of organisation by the supply authorities for the provision of cheap energy and plentiful charging stations. The manufacturers have taken a narrow view of business and based their prices on too small an output, making the capital cost high when compared with that of a petrol vehicle. In this country there are approximately 8,000 battery vehicles and trucks in use, in connection with the principal trades; when large undertakings like Messrs. Harrods and the L.M.S. Railway can find a place for a fleet of electrics amongst their petrol-driven vehicles, it is obvious that there is an immense field for their use in frequent-stop town work. It is calculated that 150 electric vehicles require one million "off peak" units every year. In both Germany and America the battery vehicle is rapidly growing in popularity, and its use is on the increase in both France and Italy.

In an address by Mr. Cowie on: "Why the American Railway Express Company runs in excess of 1,800 Electric Trucks,"* he said: "The economy in operation of the electric is due to the relatively small amount of time necessary for maintenance and repair, a result of the extremely small number of parts of the electric, its freedom from vibration and its limited speed."

The efficiency and reliability of the petrol vehicle is largely due to the electrical engineer in perfecting the magneto ignition and the electric lighting and starting systems employed.

Speaking on road transport matters in general, the one outstanding consideration is the hard fact that the dimensions of the thoroughfares in our towns, which were planned without any notion of present-day traffic, impose definite limitations upon street use in all centres of population. The local authority is the custodian of the roads and is responsible for their maintenance. There is nothing so striking in the whole range of local taxation as the increased cost of road maintenance, and there is nothing so deceptive as the mere use of aggregate figures, as compared with percentages.

Regarding the question of public health and petrol exhaust gases, we all know the effect of being shut up in a small garage with a petrol engine—carbon monoxide poisoning in a very short time. As to whether a dilute mixture of carbon monoxide and air, such as we now get in London, is detrimental to health, I took this up with Dr. Jolly, the Wolverhampton Medical Officer of Health, who said: "If this poison in concentrated form could actually have fatal results, it is highly probable that in a more diluted form it would still be injurious to health."

Discussion.

Mr. F. J. Moffett commented on the wonderful results that could be, and were being, obtained by the battery vehicle. Electrical engineers were not at the end of their resources and they hoped to be able to improve on the present storage battery. It was rather curious to contrast the storage of electrical energy with the storage of gas. The electrical vehicle was largely made up of its battery; but take the storage of gas as it was done during the war years. There was a large gas bag on the roof, the effect of which was actually to reduce the weight of the vehicle on the road. Most physical processes were reversible; why should it not be possible to combine oxygen and hydrogen in such a way as to get electric current generated? If that could be carried out the weight of the electric storage battery would be very considerably reduced.

Major Brooke said he had had details before him quite recently of a very large bogey vehicle, capable of accommodating some 70 passengers seated, and, he believed, very nearly an equal number of passengers standing. This vehicle had a petrol-electric drive and it seemed to him that a drive of that kind was particularly apt.

Mr. Malins said no mention had been made in the course of the discussion of the hindrances to other users of the roads. He suggested that that was a serious point. With regard to traffic regulations in town and city, it often happened that laden lorries were held up and had to lose a lot of time waiting, for instance, for tramcars, the roads being too narrow to accommodate a double line of traffic.

Major Aveling suggested that the whole kernel of the problem of motor traffic was the relation of the total travelling load to the carrying load and the need of increasing the useful or carrying load. It would be useful to know the ratio of this in the electric vehicle. As an engineer he thought the first complaint against the tramcar was that it did not begin and end its job; which was to lift the passenger off the footway, and set him down on it.

Mr. A. Reeve thought permanent tramways were not likely to be developed extensively in the future. Petrol-electric

* The American term for lorry is truck.

vehicles were certainly gaining ground in the U.S.A. and might still continue.

Mr. Shine said the representative of the electrical profession had enormous courage in talking of the battery vehicle. He did not think the argument raised concerning the battery vehicle could be sustained. He had the pleasure of driving an electric vehicle 20 years ago, and he did not think the type had very much improved to-day. It was much easier to sell a Ford than a battery vehicle. It was interesting to note that the people who bought battery vehicles were usually corporations who did not worry very much whether the job made a profit or loss. Possibly this was the reason why the petrol-electric vehicle was forging ahead in America.

Mr. Joseph visualised the time when charged batteries might be bought at wayside shops just as a can of petrol was to-day. He believed such a development would make the electric vehicle a possibility for urban traffic.

Dr. Lanchester, in commenting on the discussion, said a good deal had been said about the future of the battery on vehicles, but it must be remembered that it had taken a long time to build up the cells to perfection and there was nothing else in sight. The weak point of the cell lay in the question of internal resistance. Mr. Moffett had suggested that it might be possible to reverse the hydrogen and the oxygen: he believed that in the laboratory it could be done. Concerning the electric 'bus with a two-motor drive as used in America, referred to by Mr. Silvers, he pointed out that this was not new, as 16 years ago, he was asked to get out a 'bus for the London traffic for carrying 35 cwt. It came within the weight—the units were put on either side—but then it was not a great success and did not show signs of vitality.

United States Industry and Commerce.

Expansion of Exports.

A report dated September-October, 1925, upon the finance, industry, and commerce of the United States*, has been prepared for the Department of Overseas Trade by Mr. J. Joyce Broderick, Commercial Counseller at the British Embassy, Washington. The introduction to the report says that in the twelve months prior to the period covered by the report conditions were a trifle discouraging, though not really depressed; in the succeeding year there was a striking improvement. The better outlook in Europe is said to have had a strong psychological influence upon American finance and industry. In 1924 there was a substantial rise in the value of exports, although the figure was still well behind those of the "boom" years 1919 and 1920. Imports were slightly reduced, their relationship to exports falling from 91 to 78.6 per cent. There was a balance in favour of the United States of $980 millions as compared with $375 millions in 1923. In the five pre-war years the balance averaged $477 millions; in 1919 it rose to $4,016 millions. It is considered that by the payment of their obligations, the debtors to the United States will reduce this favourable balance.

Electrical Exports.

Electrical machinery and apparatus rank fifth in the list of America's exports of manufactured goods. In 1924 the total value of exports of this class was $1,588 millions; the share of the electrical industry was about $70 millions, as compared with $60 millions in 1923. The largest purchaser in this group was Canada, but the exports were fairly evenly distributed throughout European, Latin-American and Far Eastern countries. Exports to South America and Europe declined in 1924, but Australia took increased quantities of telephone equipment, electric motors, switchboards and switchgear. Great Britain was the largest European purchaser, importing principally household appliances, electric motors, and insulated wires and cables. From a list of the hundred leading exports during 1924 appended to the report it is seen that the most important section of the electrical group was electric motors, starters, and controllers, which had a value of $11,761,000. Electric switches, meters, &c., were next with a value of $7,602,000. Electric transformers, converters, &c., were valued at $6,811,000; radio apparatus was valued at $6,031,000 (as compared with $3,448,000 in 1923); and electric generators at $5,368,000. As is indicated, the United States radio industry has made great progress. Canada was the principal market in 1924, taking about two-fifths ($2,413,687) of the total exports of radio apparatus. Australia also proved a lucrative field, buying over a million dollars' worth of American apparatus. Other notable markets were Mexico and Japan, but American radio equipment of various kinds was shipped to no fewer than eighty different foreign markets.

Electrical Expansion.

The report has a good deal to say regarding the strides which the United States has made in the use of electricity in the last few years. It is shown that the mean daily output rose from 106.7 million kWh in 1919 to 174.2 million kWh in the first five months of 1925. The production per head of the population in 1924 was 500 kWh; in 1912 it was 122 kWh. The extent of the employment of electric power in industry is illustrated by a statement that there were in 1923 over two million motors with an aggregate capacity of more than 22 million h.p. installed in manufacturing works. In 1914, it is stated, there were only 769,000 motors with an aggregate capacity of less than 9 million h.p. To show the magnitude of the domestic demand, it is stated that in 1924 there were in use in American homes over eight million electric irons, 4½ million vacuum cleaners, three million electric washing machines, and an equal number of electric fans. There were also about three million radio sets. From 12 to 14 million houses and apartments are wired for electricity and there are at least 16 million users out of a total of 26 million families. New structures, whether they be private houses, apartment houses, office buildings, shops or factories, are fitted with electric wiring as a matter of course. Moreover, the price of electricity has been generally reduced as the demand has expanded, the cost of production being diminished, as well as by a strong tendency to concentrate the control of the electric power industry in the hands of a relatively small number of large regional holding corporations. These consolidations are resulting in a much more efficient operation of the various stations and the economies effected are producing net revenues for the companies in spite of heavy capital expenditure occasioned by new construction. The electrical equipment industry is enjoying a period of continued prosperity with minor fluctuations.

Foreign Loans.

The heavy volume of foreign obligations placed on the American investment market continues to attract much attention, but is scarcely surprising in the light of the country's excess gold holdings, of the abundant supply of funds, of a continuing favourable merchandise trade balance, and of the important changes that recent years have witnessed in the invisible items of the country's international balance sheet. Loans have been placed in New York by many foreign countries. Germany has raised a number of industrial loans and among them are the following:—Thyssen Iron & Steel Works ($12 millions at 7.35 per cent. net); the A.E.G. ($10 millions at 7.37 per cent.); Siemens & Halske ($10 millions at 7.70 per cent.); and the Electric Power Corporation ($5 millions at 7.67 per cent.). Apart from public loans it is estimated that $100 millions was borrowed privately by German industrialists. Among the Japanese public utility corporations which placed loans during the early part of 1925 were the Toho Electric Power Co. ($15 millions), and the Ujigawa Electric Power Co. ($14 millions).

Trading Methods.

The report states that there is usually an opening in the country for any high-class product if its quality and characteristics are exclusive or decidedly superior to those of similar articles of domestic manufacture. New York is the great import and export centre, and, with certain reservations, is the logical distributing point for British goods. There are, however, various reasons why it is not always advisable to place a sole agency for the whole of the United States in the hands of a concern established only in New York. The larger importing houses claim to, and may be able to, cover the whole of the United States; but the enormous extent of the country suggests that it is generally more desirable to divide it into its four natural geographical divisions, *viz.*: The East, Middle West, West, and South. The eastern seaboard can be easily taken care of from New York, but for the Middle West the strategic point would be Chicago or perhaps St. Louis. On the Pacific Coast, San Francisco and Los Angeles, Portland, Seattle and even Vancouver are all suitable points, and in the South it is generally agreed that Atlanta is the most convenient centre. In New York, and perhaps to a slightly less extent in Chicago, the distributive system is of long standing and there is little difficulty, as a rule, in finding agents for British firms who have a suitable line of merchandise to offer. It is difficult at present to find in the Southern States suitable representatives for British firms. An agent must do a good deal of unremunerative pioneer work before any appreciable results accrue, and there is little inducement to undertake this unless the principals in England are willing and able to lend considerable support in the way of advertising, &c. This support should in the long run prove to be very worth while. The high cost of living in the United States naturally requires a high level of remuneration. Salaries, wages, &c., are all on a very much higher level than in Europe, consequently an agent's overhead expenses are considerably greater than in similar British and Continental establishments, especially as the distances to be covered are exceedingly greater.

* Stationery Office, 3s. 6d. net.

Patents and Trade Marks.

In the course of last year the United States Patent Office was taken from under the control of the Department of the Interior and placed under that of the Department of Commerce, and an announcement was made by the latter to the effect that immediate steps would be taken to secure for American owners of patents registered in foreign countries all the advantages that are now extended to foreign owners of patents registered in the United States. A committee of American patent experts, headed by the Commissioner of Patents, was appointed to attend the international conference on the protection of industrial property arranged to be held at The Hague in October, and was said to be charged with the duty of securing an international agreement under which American owners of patents might have their rights protected without being forced to set up manufacturing establishments abroad. The general trade-mark law now in effect in the United States came into force in 1905 and apparently extended protection to owners of trade-marks registered under it for a period of twenty years only, after which period the marks would have to be re-registered. Owners of valuable trade-marks registered in 1905 who fail to apply for renewals run serious risks of infringement and even of complete loss of protection.

Electrical Exports of the United States.

Below are shown the values of electrical machinery and apparatus exported from the United States during the 12 months ended December last. Comparative figures for the year 1924 are added, and notes of increases or decreases are also given.

	1924. $	1925. $	Inc. or dec. $
Electrical machinery and apparatus (total)	69,928,000	73,558,000	+3,630,000
Generators—			
Direct current—			
Under 500 kW	1,067,000	848,000	− 219,000
500 kW and over	850,000	428,000	− 422,000
Alternating current—			
Under 2,000 kVA	169,000	324,000	+ 155,000
2,000 kVA and over	1,157,000	1,880,000	+ 723,000
Steam turbine generator sets	75,000	565,000	+ 490,000
Accessories and parts for generators	1,270,000	1,089,000	− 181,000
Self-contained lighting outfits	780,000	1,076,000	+ 296,000
Batteries—			
Flashlight batteries	893,000	1,214,000	+ 321,000
Other primary batteries	818,000	1,204,000	+ 386,000
Storage batteries	2,883,000	2,681,000	− 202,000
Transforming or converting apparatus—			
Power transformers	3,286,000	2,175,000	−1,111,000
Other transformers	2,368,000	1,315,000	−1,053,000
Rectifiers, double-current, motor generators, dynamotors, synchronous, and other converters	1,157,000	966,000	− 191,000
Transmission and distribution apparatus—			
Switchboard panels, except telephone	2,163,000	2,305,000	+ 142,000
Switches and circuit breakers over 10 A	2,245,000	2,424,000	+ 179,000
Fuses and fuse blocks	282,000	343,000	+ 61,000
Watt-hour and other measuring meters	624,000	447,000	− 177,000
Volt, watt and ampere meters and other recording, indicating and testing apparatus	1,367,000	1,696,000	+ 329,000
Lightning arresters, choke coils, reactors and other protective devices	920,000	707,000	− 213,000
Motors, starters, and controllers—			
Motors under 1 h.p.	1,687,000	2,102,000	+ 415,000
Stationary motors—			
1 to 200 h.p.	2,392,000	2,472,000	+ 80,000
Over 200 h.p.	576,000	604,000	+ 28,000
Railway motors	1,328,000	808,000	− 520,000
Starting and controlling equipment—			
For industrial motors	1,429,000	2,042,000	+ 613,000
For electric railway and vehicle motors	107,000	278,000	+ 171,000
Accessories and parts for motors	1,998,000	2,040,000	+ 42,000
Electric locomotives—			
Railway	1,923,000	482,000	−1,441,000
Mining and industrial	320,000	331,000	+ 11,000
Electric lamps—			
Metal filament	1,070,000	1,250,000*	+ 180,000
Other electric lamps	365,000	244,000	− 121,000
Flashlights	776,000	1,342,000	+ 566,000
Searchlights and projectors	381,000	562,000	+ 181,000
Electrical appliances—			
Electric fans	1,028,000	917,000	− 111,000
Motor-driven household devices	888,000	1,206,000	+ 318,000
Domestic heating and cooking devices	1,104,000	1,340,000	+ 236,000
Industrial electric furnaces and ovens	240,000	252,000	+ 12,000
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, &c.	1,058,000	1,415,000	+ 357,000
Signal and communication devices—			
Radio apparatus	6,031,000	9,904,000	+3,873,000
Telegraph apparatus	516,000	497,000	− 19,000
Telephone apparatus—			
Magneto telephones	183,000	125,000	− 58,000
Other telephones	543,000	498,000	− 45,000
Telephone switchboards	1,161,000	799,000	− 362,000
Other telephone equipment	2,096,000	2,298,000	+ 202,000
Railway signals, switches, and attachments	964,000	803,000	− 161,000
Bells, buzzers, annunciators and alarms	149,000	171,000	+ 22,000
Other electrical apparatus—			
Spark plugs, magnetos, and other ignition apparatus	1,911,000	2,708,000	+ 797,000
Insulating material	1,536,000	1,545,000	+ 9,000
Metal conduit, outlet, and switch boxes	574,000	797,000	+ 223,000
Sockets, receptacles and lighting switches	1,278,000	1,595,000	+ 317,000
Electric lighting fixtures, interior and street	755,000	1,314,000	+ 559,000
Other wiring supplies and line material	1,149,000	1,132,000	− 17,000
Miscellaneous	7,938,000	6,883,000	−1,055,000
The following, not included in the total of electrical apparatus, were also exported :—			
Insulated iron or steel wire or cable	398,000	268,000	− 130,000
Insulated copper wire or cable	3,896,000	4,900,000	+1,004,000

* These were distributed as follows :—Europe, $34,000; Canada, $23,000; Central America, $96,000; Mexico, $274,000; British West Indies, $22,000; Cuba, $196,000; Argentina, $128,000; Brazil, $21,000; Chile, $55,000; other South American countries, $91,000; Australia, $118,000; New Zealand, $33,000; British South Africa, $26,000; other countries, $132,000.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Unemployment.—On February 23rd, Mr. Betterton, Parliamentary Secretary to the Ministry of Labour, informed Captain O'Connor that the unemployed persons in the electrical engineering trade on January 25th, 1926, were 4,929, in the marine engineering trade on the same date there were 13,372, in the constructional engineering trade 3,150, and in engineering generally 76,351.

The Electricity Bill.—On February 22nd, Mr. Remer asked the Prime Minister when the text of the Electricity Bill would be circulated; and if he would give an undertaking that the second reading would not take place until Members had had at least a fortnight to study the proposals.

Mr. Baldwin said that it was hoped that the text would be circulated shortly, and it was not proposed to ask for a second reading until a reasonable time after circulation.

According to *The Times*, the Bill is to receive its second reading on March 23rd.

Imported Wire.—On February 24th, Sir H. Brittain asked the Minister of Health whether he was taking any steps to prevent imported insulated electric wire, in which reclaimed rubber had been used, being utilised in buildings in the erection of which his department had jurisdiction, in view of the risk of fire arising owing to the reclaimed rubber disintegrating and setting up short circuits.

Sir K. Wood said that the matter referred to was one within the jurisdiction of local authorities.

Metropolitan Electric Supply Company Bill.—On February 24th, on the order for the second reading of this Bill, Major Attlee moved its rejection. He explained that the Metropolitan Electric Supply Company was a company which, joined with nine others, derived its electrical power from the

London Power Company. It sought by the Bill to obtain extended powers in its present area of supply, and to increase its area both inside the area of the Joint Electricity Authority for London and the Home Counties, and also in a very wide area in a number of counties as far away as Hampshire and Buckinghamshire. There was a general objection to upsetting the work that was done by Parliament last summer, when by two Electricity Supply Bills, and by the London and Home Counties Order, they settled in broad outline the electricity programme of London. The present Bill took little or no account of the Joint Electricity Authority then set up but proposed to set up another power company in the West of London. There were some 63 opponents of the Bill, among them being many local authorities. The greater part of the Bill, so far as it related to the existing area of supply of the company, was quite unnecessary, because by collaboration, and through the Joint Electricity Authority, on which the company was represented, the whole of what it was sought to do by the new powers in the Bill could be effected. Secondly, in the added area, which was within the Joint Electricity Authority's area, the Bill would hand over certain territory to the company, and would actually infringe the rights of bulk supply given to the Authority last July. He also objected to giving in any part of the outside area an absolute freehold to any company. The Bill also anticipated the electricity proposals of the Government.

Col. Ashley, the Minister of Transport, said that the Bill did not in any way impinge on the Government's proposals, in that it was not concerned with a generating station. The Government had no objection to the Bill on that account. It would undoubtedly be beneficial to the large area outside the area under the jurisdiction of the Joint Electricity Authority. He understood from private conferences that the company was willing to meet that Authority along nine-tenths of the way, and that there was only one point of difference which stood between them and complete agreement. He advised the House to give the Bill a second reading, so that it could be carefully considered in committee.

The second reading was, however, defeated by 128 votes to 125.

Miners' Nystagmus.—On February 25th, asked by Mr. Spencer whether he was aware that nystagmus was on the increase among coal miners and whether he intended to give effect to the recommendation of the Medical Research Committee with regard to a higher standard of illumination by making it compulsory to provide this, Colonel Lane Fox, Secretary for Mines, said that the incidence of miners' nystagmus was still very heavy, but the total number of cases in 1924 was slightly less than in 1923; the number of new cases declined both in 1923 and 1924 and he hoped would continue to do so. He expected before long to be able to fix a higher candle-power standard for flame safety lamps. As regarded electric safety lamps, the present standard of candle power was much higher than the standard for flame lamps and he was advised that it was not yet practicable to raise it.

Legal.

Globe & Simpson, Ltd., v. T. W. Globe & R. C. Globe.

In the King's Bench Division recently, Lords Justices Scrutton and Sargent heard an appeal by Thomas Wilson Globe and his son, Reginald C. Globe, of Broad Lane, Sheffield, electrical car factors, from a decision of Judge Lias in the Sheffield County Court on August 14th last.

For the appellants, Mr. F. J. O. Coddington explained that the defendants sold their business to Globe & Simpson, Ltd., and both became directors of the new company. On March 24th, 1924, Mr. R. C. Globe, who had a written contract with the company, at a directors' meeting expressed a desire that his agreement should be cancelled, and instructions were given to carry this out. There were two relevant clauses in the contract: That Mr. R. C. Globe should be paid a salary and 2½ per cent. commission on amounts earned by the company; and the other, the restrictive covenant, preventing both father and son from starting business within a certain radius. The defendants started a business in Sheffield after the son had resigned, and the company brought the action. The Judge found for the plaintiffs, granted an injunction, and awarded £2 damages, and against this the defendants appealed.

Counsel submitted that the restrictive covenant not to start business in Sheffield or within a 25-mile radius was too wide and in restraint of trade. Without calling on Counsel for the respondents the Court dismissed the appeal.

Theft of Electricity.

For having abstracted and used electricity belonging to the Chesterfield Corporation after his supply had been cut off because he had not paid his previous account, Ernest Seaton, butcher, Chesterfield, was recently fined £1 by the local magistrates. Mr. S. Walker, who prosecuted, stated that on December 30th the defendant's supply was cut off because he had not paid his account. Lights were subsequently seen in his shop, and on January 26th the seals of the fuses controlling the supply were found to have been tampered with, and the meter showed a further consumption of 4 kWh. Defendant said that on the night his supply was cut off, he posted a cheque for the account mentioned, and asked for a pre-payment meter to be installed. Nothing further was done however; he admitted using the light.

False Pretences Charge.

At Old Street Police Court on February 24th, Edward M. G. Coates (known as A. W. Green), omnibus conductor, of Manor Park, E., was charged on remand with obtaining a quantity of radio accessories, value £12 12s. 2d., the property of Messrs. Brown Brothers, Great Eastern Street, E., by false pretences, with intent to defraud. There was a further charge of attempting to obtain a quantity of accessories, value £27 15s., also the property of Messrs. Brown Bros., by false pretences. Defendant had previously pleaded guilty, and it had been explained that the defendant was not in any way a customer. The firm had a customer named Johnson, at Manor Park, and on February 2nd defendant presented an order purporting to come from Mr. Johnson for goods to the value of £12 12s. The goods were delivered to him and the usual invoice was sent to Mr. Johnson, who said he had not ordered the goods. On February 16th defendant called again with a form of Johnson's, and as it was for rather a large order an assistant became suspicious, Mr. Johnson was telephoned, and it was ascertained that he had not sent anyone for goods. Defendant was given into custody. Det.-Sergt. Law now stated that all the property had been recovered. Defendant's licence as a 'bus conductor would be taken away for the present. Mr. R. E. Seaton, for the defence, said his client was a man of excellent character and had been perfectly honest. Defendant was bound over and placed on probation, and ordered to pay £2 2s. costs to the prosecution.

Marconi's Wireless Telegraph Co., Ltd., v. Shaftesbury Electric & Radio Co.

In the Chancery Division on February 25th, Mr. Justice Astbury had before him an action brought by the plaintiffs against the Shaftesbury Electric & Radio Company, of Little St. Andrew Street, St. Martin's Lane, London, in respect of an alleged infringement of their letters patent in a radio receiving set sold by the defendants. The defendants were not represented and the action was therefore undefended.

Mr. Trevor Watson, for plaintiffs, said that the letters patent were Nos. 13,636 of 1913 and 147,148. The defendants, who had put in a defence, did not deny the plaintiffs' title but they denied infringement and said that the apparatus which they had used was made under certain other letters patent. That, of course, was an entirely irrelevant plea. The rest of the defence was taken up with an allegation by the defendants that they had in fact received a licence from the Marconi company. That was an issue the burden of which was entirely upon the defendants, and unless his Lordship desired to be satisfied on the point, Counsel did not propose to trouble him about it. The Marconi Company said there was no licence and if necessary they could prove it.

Evidence was given by an employé of the Marconi Company of the purchase from the defendants of two sets which contained infringements of the letters patent in question.

Judgment was thereupon given for the plaintiffs for an injunction, an inquiry as to damages and the delivering up of the infringing articles, with costs.

Harwell, Ltd., v. Wood.

The allegation was made in the Shoreditch County Court, on February 23rd, before Judge Cluer, that an attempt had been made to evade payment of a debt by the formation of company succeeding company which disappeared. The plaintiffs are hardware and electrical supplies agents, and they sued Leonard R. Wood, of the Burwood Electrical Supplies Co., 20, Lesbia Road, Hackney, to recover £5 8s. 10d., for goods supplied.

Mr. Samuel, for the plaintiff, stated that when the case was called on the money had been paid into Court, and he was now asking for costs, and the costs of the interrogatories. Judge Cluer said he did not see his way clear to give anything special in the way of interrogatories on a £5 8s. 10d. claim. Mr. Samuel said that it had become necessary to administer these as the defendant had denied owing the money, saying that he was employed by the defendant company, and that the real debtor was a company which had disappeared. All personal liability was denied. It seemed that Wood started a company which subsequently became a limited company, and he said that he had nothing to do with the order. It was an attempt to get off payment by the forming of companies which gradually disappeared. There was a much larger sum involved than that sued for; in fact, the plaintiffs, as agents, were owed over £40; they were making this a test case.

Judge Cluer gave judgment for £5 8s. 10d., and what costs the Registrar allowed.

First Automatic Sub-station in France.—What is said to be the first automatic sub-station in France has, according to the *Electrical World*, recently been installed by the Compagnie Française Thomson-Houston at Sèvres for the Société des Transports en Commun de la Région Parisienne. The equipment comprises three 550-kVA, 13,500/445-volt transformers and two six-phase, 500-kW, 600-volt converters.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Government Electricity Scheme.

Now that Mr. C. C. Hodges has made his figures more clear, it is obvious that my prices of 6d., 2d. and 1d. would show a loss. But I would point out that his present cost of generation is £2,161 per annum—3.29d. per unit; and I, therefore, feel called upon to refute the concluding statement in his first letter in your issue of January 29th: that the Government scheme "must surely operate to the disadvantage of the public." He could still sell electricity at his present prices, while making an even larger profit.

Mr. Hodges states that, even if he could buy in bulk at 3d., he would consider it folly to sell at any price less than 3d. How, then, does he justify his action in generating at 3.29d. per unit and selling at 3d. and 1½d.?

As for the concluding remarks in his present letter, might I ask him to consider the case of a certain world-wide chain of cheap stores. It is a known fact that this organisation sells many articles at a loss, in order that it may recoup itself by the increased sale of those articles which bring in a handsome profit. Surely Mr. Hodges is doing the same: selling some of his electricity at 3d. and 1½d. in order to gain more customers for his 9d. goods!

H. J. Allcock.

Manchester, *February 26th*, 1926.

"Electrical Freedom."

Mr. L. L. Robinson, M.Inst.C.E., again indulges in "a little innocent humour" at the contractors' expense in your issue of February 26th.

The wisest men (one expects wisdom from the Civils) relish a little nonsense now and then. It is too bad, though, to caper at present when a nervous group of condemned contractors are trembling on the brink. They might, disturbed by appreciative cachinnation, precipitate themselves to perdition at once, then Mr. Robinson would be forced to take over what he calls the "worry" of all the electrical sales and service.

The worry apparently consists of controlling an absolute monopoly; producing, installing, hiring, selling, repairing, advising and collecting bills, presumably untramelled by skill, experience, or rules—with the community's money. Why worry?

If it be true that the contractors in his dense area have merely achieved negative selling results in some important electrical lines—results which can only be summed up under the headings "none," "none," "none," "some," "nil," and "very little"—then they may deserve the contempt they get from Mr. L. L. Robinson. But they must be a hardy lot. No wonder he fears to trust his future to them.

He says contractors ought to be "scrambling for my orders." The reason why these undocile varlets are not coming to heel is probably due to the fact that even Hackney has not yet sunk to that dreary dead level where Mr. Robinson's schedule of prices would apply. The schedule might even be a bait to contractors to lead them to cut their own throats. One has to watch these supermen. It would be interesting to see this schedule of prices alongside Mr. Robinson's universal specification. The specification presumably is not found wanting "when the inevitable iron, kettle, vacuum cleaner, or radiator comes along." The specification will probably provide for "cooking" and "water heating," for in these two functions at least a supply engineer is well within his charter.

Mr. Robinson devotes particular attention to vacuum cleaners. Perhaps they are a specially desirable load in his area. I hope those he is now connecting at the approximate rate of 1,404 per annum are British. Vacuum cleaners are too often made where the sales stunts come from, and sold most successfully by calling when the husband is out. The consumer is frequently landed with a short-lived glittering mass product at possibly four times its manufactured cost, or the sum on which import duty is paid. Contractors are not wholly satisfied with the present methods of vacuum cleaner dealing, and would be pleased to have this matter put on a different basis. Then some might seek to emulate Mr. Robinson in whole-hoggishness in Hackney.

There is no doubt that with the capital at the command of the municipalities and the supply companies, and from the satisfactory yields obtained by the sale of energy, they are in an excellent position to help to boost the sales of all current-consuming devices. But the variety and class of electrical appliances are so infinite and varied that the installation and development of these are best dealt with by active, free and independent contractors—each contractor bringing up his group of trained craftsmen and salesmen, and each in open competition with the other, working in a fair field, and this without adding to the number of municipal employés or increasing the rates.

Mr. Robinson's article, stimulating as all his articles are, overflows its text at times, and readers will be sorry to hear of his primitive private plumbing arrangements. These sidelights are illuminating. "To know all is to understand all" as the French say. These personal troubles may be at the bottom of his outburst on the contractors' creed.

The article concludes with the remark that "after all the proof of the pudding is in the eating." Apparently, the author wishes the municipal man to go all out for everything, and so complete the entire consuming circle.

The ideal is reminiscent of the python, which after commencing to swallow his tail, continued and congratulated himself on his increasing girth and his cheap and abundant supply. Paradoxical as it may appear, the python soon came to an end.

Donald Smeaton Munro, M.I.E.E.

Edinburgh, *February 27th*, 1926.

Country House Fires.

In the issue of *The Times* of February 19th, an article appears under the above heading, and also a very timely letter on the subject from Mr. S. G. Castle Russell.

The article referred to gives a list of 19 country houses in which serious outbreaks of fire have occurred since the beginning of 1925, and in 14 of these it is stated that the cause of the outbreak was unknown. In a considerable proportion the fire has originated in the roof, which suggests that either the electrical wiring or the flues may have been at fault.

Mr. Russell, in his letter, points out that in many instances the wiring has been in use for many years and that, in consequence, the rubber insulation has perished. He urges that owners of such houses should satisfy themselves that their electrical installations are not a potential danger.

I can heartily support from my own experience Mr. Russell's statement. Many instances of installations put in 20 or more years ago have come to my notice, where the insulation of the cables has become perfectly brittle, and has developed open cracks. Such conditions are favourable to leakage of current. But, even at the present day, a vast number of houses are being wired in a manner which causes those who are aware of the risk to experience a feeling of alarm.

Happily, recently a Register of Electrical Contractors has been inaugurated, and by the employment of contractors on this Register it is possible to reduce the fire risk to a negligible quantity.

Unfortunately, however, there are a great number of electrical contractors outside the Register who do not adopt the same high standard of wiring, and through the demand for cheapness at any price a great deal of wiring work is carried out which cannot be said to have been done in a safe and proper manner. It is against the risks due to wiring of this description that the public should be protected.

Under the existing Electric Lighting Acts the supply authority is called upon to make a test of the wiring before connection to the public mains, but wiring which has been carried out with inferior material in a careless and inefficient manner will usually pass such an insulation test without difficulty. What is wanted is a system of inspection of the wiring whilst in progress, to ascertain that the material and workmanship are both satisfactory.

I suggest that the fire insurance companies, as the protectors of the public against fire risk, are the most suitable people to take responsibility for systematic inspection of installations, more especially during the progress of the work.

The general public would feel a sense of security if the insurance companies would give a certificate to the effect that an installation had been inspected for materials and workmanship and found satisfactory.

F. J. Moffett, B.A., M.I.E.E.

Birmingham, *February 27th*, 1926.

The Metering of Three-phase Power.

The examples of phase voltages which I gave in my letter of January 25th were extreme conditions, as I pointed out, but Mr. H. H. Jaques, in his letter of February 12th, appears to suggest that they are outside the range of three-phase conditions; this, however, is not the case. The first condition I mentioned, namely, E1 and E2 equal and opposite and E3 zero, would occur if the 3-phase, 4-wire supply were given from the secondary side of a bank of three single-phase transformers connected star/star with a tertiary winding connected in delta, the supply being 3-phase, 3-wire, if one of the transformer primaries became open-circuited. The condition that E1 and E2 were equal and opposite and E3 was zero would not hold for all conditions of loading, but the condition E1 + E2 + E3 = 0 would. The delta-connected tertiary winding takes care of that. The second condition I mentioned, namely, E1 and E2 equal in magnitude, in phase with each other, E3 being 180 degrees different and twice the magnitude of the other voltages, would occur if the 3-phase, 4-wire supply were given from the secondary side of three single-phase transformers connected delta/star, the supply being 3-phase, 3-wire, if one of the supply phases were interrupted. The condition stated will not hold for all conditions of secondary loading, but the condition E1+E2+E3 =0 will; the delta-connected primary winding takes care of this. These delta-connected windings, whether they be tertiary or primary, will always compel any departure from normal voltage conditions, however great or small, to comply with the condition E1 + E2 + E3 =0. In other words, the unequal voltage referred to by Mr. Jaques in his third paragraph is compensated for by a change in phase angle auto-

matically by the nature of the supply circuit, and it is this useful feature of a three-phase supply system that is made use of in a 2-element, 4-wire meter and in other pieces of apparatus.

Now Mr. Jaques will probably say that whilst these conditions may hold at the secondary terminals of the supply transformer, they do not necessarily hold at the end of a cable when the loading is unbalanced, and I shall agree with him that one cannot expect accuracy on a 2-element, 4-wire meter under those condition. The 4-wire metering equipments that I have dealt with have all been on the terminals of the transformer, as most power consumers of sufficient size to require a maximum-demand indicator have been supplied direct from the transformer in their own substation, and I think this is the general practice.

Referring again to the relative interaction errors of 2-element and 3-element meters, I find that the maximum interaction between elements is seven times as great in a 3-element meter as in a similar 2-element meter. Without taking up space with an analysis of errors due to interaction, we may say that registration errors due to interaction will be four times as great in a 3-element meter as in a 2-element meter. This is a factor which meter engineers have to bear in mind when considering the type of meter to be used for a particular job, and in view of the fact that if the supply is delivered at the secondary terminals of the supply transformer we may rely upon E1 + E2 + E3 = 0 (the reasons for which I have outlined above), I prefer to use a 2-element meter in the interests of accuracy.

Tests taken on 2-element meters of the makes commonly used in this country showed the meter in which Mr. Jaques is interested to have least interaction, and perhaps this accounts for his views on this section of the subject under discussion.

A Meter Superintendent.

February 23rd, 1926.

The Testing of Transformers.

Allow me to reply to the letter published by Messrs. Thompson and Walmsley.

It will be noted that in connection with fig. 2 of my article of February 19th, which they take objection to, I described that method as being workable, but not sufficiently accurate.

In their letter, Messrs. Thompson and Walmsley describe a wattmeter whose field coils are wound for 220 volts; such a wattmeter, used in conjunction with a transformer, would I think be subject to some of the errors which I pointed out in connection with fig. 2, though to a lesser degree.

I would like to ask the original authors if there is any objection to connecting the field coils of the wattmeter to the low-pressure side of the transformer under test, thus cutting out the instrument transformer?

D. Pedley, A.M.C.T.

Manchester, *February 27th*, 1926.

The "Electrolux" Refrigerator.

As already mentioned, a demonstration of this refrigerator, of which we gave an illustrated description last week (Electrical Review, page 327), was given on February 23rd, before a large company of public men and Press representatives by Dr. Hele Shaw, F.R.S. The guests were entertained at luncheon at the Savoy Hotel by Major H. A. Wernher, D.S.O., who presided, and delivered a lengthy speech on refrigeration and its importance with reference to food in view of the fact that an Order has been issued by the Minister of Health forbidding the use of various stated chemicals in food as from January, 1927. Major Wernher described the "Electrolux" refrigerator as the only known contrivance which would continuously produce cold without the use of any mechanical parts. He said that the invention was a possible alternative to the use of preservatives, and was within the means of many householders, also of village shops, provision stores, butcher shops, and dairies. The inventors, Messrs. Platen and Munters, were enabled to perfect their invention through the foresight of Mr. Wenner-Gren. Major Wernher said it would be possible to sell the machine at about half the cost of those at present on the market, and a hire-system purchase was also being developed. The owners of the patents were Electrolux, Ltd., of 155, Regent Street, London, W.1, and the whole of the products of that company for the British and Colonial market would in future be manufactured at Leagrave, Luton, by an English company financed by English capital, all of which had been already subscribed.

Following upon the above function, statements appeared in the London daily and financial newspapers respecting the big patent deal that had been made in the U.S.A. by Mr. Wenner-Gren, who is mentioned above. The *Daily Mail* report states that he "has sold the patent rights of a simple domestic refrigerator, invented by two Stockholm University students, for approximately £514,000 in cash, 50 per cent. of the profits from manufacture, and a small royalty on each refrigerator sold."

"It is estimated that within two years factories in the United States will be making 300,000 of the refrigerators a year for home use, Canada, and Cuba

"The two students who made the invention, Platen and Munters, each received £40,000 for the rights. In addition they will draw royalties and have a highly-paid post in the firm of Electrolux, which bought the rights, and of which Mr. Wenner-Gren is president."

The *Financial Times* quotes Mr. Wenner-Gren, who has just gone to Sweden, as saying that on behalf of the Swedish combine, A.B. Electrolux, he had sold the refrigerator patents to the Electrolux Refrigerator Corporation for $2,500,000 cash. In addition, the A.B. Electrolux would receive one-half of the American company's stock, of no par value, and a royalty on each machine sold. The British company had just had its capital increased to £1,000,000, and when the full production and sales organisation had been completed, which would be in about two years' time, the output of refrigerators at the company's works at Luton would be 100,000 per annum.

The patents in connection with the refrigerator would be exploited by three main groups, one with control in Sweden, the second in Great Britain (for this country and the Dominions, except Canada), and the third in the United States.

The Ideal Home Exhibition.—I.

Electrical Features at Olympia.

The tenth Ideal Home Exhibition, organised by the *Daily Mail* was opened at Olympia on Tuesday last; it remains open until March 27th. Although the general scheme of the display remains the same as in previous years, there are a number of innovations likely to prove attractive to the public, and at least one important omission—radio. That is not to say that radio apparatus is entirely absent from the show; this is not the case, but in previous exhibitions, particularly the last two, there has been a special radio apparatus section in which many of the leading makers have participated. This year where radio apparatus is shown it is as a rule merely an incidental indication of the scope of a firm's production. We believe that we are correct in saying that there is only one purely radio firm exhibiting. The British Broadcasting Co., Ltd., is again arranging a series of demonstrations and concerts during the exhibition; and the Marconiphone Co., Ltd., has once more equipped the main hall with ultra-loud-speaker equipment. The British Electrical Development Association, aided by a number of electrical manufacturers, has produced an improved edition of the 1925 Electric House, one of the principal features being a contrast with methods of 50 years ago, as will be seen from the ensuing notes on the exhibit. Messrs. L. G. Hawkins & Co., Ltd., as we have previously reported, have procured the services of two well-known lady demonstrators, Ald. Mrs. Hammer and Mrs. Pearmain, of Hackney, to demonstrate electric cooking upon their stand. There are about two dozen electrical or allied firms participating, all of which, we believe, have taken part in these exhibitions before. The following is a list of these exhibitors:—Belling & Co., S. G. Brown, Ltd., Delco-Light Co., Dowsing Radiant Heat Co., Ltd., Freezone, Ltd., L. G. Hawkins & Co., Ltd., Hotpoint Electric Appliance Co., Ltd., Mechanical Refrigerator Co., Ltd., Francis Polden & Co., Ltd., Rawlplug Co., Ltd., Reliance Telephone Co., Ltd., Sheringham Daylight Co., Standard Telephones & Cables, Ltd., Thorn & Hoddle, Ltd., Beatty Bros., Ltd., British Vacuum Cleaner Co., Ltd., I. Calvete, Ltd., Electric Appliances Co., Ltd., Electrolux, Ltd., Hoover, Ltd., Hurley Machine Co., International Electric Co., Ltd., Singer Sewing Machine Co., Ltd., and Staines Kitchen Equipment Co., Ltd. We hope to publish a description of the principal electrical exhibits in our next issue.

The E.D.A. Exhibit.

The British Electrical Development Association is again playing an important part in the exhibition, and although its exhibit is another "all-electric" house, the arrangement differs considerably from the model home which formed last year's demonstration. The same position has been obtained, and upon the site has been erected an eight-roomed house covering an area of 57 ft. by 35 ft. The rooms are conveniently arranged for inspection, and comprise a modern electric living room, a modern bedroom, bathroom, laundry and kitchen, with an inquiry bureau (a feature of last year's show), and in contrast to these there are an old-fashioned living room and kitchen of the mid-Victorian period. In each of the modern apartments there is a complete range of up-to-date British electrical appliances in actual operation, and the fullest information is available regarding their cost, the method of using them, and their running cost. A special feature of the display is the lighting which has been carried out with the assistance of the E.L.M.A. Lighting Service Bureau. The Association states that the limited space available has obliged it to restrict the exhibits to really practical appliances, and novelties of a "freakish" character have been entirely eliminated. Some brief notes on the equipment of the rooms may be of interest. In the living room there are examples of wired furniture, an invisible heat screen, footstool and mat,

a "Magicoal" fire, a convector, a table fountain, a hot plate, warming plate, kettle and toaster. The illumination of the room is carried out by means of central ivory bowl fittings supplemented by candle fittings, an "Eyerestolite" floor standard, silver bracket fittings and a table lamp. The bedroom is warmed by a radiator with a clock switch and a "Sunray" radiator. At the side of the bed are an electric kettle and milk warmer, there is also an electric bed warmer. The lighting is provided by a "Partridge" type floor standard, assisted by dressing table brackets, bed brackets, a table lamp, and a night light. The principal appliances in the bathroom are a 10-gal. hot-water storage tank and a 5-kW "Santon" geyser. Warmth is provided by a wall-type radiator, while there are also an electrically-heated mirror, gown and towel rails, a shaving pot, &c. There is a central white-enamelled ceiling fitting and a separate light over the mirror. The equipment of the modern laundry is very complete, there being a "Magnet" clothes washer, an electric copper, an "Eco" clothes-drying cabinet, a "Thor" folding type ironer, a water heater, a plate washer, vacuum cleaners, irons, radiators, &c. The illumination is provided by dustproof "Swanlite" fittings and a "Trojanette" fitting and wall bracket. In the kitchen are a "Cosmos" pedestal cooker, a "Hotpoint-Falco" table-type cooker, a refrigerator, a hot-water tank with accelerator, a sewing machine and a number of small appliances; the illumination is similar to that of the laundry. The corridor through which the visitors pass is lit by eleven G.E.C. lip lanterns with a hall lantern at the entrance. In the inquiry bureau an electric typewriter is shown, as well as an eight-day 10-A clock switch, radiators, &c. A bay window in the house contains a dining-room scene illuminated by spot lights and a "Partridge" table type fitting. In a small garden at the entrance of the house are an illuminated orange tree and an electric lawn mower.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 24th, 1926. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Ankacode, No. 454,878, Ancaflex, No. 454,879, and Ankaflex, No. 454,880. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd.

N. & K. No. 462,257. Class 8. Headphones, loud speakers, and sound boxes for loud speakers.—Neufeldt & Kuhnke, Ravensberg Werk, Kiel. (T. F. Robertson, 43-46, Southampton Buildings, W.C.2.)

Neron (lettering and design). No. 464,780. Class 8. Instruments, apparatus, and parts thereof for use in radio-telegraphy and telephony. No. 464,781. Class 13. Electric lamps (ordinary), lampholders, electrodes, electrical fittings, &c.—Osram Gesellschaft, 11-14, Ehrenbergerstrasse, Berlin. (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

A B Products (lettering and design). No. 465,223. Class 8. Dry batteries, loud speakers, headphones, and transformers.—G. E. Ambatielo & Co., Ltd., 29, Clerkenwell Road, E.C.1.

Microux ((lettering and design). No. 465,271. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Auguste L. J. Bertrand, 1, Rue de Metz, Paris. (D. Young & Co., 11-12, Southampton Buildings, W.C.2.)

Navalion. No. 466,042. Class 8. Scientific and philosophical instruments and apparatus for useful purposes.—Edward A. Graham, trading as Alfred Graham & Co.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

14,018. "Electrical plug connections." Knowsley Electrical Co., Ltd., and H. J. McCarthy. March 10th, 1925. (246,607.)

18,728. "Machine for pasting accumulator grids and similar skeleton structures." W. Haddon and J. A. Fullilove. August 6th, 1924. (246,882.)

23,334. "Electric heat-treatment of wire strip and the like." H. Alexander and A. Imbery. October 3rd, 1924. (246,891.)

23,349. "Thermionic oscillation generators." C. P. Allinson. October 3rd, 1924. (246,892.)

23,357. "Protective arrangements for alternating-current electric circuits." A. Reyrolle & Co., Ltd., H. W. Clothier, and W. A. A. Burgess. October 3rd, 1924. (246,893.)

25,877. "Space discharge tube systems for electric wave signalling." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). October 30th, 1924. (246,897.)

25,891. "Electrical relays." A. West & Co., Ltd., and R. P. Bossom. October 30th, 1924. (246,898.)

25,976. "Electrical connectors." J. E. Graham. October 31st, 1924. (Cognate application 13,295/25.) (246,899.)

26,155. "Automatic regulating-apparatus for electrical supply systems." J. S. Smyser. November 3rd, 1924. (246,905.)

26,156. "Automatic regulating-apparatus for electrical supply systems." J. S. Smyser. November 3rd, 1924. (246,906.)

26,185. "Apparatus for the conversion of alternating current into high-tension continuous current." Dr. F. Dessauer, Dr. E. Lorenz, and Dr. M. Brenzinger. November 3rd, 1924. (246,909.)

26,245. "Electric ignition devices for cigarettes or the like." A. Low. November 4th, 1924. (246,912.)

26,248. "Quick-make and quick-break electrical switches." J. B. Tucker. November 4th, 1924. (246,913.)

26,287. "Radio-receiving instruments." W. H. Hunt. November 4th, 1924. (246,914.)

26,398. "Keyboard telegraph transmitters." C. F. Hilton. November 5th, 1924. (246,919.)

26,471. "Loud speakers for use with wireless receiving sets." R. W. Edmonds and Webb's Crystal Glass Co., Ltd. November 6th, 1924. (246,923.)

26,539. "High-frequency electric signalling systems." British Thomson-Houston Co., Ltd. November 6th, 1923. (224,543.)

26,540. "Electron discharge devices." British Thomson-Houston Co., Ltd. November 6th, 1923. (Patent of addition not granted.) (224,544.)

26,696. "Electric fuses." A. Reyrolle & Co., Ltd., and F. Coates. November 8th, 1924. (246,928.)

26,700. "Transformers for electric arc welding." E. Schroder. November 8th, 1924. (246,929.)

27,699. "Vapour-electric rectifying apparatus." J. L. Rowbotham and Hewittic Electric Co., Ltd. November 19th, 1924. (246,943.)

27,716. "Electrical resistances." H. R. G. Moore and J. B. Swan. November 19th, 1924. (246,944.)

28,745. "Insulating holders for inductance and like electric coils." J. Pacy and Comton Wireless Manufacturing Co. December 1st, 1924. (246,952.)

28,870. "Electrical connections or couplings." S. D. McKellen. December 2nd, 1924. (246,953.)

29,357. "Protective device for dynamo-electric generators." Siemens-Schuckertwerke Ges. December 8th, 1923. (225,878.)

29,527. "Sound amplifiers." A. H. Haag. December 9th, 1924. (246,962.)

29,544. "Method and means for measuring electrical quantities." Siemens Bros. & Co., Ltd., and W. H. Grinsted. December 9th, 1924. (246,963.)

30,207. "Thermostatic electric circuit-breakers." G. Wilkinson. December 16th, 1924. (246,969.)

30,699. "Electric insect-traps." D. Fillier. December 20th, 1924. (246,974.)

30,980. "Terminals of electric dry batteries." C. E. Cleminson. December 24th, 1924. (246,977.)

1925.

376. "Inductance coils." H. A. A. Brosse. August 18th, 1925. (246,980.)

520. "Electric lamps for motor road vehicles." J. Y. Fletcher and T. J. Sack. January 7th, 1925. (246,985.)

540. "Electric lamp signalling device." J. Jones and D. Walters. July 6th, 1925. (246,986.)

808. "Illumination of identification-plates for motor vehicles." J. Lucas, Ltd., and O. Lucas. January 10th, 1925. (246,991.)

1,874. "Electric current-transforming means." British Thomson-Houston Co., Ltd., and H. S. Petch. January 21st, 1925. (246,995.)

1,881. "Rectifying systems for polyphase alternating electric currents." N. R. Davis and Metropolitan-Vickers Electrical Co., Ltd. January 21st, 1925. (246,996.)

2,430. "Dry cells." Mannesmann-Motoren Werke. September 17th, 1924. (240,118.)

2,973. "Driving of rapidly rotating parts by electric motors." Siemens Schuckertwerke Ges., W. Peineke and O. Jahnert. February 2nd, 1925. (247,004.)

3,733. "Terminals for electric conductors used in wireless and other apparatus." E. A. Wood. February 10th, 1925. (247,013.)

4,002. "Electrically-operated shutters." A. Muhlstock. February 12th, 1924. (229,322.)

4,065. "Alternating-current induction motor." F. Krupp Akt. Ges. March 13th, 1924. (230,804.)

6,474. "Dirigible headlights for motor road vehicles." A. V. Beardsley and G. M. Elston. March 10th, 1925. (247,026.)

6,514. "Electron discharge tubes." V. F. Feeny (Magnavox Co.). March 10th, 1925. (247,027.)

10,780. "Multi-core electric cables." A. W. Williams. April 25th, 1925. (Addition to 217,002.) (247,040.)

15,399. "Electric control systems." British Thomson-Houston Co., Ltd. September 15th, 1924. (239,830.)

15,869. "Means for regulating the voltage of dynamos of variable speed and load." Eclairage des Vehicules sur Rail. September 20th, 1924. (240,128.)

16,114. "Electric discharge devices." Westinghouse Lamp Co. July 9th, 1924. (236,915.)

17,094. "Device for actuating double contacts for illuminated advertisement apparatus." N. E. Pedersen. July 3rd, 1925. (247,073.)

17,231. "Electric control systems." British Thomson-Houston Co., Ltd., and C. J. Sarjeant. July 4th, 1925. (247,075.)

17,346. "Electrical transformers." Naamlooze Vennootschap Philips Gloeilampenfabrieken. August 10th, 1923. (Divided application on 220,314.) (236,593.)

19,455. "Electric control means for reproducing position." British Thomson-Houston Co., Ltd. (General Electric Co.). July 31st, 1925. (247,087.)

20,220. "Tuning-apparatus for the elimination of undesirable magnetic coupling in high-frequency electric circuits." Haseltine Corporation. April 7th, 1924. (Divided application on 231,820.) (238,256.)

20,235. "Devices for transferring thermo-electric power effects to the skin." Dr. W. Graefe. August 12th, 1925. (247,095.)

21,387. "Re-setting device for the controllers of, particularly, one-man-operated electric vehicles with electric braking means." Maschinenfabrik Oerlikon and B. Storsand. August 26th, 1925. (247,099.)

21,506. "Electrical railway signalling devices." Siemens & Halske Akt. Ges. July 1st, 1925. (247,100.)

24,919. "Electric rail switch responding only to trains running in one direction." J. Kremenezky (firm of) and L. Wimberger. October 11th, 1924. (241,197.)

26,376. "Controllers for electric trains." Akt. Ges, Brown, Boveri et Cie. October 30th, 1924. (242,265.)

32,088. "Wireless signalling." N. Koomans. August 19th, 1925. (247,128.)

32,825. "Method of and means for operating mechanically-driven rectifiers in connection with electric transformers." Lodge-Cottrell, Ltd. (Lurgi Apparatebau Ges.). February 25th, 1925. (Divided application on 230,073.) (247,131.)

Electricity Supply in Leipzig.—The *Electrical World* says the consumption of electrical energy in the city of Leipzig is estimated to have increased sevenfold since 1914, and the growth of consumption has been especially rapid since the stabilisation of the German currency. From 1923 to 1924 it increased 100 per cent., and a further increase of 50 per cent. was shown from 1924 to 1925. The city electricity undertaking is at present installing about 2,000 new meters every month for domestic lighting. The construction of new generating plant has been handicapped by lack of funds and also by the delays in delivery of electrical machinery by German manufacturers, who are said to be overwhelmed with more orders than they can fill. Leipzig obtains the greater part of its electrical energy from the large power plant of Luchornewitz, in Prussia, which also supplies Berlin, Magdeburg and Lauterberg. This plant, which is also handicapped by delays in delivery of new machinery, is unable to increase the amount of energy supplied to Leipzig. It is expected that a shortage will be seriously felt in Leipzig unless the production capacity of the local plants is increased. Owing to its financial situation Leipzig will be unable to carry out the necessary construction unless a loan is floated, and it is doubtful whether such a loan can be obtained on favourable terms for some time to come.

The

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Freedom for Supply Development.

THE cry of the moment is for a great development of the uses of electricity for all purposes.

This cry is not uttered because the electrical industry is in a bad way and needs national assistance, but because we are behind other peoples, and because electricity and efficiency have become practically synonymous in both the industrial and the domestic fields.

Increased facilities for cheap production and wider spread distribution if they follow the work of changed organisation and control will naturally be expected to add to the volume of our electrical manufacturing and trade, but that is not the prime concern either of the Government or of others who are engaged in current discussions and investigations.

The main concern of all should be to secure a more generous use of electricity by the population of the United Kingdom for all those purposes and with all those beneficial results which are so well understood by readers of the ELECTRICAL REVIEW that they need not be recapitulated now.

It is well that we should not permit this one great necessity to be lost sight of because sectional discussions are in progress, nor obscured by exaggerated views of possible ill-effects of any movement helping towards the realisation of our desideratum.

Apart altogether from current legislative proposals for promoting advance, and from the fact that various projects have been suspended awaiting detailed particulars of the nature of such legislation, it is common electrical knowledge that in many parts of the country only the mildest sort of efforts are being made to secure the great flood of business that is awaiting us. Stated briefly, there are many thousands of people who would be using electricity, or using more of it, if we could make the way easy for them to get it. Simplification and accommodation are two comprehensive words which express the need from the standpoint of the general public. But we shall not secure these essentials unless we first take the largest possible view of our responsibilities. The community does not exist for the benefit of any section or sections, and sections can only justify their existence in so far as they meet the needs of the community satisfactorily.

Electricity supply authorities—it matters not whether they are municipalities or companies—have no right to allow their undertakings to operate for the benefit of

the few, and they are not fulfilling their responsibilities if they fail to exercise the powers that they already possess for enabling them to give a supply of electricity at reasonable rates to everybody within the area over which they have been granted control. In the present day we have as hard words to use for authorities which either deliberately or apathetically fail to exercise their powers as we ever had for little local authorities which deliberately obtained provisional orders and sat down doing nothing or just trifling with electricity supply, in order to keep more enterprising parties from coming on to the ground. There are unquestionably listlessness and unwillingness among both some companies and some municipalities.

We are able to single out, from time to time, various places in which electrical development is occurring at a most remarkable rate, but there are many where only the fringe of the possibilities has been touched, and this is not due to any need for new legislative action. It is due to failure to recognise the need for exercising to the full responsibilities which should inevitably be considered as the accompaniment of authority granted by the Government.

The foregoing are not new sentiments in the editorial policy of the Electrical Review, nor are they new in the minds of a large number of leading men who want electricity rapidly to advance into the by-ways of our common life. We reiterate them now, however, because it may be found that they have some bearing upon the principal subject discussed in our "Correspondence" columns this week.

Mr. L. L. Robinson seems to have put the fat in the fire by daring to state the other side of the case after reading the Electrical Contractors' pamphlet on "Electrical Freedom." He is occasioning mirth, because he and his authority are working hard to place electricity and electrical service within easy reach of the general body of ratepayers of his borough. His *confrères* recognise that he is succeeding in doing so, and some of them look on with envious eyes. He holds that it is no nearer to Bolshevism or Socialism to give electrical service than it is to give electrical supply, when the private contracting service of his area is less able than his own organisation to secure the popularisation of electricity.

Surely it is the duty of the industry as a whole to do its utmost to increase the uses and sale of electricity. By so doing we shall increase the demand for all classes of electrical manufactures. The more difficult it is made for the consumer, the slower will be the rate of advance and the smaller will be the output of the industry.

The New Electricity Bill.

Three years have passed since the last general Electricity Act, and now a new one is in prospect. These "general" Acts are the ones wherein to get relief from "shoe-pinches." No doubt a few such points have accumulated, which ought to be included in the new Act. There is certainly one outstanding trouble which should be drastically dealt with, namely, that of obtaining definite rights of way for rural mains. Every year the lack of adequate powers to secure wayleaves grows more irksome, and it is high time that the impediments were removed. One has only to note the character of a good proportion of the Special Orders for distributing powers taken out during the last year or so to see the big extensions that are contemplated. The difficulties over wayleaves mean, at the least, a deplorable waste of time, and frequently they result in a definite handicapping of the whole scheme. If the new Bill is to carry out its object of securing a supply in the districts hitherto uncatered-for, an indispensable provision must be that of giving the fullest powers as regards rights of way to the existing distributors. The associations representing the industry should see that if the Bill does not provide fully for this, the necessary amendments are put forward at an appropriate time. This is a matter in which the industry is united, and which interests many municipal undertakings in view of the big new areas for which certain urban local authorities have obtained Orders. What is everybody's business is often nobody's, and if this opportunity is lost, the present state of affairs may drag on for another term of years. The existing undertakings should certainly insist that every possible facility for extending their distribution systems shall be incorporated in the Bill. Consumers, or rather prospective consumers, too, are interested in seeing that this is done; otherwise, despite all the talk of electricity for everybody, they may be left out in the cold.

Electricity in Agriculture.

The paper read before the Institution of Electrical Engineers last week by Mr. R. Borlase Matthews attracted a large attendance of members, who always show their appreciation of "the pictures"; and certainly the films and other illustrations shown by the author were of exceptional interest and novelty, bringing home to the spectators the fact, amongst others, that electric ploughs are at work which can turn six furrows simultaneously at four miles an hour—over an acre per hour. Too much importance cannot well be attached to this subject, for it is to such heavy work as ploughing that we must look for the load that makes rural electricity supply a profitable undertaking, not only to the farmer, but also to the supply authority. When one quarter of the area is arable land, says the author, experience shows that the supply is remunerative even without ploughing by electricity; and the potential demand is enormous—the United States Department of Agriculture estimates that agriculture uses "as much primary power as all manufacturing and central-station plants combined." Over 500 British farmers are using electricity; but Mr. Matthews says that nearly a million farmers in other countries are employing it, and the remarkable statement is made that from 75 to 90 per cent. of the output of the Continental motor manufacturers is now of the agricultural type, which is often used also in factories.

The occasion was noteworthy, in view of recent correspondence in our columns, for the fact that the feeling of the meeting was taken by the President, and it was decided to continue the discussion on Thursday this week, thus meeting the criticism that too little time is available for the adequate discussion of an important subject. This is a reversion to a practice frequently followed by the Institution in by-gone days, with great advantage to all parties.

Gas and Electricity.

Of all the untenable claims that are made on behalf of the gas industry, there is, we think, none more inaccurate—to use the mildest expression—than the allegation that whilst electrical engineers obtain from coal only 20 per cent. of the heat energy that it contains, gas engineers get 80 per cent. The statement appears in various forms. At the recent meeting of the South Metropolitan Gas Co., Dr. Charles Carpenter, in the chair, said that "we *account for* from 97 to 98 per cent. of the energy of the coal, and of this nearly 80 per cent. is *passed on* to the consumer in one form or another" (our italics). These expressions are perfectly true if taken literally, but convey an utterly false impression to the casual non-technical reader and the lay journalist. What boots it to "account for" 98 per cent. of the heat, when the "account" includes losses amounting to 20 per cent.? and whilst it is true that "nearly 80 per cent. is *passed on* to the consumer," how much does he get out of it? Seldom more than half as much as the gas engineer takes credit for, and often much less than that. On the other hand, electrical energy delivered to the consumer is in the most suitable form for complete utilisation with negligible loss. At the meeting of the Gas Light and Coke Co. last month Mr. D. Milne Watson made a similar statement, to the effect that 80 per cent. of the heat value of coal was "recovered" in the production of gas, so that substitution of electricity for gas for heating and cooking would involve the consumption of three or four times the quantity of coal. Mr. H. Woodall at a similar meeting said

0 per cent. of the heat was "recovered." We have no bjection to a reasonable degree of optimism, but exggeration of this order is intolerable.

It is amusing to observe that the prevailing policy f placing the electrical generating station as far as ossible from the place of consumption and reducing the ost of energy by transmitting it at high pressure, seems o have spread to the gas industry. The inventor of a rocess of low-temperature distillation, Mr. Harald Nielsen, has suggested that the price of gas could in most owns be halved by supplying the gas in bulk by longistance transmission, tapping the main *en route* to erve the intervening districts.

German Confidence in the Future.

It is stated that when addressing the shareholders of the A.E.G., at the annual meeting held on February 26th, Herr Deutsch said that the directors regarded the future prospects of the electrical industry with extraordinary confidence, as the work of the electrification of the world was progressing at an accelerated rate and the consumption of energy in Germany was far behind that of other countries. Big problems therefore remained for the near future. On the whole, business transactions in Germany had changed owing to the scarcity of working capital and the general depression. Whereas formerly about one half of the company's total turnover was composed of large industrial contracts, such large orders were now entirely lacking, and the turnover was represented by a considerable number of smaller installations and of apparatus and materials which naturally required larger personnel and expenses. There was no doubt that the improvement in the economic situation and the stabilisation of the French franc and the Italian lira would afford an opportunity to the heavy industries to modernise their plants and to place orders for new installations. Herr Deutsch proceeded to express the belief that in the development of the next decade it would be seen that different countries would perceive that capital, labour and experience, and finally technical talent, would only be available to them in a limited measure; and that, according to the existence of mineral resources and the character and composition of their national economic forces, they would have to restrict themselves to the manufacture of normal products in their respective countries and obtain from abroad highly finished manufactures such as machine tools, special machines, and low- and high-pressure plant. Under the circumstances, said Herr Deutsch, the Germans must systematically advocate a reversal of the system of high protection in all countries in order that rational and systematic distribution and production might provide the basis for a new economic development of the European continent.

The Future of London Transport.

The annual reports of companies interested in electric tramways, and the deficit on the working of the London County Council system during the past year, have again brought into prominence the serious position and worse prospects with which certain undertakings are confronted. Adopting a superficial view, some of the critics allege that the tramway is obsolete, and must give place to the motor omnibus; but those who attach due weight to the considerations involved are by no means of that opinion. For one thing, some provincial tramway undertakings, although offering cheap fares, are showing very satisfactory returns, and their owners are so confident as to their future that in some cases they are expending large sums on renewals and extensions; of these the critics make no mention. Again, the Ministry of Transport, which through its Advisory Committee has made a thorough study of the subject, emphatically states that the tramways are indispensable to transport in London, and will by no means be abandoned. Lord Ashfield, who is at the head of companies operating electric railways and tramways, and motor omnibuses too, whilst deploring the unhappy state of the London transport undertakings as a whole, last week expressed his conviction that tramways should play no small part in the scheme, and could be made more popular. His remedy for the existing troubles was co-ordination of all the agencies employed in London traffic on a stable and satisfactory basis, involving common management and the pooling of receipts, and he expressed the willingness of his companies to enter into negotiations with that end in view. The London Traffic Act of 1924 empowered the Minister of Transport to restrict the number of omnibuses on routes where alternative services were provided, for the express purpose of protecting the tramways from excessive competition, and the Ministry is actually preparing schemes for specified routes.

It should not be forgotten, in all these cases, that tramways carry statutory burdens from which their competitors are exempt—namely, the paving of the roadway, and the transport of workmen at unremunerative fares; the former is a compulsory subsidy to the rates, the latter to a particular class of passenger, and neither can be justified on economic grounds. Also, in London, the tramways are heavily handicapped by their exclusion from the main thoroughfares running east and west and by the absence of adequate connections crossing central London, whilst the omnibuses are free from these restrictions.

With regard to the underground and surface railways, the enormous improvements which have been carried out since the war and are still in progress can hardly be fully realised by those who are constantly using them. Not only are the electrified portions being continually extended to the remoter suburbs, but also in the central area numerous changes have been made which, to one revisiting London after some years' absence, might convey the impression that a new system of railways had been installed. These changes are bound to attract more traffic, which, with the incessant increase in the travelling public, the development of suburban housing schemes and the anticipated revival of trade, may confidently be expected to place the railways in a more satisfactory position. Similar considerations apply to the tramway undertakings, which, we hope, have reached the limit of depression and will soon experience better times.

The National Scheme and Unit Cost.

The extent to which the enthusiasm of the modern electricity supply undertaking's staff, in getting its unit-cost figure down as low as, or lower than, that of other undertakings of similar capacity and output, is responsible for the excellence of the results obtained is probably not realised by many authorities. This was an opinion expressed recently by the chief engineer of a large modern undertaking, and it raises the question what effect the Electricity (National Development) Bill will have on this spirit. It is beyond all doubt that a lively *esprit-de-corps* between the staffs, controlling, administrative, or working, of electricity concerns, indeed in any phase of industry, is a healthy feeling which should be encouraged and cultivated by all means compatible with efficiency and economy. Under the Bill it is understood that the unit cost and load factor will be figures more or less common to all undertakings and districts, and the possibility under such conditions of the keenness of the staff engineer to outdo his rival being weakened to some extent is not remote. One thing is certain—the chief would lose a strong argument if he were not able to put before his staff the figures of other undertakings as a goal to reach or a score to beat. That the station engineer would deliberately slacken his efforts as a result of the pooling of the energy generated, is incredible; but the psychological effects of a desire to go one better are far-reaching, particularly in a nation of sportsmen. We hope that any tendency towards the damping of enthusiasm from the cause indicated will be counteracted by measures designed to maintain the keenness which is vital to progress and economy.

Electricity Supply Showrooms.

Some Recent Developments.

It is satisfactory to note that progress continues to be made by many electricity undertakings in the policy of establishing and maintaining efficient up-to-date showrooms, and some recent visits to showrooms have enabled us to see some new lines of development under varying conditions. Practically speaking, nowadays all showrooms devoted to the exhibition and demonstration of the uses of electricity and electrical appliances are designed and laid out to meet the conditions pertaining to the lives of the bulk of the people to be catered for—the middle classes. Undertakings generally have grasped the necessity of creating the correct atmosphere in their showrooms by furnishing and equipping the various departments to represent the places—domestic or industrial—where the electricity would normally be consumed. Broadly speaking, this necessity only applies to the use of electrical energy in the home, and involves the representation of the usual rooms of the normal household. In this respect it is worth while noting the improvement made to the "atmosphere" when the demonstration room in question is actually a room of normal structure and dimensions. The partly constructed room, with one side open, leaves much to be desired in the direction of making the prospective customer or consumer feel at home, although it is a big advance on what was only a few years ago the usual practice. Probably the emphasised "on-show" effect of the partly completed display room is particularly stressed where the room opens out on some attractive part of the premises such as the reception hall. Where it is deemed necessary to equip the main premises luxuriously, it seems advisable to keep the display rooms, where they are designed to create a desired "atmosphere," shadowed from the outside splendour; after all, the effect must be greatest when the customer is actually in the room with the door shut, whatever is inside or out.

It is interesting to learn of one case where a special lighting-demonstration room, with no windows, is set apart for that particular work. It is always a difficult problem to demonstrate artificial lighting during the daytime, and the difficulty increases with the modern tendency to introduce scenic window effects into the display rooms. Increased attention is being given to the important question of showroom management, particularly as regards the personality and behaviour of the staff. It would not be difficult, we imagine, in an elaborate modern showroom, for the good effects produced or which would have been produced to be destroyed by a want of affability on the part of the staff, brought about, perhaps, by a too stringent control. How far the good results referred to in the description of the North Metropolitan showrooms at Southgate are due to the policy adopted in the management of the staff, it would not be easy to define, but the fact remains that excellent business has resulted since the showrooms have been established. Comparisons cannot, of course, be definitely made between different showrooms and the policies adopted because of the differing controlling circumstances. The Croydon undertaking, for instance, is interested directly only in the supply of electrical energy, whereas with the North Metropolitan Co. the sales of apparatus and general installation work form an important feature in the business of the undertaking.



Fig. 1.—Reception Hall and Showroom, Croydon.

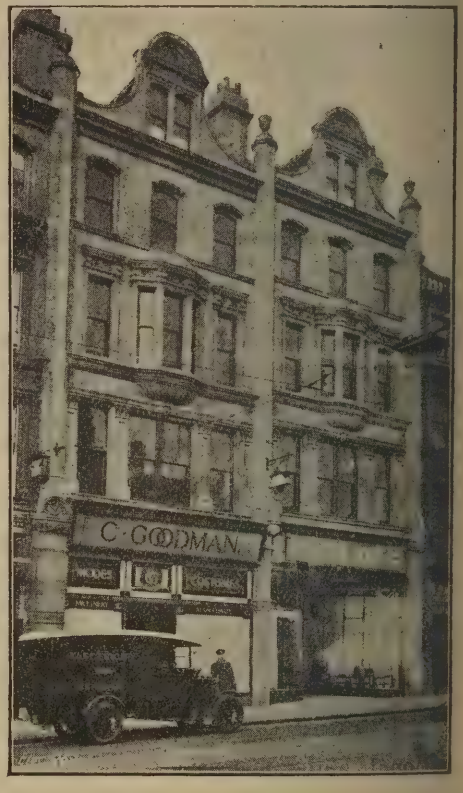


Fig. 2.—Electric House.

The New Showrooms at Croydon.

Electric House, fig. 2, which was opened recently by the Mayor of Croydon, Councillor A. J. Camden Field, J.P., is situated in the main thoroughfare of Croydon, High Street, and comprises what were, before the reconstruction, four separate premises, 38 and 40, High Street, and two shops in Surrey Street, on to which the new premises now back. The premises occupy seven floors, two of which are below the High Street level and have been allotted to business-development purposes. The principal feature of this department, and probably of the whole concern, is an all-electric flat. This comprises the usual reception rooms, bedrooms, kitchen and bathrooms, and is equipped and furnished to represent an average middle-class dwelling. The rooms of the flat, "Restholm," are complete in every respect, and of normal dimensions. Another important

art of the basement is the all-electric demonstration itchen. This is equipped with several models of elec-ic cookers and other domestic apparatus, which are ired out by the Electricity Department, and it is in-eresting to note that on the occasion of the opening inction the cookers were all in commission, and the llowing items were cooked: 250 scones, 50 small cakes, 0 Shrewsbury biscuits, 3 dozen eclairs, 2 dozen sausage olls, 1 fruit pie, and a Madeira cake.

An industrial exhibition room is another important eature of this part of the showrooms, and is equipped ith all manner of industrial apparatus positioned and



Fig. 3.—Electricity House, Southgate.

onnected so as to render it possible to hold demon-rations under, as near as possible, working conditions.

The ground floor is devoted to the main reception all, fig. 1, at the back of which is a large domestic-ppliances department, and a demonstration and ecture hall. In the reception hall, which is very rtistically decorated and furnished, the consumers' ccounts are paid. Very effective electric-fire settings f panelled marble are introduced in this, as well as n other rooms in the building. The domestic-appli-nces room is equipped with a representative display f most of the makes of electric-lighting equipment. pecial plug sockets are fixed in the walls to accommo-ate brackets already wired and fitted with plugs and rip devices so that different brackets can be shown in ny position by simply withdrawing one bracket and in-erting another in its place. The lecture hall is pro-ided with a suitable demonstration platform. The pper floors are devoted to the commercial and financial erical staffs and the management, and also the care-aker's quarters on the top floor; the last mentioned in-udes an all-electric kitchen. A room is set aside as a brary or technical-journal room; this is intended for embers of the staff who are encouraged to make use of he room, and thus keep in touch with the latest develop-ents. With the exception of about three large fires in he largest rooms, the offices are heated throughout by lectricity. Electric water heaters, with thermostatic egulation, are installed in the lavatories. A feature orthy of note is that most of the rooms and offices are quipped with different electric-lighting apparatus re-resenting the modern makes of equipment and methods f lighting. The display windows occupy one half of he building frontage, the other half being let out for he time being. The windows are equipped for colour-nd spot-lighting schemes, and one window is set apart or feature displays and demonstrations in which the ocal tradesmen will be encouraged to take part.

In conclusion, our thanks are due to Mr. Alex. C. ramb, M.I.E.E., the chief engineer and manager, to hom we are indebted for the above particulars and is courtesy in showing us round the premises.

Three of the North Metropolitan Co.'s Showrooms.

The three most recently opened showrooms of the orth Metropolitan Electric Power Supply Co. are those t Southgate, Chingford and Harpenden. These form a particularly interesting combination in that the first named represents a fairly large and densely populated partly industrial area, while the other places are almost purely residential and rural; Harpenden in fact is still an old English village. The showroms at Southgate, which were opened in August last, are favourably situated at Palmers Green, with the front of the premises nearly facing the direction of the busy road. Electricity House, fig. 3, is a three-storey building laid out on modern lines. The ground floor accommodates the actual show and demonstration rooms, workshops and stores, and the first floor is devoted to the necessary offices. The top floor is arranged in two flats, occupied by members of the staff. The showroom proper, fig. 4, and reception hall occupy the front of the premises, and is served by two large display and demonstration windows. The room is very attractively laid out, and is designed to afford a welcome to all who enter. A feature of the equipment is a glass shade-demonstration cabinet, in which all manner of shades are placed over fixed lamps on shelves. Particular attention is given to the question of dealing with consumers during the payment of accounts. A small electric cash lift, designed by Mr. C. J. Barnett, A.M.I.E.E., the resident engineer at Southgate, serves the show room and the general office immediately above, and the attendant receives the cash and sends it upstairs where it is dealt with, leaving the attendant free to give his whole attention to the client, thus avoiding the unsatisfactory position which results from the showroom clerk attempting to answer inquiries during the necessary booking of the account. A small room is equipped as a special lighting-demonstration room, being without windows of any description, and another room is set apart and fitted up as an all-electric kitchen, fig. 5, where almost any electrical domestic demonstration can be given at any time. Experience has shown that this system has proved more successful than that when the demonstrations



Fig. 4.—The Showroom Proper.

are held in full view of the street, ladies preferring, when attending cooking demonstrations or examining cookers, to be as private as possible. To avoid the staff and workmen, other than those actually employed in the showroom, passing through that part of the premises, separate entrances for the office and engineering staffs and the workpeople are provided. Every effort is made to ensure a happy relationship between the members of the showroom staff, and regulations which may possibly cause irritation are strictly avoided. In passing, it is interesting to note that an

album, filled with excellent testimonials, is suitably placed in the reception hall for the inspection of all interested.

To gain an air of prosperity is the aim of the department, and it is encouraging to know that since the establishment of the new district headquarters, the installation work done by the department has been doubled. The Southgate district was taken over by the Supply Co. in 1911, and the number of consumers now connected to the area network is over 5,000. Special periodical displays are given in the demonstration window, usually



Fig. 5.—All-Electric Kitchen, Southgate.

fortnightly, and the local tradesmen are invited to take part in these.

In contrast to the showrooms at Southgate, those at Chingford are designed to serve a comparatively small area, the number of consumers being at present about 600. The supply to the Chingford area was inaugurated in November, 1923, although the showrooms referred to, fig. 6, were not opened until December of the next year. The premises accommodate the show and demonstration rooms and the offices on the ground floor. The showroom proper occupies the whole of the front of the building, and is equipped with a representative display of the most modern domestic, lighting and heating apparatus of the well-known makers. As at Southgate, arrangements are made with the local tradesmen for special periodical displays in one window set aside for that purpose. A similar demonstration room to that at Southgate is equipped as an all-electric kitchen; this occupies a portion of the rear of the premises, the offices occupying the other part. An outhouse at the back of the building serves as a store, and a sub-station acts as the main receiving and distribution point. This accommodates two 150-kVA, 11,000/415-V, and one 100-kVA, 11,000/3,000-V transformers. The supply is received from the Brimsdown station by overhead line as far as the outskirts of the town, the transmission being continued by underground cables.

The supply and showrooms at Harpenden village are of unusual interest; the area is quite rural, and the undertaking may be regarded as experimental by outside engineers, although it is quite a practical and commercial proposition of the North Metropolitan Company. The area was taken over nearly three years ago, the showrooms being established a few months later, and at the time of our visit 343 consumers were connected to the mains. The premises, fig. 7, constituting the display rooms and offices, is a one-storey building which has been converted from an old wine store. It is arranged on practically the same lines as the premises at Chingford, and is very tastefully furnished and decorated. It is interesting to know that considerable success has been achieved in getting the rural tradesmen to take part in the special window-display work. The windows are equipped with the necessary apparatus for the demonstration of lighting schemes of all descriptions. A feature of the equipment is a lamp-demonstration board designed for comparing various types of electric lamps.

The chief interest in the Harpenden undertaking lies in the fact that the inhabitants of the district are on the whole enthusiastic over the electricity supply, and take advantage of the demonstration and display work of the department. It is encouraging to note that ten cookers are at present installed on the mains, and that the prospects of increase in this direction are good. The main sub-station for the area is located at the back of the premises, and it is connected both to St. Albans and Luton through a 20,000-V cable.

Generally speaking, in districts such as Chingford and Harpenden the company does not establish the showrooms at the same time that the area is taken over. It is considered advisable to wait until some advance with the supply has been made, when the management is the better able to estimate the value a showroom would have in the area.

In each of the North Metropolitan Supply Company's showrooms referred to, the second, or non-feature, window is laid out, in accordance with a general policy adopted by the company, as a "vista" window. This gives a view from the outside right through to the far end of the showroom. This arrangement, when the fittings suspended from the ceiling inside are illuminated, results in a very attractive effect, but it does not lend itself to variation to any great extent. The feature or demonstration window differs from this in that it is provided with a back and has a limited depth. A special department under the supervision of a lady superintendent, Mrs. Walker, arranges periodical feature displays at different times at the branches, one display being removed from one district to replace another elsewhere, and so on.



Fig. 6.—Chingford Showroom.



Fig. 7.—The Harpenden Premises.

In conclusion, our thanks are due to Capt. J. M. Donaldson, M.C., M.I.E.E., the chief engineer of the company, for his permission to inspect the showrooms referred to, and to Messrs. Barnett, Wood and Le Feuvre, the resident engineers of the Southgate, Chingford and Harpenden districts respectively, for their courtesy in showing us round their premises.

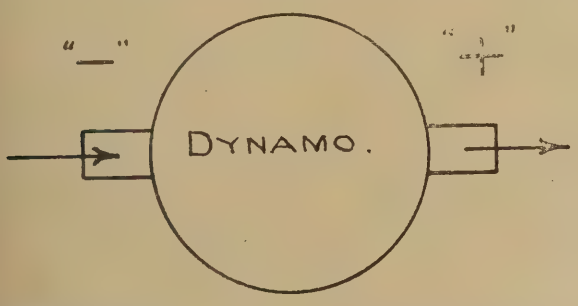
Further Notes on Commutation Problems.

By FREDERICK MURGATROYD, B.Sc.Tech., A.M.I.E.E.

Various aspects of the subject of commutation and brush selection in electrical machinery have been discussed in previous contributions by the writer.* This subject, on the surface so apparently simple, is underneath full of intricate considerations, and it is proposed in the present article to discuss a few more of these problems, namely, copper-picking, the heating of commutators, brush thickness and the fundamentals of brush selection.

Copper-picking.

This phenomenon, though not very common, can be very troublesome and baffling when it does occur. It consists of a deposition of copper particles on the contact surface of the brush, but takes place only where the current flow is from copper to carbon. Once copper-picking begins, the effect is cumulative, until in the more extreme cases the phenomenon known as "soft copper" occurs, when copper dust is thrown off from the brush contact surface and collects on the adjacent parts of the machine. The main differences between the positive and negative brushes of a dynamo are shown in fig. 1, and it will be noted that the brush which is liable



Higher Contact Drop.
Slow Brush Wear.
No Copper-picking.
Dark Commutator Path.

Lower Contact Drop.
Quick Brush Wear.
Copper-picking.
Bright Commutator Path.

Fig. 1.—Comparison of Positive and Negative Brush Phenomena.

to display copper-picking is also the one liable to wear more quickly and has a lower contact drop. It is obvious that the direction of current flow is primarily responsible for these results, but with regard to copper-picking the current flow from copper to carbon can only be regarded as facilitating some secondary cause. What this secondary cause is has never been established. The action may be in some way related to the presence of occluded gases in the copper and carbon, or may be in part a metallurgical phenomenon. The cause is certainly not purely physical, since it ceases when the current flow is reduced to zero. In the opinion of the writer, copper-picking is due to the presence of a combination of conditions of which minute sparking under the brush is the chief.

It may sometimes be observed that copper-picking has taken place on both positive and negative brushes. This result is to be attributed to the presence of circulating currents in the brushes so that in the case of the brush where the normal flow is from carbon to copper, part of the brush surface has a flow in the opposite direction. The degree of copper-picking is proportional to the current density in the brush and inversely proportional to the intimacy of contact. In fact, the first means of cure is good contact, whereby the minute sparking above mentioned is reduced.

To summarise, the cure for copper-picking is to be found in good contact, low current density, elimination of circulating currents, recessed mica and the use of interpoles. If the mica cannot be recessed, then an abrasive brush should be used.

The Heating of Commutators and Slip-Rings.

The temperature rise of a commutator or slip-ring is some function of the peripheral speed and of the watts to be dissipated for every sq. cm. of the commutator or ring surface, and may be expressed mathematically as follows:—

$$T = K \times W/[S \times (1 + 0.1v)]$$

where T = temperature rise in degrees centigrade
W = losses to be dissipated in watts
S = surface in sq. cm.
v = peripheral speed of the rotating surface in metres per second
K = a constant.

For the constant K, the figures of 100 for slip-rings and 150 for commutators have been proposed.

The above formula is, however, somewhat cumbrous, and the following procedure is proposed. It has been found not only practical, but to be as nearly infallible as an empirical method can be.

Let us for the moment assume that the temperature rise and peripheral speed are always constant. We can then omit T and v and the formula becomes—$K_1 = S/W$.

Now the losses W are proportional to the brush characteristics and to the machine current. If we eliminate the brush characteristics we have—$\delta = S/A$, where A is the machine current.

The factor δ is easily determined, being merely the number of sq. cm. of the *cylindrical* surface of the commutator or ring for every ampere passing through the machine.

From the factor δ we are able to argue backwards and define the necessary brush characteristics for a required temperature rise and peripheral speed. Where the temperature rise and peripheral speed are normal, it is found that δ should be not less than 5 for a well-ventilated commutator where ordinary carbon brushes are required, and not less than 0.8 for a well-ventilated ring using copper-graphite or pure graphite brushes. For totally enclosed machines, δ should be increased to 8 or 10 for commutators. In the case of low-voltage machines, such as coppering generators or milking boosters, δ should be not less than 2, but successful cases are known where δ is as low as 1.2. Of course, highly metallic brushes are essential in such cases of low δ, and the low voltage generated permits of their use.

Brush Thickness.

The better the commutating conditions, the thicker may the brush be made with safety. For this reason, brush thickness is of less importance in interpole machines than in non-interpole machines. Commutating conditions are, however, invariably far from ideal, and thick brushes, in spite of decreasing the current density and e.m.f. of commutation, often give rise to commutation troubles of which circulating currents are a prolific cause. It is therefore necessary in practice to reduce the brush thickness to a value which is sufficiently reasonable to avoid excessive commutation e.m.f. Various writers on this subject have specified this reasonable thickness in terms of the number of commutator bars shorted, but machines are so varied that this does not lead to a rule which is generally applicable. Experience with a large number of machines has shown that a much more useful factor is the thickness of the brush expressed as a percentage of the commutator pole pitch. This factor will be called γ. Expressed mathematically, γ is equal to $100\ p\ t/\pi d$, where t is the brush thickness in inches, p the number of poles, and d the commutator diameter in inches.

* "Mica and Commutation Troubles," *Electrician*, July 6th, 1917.
"The Examination of Commutation Conditions in Interpole Machines," Electrical Review, August 24th, 1917.
"Iron Commutators," Electrical Review, January 18th, 1918.
"Adjusting Metallic Brushes on Rotary Converter Rings," Electrical Review, October 3rd, 1919.
"Brush Selection for Electrical Machinery," Electrical Review, October 17th, 1919.

A good average figure for γ in normal machines is 5. For low-voltage machines, a γ of 10 to 15 has been found satisfactory. For high-speed commutators, the tendency should be to increase γ above 5 if other conditions allow.

To illustrate the use of γ, in various cases where sparking trouble and quick brush wear has been experienced, γ has been found to be 8 or 9, and by cutting back the brushes to make γ about 5, the trouble has been cured. Very often by thus cutting back, the current density at the contact surface of the brush has been actually reduced, due to the elimination of excessive circulating currents.

The Fundamentals of Brush Selection.

There are four fundamental factors which must be known before a grade of brush can be scientifically selected for a particular machine. Two of these, γ and δ, have already been discussed. The two remaining ones are α, the current density in the brush in amperes per sq. in., and β, the peripheral speed of the commutator in feet per minute.

The choice of the best grade should be arrived at from the consideration of these four factors as a group. It is therefore necessary to have in mind what are the normal values for α, β, γ and δ so that any deviation from the normal can be quickly detected and the choice of grade influenced accordingly. For normal machinery using the cheaper grades of carbon brush, these values are as follows:—

$$\alpha=40 \qquad \beta=2{,}500 \qquad \gamma=5 \qquad \delta=5.$$

Having determined the actual values of these factors, it is necessary to examine in what respects any abnormality is present. For instance, if α is, say, 60, it will be necessary to consider the use of a highly graphitic brush with probably a well-recessed commutator. If β is, say, 4,000, the brush chosen must not be abrasive, and a lubricator type of brush with recessed mica is indicated. The factor γ must be considered in relation to α and the type of machine, and its main use is to indicate whether brush thickness is likely to interfere with performance. δ is very important since it indicates whether the heating conditions are difficult or easy. If difficult, a brush with low friction coefficient and low contact drop is indicated. If δ is high, then friction and contact drop are of less importance, and a cheap carbon brush is admissible.

As stated, the four factors α, β, γ and δ, must be considered as a whole, and anyone who works on these lines will find the problem of brush selection not only shorn of any mystery, but becoming increasingly easy and reliable as use is made of the method.

The Metering of Electricity.

Domestic Supplies in Artisans' Dwellings.

By S. H. PENNING.

The supply of electrical energy for domestic purposes will probably form a very important part of the business of electricity undertakings in the future. There is also strong evidence of a demand arising for domestic supplies for the smaller type of houses occupied by the artisan class. If this tendency is encouraged, it is possible that the demand from this type of house may increase to very considerable proportions, in view of the fact that the great majority of new houses being built at the present time are of this class.

It is also most important that the introduction of the use of electricity into these homes should be pressed from the points of view of cleanliness of the home and atmosphere, and the saving of labour.

The domestic electrical apparatus on the market to-day is far from being perfect, the public generally are unaccustomed to its use; a certain amount of education of the consumer and vigilance on the part of the manufacturer is necessary in order to avoid unnecessary expense and waste and to make them as safe as possible in their every-day use. Probably most important of all is the question of the price of electrical energy for such purposes.

I venture to think that this is one of the greatest stumbling blocks to the introduction of electricity into the home at the present time. Supply authorities still think in terms of lighting, heating, cooking, battery charging, water heating, &c., in connection with the supply of electrical energy for these purposes, and have adopted a multiplicity of charges to cover the various uses to which electricity can be put. In many cases it is very difficult to separate the one from the other; for instance, when a plug is fitted in a dining-room for the use of an electric radiator, what is to prevent the owner from using it for a table reading lamp? It seems absurd to endeavour to force the occupier to install two plugs, one for lighting and another for power.

If electricity is to become popular in the home for the purposes of lighting, heating, cooking, washing, water heating, &c., it will not be possible for the supply undertakings to make distinctions between the various uses to which it is put; they will be compelled to adopt a tariff that will be applicable to all purposes.

Some supply authorities have adopted a low average price per unit for domestic supplies, round about 2d. per unit, but this is little better than a makeshift. It does not please anyone; either it is too cheap if the consumer uses it for lighting only, or it is too dear if he uses it to the extent of, say, a thousand units per annum for an average house.

Due partly to the ignorance of the general public of the use of domestic electrical apparatus and the quantity of electrical energy required to perform certain duties, and to the ease with which electricity can be turned off or on, it is essential have some check upon its use. A very convenient check is found in the prepayment meter, as it is impossible to leave the current on unintentionally without the meter cutting it out of use within a short period by the operation of the prepayment switch. Great improvements have been made in the construction of prepayment meters in recent years, and they can now be relied upon to perform their function accurately and without trouble.

The only suitable tariff to meet the conditions of a supply of electrical energy for general domestic purposes is one based upon the principle of a fixed charge, plus a low running charge or cost per unit. It has been difficult hitherto to apply this principle where prepaymnt meters are in use. In some cases the fixed charge is collected with the rent of the house by the weekly rent collector, the prepayment meter taking charge of the low running charge per unit; this, however, is not always convenient or possible.

The writer devised, some few months ago, means by which the total charge—that is, both the fixed charge and the low running charge per unit—may be collected by the prepayment meter. This is carried out by making the meter advance at a constant speed, its rate being proportional to the fixed charges over a definite period. This may be secured either by making the meter run on shunt, or by the introduction of a small transformer, the secondary of which is connected across the series winding of the meter, the ratio of the trans-

former being so arranged as to give the correct rate of advancement to the meter.

The cost to the supply undertaking of the electrical energy consumed in procuring this advancement will be very small indeed, and represents a very small proportion of the moneys recovered under this head.

The meter can be made to take into account those periods during which the occupiers are away on holiday; on the other hand, some supply authorities may not wish to include such periods, they being in all probability a small proportion of the total time. To cover either of these views, it is only necessary to include or exclude the prepayment switch. If the switch is included in the circuit, the meter will stop when the value of the coin has been entirely used up.

By such an arrangement it is possible to have a prepayment meter rated at one price per unit, but capable of collecting the fixed charge (based upon the kilowatt capacity of the house, its rateable value, or other method of assessing a fixed charge, to which may be added any other fixed sum, such as rental for cookers or other apparatus), and also a small running charge, such charge being proportional to the actual number of kilowatt-hours supplied to the consumer.

In this way the great benefits to be derived from the use of electrical energy in the homes of the artisan class may be secured at a price per unit which will be reasonable, and proportionately cheaper per unit the more it is used—neither too cheap for lighting, nor too dear for a general purpose supply.

The Broadcasting Committee, 1925.

Its Chief Recommendations and some of its Observations.

The Committee of 10, under the chairmanship of the Earl of Crawford and Balcarres, which was appointed by the Government towards the end of 1925, "To advise as to the proper scope of the broadcasting service and as to the management, control, and finance thereof after the expiry of the existing licence on December 31st, 1926. The Committee will indicate what changes in the law, if any, are desirable in the interests of the service," after meeting on 16 occasions and hearing the evidence of 22 individuals and groups, has presented its report* to Sir W. Mitchell-Thomson, H.M. Postmaster-General. At the outset it records its admiration for the work accomplished by the British Broadcasting Co., Ltd., and indicates that it has made full use of the report (Cmd. 1951) of the Committee appointed by the Postmaster-General in April, 1923, under the chairmanship of Major-General Sir F. Sykes, which surveyed the situation then. The principal recommendations are as follows:—

That the broadcasting service should be conducted by a public corporation acting as a trustee for the national interest, and that its status and duties should correspond with those of a public service; it should either be set up by Act of Parliament, or be incorporated under the Companies Acts, limited by guarantee; in either case the corporation should hold the licence of the Postmaster-General for a period of not less than ten years.

The "British Broadcasting Commission" should consist of not more than seven, or less than five, Commissioners, all nominated by the Crown, the first to hold office for five years; one of the Commissioners might, if thought desirable, be one of the existing members of the British Broadcasting Co., and they should have power to appoint an executive Commissioner with a seat on the Board; all Commissioners should be adequately remunerated, and they should appoint, in consultation with appropriate societies and organisations, as many Advisory Committees as are necessary to ensure due consideration of all phases of broadcasting.

The entire property and undertaking of the British Broadcasting Co. as a going concern should be vested in the Commission on January 1st, 1927, and all existing contracts and staff of the Company should be taken over by the new Commission; the Postmaster-General should remain the licensing authority and be responsible for collecting the licence fees; the detection and prosecution of those who conceal their equipment should be vigorously pursued. Provision for experiment and research should be generous, and the Commission should be empowered to raise capital.

The fee of ten shillings for a receiver's licence should be maintained; the first charge on the revenue from licence fees should be the expenditure incurred by the Postmaster-General in connection with the broadcasting service. After paying the Commissioners an income thoroughly adequate to enable them to ensure the full and efficient maintenance and development of the service, any surplus should be retained by the State. The Commission's accounts should be reviewed by the comptroller and auditor general.

The Commissioners should be entitled to all the ordinary rights as regards the use of copyright material (whether in news or otherwise) and it is unnecessary to invest them with any special privilege or preference. The claims of those listeners who desire a larger proportion of educational matter, though relatively few in number, should, if possible, be met; a moderate amount of controversial matter should be broadcast at the discretion of the Commissioners, and licences should be granted to blind persons free of charge.

Although Parliament must retain the right of ultimate control and the Postmaster-General must be the Parliamentary spokesman on broad questions of policy, the Commissioners should be invested with the maximum of freedom which Parliament is prepared to concede; the Commissioners should present an annual report to Parliament.

In the course of its general observations the Committee remarks, *inter alia*:—

The repayment of their subscribed capital to the shareholders in the British Broadcasting Co., provision for its debts and liabilities, cost of liquidation, and the fulfilment of pending contracts, &c., can be made without serious difficulty under the terms of the licence and existing arrangements with the Postmaster-General. The Committee attaches the greatest importance to maintaining continuity between the old authority and the new. Arrangements must be completed in good time, as it would be most unfortunate were there to be any dislocation of the service, or any withdrawal (even temporary) of the programmes for which listeners have paid; the injury caused by any such interruption might be lasting. Where, in view of the changed conditions, it may later on prove necessary to dispense with the service of individuals who would otherwise have been retained, compensation should be paid from the revenue of the Commissioners on a scale to be approved by the Treasury.

However the new Commission be constituted, the organisation of the Board, or governing body, and its Committees seems identical. It has been suggested in evidence that the Board should be composed of persons representing various interests, such as music, science, drama, education, finance, manufacturing, and so forth, but the Committee cannot accept this view, since compromise and even conflict might ensue owing to division of allegiance. On the contrary, it holds that the Commissioners should be persons of independence, free of commitments, and that they will inspire confidence by having no other interests to promote than those of the public service. Advisory Committees, of which a considerable number can be appointed, may frankly comprise advocates, as their duty will be to ensure due consideration for particular phases of broadcasting. The Commissioners should appoint these Committees, and in doing so will doubtless consult societies and organisations which are qualified to advise on questions of *personnel*.

Regarding finance, the Committee assumes that increasing outlay on plant will be necessary; moreover, the Commission must be self-supporting and can expect no grant from public funds. It is anticipated that the overhead and administrative charges of the new authority will rise; its Committees will, in effect, be continuing responsibilities and the control of programmes will be more onerous than hitherto. The duties pertaining to the chairmanship will absorb the greater part of any man's time, and it would be most unfortunate if the programmes came to be treated as matters of routine; even if the cost is considerable, it will prove a wise investment to pay such fees as will secure the best available service.

Outlay on bold experiment should not be meagre; research should be constant, both official and unofficial. The Commission should be empowered to raise capital on the security of its income from licence-fees, and the Treasury might also be authorised to advance capital for approved purposes. All witnesses seem to agree that improvement of the service will increase the number of licensees. When an adequate service has been assured, but not until then, it is expedient that the surplus should be retained by the State.

The Committee points out that it cannot devise an organisation which may not be shown by experience to need revision. On the one hand, it is conceivable that broadcasting might have to become a department of State like the telephone service: on the other, it is possible that its character as a monopoly might have to disappear, and that the rights of transmitting should be distributed. While, therefore, it is essential that the new Commission should be so constituted as to command public confidence, it is equally clear that should

*Cmd. 2599. H.M. Stationery Office; price 6d. net.

circumstances change, the Government shall be able to supersede, or modify, the Commission. It must be laid down that so soon as its licence expires, or is withdrawn, the Commission, on due provision being made for the discharge of all debts and liabilities, shall be bound to transfer, or dispose of, its whole undertaking in such a manner as the Postmaster-General may direct.

The British Broadcasting Co. has enjoyed certain patent rights advantages which may not appertain to its successor. It has been permitted, without royalty, to use some transmission patents which are the property of constituent members of the Company, but even if their continued user is essential to broadcasting, their existence will not impose any impossible burden on the new authority. It will not be to the commercial interests of the patentees to hamper that authority by making such user unnecessarily burdensome, and in this connection Section 29 of the Patent and Designs Act, 1907, may not be without its relevance.

The Committee received a good deal of evidence, sometimes vague, sometimes specific, showing that broadcasting is viewed with alarm by various interests of importance. Such representations have reached it from the Press, concert-givers, proprietors of theatres and music-halls, as well as from owners of dramatic, musical, and literary copyright. Apprehension is generally felt lest broadcasting should supplant existing agencies, professions, or pursuits. The evidence is conflicting, for speculative elements abound, and the Committee is far from convinced that these forebodings are just in that one all-important factor is omitted therefrom. The fears of those who have expressed them are based upon the effect on their existing clientèle, whereas there are multitudes to whom these things are a closed book to-day, whose appreciation may well be brought into being, and formulated in such a manner by broadcasting as to create a new and extensive audience with its fresh demands and requirements. Secondhand versions, even when reception is more perfect than now, are not a full substitute for the original performance, and in the long run art will not be injured by science, nor the printed page be displaced by the spoken word. Broadcasting is not only an institution, but has become a necessity throughout the civilised world. At the same time those who supply the raw material of broadcasting should be adequately rewarded. Experience will prove that apprehensions, though natural enough at present, will in the future be allayed.

The Committee is much impressed by evidence from authoritative witnesses who advocated the vigorous and extended employment of broadcast education in its widest and most liberal sense. A demand exists which deserves every encouragement, although it is clear that educational transmission may in existing circumstances have to give place to other items, and would suffer from such irregularity. A solution may possibly be found in the allocation of a special wave-length for a special subject, perhaps for several subjects, or again for a particular standard of a particular subject, such as music. Scientific and financial problems of magnitude are involved, and meanwhile the Committee recommends the Postmaster-General to continue negotiations which have recently been initiated in connection with a scheme for new high-power stations. The listener is entitled to latitude; he must not be pressed to assimilate too much "highbrow" broadcast, but at the same time every effort must be made to raise the standard of style and performance. The gradual infusion of improved standards will be welcomed by listeners, unconsciously at first, but with growing appreciation amongst those who will instinctively learn to desire better performances.

Appendix I, besides a list of witnesses, contains particulars of written evidence, while Appendix II is a historical summary of the broadcasting service in Great Britain. The expenses incurred in preparing, printing, and publishing the report are estimated at £106.

An Institution of Fuel Technology.

Organising Committee Formed.

THERE was a very largely attended meeting at the Institution of Civil Engineers, London, on Friday, March 5th, when the desirability of forming an Institution of Fuel Technology was discussed, and resolutions were passed in favour. The audience contained a large proportion of electrical engineers.

Sir WILLIAM LARKE (Director of the National Federation of Iron and Steel Manufacturers), who presided, said the meeting had been called as the result of a strong desire on the part of a large number of people concerned with the production and use of fuel, to form an organisation on a national basis capable of investigating the whole of the problems concerned in a manner which was not possible to any existing organisation. In reply to the preliminary letter which had been circulated, 400 people had expressed unqualified support, although a small number had dissented or remained neutral. Fuel practice and problems in widely divergent industries, however, had so much that was fundamentally common, that an organisation specially designed to provide a means of co-ordinating experience and results must be to the national advantage and contributory to the general improvement of industrial efficiency. There at present existed an Institute of Fuel Economy Engineers, but he understood that that body was willing to co-operate so that there should be one national organisation of the nature contemplated. It had been suggested by some people that the work of such an organisation dealing with fuel could be carried on as a section of on of the existing institutions, but such a fuel group would no cover the field so effectively as an organisation devoting itsel solely to the task.

Sir PHILIP DAWSON, proposing a resolution that an institut should be formed having for its objects the promotion of th efficient production and utilisation of fuel, and the co-ordina tion of work in this country and abroad associated with th scientific utilisation of fuel in industry—which resolution wa seconded by Sir Richard Redmayne—said that in the mos efficient electric power stations, fuel represented 50 per cen of the cost of generation, whilst it represented between 3 and 45 per cent. of the cost of operating locomotives. Tha was sufficient to show the importance of finding means fo utilising more efficiently and more economically the fuel re sources of the country. The average quantity of coal used i electricity generation was 2.53 lb. per kWh, but as evidenc of what could be done by scientific methods, he mentioned tha at the Barton power station of the Manchester Corporation with a load factor not exceeding 30 per cent., the fuel con sumption had been reduced to 1.35 lb. He had just returne from a visit to Germany where he had ascertained that on of the largest steel works there, by the scientific applicatio of heat, had been able to reduce its fuel bill by £25,000 pe month, which was equivalent to 3s. per ton of steel made there

On behalf of the Institute of Fuel Economy Engineers, i was stated that whilst the Council of that body was in ful accord with the desire to have one national organisation, i was felt that the existing Institute should be taken as foundation upon which to build the more comprehensive body and an amendment to the resolution was moved to the effec that a committee be appointed to confer with the Council o the existing Institute, and enlarge or amend its constitutio in any way thought fit. This amendment was eventuall withdrawn on an assurance by the chairman that the Institut of Fuel Economy Engineers would be represented on th organising committee, which it was proposed to appoint, thus in effect, doing what the amendment proposed.

Dr. E. W. SMITH expressed the view that it would be unwis to form yet another institution, and contended that the wor in view could be done by a special group of the Society o Chemical Industry, after the manner of the chemical eng neering group of that Society, which was an autonomous bod with its own committee and officers and its own proceedings One or two other speakers were inclined to take the sam view, but they were heavily outnumbered by those who wer firmly convinced that a separate organisation was required having in mind the fact that fuel entered into all industrie in some degree, but that none of the existing societies coul deal with it in a really comprehensive manner. It was als explained that the proposed Institution of Fuel Technologists— or whatever name the organising committee might eventuall adopt—was intended to have as wide a membership as possibl so as to bring in manufacturers and others who at presen could not join many of the existing institutions and, moreove that membership would in no way imply a qualification t practise in connection with fuel technology.

Eventually, the resolution proposed by Sir Philip Dawso was passed *nem con.*

Principal G. KNOX, of the South Wales School of Mine proposed that an organising committee should be elected t determine the general basis of organisation, and to defin more specifically the object of the work of the proposed in stitution. This was adopted, and amongst the members pro posed were Sir Philip Dawson, Mr. S. McEwen, Sir Richar Redmayne, Mr. W. M. Selvey, Prof. R. V. Wheeler, Mr. D Wilson, and Mr. C. P. Sparks. The chairman gave an unde taking that the committee would deal with the appointmen of representatives of the Institute of Fuel Economy Engineer at its first meeting, and it was resolved that the organisin committee be requested to prepare a report as to the con stitution of the proposed institution, and to make recom mendations as to the name thereof.

Wireless on Aircraft.—The "Norge 1," the airship i which the well-known Polar explorer Amundsen is to attemp to fly from Europe over the North Pole to Alaska, and whic will pass over London on its journey, has been equipped wit wireless. By special arrangement with the Marconi Co. th vessel is to be equipped with transmitting apparatus which wi enable the commander to keep in touch with either land or shi stations at distances up to 1,000 miles. Receiving apparatu specially designed to cover a wave-range of from 300 to 25,00 metres will also be carried, whilst direction-finding apparatu will be installed which will enable the navigators accuratel to determine their course and direction even over the Pol itself when the compasses will be of no navigational value since all direction will be due south. The direction finde will enable all the long-wave European and American station to be picked up and oriented with ease, large loops having bee erected right round the envelope of the airship; by this mean the sensitivity of the apparatus has been made much greate than any hitherto employed on any aircraft. The Marconi Co is making arrangements to forward any reports from amateur of reception from the airship during its flight to the Nort Pole to the wireless officer with the expedition. The airshi has been reconditioned in Rome, and is now carrying out it trials.

Reviews.

The Dynamical Theory of Gases. By J. H. Jeans, F.R.S. Pp. 444; 28 figs. London: Cambridge University Press. Price 30s. net.

This is the fourth edition of Dr. Jeans's classic work, which has this year attained its majority. We reviewed the third edition at some length in 1921, and the present issue differs only in that the author has made the few changes necessary to bring the book up to date.

Dr. Jeans stands in the front rank of mathematical physicists, who nowadays occupy a commanding position in the attack on the hidden mysteries of Nature; it is singular that the battle rages at two extremes—around the constitution of the atom on this globe, and about that of the giant suns at distances from us of which the human intellect can form no adequate conception. We are told that in the latter case we have to deal with atoms stripped of their electrons, and therefore able to pack so closely together that the density of the gases is 1,000 times that of platinum. And now we learn that Dr. Millikan has demonstrated the existence of a type of radiation of far shorter wave-length even than X-rays, which he ascribes to nuclear transformations, but as yet we know very little about the structure of the nucleus. The marvels of these explorations of the infinitesimal are as amazing as the intellectual genius which has directed them and interpreted their results; as Dr. Jeans remarks, there is still vastly more to learn than has already been encompassed, and his own work, of which this volume forms a brilliant part, has been most fruitful in pushing on the advance of science into the unknown.

Photo-Electricity; the Liberation of Electrons by Light, with Chapters on Fluorescence and Phosphorescence, Photo-Chemical Actions and Photography. By H. Stanley Allen, M.A., D.Sc., F.R.S.E. 2nd Edition, Pp. xi + 320; figs. 43. London: Longmans, Green and Co. Price 18s. net.

This is the second edition of a work by Dr. Allen, the first edition of which appeared in 1913, and forms one of the series of "Monographs on Physics," edited by Sir J. J. Thomson, O.M., F.R.S., and F. Horton, D.Sc., F.R.S.

Great strides within recent years have been made in this domain of science and the appearance of a new edition of the monograph is timely. During the interval since the publication of the first edition much has been added to the knowledge of photo-electricity and probably no branch of physics has made such tremendous advances. A second edition has been rendered necessary due to the modifications in our ideas and concepts of atomic structure consequent on the classical researches of Rutherford, the Braggs and many others, and the distinct change in views as to the relation between matter and radiation by the development of Planck's quantum theory by Bohr. The outstanding advance in the subject is due to Millikan, who has proved that photo-electric emission conforms exactly to the rules of the quantum theory and provides us with one of the most accurate values for Planck's constant.

The author states in his preface that "the chief aim in this edition has been to give a connected view of the subject of the liberation of electrons by ordinary and ultra-violet light, showing how the experimental facts have led up to, and may be expressed in terms of, modern theories of matter and radiation." In this the author has succeeded admirably.

The term photo-electricity denotes the release of electrons by certain metallic surfaces and the change in state of electrification of a body produced by the action of light. The number of electrons released is proportional to the intensity of the light, and there are very accurate methods of determining this number. By photo-electric methods minute changes of magnitude are detected that were concealed from the older methods and there is every indication that the photo-electric photometer, in particular, will make very important contributions to our knowledge of the Universe as a whole. It is capable of measuring the brightness of a star with an accuracy of one thousandth of a magnitude. Photo-electric cells have also been shown to greatly increase the accuracy of measurement of the energy distribution in a spectrum and have been applied in measuring the temperature of a few stars. The photo-electric cell will prove to be an instrument of much value in pure scientific research and in investigations of a technical character, and may rival in certain commercial and industrial applications, the thermionic valve. This affords yet another instance of the uses to which results obtained from highly specialised investigations may be put, and the unforeseen practical applications which may ensue.

By direct photo-electrical methods the existence of X-ray spectrum lines can be traced across from the shortest ultra-violet ray of wave-length about 900 A.U., to the longest X-ray of wave-length 8 A.U. Spectral lines of extremely short wave-length can also be obtained in a vacuum spectragraph so that the gap between the ultra-violet and the X-ray region has now disappeared. The subject of photo-electricity is of considerable theoretical and practical importance through its relation to photochemical processes of all kinds, particularly photography and phototheraphy. Photo-electricity has a direct bearing on photochemical processes in general and photographic changes in particular. Dr. Allen in this monograph has further developed the views of Professor Joly as to the nature of the latent photographic image, and explanations are offered on the complicated phenomena of photographic reversal.

The treatise under review gives a wide survey of the present state of knowledge of photo-electricity. In the introductory chapter an historical review is given. In the succeeding chapters an account is given of the outstanding experimental work on the subject, photo-electric action and fatigue, fluorescence, phosphorescence, photochemical actions, photography, phototheraphy and the photo-electric theory of vision. An important chapter in the monograph is that on the "photo-electric activity of gases," experimental results having already shown that ionisation is produced in the atmosphere of the earth by the solar rays.

The author is to be commended for adopting the admirable plan of limiting the size of the monograph by providing a bibliography of all the relevant papers published on the subject between 1913 and 1924, together with references at the end of each chapter to important articles and books bearing on the subject. The monograph contains much fresh information, Dr. Allen having carried out considerable original work in these delicate investigations and being thoroughly conversant with the extensive literature of the subject, has well summarised and balanced the evidence. The volume will be widely appreciated as a coherent, critical and reliable summary of this branch of physical science, covering a wide field of information, carefully sifted and condensed by one who from experience and aptness is well qualified to supply a clear and comprehensive view of an intricate subject. Much valuable experience is here digested and made easily accessible.

We can only recommend that everyone interested in the recent development of the subject, especially those undertaking further investigations, should study this volume very carefully; it is indispensable and an inspiration, and the only really modern treatise on photo-electricity.

Exercises in Practical Physics. By Sir A. Schuster, Sc.D., F.R.S., and C. H. Lees, D.Sc., F.R.S. Fifth Edition (revised). Pp. ix + 373; figs. 136. Cambridge: University Press. Price, 12s. 6d. net.

This well-known laboratory text book is intended for students preparing for final B.Sc. examinations. It covers a course of 73 experiments, and the description of each is accompanied by some discussion of the underlying theory, and of the method of recording the observations and deducing the results. In this course of work there are twelve experiments on General Physics, twelve on Heat, three on Sound, sixteen on Light, and thirty on Electricity and Magnetism. The most important changes since the last edition are the omission of Hygrometry, the addition of an experiment on Newton's rings and an extension of the section on Electricity and Magnetism, which has been raised in standard and brought up to date by the inclusion of experiments on the triode valve, the quadrant electrometer and ionisation currents. The instructions for carrying out the experiments are clear and concise and the apparatus is adequately described. The authors have been content, however, to tell the student what to do and how to do it, and have not included any of those stimulating questions which, no doubt, they would ask of students in their own charge who had worked through the various experiments they have described. They may think, perhaps rightly, that these questions would come better from the teachers concerned.

The first three chapters deal respectively with the Treatment of Observations, the Measurement of Length, and the Measurement of Time. In the first a brief reference is made to the normal probability curve and to a number of theorems bearing on the probable error of a result calculated from a number of observations. In the limited space allotted to it the treatment cannot be very full, but adequate references to standard works are given and the student who wishes to pursue the subject further may easily do so. In the third chapter the given theory is applied to the problem of determining the periodic time of a galvanometer from twelve successive readings of the time at which the needle passes through zero, in a given direction. The readings are taken to the nearest second. The authors show that according to the theory of Chapter I, the smallest probable error will be made in interpreting the observations if the first four and last four only are considered, the middle four being rejected, although they are not regarded as untrustworthy. This process will almost certainly arouse the suspicions of the thoughtful student. The final result is given as 9.656 sec., without any hint that the second figure may be wrong. The acceptance of this result virtually involves the rejection of the second or the eighth reading for which there is no apparent justification. A careful examination of the readings indicates that the true periodic time lies between 9.666 and 9.700, and reveals no reason for suspecting any error of observation in the whole series.

The topic is one which well deserves a place in a book of this kind, but the authors are unfortunate in the particular illustration which they have chosen. It is rather surprising, too, in this connection, that nowhere throughout the volume do they appear to contemplate the use of a stop watch for such measurements as this.

This criticism relates to a very small portion of the book; however, most of the matter is excellent and will be found very useful by degree students in their final years and by teachers in charge of them.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Next Advertisement Competition.—We hope to announce in the course of a few weeks, the particulars of our Second Advertisement Competition. It is proposed to run it on the lines advocated by the judges in the last competition, in their article published on page 244 of the Electrical Review for February 12th, 1926, where they stated that it would be easier to judge the advertisements if they were divided into classes according to manufactures.

Electricians' Strike Settled.—The strike of the employés of Messrs. Grierson, who are carrying out the electrical work in the rebuilding of Devonshire House, Piccadilly, was settled last week. The men who were working for less than the standard electricians' rate left the job, and the 600 men who struck work as a protest resumed after a two-days' stoppage.

A Rating of Machinery Committee.—The Minister of Health has appointed a committee consisting of the Right Hon. Edward Shortt, K.C. (chairman); Mr. Arthur Body, F.S.I.; Mr. W. Craig Henderson, K.C., Mr. W. H. Patchell, M.Inst.C.E., and Mr. A. H. Preece, M.Inst.C.E., to prepare a statement, in accordance with the provisions of Section 24 of the Rating and Valuation Act, 1925, setting out in detail all machinery and plant which appears to them to fall within any of the classes specified in the Third Schedule to the Act. The secretary is Mr. A. N. Rucker, Ministry of Health, Whitehall, S.W.1.

A Visit to the Chloride Works.—On February 16th about 100 members of the South Lancashire Section of the Institution of Post Office Electrical Engineers paid a visit of inspection to the works of the Chloride Electrical Storage Co., Ltd., at Clifton Junction, near Manchester. Very efficient arrangements were made for the reception and conducting of the visitors over the works, enabling them to understand fully all that they saw. The party was particularly interested in the examples of Post Office standard battery plates and cells for the new automatic exchanges. At the end of the tour the party and a number of the company's officials were photographed on the lawn at Crompton Fold, adjoining the works. This photograph is reproduced herewith. A speech of thanks was made by Mr. Herbert, on behalf of the Institution, and Mr. G. Stevenson, A.M.Inst.C.E., replied for the company.



Post Office Electrical Engineers at the Chloride Works.

Lighting Development in the Midlands.—On Tuesday, March 2nd, a meeting was held in the Queen's Hotel, Birmingham, to discuss the formation of a Lighting Service Bureau to serve the Midland area. A luncheon was arranged under the auspices of the E.L.M.A., and many gentlemen, prominent in the supply, wholesale and retail sections of the industry, were present. Mr. J. Y. Fletcher presided at the meeting, and, after addresses by Mr. C. W. Sully and Mr. W. E. Bush, a resolution in favour of the inauguration of a Lighting Service Bureau for the Midland area was proposed by Mr. R. A. Chattock and seconded by Mr. S. T. Allen. After several speeches by visitors in favour of the resolution, it was carried unanimously by the meeting.

Mining Automatic Telephone Approved.—The International Electric Co., Ltd., informs us that its automatic telephone system for mines has been approved by the Home Office under Regulation No. 132, after passing tests at Sheffield University.

Developments in the Radio Industry.—The *Broadcaster and Wireless Retailer* reports the formation of a new Society of Radio Manufacturers, of which Mr. W. H. Lynas is chairman *pro tempore*. Among the objects of the new body are the supporting and enforcement of all agreements entered into between the Society and its members or between the Society and other organisations for the strict maintenance of retail prices; and the approval and promotion of radio exhibitions. The Society, although primarily for the British manufacturer, permits the membership of foreign firms under certain conditions, as well as sole concessionaires for apparatus. Meanwhile the N.A.R.M.A.T. proposes to continue after reconstruction, and, according to Mr. Lynas, has approached seceding members with a view to their return. Particulars of the Society of Radio Manufacturers can be obtained from Mr. W. H. Lynas, 25, Savile Row, W.1.

The Threatened Engineering Lock-out.—The employés of Messrs. R. Hoe & Co., Ltd., last week decided to ignore the advice of the national executives of their unions to return to work pending negotiation regarding the matters at issue. Consequently the employers' lock-out notices posted on Friday last will operate to-morrow (Saturday) unless there are further developments after we have gone to press. A meeting of representatives of the London District Committees of the unions concerned met on Friday last and declined to endorse the national executives' advice to the men to return to work. An endeavour is being made to hold up public utilities in the event of the employers' proceeding with the lock-out, and a meeting of representatives of the unions was to be held to-day to discuss the matter.

In the meantime, at last Friday's meeting the engineering unions (London district) decided to proceed with their claim for an all-round increase of 20s. per week for their members and to ask for authority to take a ballot upon strike action. It was also proposed to secure authority to take a ballot upon the continuance or abandonment of the existing agreement relating to the avoidance of disputes which has been broken by the strikers at Messrs. Hoe's works.

Burnley and the E.D.A.—At a meeting of the Burnley Town Council on March 4th, Councillor Lees said that £56 seemed to be an extraordinarily big subscription to pay to the Electrical Development Association. Alderman Nuttall replied that the Association did a lot of publicity work and Burnley was greatly indebted to it. When the recent exhibition was opened the Association sent a representative who was of considerable assistance, and whose speech at the opening was worth the full subscription. They were asked to subscribe on the basis of energy generated, and the amount mentioned was in that proportion.

Unemployment.—There was a further reduction in the number of unemployed registered at the Employment Exchanges during the week ended February 22nd. At that date the total was 1,125,800, as compared with 1,139,228 on February 15th, and 1,236,065 on February 23rd, 1925.

A Multi-Circuit Radio Device.—A useful device for those interested in the construction of radio receiving sets has been produced by the Igranic Electric Co., Ltd. This takes the form of a seven-part folder which by simple manipulation can be made to show nine theoretical circuits, with corresponding pictorial diagrams, relating to a number of sets from a simple crystal set to a 4-valve receiver.

Social Events.—The staff of the Sterling Telephone and Electric Co., Ltd., Dagenham, met at dinner in the Abercorn Rooms, on February 20th. Mr. W. H. Peak, O.B.E., managing director, presided, and was supported by Mr. C. E. Hunter, works manager, and Mr. N. Blades, chief telephone engineer. The loyal toast was proposed by the chairman, and the toast of "The Firm" was proposed by Mr. N. Blades, and responded to by the chairman. A splendid musical programme was provided by members of the staff.

On February 27th the staff and employés of the Doncaster Corporation Electricity Department held their first annual dinner at the Red Lion Hotel, when there was an assembly of 75 persons, including Councillor T. Bramworth, chairman of the Electricity Committee, and other members of the committee. Mr. S. R. Windle, borough electrical engineer, presided, and gave the toast of "The Visitors," to which Councillor Bramworth replied.

The annual dinner of the employés of the Poplar Borough Council Electricity Department was held recently. During the evening Mr. Horace Bowden, the borough electrical engineer, was presented with a silver smoker's cabinet to mark his completion of twenty-one years in his present office.

Works Extension.—INTERNATIONAL COMBUSTION, LTD., informs us that it is considerably extending its Derby works at which "Lopulco" pulverised fuel plant is produced. The extensions include a new foundry section for heavy castings, and machine and sheet-metal shops. The transport arrangements are also to be improved.

Trade Announcements.—MR. W. A. WOOD, A.M.I.E.E., has opened an electrical contracting business at 131, London Road, Bedford, and would like to receive catalogues dealing with lighting, heating and power apparatus.

THE EASTERN ARMATURE WINDING CO. has removed to 73a, Garford Street, Poplar, E.

From to-morrow the address of MESSRS. WATSHAMS, LTD., will be: Windsor House, Victoria Street, London, S.W.1.

On Saturday last the WEINBAU INCANDESCENT & ELECTRICAL Co., 327-335, Commercial Road, E.1, opened new premises. The front of the building is flood-lighted and on the first floor is a fittings showroom containing over 600 types of lighting fittings, each wired independently of the others. Ample trade facilities are available.

Catalogues and Lists.—MARCONI'S WIRELESS TELEGRAPH Co., LTD., Marconi House, Strand, W.C.2.—Leaflets Nos. 1,053 and 1,054, dealing, respectively, with an extra selective receiver, and wireless call apparatus.

MESSRS. L. MCMICHAEL, LTD., Wexham Road, Slough, Bucks.—An illustrated leaflet advertising "Dimic" coils. Priced.

RAY MANUFACTURING CO., 350, Fishponds Road, Bristol.—A pamphlet dealing with the "Marshall" constant-potential battery-charging system.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—Folder L.259, containing details and prices of the "Tungar" battery charger.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—Folder No. 3,760, giving prices of "Elasta" vacuum and gasfilled lamps.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for February, containing notes on "Osram" installations, "Gecophone" radio apparatus, &c. This issue includes articles on the illumination of Bush House, Baker Street, and the Hearts of Oak Building (Euston Road).

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—A blotter with a calendar for March, illustrating the company's boiling plate.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 39, Upper Thames Street, E.C.4.—March price sheet of electrical accessories and appliances. Fully illustrated.

THE MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—An illustrated and priced pamphlet (No. 390 D) dealing with "Sterling" loud speakers.

THE BRITISH-THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—A coloured and priced pamphlet dealing with "Mazda" colour-sprayed lamps. Also a mailing card advertising B.T.-H. radio valves.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—The "Benjamin Reflector" for February-March containing notes on industrial and commercial illumination and other matters.

RADIO INSTRUMENTS, LTD., 12, Hyde Street, New Oxford Street, W.C.1.—An illustrated pamphlet containing particulars of a new l.f. transformer with tappings to give seven different ratios.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 108, illustrating and describing worm-geared pulley blocks, and pamphlets dealing with battery trucks and vertical cross-tube boilers.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—A catalogue of paper-insulated cables containing exhaustive particulars of each type.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—A price list (March) of electrical materials, appliances, and accessories, including wiring devices, cookers, fires, &c.

MESSRS. HENRY JENKINS & SONS, LTD., Unity Works, Vittoria Street, Birmingham.—A well-illustrated and priced catalogue of lighting fittings, principally open and closed bowls.

Bankruptcy Proceedings.—W. J. AYLING, 2, Rosemount Villas, Ballards Lane, North Finchley, Middlesex, late electrical engineer.—The public examination of this debtor was held recently at the Court House, Barnet. The statement of affairs showed liabilities of £1,052, against assets of £7, leaving a deficiency of £1,045. Debtor attributed his failure to being unable to obtain money owing to him by a limited company which he promoted from his own business. He stated that he commenced business in 1900 as an electrical engineer at New Southgate, and subsequently traded at various other places. In July, 1920, he paid a composition of 7s. 6d. in the £ to his creditors on liabilities of £90, and in November, 1924, he transferred the business which he was carrying on at Edgware to a private limited company, of which he was appointed managing director. The examination was formally adjourned to be closed.

JOHN RIGG, chauffeur, Revidge Road, Blackburn, and FRANK STEAD, engineer, Samlesbury, trading at Old Chapel Street, Blackburn, as Rigg & Stead, radio engineers.—These debtors underwent their first examination at Blackburn Bankruptcy Court, on March 3rd. The liabilities were £250, and the deficiency £128. Debtors attributed their failure to want of capital and increasing competition in trade. Stead said when the partnership was commenced he put in £100 in plant and capital and Rigg furnished £100. They each took £3 a week in wages. They were solvent until their stock was sold by auction, when it did not realise the figure expected. Following the examination of Rigg, the Official Receiver asked for an adjournment so that Stead might furnish additional details regarding some furniture. This was granted.

JOHN F. STANIFORTH, wireless salesman, Central Beach, Blackpool, and formerly of Scarborough.—This debtor was examined at Blackpool Bankruptcy Court, on March 5th. The accounts showed liabilities of £923 and a deficiency of £903. Debtor attributed his failure to bad trade. The examination was adjourned.

H. E. MALLINSON, electrical engineer, Portelet, Tomline Road, Felixstowe.—Trustee, Mr. H. S. Gotelee, Official Receiver, 9, Arcade Street, Ipswich, released February 23rd.

J. A. REFOY (Varley Radio Co.), dealer in wireless apparatus, 178, Ancona Road, Plumstead.—Last day for proofs for dividend, March 17th. Trustee, Mr. T. Gourlay, 29, Russell Square, W.C.1.

T. A. WICKHAM, electrical engineer, Snaresbrook, Station Road, New Milton, Southampton.—First and final dividend of 2s. 10d. in the £, payable at the Official Receiver's Office, Midland Bank Chambers, High Street, Southampton.

A. KERSHAW and C. H. WOOD (Kershaw & Wood), electrical engineers and merchants, 9, Bradford Road, Dewsbury—Supplemental dividend of 8½d. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

A. KERSHAW (separate estate).—First and final dividend of 4½d. in the £, payable at the Official Receiver's offices, 12, Duke Street, Bradford.

C. H. WOOD (separate estate).—First and final dividend of 4d. in the £, payable at the Official Receiver's office, 12, Duke Street, Bradford.

C. J. BROOKES, wireless and gramophone dealer, 6, Cross Street, Wigston Magna, Leicester.—First meeting, March 12th, at the Official Receiver's office, 1, Berridge Street, Leicester. Public examination April 9th at the Castle, Leicester.

A. F. WEBB, electrician, 102, Duke Street, St. Helens, Lancs.—First meeting, March 12th, at the Official Receiver's offices, 11, Dale Street, Liverpool. Public examination, April 13th, at the Court House, Liverpool.

M. KELLY, radio apparatus dealer, 12, Jackson's Row, Manchester.—First meeting, March 15th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, April 16th, at the Court House, Manchester.

A. F. KINGDOM, electrical and mechanical engineer, Tavistock Street, Devonport.—First meeting, March 15th, at 11, St. Aubyn Street, Devonport. Public examination, April 9th, at the Guildhall, Plymouth.

T. BARTON, electrical engineer, The Electric Works, Ainsworth Street, Blackburn.—Application for discharge, to be heard April 19th, at the County Court House, Blackburn.

Company Liquidations.—WESTON ELECTRIC LIGHTING CO., LTD.—A meeting of members is called for April 6th, at 37, Mawdsley Street, Bolton, to hear an account of the winding-up from the Liquidator, Mr. J. Greenhalgh.

RADIO EQUIPMENT CO., LTD.—Winding-up order made March 2nd.

C.A.C. (RADIO), LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. Honeywill Bros., Ltd., of 79, Mark Lane, E.C., creditors, and will be heard in London on March 16th.

SCIENTIFIC RADIO, LTD.—Winding up voluntarily. Liquidator, Mr. J. E. Hartles, Alston Buildings, Spiceal Street, Birmingham.

Dissolution of Partnership.—C. LINDOP & Co., electrical and mechanical engineers, 8, Lower Breck Road, Liverpool.—Mr. J. L. Sleightholme and Mr. C. F. Lindop have dissolved partnership. Debts will be attended to by Mr. Sleightholme, who will continue the business under the same style.

Receiver Appointed.—SHENTON & Co., LTD.—Mr. W. B. Pearson, 5, John Street, Bedford Row, London, W.C.1, has been appointed receiver and manager. He is continuing the business and hopes that the ordinary creditors will eventually be paid in full.

Private Arrangements. — Albert Maund, electrician, Hoghton Street, Southport.—A meeting of creditors was held on March 5th, at Southport, when a statement of affairs was presented which showed liabilities of £1,320, and net assets of £457, leaving a deficiency of £863. It was reported that the debtor was originally employed by a firm of electrical engineers, but started trading in partnership many years ago at Lord Street, Southport. In 1902 the partner retired, but the debtor was then joined by another. The second partner died about fifteen years ago, and since that time the debtor had traded alone at various addresses. During the twelve months to June 30th, 1922, the sales were £3,797, but there was a net loss of £329. The following year the turnover fell to £3,015, but there was a net profit on the trading of £64. In the succeeding twelve months the sales still further declined to £2,568, with a net loss of £106. During the year to June 30th last the sales increased to £3,020, with a net profit of between £300 and £400. Since June 30th, 1925, the sales had been £1,416, with a net loss of £140. A resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. Bond, of Messrs. Davies & Crane, of Southport, as trustee, together with a committee of three of the largest creditors. The following are creditors :—

	£		£
Electric Lamp Factors, Ltd.	... 210	Rowe Bros. & Co., Ltd. ...	... 73
General Electric Co., Ltd.	... 45	Ward & Goldstone, Ltd. ...	... 29

F. C. Brown (Electricity), Ltd., Union Street, Coventry.—A meeting of creditors was held recently, when a statement of affairs was presented which showed liabilities of £1,440, and net assets of £589, leaving a deficiency of £851. An offer of a composition of 2s. in the £ was submitted, it being stated that there were hopes of the business being carried on successfully. After some discussion the amount was increased to 2s. 6d. in the £, payable on August 1st next, and guaranteed; this was accepted.

For Sale.—Motherwell and Wishaw Burgh Council Electricity Department invites offers for one Willans-Siemens 1,100-kW d.c. turbo-generator with surface condenser, &c., four Willans 500-kW generating sets with condensers and auxiliaries, three B. & W. boilers with grate stokers, induced draught fan, economiser, &c. Messrs. Veryard & Yates will sell by auction on March 16th and following days at the British Empire Exhibition, Wembley, large quantiites of electrical cable and equipment, generating sets, motors, electric lamps, switchboards, &c. Walthamstow Urban District Council Electricity Department has for disposal two Belliss and Morcom triple expansion engines, direct coupled to Siemens Bros. & Co. generators, complete with air and circulating pumps. Dundee Corporation Electricity Department invite offers for two 2,000-kW Willans-Parsons steam turbines, coupled to Dick Kerr 3-phase alternators, with condensers and air pumps. Messrs. Jackson & Greenen, of 5, Yelverton Road, Bournemouth, have for disposal a complete electric light generating plant now in use at the Haven Hotel, Bournemouth. (See our advertisement pages to-day.)

Merchandise Marks.—The Merchandise Marks (Imported Goods) Bill has been printed and copies can be obtained at H.M. Stationery Office. It provides for the constitution of standing committees which will consider and report from time to time whether goods shall be required to bear an indication of origin at the time of importation and if an Order in Council ought to be made, and will recommend in what form and manner the indication of origin should be applied to the goods. An Order in Council may provide that imported goods so specified, if they cannot bear a mark of origin, shall not be sold or exposed for sale in the United Kingdom unless they are distinguished from similar goods of United Kingdom manufacture by some form of distinctive colouring or other variation in their make-up.

Swiss Foreign Electrical Trade.—An article upon Swiss foreign trade during 1925, from the British Legation at Berne, appeared in the *Board of Trade Journal* for March 4th. In this it is stated that the increase in the German Customs tariffs affected a number of important Swiss industries, including electrical apparatus, although the burden was somewhat lightened by a provisional agreement signed in December last. Negotiations are proceeding for a definite commercial treaty between Switzerland and Germany. The imports of apparatus during 1925 comprised electrical material, automatic telephones, and radio sets. Large purchases of vacuum cleaners were also made. The exports of dynamo-electric machinery rose from 6,222 tons to 7,558 tons, continuing a steady upward trend.

New Jugo-Slavian Insulator Works.—The *Gazette de Prague* states that a Jugo-Slav company has been granted permission to construct in Jugo-Slavia a factory for the production of porcelain insulators. The national administrations of Jugo-Slavia themselves absorb every year porcelain insulators to a large value. Moreover, the requirements of the Jugo-Slav market are bound to increase since the Government proposes actively to push forward the extension of the national telephone and telegraph systems. It appears that Germany is interested in the establishment of this factory.—*Reuter's Trade Service* (Prague).

Australian Tariffs.—The Sydney correspondent of *The Times* reports that the Prime Minister, Mr. Bruce, in reply to inquiries concerning the working of the Tariff Board, the appointment of which was announced last September (when the new Tariff Act was passed by the Federal Parliament), says that the work of the Board has been proceeding for many weeks. Some British manufacturers wanted a three months' adjournment of the Board, in order to consider the proposed increased duties. This period Mr. Bruce considered excessive, but he was prepared to grant manufacturers a reasonable time in which to formulate their views as to the new duties.

Book Notices.—" Principles of Electric Power Transmission and Distribution," by L. F. Woodruff. Pp. v+340; pp. 110. London: Chapman & Hall, Ltd. Price 20s. net.

" Pitman's Electrical Educator."—Among the additional subjects to be found in parts 10 to 13 of this work are " Historical Development of the Dynamo," by W. Cramp, D.Sc.; " Heat and Heat Engines," by M. E. J. Gheury de Bray; and " Electrical Welding," by E. Arthur Atkins, M.I.Mech.E. The series of articles on the " History of the Electrical Industry " is continued.

" House Wiring." By George A. Willoughby, B.Sc. Pp. xi + 219, figs. 209. London: Chapman & Hall, Ltd. Price, 10s. net.—This book deals fully with the knob-and-tube systems of installation work practised in America and Canada, but not to any great extent in this country. The system is a modification of the porcelain cleat methods; the wires are suspended on knobs on cleats and run in porcelain tubes through the walls, &c. The various cables and accessories used under the system are fully described.

" The Turbine Pump: What it is and what it does."—This useful little booklet, issued by the Pulsometer Engineering Co., Ltd., deals in a novel way with the construction and operation of the turbine pump. The information is arranged in the form of questions and answers, into which some interesting technical problems of speed, power, &c., are introduced.

" Radio Press Year Book," 1926. Pp. xxxv+169; illustrated. London: Radio Press, Ltd. Price 1s. 6d. net.—The collection of useful data and articles by representative authorities in this work of reference will appeal alike to the beginner and the more advanced experimenter. In the valve section is to be found up-to-date information about the various types to employ for different purposes, in addition to a large selection of characteristic curves. The calculations portion of the book has been written in simple language to facilitate the design of coils and condensers and the calculation of resistance, &c.; valuable hints are to be found in the workshop section, and other features are lists of amateurs' call signs, wireless societies, &c.

" Year Book and Directory of the South African Mining and Engineering Journal for 1926." London: Argus South African Newspapers, Ltd. Price 10s. 6d.; postage 1s. 6d. extra.

" The Red Club," by H. R. Taunton. Pp. 282. London: Hurst & Blackett. Price 7s. 6d. net.

Conditions in the Austrian Engineering Industry.—No change has taken place in the situation of the Austrian engineering works. German and Czecho-Slovak competition has been extremely keen in export business, but the commercial treaties concluded have been of special benefit to this branch of industrial production. The electrical industry is also in a very favourable situation. The " strong current " section in the first place has received a great impetus from the development of Austrian water power, the electrification of Austrian railways and the extension of the telephone system, although the capacity of the industry does not yet appear to be fully utilised. In the " weak current " industry production conditions are less favourable, principally owing to the fact that export business leaves much to be desired.—*Reuter's Trade Service* (Essen).

A Bootle Wiring Contract: Disclaimer.—Messrs. James Scott & Co., Knowsley Electrical Works, Brasenose Road, Bootle, ask us to state, in order to prevent confusion, that they are in no way connected with the Knowsley Electrical Co., Ltd., the contractors for the electrical installation at the Cleaver Sanatorium, Heswall, of the West Derby Board of Guardians.

A committee of the Guardians which investigated the matter of the contract recommended the Board to " place on record their disgust that cable and tubing inferior to quality specified should have been so extensively and deliberately employed upon the job, and that the name of the Knowsley Electrical Co., Ltd., be entered in the record of unsatisfactory contractors." The company is to make full replacements of the material referred to. In the course of a discussion by the Board of Guardians, Mr. James Maguire, vice-chairman of the Engineering Committee, who discovered the discrepancies, said that the material put in only cost £5 10s. per 1,000 yards, whereas that stipulated for in the contract was priced at £12 3s. It was a disgrace and a danger to put in tubing which resembled salmon tins. By 28 votes to 22 it was resolved to apply to the Ministry of Health for a judicial inquiry to be held into the contract

The contract was for the installation of electric lighting, telephones, motors, wiring, &c., at the Cleaver Sanatorium at £1,098 2s., and the tender was the lowest of nine received. The order was given out on September 10th, 1925. On January 8th, 1926, the architect wrote to the contractors condemning all non-association cable and requiring re-wiring with cable as per contract. The contractors replied undertaking to carry out the architect's requirements. A detailed report of the whole matter will be found in the *Bootle Times* for March 5th.

New Municipal Showroom. — The Lincoln City Council has decided to erect a new showroom for the Electricity Department.

Local Exhibitions.—Bacup.—At a meeting of the Town Council, on March 4th, Councillor J. Ireland, J.P., chairman of the Electricity Committee, stated that the recent Electrical Exhibition had been productive of good, the direct result being a much larger demand for current. So rapid had been the progress made that an extension of mains and services had had to be considered and provision made for the expenditure of £13,000 on this work alone during the next two or three years.

Bradford.—An Ideal Homes Exhibition at Belle Vue Drill Hall, Bradford, was opened on March 3rd by Alderman Wilfred Turner (Deputy Lord Mayor). The Bradford Corporation Electricity department had three attractive stands, at which daily demonstrations were given in electric cooking, washing, ironing, and cleaning.

Municipal Trading in Australia.—Parallel with the campaign which is being carried on in this country against electrical trading by municipal authorities, there is a similar movement afoot in Australia. The Sydney City Council recently decided to open showrooms for the exhibition and sale of electrical appliances. The Electrical Employers' Association has issued a pronouncement against this, characterising the Council's action as a gross act of repudiation of the recently-formed Electrical Development Association of New South Wales, whose formation was encouraged and assisted by the Council. The Association was formed by the electrical traders, principally, and financed by them to conduct a big educational campaign on behalf of electrical development and guarantees of £9,000 per annum for three years were obtained; the City Council agreed to contribute a sum not exceeding £4,000 per annum and the City Electrical Engineer (Mr. Forbes Mackay) was one of the first executive members. Then, it is said, the Council suddenly discovered that it had no legal power to allocate funds to the Association, and finally decided to drop the scheme and instead become a trading institution itself. No explanation was received in reply to the Electrical Employers' Association's protest. Thus the Council has become a direct competitor with every retailer within a 15-mile radius from the centre of the city, and "proposes to jeopardise the livelihood of men who have spent half their lives building up businesses; who have done their utmost to help the city sell electric current, and who have expressed themselves willing to combine their own interests with those of the Council to the extent of spending some thousands of pounds per year in increasing the use of the Council's current." It is stated that politically-controlled state and municipal enterprises are "almost invariably" inefficient and the announcement quotes the case of the London boroughs as examples of the bad results of municipal electrical trading (before the war), saying that Battersea, Bermondsey, Fulham, Southwark and Woolwich all made heavy losses. Another statement made is that "the average rates in the pound of the 14 Metropolitan boroughs not trading in electrical supplies were approximately, on an average, tenpence in the pound (equal to nearly £750,000) less than those of fourteen boroughs dealing in electrical supply. From this, it is obvious that when municipal trading fails, the burden of the loss falls on the whole of the ratepayers; when private enterprise fails, nobody suffers but the trader." The Association, in conclusion, calls upon trade organisations and ratepayers to "voice an emphatic protest."

The German Insulated Wire Industry.—Since the end of November, it is stated, business in the insulated wire industry in Germany has been almost at a standstill. Usually the season lasts from October to March, but for the past two months the demand has considerably declined. A number of Rhenish works has already been compelled to introduce restrictions in working and discharge workmen. Most producers, however, are less affected by the crisis as the manufacture of insulated wires only forms a small part of their output. The unfavourable course of business is attributed chiefly to the slackness in building operations and the scarcity of capital on the part of the installation firms; and a revival in the demand is scarcely expected from the recent reduction of 10 per cent. in prices.

English Plant for British Columbia.—The British Trade Commissioner at Vancouver (Mr. L. B. Beale) informs the Department of Overseas Trade that the laboratories of the mechanical and electrical engineering departments of the University of British Columbia, under the administration of Dean R. W. Brock, Faculty of Applied Science, and Dr. H. Vickers, Professor of Electrical and Mechanical Engineering, are now nearing completion with regard to equipment. It is interesting to note that practically all the equipment thus far installed is of British make. The following items, all of British manufacture, have already been installed, or are on order for installation:—A 50-b.h.p. Diesel engine, a 50-b.h.p. Froude brake, a 10-kW De Laval steam turbine and dynamo, a 12-h.p. "National" gas engine, an 11-h.p. "Crossley" oil engine, a 3-ton refrigerating plant, a 250-kVA alternator, a 250-b.h.p. compound engine in the power house, a 50-h.p. marine engine, two d.c. level-compound generators, a 3-phase rotary converter with transformer and starter, an induction motor, an oscillograph, an a.c. potentiometer, a d.c. potentiometer, galvanometers, condensers, resistances and other standard equipment, electrostatic voltmeters, four transformers, iron testing equipment, a 350-Ah, 220-V storage battery, a h.p. switch panel, instruments and current transformers, samples of cables, &c. A large number of British text books replacing American text books have also been purchased.

A Finger in the Pie.—Under the heading, "Just cut yourself a piece of pie—there's plenty left," *Electrical Merchandising* depicts a number of pies, each of which represents a class of electrical appliances. Out of each of these pies a wedge has been taken showing the proportion of wired homes which have been equipped with the appliance in question. Over each pie in large red figures is stated the proportion of these homes still without the appliance named For instance, it is shown that the electric iron "pie" has been consumed to the extent of 71 per cent., leaving only 29 per cent. available. On the other hand, hardly any inroad has been made in the case of refrigerators and dishwashers, ½ and ¾ per cent., respectively. It is surprising to learn that only 3 per cent. of the wired homes have electric ranges—although this means that there are about 435,000 in use. Heaters are in use to the extent of 10 per cent.; washers represent 21 per cent.; fans, 19 per cent.; percolators, 13 per cent.; vacuum cleaners, 31 per cent.; and toasters, 23 per cent.

Public Lighting Exhibition.—In connection with the annual meeting and conference of the Institution of Public Lighting Engineers at Newcastle-on-Tyne, it is proposed to hold an exhibition of up-to-date lighting appliances (both gas and electrical) from September 14th to 16th. Firms desirous of exhibiting should apply at once to Mr. R. Davison (President-elect), Public Lighting Superintendent, Corporation Lighting Department, Blagdon Street, Newcastle-upon-Tyne, stating the amount of space required and if electricity or gas will be needed in connection with their exhibits.

New French Companies.—Among the new companies recently formed in France are the Société d'Electricité de Danze, organised at Danze (Loire et Cher Department) with a capital of 100,000 fr., to establish an electricity distribution system in the town, and the Société de Regularisation des Forces Motrices de la Ville de Romanche formed in Grenoble with a capital of six million francs to establish another hydro-electric station on the River Romanche at Chambon (Isère).

Austrian Loan in Switzerland.—The A.E.G.-Union Electricitats Gesellschaft is reported to have concluded arrangements with a Swiss bank for the floating of a loan of seven million Swiss francs (about £280,000), repayable in 25 years.

A Swedish Company's Report.—The directors of the Allmanna Svenska Elektriska A.B. have now issued their report for 1925, which, as was mentioned previously, shows larger net profits and an increase in the rate of the dividend from 2½ per cent. in 1924 to 4 per cent. last year. According to the report, the turnover, both in the home and export markets, experienced an augmentation, although no improvement took place in prices. It was possible to reduce the costs of production as a result of the introduction of improvements in construction and simplifying the methods of working. Extensions of the workshops were carried out in order to meet the demand for still larger generators for hydro-electric works, and these additions, it is stated, will permit the company to produce such sizes of machines as are likely to be required for some years. The laboratory at Vasteras was transferred to more appropriate premises, and was provided with modern equipment. The stock of orders on hand at the end of 1925 was somewhat greater than the corresponding figures a year ago. Among the orders carried out during the year the report mentions the delivery of 43 out of the 50 electric locomotives ordered for the Stockholm-Gothenburg railway, besides motor generators and instruments for the transformer stations. The turnover in the mechanical department also showed an increase. At the end of 1925 the number of persons employed at the works and offices in Sweden was 6,403. The share capital amounts to 75,000,000 kr., and the financial position of the company is stated to have improved during the year.

Chinese Notes.—It is reported that the Chinese Eastern Railway has decided to install 13 power stations in towns upon its system during the next three years. The cost of the entire scheme is estimated at $469,000. In the first year stations will be erected at Anta and Suifeng.

Four companies are now operating electric lighting plants in Pinghu, Chekiang province, *viz.*:—The Ming Hwa Electric Light Co., the Sheng Chia Co., the Chapoo Co., and the Hsin Chi Co.

Long-distance telephone services have been commenced between Kweihwa, Sunyuanhsien, Paotowchen, and Wuyuan; and between Shanghai and Wusih, Kiangsu Province.

The Wuchow Electric Power Co. (Kwangsi Province), hitherto a private concern, has become a joint Government and private enterprise. A sum of $500,000 has been voted for the capital of the company from provincial funds.

Spanish Duty on Radio Valves.—Radio valves which, for import duty purposes, were formerly embodied in the section "incandescent electric bulbs," have now been given a separate heading in the Spanish Customs tariff. The duty is to be 156 pesetas (gold) per kg. net under the first tariff and 52 pesetas under the second.

A Czecho-Slovakian Amalgamation.—An amalgamation of the businesses of Siemens & Co., of Pressburg, and the Muglitzer Electricitäts Gesellschaft, of Muglitz, has recently been effected. The Pressburg works are to be devoted to the production of large electrical plant and those at Muglitz to small dynamos and motors and electrical apparatus.

The Rumanian Electrical Industry.—The Mid-February "Review of Central Europe," issued by the Anglo-Austrian Bank, Ltd., states that a number of Rumanian industries found it difficult to obtain funds during 1925 and had to have recourse to the National Credit Institution. Among these was the electrical industry, which applied for a grant of 244 million lei and received 101 millions.

New Portuguese Import Duties.—The *Diario do Governo* for January 27th contains a decree which raises a new heading in the Portuguese Customs Tariff for "complete installations for telephone exchanges," the duties being 3 centavos per kg. under the "maximum" tariff, and 1 centavo per kg. under the "minimum" tariff. This new heading is not regarded as covering accumulators, dynamos, or motors and their respective switchboards.—*Board of Trade Journal.*

Employment, Wages, and the Cost of Living.—A special supplement was issued with the February *Ministry of Labour Gazette* containing graphic details of wages in Great Britain and Northern Ireland, 1920 25; the comparative levels of real wages in the leading industrial countries; the aggregate duration of industrial disputes from 1900 to 1925; changes in food prices and cost of living, 1900-1925; unemployment from 1900 to 1925; a comparison of international unemployment, 1920-25; trade union membership, 1900-1925, &c. Each curve and diagram is of absorbing interest to the student of economic affairs, and the method of presentation causes many salient facts to become apparent at a glance. It is seen, for instance, that, gauged by the percentage of trade union members out of work, unemployment in 1924 fell below the 1908 level and was not a great deal higher in 1925. This same curve also illustrates the operation of the trade cycle, although the war period caused abnormal developments. The curves illustrating international unemployment show, generally speaking, a common tendency in each year; also that Great Britain was not afflicted with such violent fluctuations as a number of other nations. The "real wages" diagram (as at October 1st, 1925) shows that superior conditions existed in Philadelphia, Ottawa and Sydney. London and Oslo were about level. Real wages in Berlin were higher than in five other Continental capitals, the lowest being Lisbon. Paris, for some reason, is not included. The first curve shows that wages in Great Britain and Northern Ireland have remained practically unchanged, in the aggregate, for the past three years after a steep descent from the 1920 level.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. and Messrs. James & Shakespeare report, March 9th: No change in copper prices.

Messrs. James & Shakespeare report, March 9th: English pig lead, £33, 10s. dec.

Messrs. Edward Till & Co. report, March 9th: India rubber, Para fine, 2s. 1½d., 2½d. dec.

Swiss Glow Lamp Prices.—The glow lamp factories in Switzerland, which stand in a syndicate relationship with the other makers in Europe and the United States, brought into operation on February 9th a new list of prices, showing increases in some cases. Under the new regulation, lamps of low pressure (110 volts) have been placed on the same level as those for 220 volts.

Fire.—A fire occurred last week at the Anaconda Works, Salford, of Messrs. Frederick Smith & Co., wire manufacturers, and considerable damage was caused.

Vienna Telephone Cable Contracts.—Orders for the extension of the Budapest-Vienna telephone cable are reported to have been placed with a syndicate composed of the Felten and Guilleaume Company, the Siemens-Schuckert Company, and the Ver. Gluhlampenfabrik.

Lighting and Power Notes.

Accrington.—New Sub-Stations.—The Corporation Electricity Committee is considering the erection of three sub-stations.

Loan.—Application is being made for sanction to borrow £50,000 for mains required during the next four years.

Barking Town.—Loans.—Application is being made by the Electricity Committee for sanction to loans of £1,500 for mains extensions, and £2,250 for a l.p. feeder.

Bath.—Mains Extensions.—The Electric Lighting Committee has recommended the Town Council to extend the mains to Batheaston, Bathampton, and Bathford, at an estimated cost of £28,935.

Beckenham.—Electricity Extensions.—The Electricity Committee has prepared a scheme for the extension of h.p. feeders at a cost of £32,000.

Loan Sanctioned.—The Committee has received sanction to a loan of £10,000 for mains and services.

Birmingham.—Loans Sanctioned.—The Electricity Committee has obtained sanction to the borrowing of £11,000 for building alterations, £20,480 for cooling towers, £14,000 for plant, and £24,500 for sub-stations.

Blackpool.—Loan Sanctioned.—The Corporation has received sanction to the borrowing of £49,000 for mains and services.

Bolton.—New Plant.—The Electricity Committee has decided, on the recommendation of the borough electrical engineer, to install two additional boilers, complete with economisers, stokers, and accessory plant, at Back-o'-the-Bank station.

Electricity Extensions.—The Electricity Committee has decided to strengthen the e.h.p. cable system at a cost of £21,000, to provide additional switchgear at Spa Road sub-station at a cost of £9,000, and to install additional transforming plant at a cost of £4,300.

Bridport.—Electricity Scheme.—The Town Council proposes to introduce an electricity supply for the town, and application is being made for an Order to proceed with the scheme. The capital cost of the plant is estimated at £14,000 and a further sum of £800 will be required for the laying of a cable for the lighting of about 100 street lamps. It is estimated that at the end of three years further plant costing £3,000 will be required. The proposed charges for electricity are 10d. per kWh for lighting and 3d. per kWh for power. Mr. T. Hood, of Bristol, has been engaged as engineer to carry out the scheme.

Continental.—Portugal.—According to the annual report of the British Chamber of Commerce in Portugal, the water power available in the country amounts to 500,000 h.p., of which only 16,000 h.p. is utilised at present.

Belgium.—Of a total of 345 communes in the province of Brabant, 237 are now supplied with electricity. With regard to the remaining 108 communes, as the work of providing a distribution system is not sufficiently attractive to private enterprise, it is to be undertaken by the provincial authorities, who have provided a sum of 500,000 fr. for the purpose in their 1926 Budget.

France.—La Société des Forces Motrices du Vercors has secured a concession to establish a hydro-electric station to utilise two waterfalls on the river Lyonne, in the Department of Drome.

Germany.—A feature of the extension of the electricity distribution in the Rheinland district of Germany is the increasing use of lignite as the fuel for the boilers. It is reported that out of 1,797 million kWh supplied in the district in 1921, 40 per cent. was generated by coal, 49 per cent. by lignite, 9.5 per cent. by gas, and 1.5 per cent. by water. Last year the output amounted to 2,462 million kWh, and of this the proportion generated by lignite had increased to 54.7 per cent., while coal-using stations had dropped to 30.5 per cent. Those using gas as fuel had increased to 12.8 per cent., and hydro-electric stations to 2 per cent. The principal power stations in the area using lignite as fuel are the Goldenberg, the Fortuna I (40,000 kW), and the Fortuna II (80,000 kW).

Chile.—Valparaiso.—The Municipality of Valparaiso is considering a project for a new water supply system, which will also include plans for a hydro-electric plant to furnish an electricity supply to the towns along the route of an aqueduct leading from the Andean mountains to the city. Several favourable sites for the erection of the hydro-electric generating station have been found, and it is anticipated that approximately 40,000 kW will be available.—*Reuter's Trade Service* (Valparaiso).

Dereham.—Inquiry.—An inquiry into the application of the Urban District Council for authority to distribute electricity in its area was held by Mr. J. A. Lee, of the Electricity Commission, on February 25th. Mr. W. R. May, electrical engineer to Lowestoft Corporation, in outlining the scheme, said the estimated capital expenditure was £7,600, and the revenue was estimated at £1,350 per annum with working costs at £900. Mr. W. R. Long, Norwich city electrical engineer, said his Corporation proposed to carry its supply as far as Wymondham, and the capital charge for extending the main to Dereham would be approximately £600 per annum. The charge per kW would not exceed £5, and the "unit" charge would be about ¾d. Objections were raised by agricultural owners and occupiers on the ground that the scheme would be a burden upon the rates. The Commissioners will give their decision in due course.

Irish Free State.—Limerick.—At a recent meeting of the Electric Lighting Committee, the report of the electrical engineer on the subject of the proposed extension of the electric lighting scheme was considered, and it was decided to adjourn the question pending a further report on the matter. The estimated cost of the extension is £20,000.

Liverpool.—Loans.—The Electric Power and Lighting Committee is making application for sanction to the borrowing of the following sums for the provision of mains and services for the supply of electricity to houses in course of erection:—Walton-Clubmoor Housing Estate, £7,800; Knotty Ash Housing Estate, £6,052. Extensions of h.p. mains are to be carried out at an estimated cost of £600, and the equipment of a sub-station at a cost of £2,000 in connection with the Mersey tunnel works.

London. — Southwark.—*Electricity Supply.*—The Electricity Committee has recommended a scheme of extensions in preference to arranging for a bulk supply, and is making representation to the Electricity Commissioners accordingly.

Manchester.—Progress during January.—During the month of January, the Corporation electricity undertaking showed an increase in connections of 2,114 kW, bringing the total to 277,320 kW; and the number of applications received for supply, including existing consumers for additional supplies, was 811, representing a total of 1,645 kW. The number of hired cookers connected increased by 54, bringing the total actually on circuit to 1,307. Applications for the hire of cookers totalled 71. 500-kVA transformers were put into commission at the Lumb Mill, Droylsden, and Burnage sub-stations, one of 250-kVA at Messrs. J. Hetherington & Sons' Works, and one of 100-kVA at Droylsden.

Loan Sanctioned.—The Electricity Committee has received sanction to a loan of £120,000 for sub-station equipment.

Mansfield.—Committee of Inquiry.—As briefly reported in our last issue, a special committee has been appointed "to make a full investigation into the affairs of the electricity undertaking." During a debate upon the matter at a meeting of the Town Council, as reported in the *Mansfield and North Notts. Advertiser*, a number of matters were mentioned. The department was criticised for an alleged delay in the opening of a new showroom; for changing over to a bulk supply and "scrapping" the generating plant; for laying cables which had lain idle for a long period; for the high price of energy; and for the low voltage in a certain district. One of the major criticisms related to contracts for the laying of cables. It was stated that a company had charged 4s. a yard for laying cables for a period of 10 years. Upon a recent occasion tenders were invited and one was accepted for 1s. 10½d. per yard. The mover of the resolution considered that the disparity between the prices should be investigated.

Moray.—Electricity Supply.—The exclusion of the North of Scotland from the Government's electricity scheme was recently discussed by the County Council, and it was decided to join Banff and Inverness in pressing for the extension of an electricity supply to the area north of Aberdeen.

Palestine.—Rutenberg Concession.—According to the Jerusalem correspondent of the *Daily Express*, the five years' negotiations over the Rutenberg scheme were completed on March 5th, when Lord Plumer, the High Commissioner, signed a £2,000,000 concession for the utilisation of the 600-ft. waterfall on the River Jordan for the generation of electricity and the irrigation of the Jordan basin. The original agreement, which was concluded in 1921, expired in 1923. Mr. Rutenberg then began negotiations with the Colonial Office and the High Commissioner for the renewal of the agreement. This has involved important changes, including the extension of the concessionnaire's rights in Transjordania.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

London.—*St. James' & Pall Mall Electric Light Co., Ltd.*—Lighting: First 4,000 kWh per annum, 5d. per kWh; all energy in excess of this amount, 4d. per kWh; minimum charge of 10s. per quarter. Power: A fixed quarterly charge of 7s. 6d. per rated h.p. and 1d. per kWh for electricity consumed. Heating: 1d. per kWh.

Reigate.—Lighting: From 7d. to 6½d. per kWh. Power, heating and cooking: From 2½d. to 2d. per kWh.

Carlisle.—The percentage increase on the pre-war rates for lighting from 60 to 45 per cent.

Winchester.—Cooking, heating, and other domestic purposes during the spring and summer months: From 1¾d. to 1d. per kWh.

Ripon.—Electricity Supply.—At a recent meeting of the Electricity Committee a letter was received from the Electrical Distribution of Yorkshire, Ltd., stating that it proposed applying for a Special Order authorising it to distribute electricity in Ripon in conjunction with a scheme for the supply of electricity in neighbouring districts. The Committee decided to recommend the Corporation to proceed forthwith with an application for an Order empowering the Corporation (or any undertakers to whom it may lease such powers) to supply and distribute electricity within the city and adjoining parishes.

Sheffield.—Mains Extensions.—The Electric Supply Committee has during the past month approved extensions of mains for general distribution purposes, at an estimated cost of £22,518.

South Africa.—Linking-up Scheme.—The *African World* reports that the Cape, Durban, and Rand electricity supply systems will be the starting points for a system of interconnected power stations throughout South Africa. According to Dr. Van der Bijl, chairman of the Electricity Supply Commission, important developments are projected for supplying power to the Valley as far as Worcester, and large extensions are contemplated for Durban which will ultimately link up with the Colenso power station.

South Kirkby.—Electricity Scheme.—The Carlton Main Colliery Co. is preparing a scheme for supplying South Kirkby with electricity, and is considering the possibility of furnishing a supply to the parishes of Great Houghton and Shafton.

Special Orders.—Application has been made to the Electricity Commissioners for Special Orders by the following authorities:—The Auckland Rural District Council for the supply of electricity in the township of Witton-le-Wear, and authorising the Council to purchase electricity in bulk; Stepney Borough Council for the purchase of land and the erection of a transformer station; the Yarmouth (Isle of Wight) Electricity Supply Co., Ltd., for the supply of electricity in certain parts of the rural district of the Isle of Wight.

Stockton-on-Tees.—Loan Sanctioned.—The Town Council has received sanction to a loan of £5,000 for installing electricity in private houses on the instalment system.

Stoke.—Electricity Extensions.—The Electricity Committee has decided to lay a main at a cost of £1,000 in connection with the supply of electricity to the new telephone exchange in Scotia Road, Burslem.

The electrical engineer has reported upon additions to the distributing system which will be necessary to maintain a satisfactory supply to Tunstall, and has submitted a scheme involving an expenditure of £9,500. A site has been obtained in the Tunstall area for the erection of a sub-station. The committee has obtained sanction to a loan of £11,500 for mains and sub-station equipment.

United States.—Electrical Development.—According to *Power*, the total annual output of electricity by public-utility power plants in 1925 was 65,801,000,000 kWh, an increase of 11.5 per cent. over the output for 1924. Of this quantity, about 34 per cent. was produced by the use of water power, a slight increase over the percentage for 1924. The gain in efficiency in the use of fuel continued in 1925, there being a decrease of about 0.1 lb. in the average consumption of coal per kWh, as compared with the rate of 1924.

West Ham.—Electricity in Bulk.—The Town Council has applied for a Special Order authorising it to supply electricity in bulk to East Ham and Ilford.

Worcester.—Electricity Extensions.—The Corporation Electricity Committee has recommended to the Council that the following works be carried out:—Sub-station in Queen Street, £2,500. Foundations, platforms, alterations and extensions to the circulating water piping and cable work in connection with the turbo-alternator, £4,742. Excavations and building work for the completion of boilers, dampers, steel chimney, steam pipes, and pulverised fuel milling plant, £13,000.

York.—Loan Sanctioned.—The Electricity Committee has received sanction to a loan of £15,000 for feeder cables.

Tramway and Railway Notes.

Continental.—France.—Plans have been prepared for the electrification of the steam-operated local lines of the Société des Voies Ferrées des Landes (about 200 miles), and of the Compagnie des Tramways à Vapeur de la Chalosse et du Bearn (about 90 miles) in the Department of Landes. It is proposed that a rural electricity supply system shall be included in the scheme and to this end that the masts carrying the 1,500-V line for railway traction purposes shall also carry a 10,000 or 20,000-V three-phase line to feed transformer sub-stations in the various communes on the route traversed.

Belgium.—The 1926 Budget of the Belgian Ministry of Railways and Electricity includes a sum of 1,200,000 fr. for the installation of electric lighting in the German railway carriages running on the Belgian State railways and a sum of 14 million fr. for the extension of the electric lighting and power installations at all the principal railway stations on the system.

Portugal.—A concession has been granted by the Municipality of Lisbon to a group of Spanish financiers for the construction of a metropolitan underground railway, the plans for which have been drawn up by Spanish engineers. The enterprise includes the construction of eight lines. Vignole rails, 18 metres in length, will be used, and the lines will have a gauge of 1.44 metres. The total cost of the scheme is estimated at 128,000,000 pesetas.—*Reuter's Trade Service* (Lisbon).

Switzerland.—The first section of the Lausanne-Berne railway to be electrified is that between Lausanne and Palezieux, on which electric trains are now running. The necessary power is being supplied from the Puidoux transformer station where two 5,000-kVA, 60,000/15,000-V transformers are installed.

Bavaria.—According to *Modern Transport* the Munich administration of the Reichs Railways has issued the details relative to the electrification of the railways in Bavaria. The following lines were completed and included in the electrical service during 1925: Munich-Garmisch, Tutzing-Kochel, Munich-Herrsching; Weilheim-Peissenberg, and Munich-Landshut, increasing the system under electrification by 172¾ miles. It is proposed during the present year to finish the work on the Landshut-Regensburg line and push forward the conversion of the Munich-Kufstein track in order that a portion may be working before the end of the year.

Huddersfield.—Omnibus Dispute.—There has been a dispute between the Corporation, on behalf of the borough tramways and a motor 'bus company, with regard to rights of running passenger motor 'buses on the Bradley, Ravensthorpe and Dewsbury route, and an inquiry into the respective applications for running powers was held by the Ministry of Transport recently. The Corporation claimed exclusive rights, but the Ministry has now intimated that both concerns have equal rights, and an Order has been made accordingly.

Irish Free State.—Dublin.—A proposal has been made that when the extension of the Dublin United (Electric) Tramway Co.'s lines to Lucan is commenced, a clause should be included in the Parliamentary Act for extension to Leixlip. This would give a direct route to the central portion of Dublin, covering, in the main, the route of the old Lucan-Dublin Electric Railway recently closed down. The proposal has been supported by a memorial to the Tramways Company from the inhabitants of the Leixlip district. Meantime the Extension Bill is being delayed by the attitude of some of the Dublin townships which have not given their consent to the extension of the period of optional purchase by public authorities of the tramway system as arranged between the company and the City Commissioners.

London.—Waterloo Station Reconstruction.—In view of the heavy traffic which will have to be dealt with at Waterloo tube station in the future, considerable improvements are to be made to provide for the free and rapid movement of the traffic. Contracts have been placed, and work is now in hand. Three escalators of the comb type will supplement the existing lifts. The work at the lower landing of the escalators will include the construction of new footbridges, passages and staircases leading to the new Waterloo station of the Hampstead railway, and connections to the existing passages leading to the Waterloo station of the Bakerloo railway. At the upper level of the escalators there will be a booking hall 52 ft. wide which will be provided with passimeters.

Nottingham.—New Depot.—The Town Council has approved a scheme for the erection of a new central depôt in the Cartergate area for the accommodation of tramcars, 'buses, railless cars, offices; &c., at a cost of approximately £102,000.

Preston.—Tramway Renewals.—The Tramways Committee has recommended to the Town Council the renewal of permanent way at a cost of £4,900, and tramcar renewals at a cost of £3,920.

Sunderland.—Tramway Improvements.—The Corporation is to construct new tramway crossings at the north end of the railway station, and lay a new junction from High Street into Bridge Street, at an estimated cost of £4,500.

Uruguay.—Montevideo.—According to the *Bank of London and South America Monthly Review* there is a scheme on foot to electrify the railway running from Montevideo to the village of Santiago, Vazquez, and preliminary trials have been made, in conjunction with the Compañia de Tranvias La Transatlántica.

Worcester.—Purchase of Undertaking.—A sub-committee has recommended to the City Council that, subject to the approval of the Ministry of Transport, the tramway undertaking of the Worcester Electric Traction Co., Ltd., shall be purchased at a cost of £58,000.

Telegraph and Telephone Notes.

China.—Telephone Agreement.—According to the Shanghai British Chamber of Commerce *Journal*, an agreement has been concluded with the Chinese Government Telephone Administration and the Shanghai Mutual Telephone Co., Ltd., for intercommunication between their respective subscribers.

Hull Telephone Service.—New Sub-station.—The Municipal Telephone Committee has acquired a site in Somerset Road, for the erection of a sub-station.

The Telephone Service.—Street Kiosks.—The erection in London streets of a new type of telephone kiosk is, the Press Association learns, under consideration by the G.P.O. The kiosks are to be a little bigger than the present type, and will include a pillar-box and stamp machine.

Mexico.—Telegraph Service.—The Western Union Telegraph Co. announces that its vice-president, Mr. J. C. Willver, who is in Mexico City, has concluded a contract with the Mexican Government for the introduction of a modern telegraph service in Mexico. According to the *Financial News*, this will mean the ending of the monopolistic system and the opening of a way for other companies. The service will be extended southward through "all America cables." The agreement is subject to the approval of Senor Calles and the boards of the Western Union and Mexican companies.

Transatlantic Telephony.—Two-way Demonstration.—On Sunday afternoon, March 7th, the Post Office Engineering Department successfully demonstrated the possibility of two-way radio-telephony across the Atlantic Ocean, when Press representatives in London and New York were given an opportunity of conversing with each other. By means of a repeater installed within the London Telephone Trunk Exchange the voice is conveyed by land lines to the radio transmitting station at Rugby, whence it is wirelessed across the Atlantic to a receiving station at Houlton, 600 miles distant from New York; thence by land lines it passes through repeater stations to New York City's telephone terminal. The return transmission from America is *via* land lines to Rocky Point, Long Island, 70 miles from New York, then by radio across the ocean to the Wroughton receiving station, near Swindon, and thence by ordinary telephone circuit over 90 miles to London. The wave-length used from this side is 5,770 metres, that from America is 5,260 metres, and the power used at each end is about 200 kW.

Radio Notes.

Broadcasting Committee.—Cabinet Consideration.—The report of the Broadcasting Committee, which is summarised elsewhere in this issue and is now under the consideration of the Postmaster-General, will be brought before the Cabinet immediately with a view to deciding whether legislation should be introduced to give effect to its recommendations. It appears that the new method of controlling broadcasting advocated by the committee has already been accepted by the Government in principle, but while the view has been advanced in some quarters that the new Board of Control could be set up without recourse to a Parliamentary Bill, it is stated in the *Daily Mail* that that view is not shared by Ministers.

Copyright.—B.B.C. Injunction.—The B.B.C., as owners of the copyright of the *Radio Times*, were, on March 4th, in the Chancery Court, granted an injunction, with costs, against the Wireless League Gazette Publishing Co., Ltd., restraining it from publishing wireless programmes taken from the *Radio Times*.

Storm Damage.—Service Interrupted.—A return to winter weather, with high wind, snow, and lightning, was experienced last week. On March 3rd the Daventry station closed down for some minutes from 10.14 p.m., and on the 4th the London station's transmission was temporarily interrupted from 4.30 to 6.30 p.m. on account of the electrical storm. The fault is reported to have been located in the power line, and the old aerial at Marconi House had to be requisitioned for use during the remainder of the evening. The Manchester station also apparently closed down for a time.

Wave-length.—Readjustment.—On March 4th, the Dundee and Liverpool relay stations of the B.B.C. exchanged places in the broadcast wave band. The Dundee station is now working on 315 metres and Liverpool on 331. The effect of this change is to create a greater margin between the two adjacent Scottish stations, Edinburgh (328 metres) and Dundee; also to remove Liverpool farther from the shipping wave-length (300 metres).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—Buenos Aires.—April 12th. Public Works Department. Rock drilling installation, including steam shovel, aerial transporters, 170-h.p. electric generating plant, &c.*

May 3rd. Electric travelling crane, capacity 1½ metric tons.*

Australia.—Brisbane.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company, Boundary Street, Brisbane.

Ayrshire, Kilmarnock.—Ayrshire County Council. Electric lighting work in connection with the housing scheme. Mr. D. R. Sturrock, district clerk, Kilmarnock.

Belfast.—April 3rd. Electricity Department. One 1,000-kW rotary converter, with transformer, l.p., a.c. switchgear, &c. (See this issue.)

Brazil.—Rio Grande do Sul.—April 15th. Port and Bar Management. 10 electrically-operated portal cranes, capacity 2,500 kilos; 2 ditto, 5,000 kilos capacity; and 7 electric winches or capstans.*

Cardiff.—March 22nd. Electricity Department. Grit-collecting plant, 100-kW, 400-V alternator, &c. (March 5th.)

Croydon.—March 17th. Board of Guardians. Six months' supply of electrical fittings and sundries. Forms of tender from the Union Offices, Mayday Road, Thornton Heath.

Dublin.—Dublin City Commissioners. Wiring for electric lighting at 230 houses at Croydon Park and 218 houses at Kehoe Square. City Architect, Lord Edward Street, Dublin.
E.h.p. switchgear and accessories for Pigeon House and Fleet Street stations. City Electrical Engineer, Fleet Street, Dublin.

East Ham.—March 15th. Electric Lighting and Tramways Department. Cable, bifurcating boxes, and joint boxes. (February 26th.)

Edinburgh.—April 12th. Electricity Department. Four water-tube boilers, economisers, and mechanical stokers or alternatively, boilers, economisers, air heaters, and mechanical stokers or boilers, economisers and powdered fuel plant. (See this issue.)
Education Authority. Electrical work at additions to Balgour Place School. Mr. John Stewart, executive officer, Education Offices, Edinburgh.

Egypt.—Cairo.—April 27th. Egyptian Government. 1,100 desk telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.—*Reuter's Trade Service* (Cairo).

Galston.—March 15th. Town Council. Electric lighting installation at 52 houses. Messrs. J. Hay & Steel, architects, Kilmarnock.

Grimsby.—March 29th. Electricity Department. One 2,000-kW converter, one 1,000-kW ditto, l.p. switchgear, cable work, &c. (March 5th.)

Hull.—March 18th. Electricity Department. Static transformers and motor converters. (March 5th.)
Telephones Committee. Supply of lead-covered cable and r.c. wire. (See this issue.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (February 26th.)
March 19th. Inert electric cells, "S" pattern. (March 5th.)
March 24th. 30-line automatic and 10-line manual telephone equipment. (See this issue.)
April 19th. Goods lifts for the Imperial Record Offices at Raisina, Delhi. (A.X. 2,904)*
April 2nd. Cable. (March 5th.)
April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (March 5th.)
April 13th. 23 electric passenger locomotives. (February 26th.)
May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (See this issue.)

Kettering.—March 23rd. Electricity Department. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary-converter equipment, and one steam turbo-boiler feed pump. (February 26th.)

Leyton.—April 9th. Education Committee. Installation of electric lighting and central heating at the Sybourn Street new school. (See this issue.)

London.—London County Council.—March 23rd. Wiring and fittings for electric lighting at St. Paul's Road elementary school, Bow. E. (March 5th.)
Bethnal Green.—March 16th. Board of Guardians. Installation of electric lighting in the office extension at Bishop's Road, N.E., and rewiring of the existing building. (March 5th.)
Metropolitan Asylums Board.—March 24th. Installation of electric lighting at the Southern (Lower) Hospital, Dartford. (March 5th.)
Islington.—March 16th. St. Mary's Board of Guardians. Electrical supplies for six months. Forms of tender from Mr. A. King, Guardians' School, Hornsey Road, N.
March 29th. Borough Council. Two 3½-ton electric refuse-collecting vehicles fitted with steel tipping bodies. (See this issue.)

Manchester. — March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)
March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (February 26th.)
April 6th. 3-phase, 6,600-V, sub-station switchgear. (See this issue.)
Province of East Lancashire. Wiring, &c., Masonic Temple, Manchester. (See this issue.)

Midlothian.—March 15th. Education Authority. Electric light installation at extensions of Fisherrow School, Musselburgh. Mr. A. L. Fletcher, executive officer, County Education Offices, 9, Drumsheugh Gardens, Edinburgh.

Mountain Ash.—March 22nd. Electricity Department. Two 500-kVA transformers. (March 5th.)

Newark-upon-Trent.—March 16th. Electricity Department. Medium and l.p. switchgear and accessories. (February 26th.)

Newcastle-on-Tyne.—March 19th. Board of Guardians. Lighting installation and the installation of a lift at the nurses' home. Specifications from Messrs. Harrison & Ash, 22, Ellison Place, Newcastle-on-Tyne.

Newcastle-under-Lyme.—March 16th. Electricity Supply Department. 2,300 yd. single l.p. cable and 800 yd. single l.p. cable. (March 5th.)

Otley.—March 30th. Wharfedale Isolation Hospital Committee. Electrical installation at the Isolation Hospital, Menston. (March 5th.)

Portsmouth.—March 17th. Board of Guardians. Three months' supply of electrical stores and lamps. Forms of tender from the Guardians' Offices, St. Michael's Road, Portsmouth.
Electricity Supply Department. Erection of a steel-framed turbine house. (February 19th.)

Preston.—March 12th. Electricity Department. Steelwork in connection with foundations for a turbo-generator at Ribble power station. Specifications from Mr. J. A. Robertson, consulting engineer, 20, Brazennose Street, Manchester.

Pentre, Rhondda.—March 27th. Rhondda U.D.C. Electricity Department. 12 months' supply of house-service a.c. ordinary and prepayment meters, cable, joint boxes, compound, cut-outs, &c. (March 5th.)

Rochdale.—March 16th. Gas and Electricity Committee. One 1,250-kW (or alternatively 1,500-kW) rotary-converter equipment, including transformer and switchgear. (February 26th.)

Roxburgh.—March 15th. Electrician's work required in extension of Grammar School. Schedules from Messrs. Reid and Forbes, architects, 7, Ainslie Place, Edinburgh.

South Africa.—Johannesburg.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)
May 6th. Two electric goods lifts.*

Spain.—The Junta de Obras of the Port of Tarragona invites tenders for the supply of two 3-ton electric cranes.—*Reuter's Trade Service* (Madrid).

Sutton Coldfield.—March 24th. Electricity Department. E.h.p. underground mains, distributors, feeder pillars, and network fuse boxes. (March 5th.)

Tynemouth. — March 15. Electricity Department. One 250-kVA transformer. (February 26th.)

Walthamstow.—March 24th. Electricity Department. 12 months' supply of l.p. cables and v.i.r. wires. (See this issue.)
April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (See this issue.)

Warrington.—March 15th. Electricity and Tramways Committee. Motors and transformers. (February 26th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Bath.—Electric Lighting Committee. Recommended:—
Boiler and economiser (£5,963) and mechanical stoker (£1,562).—Babcock and Wilcox, Ltd.
Two sets of 1,000-kVA Scott-connected transformers and two 6,600/11,500-volt, three-phase transformers (£2,466).—Hackbridge Electric Construction Co., Ltd.
Economisers (£1,778).—Green & Sons.

Blackpool.—Tramways Committee. Accepted:—
Supply of electrical equipment for six new saloon cars and six "toast-rack" cars.—British Thomson-Houston Co., Ltd.

Cardiff.—According to the *South Wales Echo*, fourteen tenders were recently received by the Electricity Committee for a supply of low-pressure paper-insulated cables, and discussion arose as to whether the contract should be sent abroad, as the three lowest were from foreign firms—Belgian, Italian and German. After reviewing the whole of the circumstances the committee unanimously recommended the acceptance of the tender of the Belgian firm, the Ateliers de Constructions Electriques de Charleroi at £8,818, which was £2,188 below the lowest British tender.

Chesterfield.—Electricity Committee. Accepted:—
E.h.p. switch cubicle (£105).—British Thomson-Houston Co., Ltd.
2- and 3-core cable (£755).—Standard Telephones & Cables, Ltd.
4-core cable (£565).—Macintosh Cable Co., Ltd.

Doncaster.—Town Council. Accepted:—
L.p. cable (£1,427).—Enfield Cable Works, Ltd.

Faversham.—Town Council. Accepted:—
Cables (£1,100).—W. T. Henley's Telegraph Works Co., Ltd. The tenders received ranged from £1,308 to £814, the two lowest being for cables of foreign manufacture. W. T. Henley's Telegraph Works Co., Ltd., as the result of negotiations, reduced their original tender of £1,193 to £1,100 net.

Forres.—Managers of Leanchoil Hospital. Accepted:—
Installation of electric lighting in hospital (£732).—Claud Hamilton, Ltd.

Glasgow.—Statute Labour Committee. Accepted:—
Electrical installation at Stockwell Street buildings (£1,592).—James Laird & Co.

Tramways Committee. Accepted:—
Cable (v.i.r. and cab tire).—Standard Telephones & Cables, Ltd.
Copper trolley wire.—Thomas Bolton & Sons, Ltd.

Halesowen.—Accepted:—
Installing electric light at the new model factory at Hunnington, for Henry Vincent, Ltd.—Mr. B. French.

Hull.—Telephones Committee.
C.b. table instruments and dials:—

International Electric Co., Ltd.	£749
Sterling Telephone & Electric Co., Ltd.	514
Automatic Telephone Manufacturing Co., Ltd.	514
Standard Telephones & Cables, Ltd	540
Siemens Bros. & Co., Ltd.	515
Peel-Conner Telephone Works. (Accepted.)	**499**

H.m. cords:—

British L. M. Ericsson Mfg. Co., Ltd. (Accepted.)	**81**

Irish Free State.—DUBLIN.—The following contracts were among those placed by the Controller of Stores, Department of Posts and Telegraphs, during the month January 23rd to February 22nd, inclusive:—
Cable suspenders.—Sparton Mfg. Co., Ltd.
Electrical protecting apparatus.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Indicators.—British L.M. Ericsson Mfg. Co., Ltd.; International Electric Works, Ltd.
Insulators.—W. J. Kellie; Harwell, Ltd.; and Litholite Insulators, Ltd.
Telephone keys.—Sterling Telephone & Electric Co., Ltd.
Relays.—Sterling Telephone & Electric Co., Ltd.
Stay rods.—T. W. Lench, Ltd.
Telephone cabinets and receivers.—Siemens Bros. & Co., Ltd.
Telephone mouthpieces.—North British Rubber Co., Ltd.; Siemens Bros. and Co., Ltd.
Zinc rod and strip.—London Zinc Mills, Ltd.
—*Irish Builder and Engineer.*

London.—METROPOLITAN ASYLUMS BOARD.—Works Committee.
Installation of automatic telephones at the Downs Hospital for Children:—

Buchanan & Curwen. (Recommended.)	**£934**
V. G. Middleton & Co., Ltd.	1,020
Riddle & Goddard, Ltd.	1,033
Toy & Winslow	1,075
G. E. Taylor & Co.	1,105
T. Clark & Co., Ltd.	1,200

Electric lighting installation at Southern (Upper) Hospital:

Kershaws	£7,576
Read & Partners, Ltd. (Recommended.)	**7,865**
T. Clarke & Co., Ltd.	8,760
Brightside Foundry & Engineering Co., Ltd.	8,975
Douglas Electric Light & Power Co.	8,987
Coley & Swinnerton, Ltd.	9,450
H. B. Giles	10,221
S. Dixon & Son, Ltd.	10,722
Taylor & Allen, Ltd.	10,790

Electric lighting installation at Joyce Green Hospital:—

Douglas Electric Light & Power Co. (Recommended.) ...	**£9,997**
L. G. Tate & Co., Ltd.	10,800
T. Clarke & Co., Ltd.	11,000
Kershaws	11,418
Read & Partners, Ltd.	11,703
Brightside Foundry & Engineering Co., Ltd.	11,985
Coley & Swinnerton, Ltd.	12,200
Higginbotham & Sons	12,200
S. Dixon & Son, Ltd.	12,408
H. B. Giles	12,704
A. S. Goodwin & Co.	13,700

Fire alarm system at Tooting Bec Hospital:—

Riddle & Goddard, Ltd. (Withdrawn.)	£328
V. G. Middleton & Co., Ltd. (Recommended.)	**397**
T. Clarke & Co., Ltd.	395
Toy & Winslow	415
W. H. Agar	435
G. E. Taylor & Co.	440
Buchanan & Curwen	500

HACKNEY.—Electricity Committee. Recommended:—
Additional stand-by cooler unit and pump (£760).—C. A. Parsons & Co., Ltd.
E.h.p. switchgear for the works sub-station main power house switchboard (£1,037), works sub-station e.h.p. switchboard (£1,050), reactances (£1,162).—A. Reyrolle & Co., Ltd.

HAMMERSMITH.—Electricity Committee. Recommended:—
150 yd. .2 sq. in. 3-core, 250 yd. .5 sq. in. concentric, and 2,000 yd. .25 sq. in. concentric cable (£1,816).—Macintosh Cable Co., Ltd.
Annual Contracts recommended:—
Insulating compound.—Dussek Bitumen Co., Ltd.
L.p. cables.—Macintosh Cable Co., Ltd.
Electrical goods.—Falk, Stadelmann & Co., Ltd.
Insulated wires.—W. Geipel & Co.
Joint boxes, &c.—Sykes & Dyson, Ltd.
Meters.—Chamberlain & Hookham, Ltd.

Norwich.—The Corporation has placed an order with Richard Garrett & Sons, Ltd., for a further eight 3½-ton electric refuse-collecting vehicles.

Oldbury.—Urban Council. Accepted:—
Stand-by motor for the vertical retort plant at the gas works (£71).—Electromotors, Ltd.

Peterborough.—The Town Council has placed with Messrs. Peter Brotherhood, Ltd., of Peterborough, a contract for the supply of electrical machinery for the power station extensions at £28,518. Two Continental tenders, which were about £6,000 less, were rejected.

Ripon.—CORRECTION.—Messrs. Cox-Walkers were successful in securing the contract for the electrical installation for the Board of Guardians (see ELEC. REV., March 5th, p. 380), not Messrs. Cox-Walker & Partners. The two firms are separate concerns.

Salford.—With further reference to the note on page 380 (ELEC. REV., March 5th), the Town Council on Wednesday last week, after a long discussion, accepted the tender of the Nederlandsche Kabelfabriek, of Delft, Holland, for the supply of 4,500 yd. of l.p. cable of varying sizes to British standard specification, at £1,497. Alderman Billington, chairman of the Electricity Committee, in moving the adoption of the recommendation of the Electricity Committee, said the same firm had previously contracted to the satisfaction of the Corporation, and the price was £405 less than the lowest of a "non-ring" firm; on a previous contract a saving of £700 was effected. An amendment to refer the resolution back was supported only by 5 votes against 19, and the original motion was carried.

Sunderland.—Corporation. Accepted:—
Tower wagon and charging plant (£380).—Sunderland and District Transport Co., Ltd.

Taf Fechan.—Water Board. Accepted:—
Turbines and generators for high level supplies (£1,454).—James Gordon and Co., Ltd.

Watford.—Electricity Committee. Recommended:—
Two transformers (£708).—Metropolitan-Vickers Electrical Co., Ltd.
Air filter (£401).—Brush Electrical Engineering Co., Ltd.
Stokers, &c. (£3,910), air heaters (£2,500).—Underfeed Stoker Co., Ltd.
Switchgear (£250).—Plumtree & Co.
Two e.h.p. cubicles (£396).—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

National Association of Supervising Electricians (Manchester District Branch).—Friday, March 12th. At the Y.M.C.A. Buildings, Peter Street, Manchester. At 7.30 p.m. Lecture on "Electric Driving of Textile Factories," by Mr. E. Preece.

Birmingham Electric Club.—Friday, March 12th. At the Grand Hotel, Birmingham. At 7 p.m. Annual dinner.

Royal Institution.—Friday, March 12th. At 21, Albemarle Street, W. At 9 p.m. Lecture on "Radiation from Electric Discharges," by Sir J. J. Thomson.
Saturday, March 13th. At 3 p.m. Lecture on "The Rare Gases of the Atmosphere," by Sir E. Rutherford.
Tuesday, March 16th. At 5.15 p.m. Lecture on "The Growth of Crystals," by Prof. C. H. Desch.

Association of Mining Electrical Engineers (London Branch).—Saturday, March 13th. Visit to Chislett Colliery, at the invitation of Mr. J. W. Robinson. Paper, "Some Notes on the Electrical Plant at Chislett Colliery," by Mr. C. Dawson.

Royal Society of Arts.—Monday, March 15th. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture on "Thermometry," by Mr. W. F. Higgins.
Wednesday, March 17th. At 8 p.m. Lecture on "Co-partnership," by Lt.-Col. J. H. Boraston, C.B.

Nottingham Society of Engineers.—Monday, March 15th. At the Technical College, Derby. At 7.30 p.m. Joint meeting with the Derby Society. Paper on "Some Considerations Relating to Electricity Supply," by Mr. A. D. Phillips.

Paisley Association of Electrical Engineers.—Tuesday, March 16th. At 16, High Street, Paisley. At 7.30 p.m. Apprentice papers.

Edinburgh Electrical Society.—Wednesday, March 17th. At the Royal Society of Arts, 117, George Street. At 8 p.m. Paper on "Organisation," by Mr. P. J. Sims.

Batti-Wallahs.—Wednesday, March 17th. At the Hotel Victoria, W.C. At 7 for 7.30 p.m. Annual dinner.

Institution of Electrical Engineers.—Thursday, March 18th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Developments in High-power Fuses," by Mr. L. C. Grant.
(South Midland Students' Section).—Annual joint meeting with the Students' Sections of the Institution of Civil Engineers and the Institution of Mechanical Engineers. Friday, March 12th. At the Grand Hotel, Birmingham. Discussion on the "Design and Equipment of a Modern Factory," to be opened by Messrs. F. B. Warder, E. T. Hussell, and A. R. Cole.
(Mersey and North Wales (Liverpool) Centre).—Monday, March 15th. At the University, Liverpool. At 7 p.m. Informal discussion on "Electricity on Board Ship," to be opened by Mr. J. E. Allan and Mr. A. G. Barnard.
(North-Eastern Centre).—Monday, March 15th. At Messrs. Sopwith's Lounge, Northumberland Street, Newcastle-on-Tyne. At 7 p.m. Informal discussion on "Power Station Economics."
(North-Western Centre).—Tuesday, March 16th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Developments in High-power Fuses," by Mr. L. C. Grant. Annual general meeting.
(Sheffield Sub-Centre).—Wednesday, March 17th. At the Mappin Hall, St. George's Square, Sheffield. At 7.30 p.m. Paper on "Permanent Magnets in Theory and Practice," by Mr. S. Evershed.
(Tees-side Sub-Centre).—Monday, March 15th. At the Cleveland Technical Institute, Middlesbrough. At 7.15 p.m. Lecture on "Electro-farming; or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

British Electrical and Allied Manufacturers' Association.—Thursday, March 18th. At the Connaught Rooms, W. At 1 p.m. Annual luncheon.

British Electrical Development Association.—Friday, March 19th. At the Hotel Cecil, Strand, W.C. At 7 for 7.30 p.m. Annual dinner.

Manchester Electro-Harmonic Society.—Friday, March 19th. At the Albion Hotel, Piccadilly, Manchester. Monthly concert.

Institution of Engineering Inspection.—Friday, March 19th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "Lubricating and Allied Oils," by Mr. E. A. Evans.

City & Guilds of London, Central & Finsbury Engineering Colleges Old Students' Associations (Northern Section).—Friday, March 19th. At the Engineers' Club, Manchester. Annual dinner.

Electrical Power Engineers' Association (London Western Section).—Saturday, March 20th. At Stewart's Restaurant, Victoria Street, S.W. At 7 p.m. Annual dinner.
(Kent Section).—Saturday, March 20th. At Hollingworth Hall Church Institute, Maidstone. At 6 p.m. Lecture on the "Brush-Ljungström Steam Turbine," by Mr. J. R. Hutchings.

Electrical Trades Commercial Travellers' Association.—Saturday, March 20th. At the Manchester Hotel, Aldersgate Street, E.C. At 7.30 p.m. Grand carnival dance.

Notes.

The Batti-Wallahs' Society.—At the annual general meeting, held on the 3rd inst., the following officers were elected for 1926:—President, Mr. A. W. Blake; vice-president, Mr. G. W. Partridge; hon. sec. and treasurer, Mr. M. Whitgift.

Swiss Hydro-Electric Competition.—The municipal authorities of Zurich are organising a premium competition, confined to Swiss engineers, for the best scheme for a dam and hydro-electric power plant in the Limmat.

Registered Contractors.—The following additional applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its meeting held on March 5th :—

Haycraft, C. H., & Son, Ashton-on-Ribble
Doyle, Charles, Gateshead-on-Tyne
Girling, John, & Son, Ashington
Spink, T. H., Headingly, Leeds
Veston Contracts Co., Euston, N.W.1
Dunkley, A. F., Margate
Wilkinson, J. C., Leeds
Smith & Poyner, Leicester
Knight, A. J., Newcastle-on-Tyne
McCullock & Newitt, Leeds
White Bros., Leeds
Hapgood, R., & Co., Pontardawe, Glam
Sproates, H. S., & Co., Middlesbrough
The Electric Service Co., Grimsby
Caffrey, T., Londonderry
Attree, L. G., Bishops Stortford

Fatality.—According to the *Manchester Guardian*, John Horton, aged 10, of Longton, near Preston, received a fatal electric shock at Southport on March 4th. He was playing in a field near a school, of which he was a pupil, when he came into contact with a live wire, one of a number which supply the houses of the district with electricity.

At the inquest at Southport on March 6th it was stated that the cradle of the overhead wire had been dislodged by the gale and had come into contact with the wire, causing it to fall to the ground. Some schoolboys were playing, and Horton apparently gripped the wire. The borough electrical engineer said the wire was protected in accordance with the Board of Trade specifications. A verdict of "Death from misadventure" was returned.

Electric Smelting.—It is reported from Trondhjem that the A. S. Norsk Staal (Norwegian Steel Co.), which has been engaged on experiments with the method devised by Mr. Emil Edwin for the electrical production of steel, has proceeded so far that trial working on a larger scale is expected to be undertaken. The company has fixed on Glomfjord as a suitable site for the establishment of the proposed new plant, and an application has already been made to the State hydro-electric administration for the supply of 6,000 h.p.

Local Societies.—A party consisting of over 100 members of the Nottingham and Derby Societies of Engineers visited the Witton Engineering Works of the General Electric Co., on February 25th. The members were welcomed by Dr. A. H. Gailing, the works director, and were entertained to luncheon at the G.E.C. Magnet Club.

London Traffic Signals.—According to *Modern Transport*, the Westinghouse Brake and Saxby Signal Co., Ltd., has been authorised by the Ministry of Transport to provide eight three-aspect coloured light traffic signals for the regulation of traffic along Piccadilly from east and west, and entering Piccadilly from the north by Berkeley Street, Dover Street, Albemarle Street, and Old Bond Street, and from the south by Arlington Street, and St. James's Street. A signal will be placed at the corner of each of the above-named streets to control the traffic entering Piccadilly, while the signals in Piccadilly for east and west traffic will be placed near the entrances from Old Bond Street and Berkeley Street respectively. The aspects displayed will be red for "halt," green for "proceed," and yellow, the latter bridging momentarily the period between "halt" and "proceed" to allow for slowing down or getting ready to move, as the case may be. These signals will be operated from a central control point situated in Piccadilly opposite the end of St. James's Street.

Boiler Explosion Report.—We have received a copy of the report of the preliminary inquiry held on the explosion from the water-screen of a boiler fired with pulverised fuel at the Prince's Generating Station, Birmingham. The boiler and screen are of the Vickers Boiler Company's make. The second tube from the left-hand side in the water screen inside the rear wall of the combustion chamber was ruptured for a length of about 12 in. and the explosion was due to the overheating of the tube, caused, it is thought, by shortness of water. All the other tubes in the screen showed signs of having been overheated. No material damage was caused by the explosion, showing that there was very little potential energy in the boiler at the time. There were five boilers on range at the time of the explosion; four of these are situated in close proximity to the feed pumps and the fifth, the one in which the explosion occurred, is about 200 ft. away. The boiler has an economiser superimposed above it, and, owing to the height of the boiler, the feed inlet is about 20 ft. higher than the inlet to the other boilers. The low-water alarm, which was blowing at the time, did not attract the attention of the engineer-in-charge. In order to sustain the pressure in the feed main, orders have now been given that when any of the boilers of this type are steaming an additional feed pump, which is situated at the same end of the boiler house, is to be used.

A Tibetan Tragedy?—Some months ago we reported that Messrs. Crompton & Co., Ltd., were supplying electrical machinery to Lhasa, the capital of Thibet. The *Daily Mail* states that the party, in charge of a young Tibetan engineer who had received an English education, which was transporting the equipment to the "Forbidden City" was massacred *en route* and the machinery was thrown over a precipice. According to a *Reuter* message from Delhi, however, this report has been authoritatively denied.

Large Diesel Engines at Hamburg.—In the course of the discussion on Mr. Geoffrey Porter's paper on "Heavy-Oil Engine Installations; Choice of Site and Lay-out of Plant," at the recent meeting of the Diesel Engine Users' Association, Mr. W. Roylands Cooper gave some interesting information concerning Diesel engines of large powers. He referred to an engine developing about 4,000 b.h.p. in four cylinders which he had recently inspected at the works of the M.A.N. Company, at Augsburg, and also to the 15,000-brake-horse-power Diesel engine built for the Hamburg electricity supply undertaking by Messrs. Blohm & Voss. It was evident, he said, that Continental engineers were of the opinion that large-sized Diesel units would find a very important use in interlinking schemes, both in connection with large water-power plant and large steam turbine installations. The 10,000-kW set at Hamburg was comparable with the large turbo-generators now in use. It was of great interest, particularly the generator, which was water-cooled and of a special low-speed design. The engine was of the M.A.N., double-acting, two-cycle type, such as had been installed in, and ordered for, several German ships. It was a nine-cylinder set; the overall length of the engine was about 73 ft., and its breadth about 14 ft.; the height from the floor to the top of the valves was about 33 ft. Mr. Roylands Cooper suggested that it would be a matter of importance for the Association to watch very closely the use of this size of set on the Continent and to see if it was not advisable to adopt larger Diesel engines in our schemes of interlinking in this country. British-built engines were now available for large powers.

A Large Electric Cooking Installation.—An interesting installation of electric-cooking equipment, designed for dealing with 150 luncheons daily, has recently been provided at Unity



Electric Cooking Equipment at Unity House.

House, the headquarters of the National Union of Railwaymen. The apparatus includes a double roasting oven, boiling table, and a combined hot-closet and serving table. The internal dimensions of the ovens are 24 in. high, 24 in. deep, and 22½ in. wide; the total loading of each oven is 5 kW, and they are controlled by rotary multiple switches.

The boiling unit dimensions are 5 ft. 6 in. x 2 ft. 6 in. x 2 ft. 9 in. high. This is equipped with six separate 1,600-W elements. The hot closet and serving table is 5ft. long, 2 ft. 6 in. wide and 2 ft. 6 in. high. Two sets of elements, one beneath the lower shelf, and one beneath the hob of the serving table, are separately controlled.

The equipment, supplied by the General Electric Co., Ltd., was installed by Messrs. Burdette & Co., Ltd.

Accident.—An explosion which occurred in the boiler house of the Keswick (Cumberland) electricity works on March 1st caused serious injuries to Thomas White and George Whittle. It is believed that one of the men threw some oil on the furnace and thus caused the explosion. It was customary to dispose of the waste oil from the Diesel plant in this manner, instead of throwing it into the beck, but on this occasion the dampers were closed, and the oil blew out one of the doors of the boiler.

Appointments Vacant.—Deputy transportation superintendent, electric traction section (Rs.1,750 per calendar month) for the Indian State Railways. Power station fitter for the Worcester Corporation Electricity Department. Switchboard attendant (65s.) for Newton Abbot Power Station. (See our advertisement pages to-day.)

Multiple Tariff Electricity Meters.—In a paper read before the Union des Centrales Suisses d'Electricité, M. L. Martinet, electrical engineer, Neuchatel, described the methods adopted by the municipality to increase the energy consumption, by the introduction of tariffs varying in amount according to the period of the day and year, to encourage consumption during the ordinary low-peak hours by lower charges. After considerable research, means were devised for converting the existing meters into multiple-tariff meters by interrupting the shunt circuits by means of suitable central clocks. A 50 per cent. tariff reduction is effected by breaking the shunt circuit for one minute out of every two, proportional time breaks being adopted for other tariff reductions. Several meters in any particular building, street, or section, are dealt with by means of a pilot wire to which the shunts are connected. This system facilitates the rendering of accounts, but it does not give a record of the energy consumed. Although this is considered unimportant, in that it has only a statistical value, a somewhat different form of meter has been introduced, which, while requiring only a single pilot wire, actuates not only the amount-recording dial, but also a relay and mechanism showing the kWh consumed. The two forms of multiple-tariff meter have both been approved by the Swiss Federal Weights and Measures Department. Five different tariffs are in operation on the Neuchatel system. Out of the 10,102 meters installed, over 5,000 are of the multiple-tariff type, and the number is steadily increasing. These are controlled by 1,561 clocks, or an average of about 3 meters per clock.

International Electrotechnical Commission.—New York Meeting.—The list of delegates to the meeting of the International Electrotechnical Commission and the International Conference on Standardisation, to be held next month, is headed by the names of Signor Guido Semenza, President, I.E.C.; Dr. C. O. Mailloux, E.E., Honorary President, I.E.C.; Col. R. E. Crompton, C.B., R.E., Honorary Secretary, I.E.C.; and Mr. C. le Maistre, C.B.E., General Secretary, I.E.C. Seventeen countries will be represented; omitting Canada and the United States, whose representatives' names will be included later, there are 94 names in the list. The following are the British delegates:—President, Sir Richard Glazebrook, K.C.B. (Chairman, British National Committee). Vice-Presidents: Sir Archibald Denny, Bart. (Chairman, British Engineering Standards Association); Mr. L. B. Atkinson (Director, Cable Makers' Association); Mr. C. P. Sparks (Vice-Chairman, British National Committee); Mr. S. T. Allen (Municipal Electrical Engineer, Wolverhampton); Mr. E. G. Batt (General Electric Co.); Mr. W. S. Burge (English Electric Co.); Mr. S. B. Donkin (Association of Consulting Engineers); Capt. P. Dunsheath (W. T. Henley's Telegraph Works); Mr. A. R. Everest (British Thomson-Houston Co.); Mr. J. P. Gregory (British Thomson-Houston Co.); Mr. W. Lee (Silvertown Lubricants, Ltd.); Mr. S. W. Melsom (Callender's Cable and Construction Co.); Dr. A. C. Michie (Electrical Research Association); Mr. R. B. Mitchell (President, Incorporated Municipal Electrical Association); Mr. A. P. Mossay (Electric Vehicle Committee of the U.K.); Mr. J. S. Peck (Metropolitan-Vickers Electrical Co.); Mr. C. Rodgers (Secretary, British Electrical and Allied Manufacturers' Association); Mr. T. Roles (Municipal Electrical Engineer, Bradford); Mr. P. F. Rowell (Secretary, Institution of Electrical Engineers); Mr. F. Wallis (English Electric Co.); Lt.-Col. K. Edgcumbe (Everett, Edgcumbe & Co.); Representative of the Railway Companies; Mr. P. Good (Secretary of the British Delegation). The four gentlemen first named will represent the B.E.S.A. at the International Conference on Standardisation to be held in New York on April 17th and 18th.

Large Concrete Pipe.—One of the largest concrete pipes in the world is being laid in the French Alps, and will help to provide power for industrial works at Grenoble. It has an internal diameter of 19 ft. 6 in., and when completed will be nearly a mile in length.—*Financial Times.*

Thermal Expansion of Tungsten.—Scientific paper of the Bureau of Standards, No. 515 (Dept. of Commerce, Washington, U.S.A.), by Messrs. Peter Hidnert and W. T. Sweeney, gives the results of an investigation on the thermal expansion of tungsten (99.98 per cent.). The expansion of tungsten is given by the following empirical equation:

$$L_t = L_0 [1 + (4.28\ t + 0.00058\ t^2)\ 10^{-6}]$$

applicable between − 105 and + 502 deg. C.

The coefficients of expansion increase regularly with temperature. From 0 to 500 deg. C. the average coefficient of expansion is 4.6×10^{-6} per degree.

Telephotography.—The German Wireless Co. (Telefunkengesellschaft) claims to have beaten all speed records in the transmission of wireless photography between American stations and the German station at Nauen. According to the *Manchester Guardian*, it has succeeded in transmitting 15,000 apertures per second, a speed equivalent to the transmission of 25 words per second. This achievement shows progress, as text and diagrams can be transmitted simultaneously with pictures. At the annual dinner of the Institution of Electrical Engineers in London, the president, Mr. R. A. Chattock, remarked that the Marconi Co. had recently transmitted his photograph and signature across the Atlantic Ocean by means of "wireless." Photographs of the Lenglen-Wills lawn tennis match at Cannes were transmitted over the telephone wires from Nice to Paris by means of the Belinograph process.

The Jean Bares Prize.—Among the annual premiums awarded by the French Office National des Recherches Scientifiques et Industrielles is that known as the Jean Bares, which is offered to the inventor "who is the father of at least three children," and who is regarded as having rendered the greatest service to French industry. For 1925, the premium, which amounts to 10,000 fr., has been awarded to M. Vedovelli, who has been responsible for over 100 patents, and has a wide reputation in connection with high-pressure electrical apparatus and control gear. M. Vedovelli was responsible for the electric luminous fountains at the Paris Exhibition of 1900, and for the electric waterfall and other electrical illuminations at the Paris Decorative Arts Exhibition of 1925.

Impact Stress in Granular Materials.—At a recent meeting of the Physical Society of London, the application of the piezo-electric properties of a Rochelle salt crystal and the tri-electrode valve to the determination of impact stresses in granular materials was demonstrated by Messrs. J. J. Hartley, M.Eng., M.Sc., A.M.Inst.C.E., and R. H. Rinaldi. The apparatus employed was designed to utilise the charge of a strained crystal for the measurement of impact stresses in sands. A crystal was shown mounted between two brass plates and initially strained to 15 kilogrammes by means of three springs; this had an impact load of 400 gm. steadily applied to a lever arm which gave the strained crystal a further torsional strain. A negative charge was collected from the tinfoil girdle, about the major axis of the crystal, and was applied to a valve grid, causing a fall in the small steady plate current on a microammeter.

Institution Notes.

Institution of Electrical Engineers.—Sheffield Sub-Centre.—In an address to the Sub-Centre, Mr. R. A. Chattock, the president of the Institution, said that railway electrification still seemed to be hanging fire in this country, apparently due to the apathy, or conservatism, of the railway magnates. The way was already being shown on the Continent; the electrification scheme for the Paris-Orleans Railway, it was specially illuminating to realise, was designed to utilise several sources of power, hydro-electric stations were to work in company with the large steam-driven stations in Paris and elsewhere. This was a proposal that would appear to be very highly desirable from the point of view of the new Government scheme, as it would undoubtedly have the effect of considerably increasing the load factor and consequently of cheapening the cost of producing electrical energy throughout the country. It was thought, he hoped very wrongly, that railway engineers in this country would not agree to purchase their energy from public supply undertakings, chiefly on the score of reliability and not themselves having control of the stations. Also, so far, no mention had been made of including the supplies to railways in the Government scheme. He hoped that this proposal would not be overlooked when the scheme developed. Referring to the developments taking place in the electricity supply industry, Mr. Chattock said that low-temperature carbonisation of coal was likely to revolutionise boiler-house practice. The Milwaukee Electric Railway and Electric Light Co., in the United States, would soon have a plant at work for skimming the volatiles from pulverised fuel and passing the residue on to the boiler house still in its pulverised form. The results would be watched with the greatest interest, and if such a process could be commercially possible it should be of the greatest value.

Junior Institution of Engineers.—At a special meeting of the above Institution held at the Engineers' Club, Birmingham, on March 5th, a paper on "Lifting and Shifting Machinery," was read by Mr. C. H. Woodfield, M.I.Mech.E. The author described a great many types of electric cranes and showed the advantage of compensated luffing gear. Steel wireless masts 820 feet in height, recently erected by the lecturer in South Africa, were described; the chief difficulty encountered during erection was caused by high winds. A three-storied cage passed up the interior of the triangular mast, being hoisted by a wire rope attached to the engine of a "Ford" car.

In a paper on "Tendencies in Modern Electric Practice," presented by Mr. J. M. Seddon, A.M.I.E.E., several of the latest hydro-electric stations in Sweden were described. It was emphasised that the civil engineering work in connection with these power stations were very costly, and the energy supplied by them to consumers was on the average more expensive than that supplied by the cheaper English companies. Their existence was principally justified by the fact that coal was dear. Steam stations were next discussed with special reference to powdered fuel. The dust and grit which was ejected from the chimneys of powdered-fuel plants presented a difficulty, but special fan arrangements had been devised to overcome this.

In the discussion which followed, the majority of speakers expressed the opinion that there was not much prospect of reducing the cost of electricity by linking up on a large scale, or by any advance in the method of generating which was likely to occur in the near future. The main hope was in improving the load factor by attracting off-peak loads at very low rates, such as water heating through the night. Several Borough Councils now supplied electricity for this purpose at ½d. per kWh.

Institution of Heating and Ventilating Engineers.—In paper read before the above Institution on the design and plication of electric motors relative to heating and venti-ing, Mr. Joseph Meech, A.M.I.E.E., dealt very fully with e design of various types of motors used for fan and pump rk, and the methods of driving, speed control, and attaining ence. He explained how a contractor who had a motor stock could utilise it on a pressure for which it was t primarily designed. The causes of hunting and surging re considered. Mr. Meech concluded with some notes on wer factor and starting and controlling devices, and urged e consideration of the advantages of remote control for tors scattered over a building.

Society of Engineers (Inc.).—On Monday last, Mr. W. M. ckett, M.B.E., read a paper on "Tidal Power on the River vern," giving details of his survey of the site which he nsidered best suited for the construction of a dam across e estuary, and discussing the various methods of utilising al power. His proposals included the installation of 100 rbines, yielding an average output of 150,000 b.h.p. over hours' day load, and 50,000 b.h.p. over 12 hours' night-ad, with a maximum demand of 250,000 b.h.p. The scheme ntemplated the construction of a large storage reservoir the River Augidy, a power house on the River Wye, and tunnel 35 ft. in diameter. Surplus power would be used pump water through the tunnel into the reservoir, which uld drive turbines when those on the Severn were not le to cope with the load. The total cost of the scheme as estimated at 12 million pounds, including about one illion for transmission lines and transformer stations. The t income was estimated at one million pounds per annum.

Institute of Metals.—The Institute has just issued to its embers a ballot paper containing the names of 77 candidates r membership—a record list. This is the last occasion upon hich a postal ballot for the election of members will be ken. In future election to membership will be by the uncil, the first election under the new arrangement being ld on April 21st.

Electrical Association for Women.—On Tuesday last, a rty of members of the Association paid a visit to the Ideal ome Exhibition, where they gave particular attention to e E.D.A.'s "Electric House" and the stands of Messrs. G. Hawkins & Co., Ltd., Freezone, Ltd., Electrolux, Ltd., d other electrical exhibits.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. Leslie Gordon, town clerk of St. Marylebone, having ccepted the unanimous invitation of the Joint Electricity uthority for the London and Home Counties Electricity Dis-ict, established by Parliament last year, to act as clerk, licitor and Parliamentary agent to the Authority, has re-gned his present office, to which he was appointed in 1924. is knowledge of London's electricity problems, the solution which has been entrusted to the Joint Authority, is stated be unique. For many years he acted honorarily as clerk the Conference of Local Authorities Owning Electricity ndertakings in London and the Home Counties, which was rmulated to safeguard and co-ordinate the interests of the uthorities in question.

Mr. J. S. Trelease, assistant technical engineer in the Sal-ord Corporation electricity department, has been appointed lectrical clerk of works to the County of London Electric upply Co. On the occasion of his leaving Salford, he was resented with a mahogany clock by Mr. S. J. Watson, orough electrical engineer, on behalf of the whole of the taff of the department.

The Bradford City Council has approved the following alary increases:—Mr. Thos. Roles, city electrical engineer, rom £1,500 to £1,600 per annum; Mr. J. Fairburn, works uperintendent, from £618 to £695; Mr. C. E. Allsopp, com-ercial assistant, from £618 to £695; Mr. C. A. Gillin, mains ngineer, from £516 to £561; Mr. G. W. Hodsman, chief raughtsman, from £469 to £516; Mr. H. E. Bottom, assist-nt sales engineer, from £316 to £365; Mr. H. Newsham, hemist, from £278 to £312; and Mr. R. H. Wilkinson, tram-ay manager, from £1,000 to £1,100.

Mr. Thos Roles has been authorised by his Committee to ccept an invitation to be one of the delegates to attend, on ehalf of the British Engineering Standards Association, the orthcoming conference in New York with reference to the ormulation of international standards for electrical and other nachinery

On March 1st, Mr. Robert Birkett was entertained to linner by his staff to celebrate his completion of 21 years' ervice as borough electrical engineer of Southend. Mr. A. C. ohnson, assistant electrical engineer, who presided, presented Mr. Birkett with an inscribed gold watch on behalf of the taff.

According to the *Electrical Engineer of Australia*, Mr. M. C. immis, of Messrs. Siemens Bros. & Co., Ltd., Melbourne, was o leave for England at the end of January to take up an important technical appointment in the cable works of his ompany at Woolwich, dealing largely with research work nd new developments in electric cables.

Mr. William Hainsworth, who has been commercial assistant to Mr. C. H. Yeaman, city electrical engineer, for the past six years, is leaving the service of the Stoke-on-Trent Corporation to take up a similar position in the Croydon Electricity Department. He was recently presented with a silver cigarette case by Mr. Yeaman, on behalf of the members of the staff and the department.

The Stoke Corporation Electricity Committee has appointed Mr. T. Lockett as commercial assistant at a salary of £250 per annum, plus bonus, in place of Mr. W. Hainsworth.

The Newcastle-on-Tyne Corporation Transport and Electricity Committee has recommended to the City Council that Mr. Thomas P. Easton be appointed general manager, and Mr. W. T. Dalton, engineer, of the tramways, in place of Mr. E. Hatton, who has just resigned. Mr. Hatton's duties will thus be split, at, it is understood, an increased cost of about £150 a year. Mr. Hatton's salary was £1,650, and under the new scheme the general manager will receive £1,000 and the engineer £800 per annum. Mr. Easton has been with the Corporation for 25 years.

On the unanimous recommendation of its Electricity Committee, the Exeter City Council has resolved that the remuneration of Mr. H. D. Munro, the chief electrical engineer, shall be in accordance with the minimum salary scale of the Associated Municipal Electrical Engineers (Great Britain and Ireland).

The Wimbledon Council has resolved by 20 votes to 4, to increase the salary of Mr. A. E. McKenzie, the borough electrical engineer, from £1,500 to £2,000 per annum, as from April 1st. If the net profits for 1926-27 or any of the following three financial years, exceed £30,000, he is to be paid a bonus of 2½ per cent. on the profits in excess of this figure. We understand that Mr. McKenzie is still free to practise as a consulting engineer.

Ald Sir G. H. Hume, M.P., M.I.E.E., has been elected chairman of the London County Council for the ensuing year.

Mr. T. A. Edison celebrated his 79th birthday on February 11th, at his winter home in Florida.

Mr. Maxwell Webber has been appointed electrical engineer to the Haworth Urban District Council.

Obituary.—Mr. H. Hatfield.—We regret to record the death of Mr. Henry Hatfield, I.S.O., Chief Examiner at the Patent Office for 31 years, from which post he retired six years ago.

Mr. G. Stevenson.—We regret to learn that Mr. George Stevenson, A.M.Inst.C.E., M.I.E.E., assistant sales manager of the Chloride Electrical Storage Co., Ltd., passed away on Sunday last. He became ill while travelling to Bordighera from Paris and died at Mentone station.

New Companies Registered.

Birkbys, Ltd. (212,173).—Private company. Registered March 5th. Capital, £40,000 in £1 shares. Objects: To acquire the business of specialists in synthetic resin insulation carried on at Liversedge, Yorks., and elsewhere, to adopt an agreement with A. T. Birkby and F. E. Birkby, and to carry on the business of electricians, electrical, wireless and mechanical engineers, manufacturers of and dealers in mouldings, moulding powder, resin, varnish, and other articles used in synthetic resin insulation, &c. The first directors are:—A. T. Birkby, The Nook, Liversedge, electrical engineer; F. E. Birkby, Round Oak, Mirfield, electrical engineer (both permanent, subject to holding 5,000 ordinary shares each). Qualification of other directors, 500 shares. Remuneration as fixed by the company. Solicitors: Mumfords & Gordons, 14, Piccadilly, Bradford. Registered office: Woodfield Mills, Liversedge.

Hopkinsons, Ltd. (212,201).—Registered as a public company on March 5th, with a nominal capital of £700,000 in £1 shares (350,000 preference and 350,000 ordinary). The objects are:—To acquire the goodwill of the businesses of manufacturers of and dealers in boilers, boiler flues, mountings and fittings and valves of every description belonging to J. Hopkinson & Co., Ltd., and carried on at Huddersfield and elsewhere; to take over and undertake all or part of the assets and liabilities of those businesses; for that purpose to enter into an agreement with the British Shareholders Trust, Ltd., to carry on in Great Britain or elsewhere, both directly and by means of subsidiary companies all or any of the trades or businesses of mechanical and electrical engineers, machine and engineering tool makers, makers of boilers, mountings and fittings, &c. Minimum cash subscription, 7 shares. The directors are:—R. A. Hopkinson, 36, York Place, Harrogate, manufacturer; E. W. Crammond, 3, Lombard Street, E.C. (director of Platt Bros. and Co., Ltd., and managing director of British Shareholders Trust, Ltd); N. H. Docker, Wootton Courtinay, Taunton, Somerset, and 4, Central Buildings, Westminster (director of John Wilkes, Sons & Mapplebeck, Ltd., and International Combustion, Ltd.); C. J. Hofton, Holme Villas, 10, Holme Road, West Bridgeford, Notts., salesman; P. G. Hopkinson, 12, Cambridge Road, Huddersfield, engineer; Sir William Ramsden, Kt., J.P., Marshfield, Huddersfield, solicitor; R. S. Turnbull, 1, Alwinton Terrace, Gosforth, Newcastle-on-Tyne, salesman. Qualification, £500. Remuneration, £2,400 per annum divided between them. Solicitors: Pinsent & Co., 6, Bennetts Hill, Birmingham.

J. H. Runbaken, Ltd. (212,068).—Private company. Registered March 1st. Capital, £7,500 in 3,800 "A" ordinary shares of £1 each and 74,000 "B" ordinary shares of 1s. each. Objects:—To acquire the business of an electrical engineer carried on by J. H. Runbaken at 30, Tipping Street, Manchester. The permanent directors are:—J. H. Runbaken (managing director), "Maryvale," Hilltop, Wilmslow; C. Lewis, "Roselawn," 68, Chartfield Avenue, Putney; J. C. Maurice, 33, Muswell Hill Road, N. (all permanent, subject to each holding 100 shares). Qualification of directors, 500 shares. Remuneration, £225 each per annum. Solicitors: Woolfe and Woolfe, 13a, Old Burlington Street, W. Registered office: 30, Tipping Street, London Road, Manchester.

Wagner Electric Supplies, Ltd. (212,107).—Private company. Registered March 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical apparatus, including engines, turbines, generators, motors, transformers, switchboards, cables, meters, fans, lamps, and all devices suitable for electric generating stations, &c. The directors are:—H. C. Walsh, 28, Swinderby Road, Wembley, C.A.; A. Woolley, "St. Andrews," Burford Road, Bickley, accountant. Secretary: D. A. Turner. Solicitor: H. F. Strouts, Monument Station Buildings, E.C.4. Registered office: 49, Eastcheap, E.C.4.

Fordham Electrical Engineering Co., Ltd. (212,016).—Private company. Registered February 26th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electricians, electrical and mechanical engineers, wireless engineers, &c. The subscribers (each with one share) are:—C. Ashton, 253, Clapham Road, S.W.8, funeral furnisher; Mrs. K. Ashton, 333, Clapham Road, S.W.9. The permanent directors are:—W. Ashton and C. Ashton.

Midland Electric Lamp Co., Ltd. (212,135).—Private company. Registered March 3rd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers, factors and dealers, manufacturers of electrical goods, &c. The first directors are:—S. Swerling, 140, Leicester Road, Higher Broughton, Manchester, cotton goods merchant; M. End, 40, Cramp Street, Higher Broughton, Manchester, lamp factor. Qualification, £1. Secretary: S. Swerling. Solicitor: S. Linder, 7, Brazennose Street, Manchester. Registered office: 5a, St. Peter's Square, Manchester.

Official Returns of Electrical Companies.

Callender's Cable & Construction Co., Ltd. (48,915).—Reverting to the notice published here on February 26th, we should state that since the date of the last annual return (June 11th, 1925), the capital has been increased from £1,300,000 to £1,500,000 in £1 shares. On July 25th, 1925, 100,000 of the new shares (ordinary) were allotted, making the nominal amount of the issued capital £1,400,000 (£600,000 ordinary and £400,000 preference, and £400,000 "B" preference). To June 11th, 1925, £1,025,000 had been paid up in cash, and £275,000 was considered as paid. At July 2nd, 1925, 15s. per share was paid or due and payable on the 100,000 new ordinary shares. We understand that the remaining 5s. per share has been paid up since the date named, making the paid-up capital £1,125,000. Mortgages and charges at June 11th, 1925, £300,000.

Telephone Manufacturing Co., Ltd.—Particulars filed of debentures for a principal sum not in any event exceeding a third of the total secured rentals as defined in the trust deed, together with a premium of 2 per cent., authorised by resolutions of November 29th, 1921, December 16th, 1925, and February 11th, 1926, and having the benefit of a trust deed dated February 17th, 1922, charged on the premises comprised in the said trust deed, the amount of the present issue being £20,000, ranking *pari passu* with £310,000 already registered in accordance with the provisions of the trust deed. Trustees: London City and Midland Executor and Trustee Co., Ltd., 5, Princes Street, E.C.2.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (1,122C).—Capital, £1,250,000 in 750,000 ordinary, 250,000 preference, and 250,000 unissued shares of £1 each. Return dated December 10th, 1925. 750,000 ordinary and 250,000 preference shares taken up. £1,000,000 paid. Mortgages and charges, £400,000.

Electron Co., Ltd.—Particulars filed of £1,500 debentures authorised by resolutions of September 22nd, 1925, and February 2nd, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Simmonds & Stokes, Ltd.—Issue on February 23rd, 1926, of £1,000 debentures, part of a series already registered.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £12,100 on various dates between March 19th, 1925, and February 9th, 1926, of debentures secured by trust deed dated October 6th, 1913, and supplemental trust deed dated December 31st, 1918, securing £250,000.

Technical Instrument Case Manufacturing Co., Ltd.—W. B. Pearson, of 5, John Street, Bedford Row, W.C.1, ceased to act as receiver or manager on February 17th, 1926.

Robins Wholesale Electrical and Wireless Co., Ltd.—J. W. Williams, of 5, St. Andrew's Crescent, Cardiff, ceased to act as receiver or manager on February 23rd, 1926.

British Ebonite Co., Ltd.—Particulars filed on February 20th, 1926, of £10,000 debentures authorised April 27th, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Attaix, Ltd.—Mortgage on the company's property, present and future, including uncalled capital, dated February 10th, 1926, to secure all moneys which the mortgagee (H. Benger, South-Western Hotel, Southampton) may be called upon to pay under a guarantee to bankers to secure an overdraft up to £500.

Davis Electrical Co., Ltd. (177,301).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925. 677 shares taken up. £377 paid. £300 considered as paid. Mortgages and charges, nil.

Elba, Ltd.—J. Chapman, of 46, King's Road, Sloane Square, S.W.3, ceased to act as receiver and manager on June 16th, 1925. (Notice filed February 24th, 1926.)

Red Seal Products, Ltd.—E. A. Mallett, of 32-34, Theobald's Road, W.C.1, was appointed receiver on February 23rd, 1926, under powers contained in debenture dated February 3rd, 1926.

Llangollen and District Electric Light and Power Co., Ltd.—Satisfaction in full on February 5th, 1926, of debenture and mortgage dated December 14th, 1907, securing £400.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Charing Cross Electricity Supply Co., Ltd.

The accounts for the past year show that the gross earnings of the West End Undertakings were £325,985 (as compared with £304,013), and that the net earnings were £144,690, as against £113,621. A balance of £19,444 brought forward, and £55,667, interest, &c., are added, making £219,800. After providing for depreciation (£22,000), debenture interest, preference dividend and interim ordinary dividend (1s. 6d. per share) there remains £118,771. It was proposed to pay a final dividend at the same rate on the ordinary shares, to transfer £55,000 to general reserve (income) account, and to carry forward £20,571. The connections are stated to total 29,896 kW.

The gross earnings of the City Undertaking were £417,862 (against £423,811), and the net earnings £211,004 (£217,222). A balance of £20,500 brought forward is added, making £231,305, and after deducting debenture interest, &c., preference dividend, and an interim dividend at the rate of 2s. per share on the ordinary shares, there remains £105,217. From this, £85,000 is to be transferred to the general reserve (income) account, and the balance (£20,217) is carried forward. The connections now amount to 35,142 kW. The report refers to the reorganisation of London electricity supply, and states that the directors are engaged in taking the necessary steps to carry out the arrangements embodied in the Act. Referring to the capitalisation of the company's free reserves for distribution as bonus shares, the report says that the amount for the City is settled by the Act as £200,000, but the figure for the West End has not yet been ascertained as certain adjustments have to be made and approved by the authorities concerned. It is not proposed to make any distribution of bonus shares to the ordinary shareholders of the West End Undertakings until the whole amount available is known, when a further general meeting of the shareholders will be called. In the meantime the directors propose to bring the £200,000 through the Suppliers Construction Co. into the accounts of the West End Undertakings.

The annual meeting was held on March 4th. Mr. W. F. Fladgate (chairman), who presided, said that the directors had considered the amalgamation of the accounts of the City and West End Undertakings, but did not think that that was expedient. The progress of the undertaking as a whole had been extremely satisfactory. The energy sold had increased by over four million kWh, although 1½ million kWh of this was a temporary supply to the Metropolitan Electric Supply Co., Ltd. The gross revenue had increased by £12,000 while the expenses had been reduced by some £10,000, making a net increase of about £22,000. That was mainly due to the efficiency of their Bow station, aided to a small extent by cheaper coal. The accounts of the City Undertaking showed decreased receipts due to the reduction of charges to consumers. The expenses were, however, about the same in spite of the increased output. After dealing at some length with the changes in organisation, the chairman said that owing to the special terms of the City Provisional Order they had succeeded in getting a specific sum of £200,000 allowed to them without waiting for the result of the valuation. They had also succeeded in obtaining a provision that the rate of dividend, which in the case of all the other companies was to be reduced from 10 to 7 per cent. in 1931, was in respect of the City Undertaking to continue without reduction until 1936. Mr. Fladgate said that a gratifying response had been made to the recent issue of capital by the London Power Co., which showed that the investing public considered the scheme a sound one. He deprecated the attitude of hostility which had been adopted by the directors of some of the gas companies. He thought that there was ample room for both industries, and that their interests would be better served by friendly relationship.

The report and accounts were adopted, and subsequently a resolution was passed authorising the directors to create a further 150,000 City Undertaking ordinary shares of £1 each, ranking *pari passu* with the existing shares; and to capitalise a sum of £200,000 of the undivided profits of the company for distribution as ordinary shares to the present ordinary shareholders in the proportion of four new shares to each seven now held.

At the conclusion of the proceedings Mr. J. M. Gatti expressed appreciation of the chairman's services, and asked him to sit for a portrait to be hung in the board room. The chairman expressed his thanks and the meeting terminated.

Telegraph Construction and Maintenance Co., Ltd.

The annual meeting was held on March 4th, the Earl of Selborne, K.G., in the chair. In proposing the adoption of the report, the chairman, dealing first with the accounts, said there was an increase of £382,482 under the head "Debts owing by the Company," which was due to the receipt of instalments for cable not actually laid before the close of the year. That figure was reflected on the credit side by the greatly increased value of property, &c., which stood at £1,369,570, an increase of £960,794 over the figure for the previous year, which was due to the very large stocks of manufactured cable and of material purchased for cable to be made during the current year. The net profit amounted last year to £110,630, and adding £114,861 brought forward from the previous year they had a total of £225,492. Out of that amount the interim dividend, amounting to £22,410, had been deducted, leaving £203,082 for disposal. The directors proposed to distribute the same dividend as in the previous year (10 per cent.) and again add £30,000 to the reserve fund, which would leave £105,852 to be carried forward. On the occasion of the last general meeting, Mr. Colin Campbell, who presided in his absence, had referred to the fact that rather less profit than usual was shown, which, he had said, was due to an additional expenditure on buildings and machinery erected for carrying out a most important and interesting experiment for the Western Union Telegraph Company in connection with a submarine cable, having some special features, which they had manufactured and laid between New York and the Azores. The chief feature consisted in covering the copper conductor with a thin metal wrapping of special high permeability alloy before being insulated with the usual gutta-percha, and cables

this kind were now commonly known as "loaded." In ie particular cable to which he had referred, the alloy used as known as "permalloy," and was supplied for the purpose y the Western Electric Company of New York. The results otained in the working speed of this experimental cable had een such that the Western Union Telegraph Company deter- ined to take full advantage of its superiority over long sub- arine cables of the unloaded type, and had placed with em a further order for a loaded cable from New York to ay Roberts in Newfoundland, and for another from Bay oberts to Sennen Cove in Cornwall. Both of those cables ere in course of construction and were being loaded with ie Western Electric Company's alloy. They also possessed nportant and valuable patent rights relating to the loading cable conductors including a high permeability alloy known "Mumetal," and since those patents were likely to conflict ith those for a similar purpose possessed by the Western lectric Company of New York, it was thought advisable in ie interests of both companies to enter into an agreement hereby the patents should be pooled on terms of equality. hat agreement had now been signed, and he had no doubt at it would prove to the advantage of submarine tele- aphy. The first cable actually loaded with their own alloy d been manufactured for the Eastern Extension Company order to duplicate the cable between Perth and Cocos land, a distance of 1,624 nautical miles, and was now being id by their cable steamship *Colonia*. The Pacific Cable Board d resolved to duplicate its cable from Canada to Australia, d the company had secured the order for the section of ie cable to be laid between Vancouver and Fanning Island, d it was to be loaded with "Mumetal." That cable, which ould be the longest submarine span in the world, would e 3,625 nautical miles in length, and they hoped to have it mpleted in the autumn. The original cable that they had id more than 23 years ago had never needed repairing in l those years. Their new cable ship, the *Dominia*, was a vin-screw oil-fuel steamer with a gross displacement of 9,000 ns. She was 509 ft. in length, and was fitted with all the test machinery and appliances for laying cable. She was pable of carrying 9,000 tons of cable (approximately 3,700 iles). Loaded cable could be used for direct working at igh speed over much longer distances than cable of the rdinary or unloaded type, with the result that relay stations uld be dispensed with and increasingly longer spans would obably be required in the future. Referring to the retire- ent of Mr. Francis Lucas from the board and from the anagement, his Lordship remarked that Mr. Lucas joined e Telegraph Construction Company on its formation in 64, and went to sea in the *Great Eastern* in 1865-66. He as now the sole survivor of those who took part in the oyage when the first Atlantic cable was successfully laid. s long ago as in 1874 he was first sent away in charge of cable-laying expedition, and by the time he was appointed managing director 20 years ago, he had laid 75,000 miles f submarine cable. The report was adopted after a short iscussion.

St. James' and Mall Electric Light Co., Ltd.

Mr. Walter Leaf (chairman) presided at the annual meeting on March 2nd, and in moving the adoption of the report and accounts (Electrical Review, February 19th, p. 306), said that the past year had een one of supreme importance to the electrical industry wing to the passage of legislation for the entire reorganisa- on of the London electricity supply. This would form the asis of the company's operations for the next 45 years. e then outlined in some detail the general provisions of he scheme, and said that the present position was that ey had submitted their schedules to the Joint Electricity uthority and had handed to the London County Council eir computations of the standard price, and were awaiting communication from those bodies. When they had come terms a meeting would be called to reconstitute the capital f the company on a new basis. One of the changes involved the Bill was the transfer of the Central Electric Co.'s ower station at Grove Road to the London Power Co. By his the St. James' and Westminster companies would be elieved from their liability for considerable sums invested the Central Company. Turning to the company's accounts, e said that after transferring £25,000 to the contingency und they had £72,800 to deal with, as compared with £46,893 n 1924. That great increase was due to two causes—a fall n the cost of generation combined with a large increase in utput. Although they had supplied 2½ million kWh more, he cost of generation was actually less. This was partly ue to a fall in the price of coal and partly to increased fficiency. The total cost per kWh had fallen from 0.989d. o 0.905d. Large extensions consisting of a boiler house, urbine house and pump house, to accommodate two new 5,000-kW sets and six 75,000-lb. boilers, were completed y the company's own staff during the year. Some £30,000 ad been saved by this direct employment of labour. The argest of the two sets and two of the boilers were practically ompleted and were available for load. The third boiler was ell advanced, and three additional boilers would be com- leted during the current year. Additional cooling towers f 20,000-kW capacity would be ready for next winter. The 2,000-V feeders linking up with the Willesden station of he Metropolitan Co. were in regular operation, and similar nks with the Charing Cross and Kensington and Notting Hill companies would be completed this year. Their large ncrease in revenue had enabled them to consider the for- mation of a pension fund. Now that they had an extension of existence for 40 years from 1931, they regarded it as an obligation to establish such a fund on the usual lines. It was proposed to set £25,000 aside as a reserve for the pro- vision of that fund as a beginning. When the question of capitalisation of their "free reserves" came up, the share- holders would be asked to devote a part of them to making a very substantial addition to the fund. The further question of an immediate reduction in charges was complicated by the fact that the Electricity Commissioners had determined that the sliding scale of prices should be effective from January 1st, 1926, and they expected shortly to have their standard price per kWh agreed. In the meantime the Board had decided to make certain reductions which would take effect from January 1st last. Any further concession which the L.C.C. might enable them to make would form the subject of a separate announcement. The report and accounts were adopted, and at a subsequent extraordinary general meeting the proposal to establish a pension fund was approved.

Midland Counties Electric Supply Co., Ltd.

The annual meeting was held on March 1st, Mr. George Balfour, M.P. (chairman) presiding. In moving the adoption of the report and accounts (Electrical Review, February 26th, p. 346), the chairman re- ferred to the death of Lord Chilston. He then said that the conditions under which all public service undertakings oper- ated last year were, to say the least, difficult. Tramways, railways and power undertakings were all operating under artificial conditions, or conditions of uncertainty, due to pend- ing legislation. Tramway undertakings had suffered from excessive omnibus competition, and the traction properties owned and operated by the company had, for the first time, made no contribution to the revenue. He believed, however, that the present conditions were only a passing phase, and that eventually the problem would be solved. Referring to the Government's electricity proposals, he said that a great deal had been said about linking up stations, and standardising frequency as a means of providing a cheap and abundant supply of power. That sort of supply could only be forth- coming if the industry was left alone and legislation confined to the protection of the public interest. Because the com- pany had only started active development three or four years ago, and had during the last three years laid 207 miles of high-pressure lines, it might be imagined that the average price per kWh would be high. In Derbyshire and Notting- hamshire, however, it was only 0.885d., and over four counties, including Leicestershire and Warwickshire, the average price was about 1d. If companies were left to develop upon the lines laid down in their Acts, progress would be much quicker. If the company had followed the decision of the Commis- sioners and not proceeded with the erection of a new power station, it would have been supplying only about 1/10th of its present load. During the present session of Parlia- ment the Leicestershire and Warwickshire Electric Power Co. was promoting a Bill empowering it to increase its capital by £500,000, and to increase its borrowing powers to 50 per cent. of the capital issued. Other clauses in the Bill related to removing the veto against overhead lines, to supply- ing electricity for traction purposes, &c. During the past year three Special Orders had been obtained and supplies in the districts had commenced; a further order awaited confirmation. After considerable delay the Derbyshire and Nottinghamshire Electric Power Co. had secured an Order to supply electricity in the Shardlow Rural District. The energy sold during 1925 totalled about 60,410,000 kWh in- clusive of bulk supplies given by the power companies to the company's own undertakings for distribution. This repre- sented an increase of, roughly, 14½ per cent. The number of consumers now served by the various supply companies was 8,657, as against 6,814, and the load had grown from 46,800 to 54,240 kW. During the year the installation of a 12,000-kW turbo-alternator at the Spondon station was com- pleted; the station buildings were capable of accommodating an additional 50,000 kW. At the Avon station an additional 6,000-kW turbo-alternator and boiler plant were in course of erection, and there was sufficient room for another unit. An additional boiler plant had also been installed in the Hinckley station. During the year an issue of 250,000 ordi- nary shares and 250,000 preference shares was made, the capital of the company being increased to £3,000,000.

Electrical Distribution of Yorkshire, Ltd.

The annual meeting was held at Leeds on March 2nd, Mr. R. W. Wickham pre- siding. In presenting the report and ac- counts (Electrical Review, February 26th, p. 347), he said that the large and im- portant development which had taken place had required a capital expenditure of £245,107. The issue of 250,000 ordinary shares made last October to provide for this was very suc- cessful. That capital was, however, nearly exhausted, and another issue would be necessary before long. The chairman then reviewed the progress of the company during the 21 years of its existence. He said that the imminence of the Government proposals for reorganisation had led to the sus- pension of their applications for further Orders. These appli- cations concerned 31 districts in which the local authorities had already intimated their support of the company's pro- posals, and seven other districts in which negotiations with the local authorities were still proceeding. He said that he could not speak as to the need for new legislation in other

parts of the country, but he considered that in the company's own area there was no need whatever for an additional organisation. If it was intended to tax one citizen to supply another with electricity at a loss, that was a political view with which he disagreed as being contrary to sound business principles. To the classes of generating and distributing companies it was proposed to add a third authority—an electricity board—which would purchase electricity from the generating authority, which would have to purchase back the energy which it had produced at a cost increased by the separate organisation. If Parliament would free the industry there was no doubt that the use of electricity would extend much more rapidly. The industry was able to finance itself and only needed reasonable facilities to increase the production and sale of electricity. The progress which had been made in the past was made in face of legislative and other difficulties, and he hoped that Parliament would not impose further fettering restrictions on the legitimate development of private enterprise.

London and Suburban Traction Co., Ltd.

In moving the adoption of the report and accounts at the annual meeting held on March 3rd, Lord Ashfield (the chairman) said that the company was in the same unhappy financial position as it was in a year ago. The sum available was entirely insufficient for the payment of any dividend. During 1925 the London Traffic Act had been put into force. It was the intention of the Act to give protection to tramways, and the London Traffic Advisory Committee proposed to see that that was done. A scheme had been drawn up by the Committee with a view to restricting omnibus competition on tramway routes. During last year the three tramway companies in which the company was interested had lost 10 million passengers, or over 5 per cent. of their traffic. In the meantime the workmen passengers had increased by about two millions. That increase impaired the operating efficiency of the undertakings by exaggerating the peak load traffics and reducing the average fare per passenger. He was convinced that there was a place for the tramways in the scheme of London's transport, and that that place was not a small one. As regarded the future, he said that any forecast must depend entirely upon the steps which the Minister of Transport took under the London Traffic Act. What had been done recently had encouraged him to hope that the Minister proposed to tackle this vital question of London's transport earnestly and vigorously. If that was done they might hope for better results in the future.

Underground Electric Railways Co. of London, Ltd.

The report for the year ended December 31st last shows total receipts of £740,445, a decrease of £53,363, and an expenditure of £62,378, a decline of £27,537, leaving net receipts of £678,067, as compared with £703,893 in 1924. A sum of £126,685 brought forward is added, and after the payment of interest on the company's 4½ per cent. bonds, the 6 per cent. first cumulative income debenture stock, and the 6 per cent. income bonds, a balance of £145,959 is carried forward. The investments have been increased by the purchase of 110,000 ordinary shares of £1 each of the North Metropolitan Electric Power Supply Co. The report shows that the balance of the Common Fund divisible among the companies forming the "Underground" group was £844,519, as compared with £819,724 in 1924. The Associated Equipment Co., Ltd., made a profit of £68,123, which, together with a balance brought in of £53,097, has been carried forward. The report states that the traffic of the tramway companies has continued to decline owing to growing omnibus competition, and the London & Suburban Traction Co. is again unable to pay its preference dividend. The report also reviews the developments in hand by the operating companies, and the Parliamentary proposals, which were dealt with in our summaries of the companies' reports. The death of Sir William M. Acworth is mentioned. The meeting was to be held yesterday (Thursday).

Isle of Thanet Electric Supply Co., Ltd.

Mr. A. R. Monks (chairman) presided at the annual meeting on March 1st. In moving the adoption of the report, which was reviewed in our issue of February 26th (p. 347), the chairman said that of their total revenue (£137,990), the tramway and omnibuses contributed £78,304, lighting and power £59,235, and discounts and transfer fees £451. During the year the capital expenditure amounted to £64,709, mainly upon additional plant and transmission and distribution cables. A 3,000-kW set had been installed to meet the increasing load. As their capital expenditure during the next year or so would be heavy they proposed to increase the capital to £500,000. Applications for new connections continued to come in at a satisfactory rate, and a supply was now being given in Birchington and Westgate which should lead to increasing revenue. The report and accounts were approved, and at a subsequent extraordinary meeting a resolution was passed for the raising of the company's capital.

Durelco, Ltd.

The report for the year ended September 30th, 1925, shows that after writing £545 off debenture expenses there was a loss of £1,345. The company is a holding concern dependent for its income on its subsidiaries. The combined profit of the latter, before providing for debenture interest, &c., was £20,000. Cryselco, Ltd., is said to have earned enough to pay a 10 per cent. dividend on its capital. Duram, Ltd., experienced a record year. Debenture interest and sinking fund absorb nearly £8,500 a year, and this, together with the generally difficult trading conditions, make it incumbent upon the directors to conserve the cash position of the subsidiary companies, and no dividends have therefore been received from these. At the annual meeting on March 4th, the chairman (the Earl of Kintore) said that both Duram, Ltd., and Cryselco, Ltd., had done well during the year. The financial position was being strengthened year by year. Steps had been taken to reorganise the capital of Duram, Ltd., with a view to writing down certain items.

Oxford Electric Co., Ltd.

The balance to the credit of the revenue account for 1925 is £50,112 (including £2,302 brought forward), and after providing for interest, &c., there remains £44,825. It is proposed to place £33,000 to reserve and renewal of plant account, and to pay a dividend at the rate of 7 per cent. on the ordinary shares (2½ per cent. already paid), leaving £2,075 to be carried forward. The directors recommend the division of the £5 ordinary and preference shares into £1 shares, and also the increasing of the capital by the creation of 75,000 6 per cent. cumulative preference shares of £1 each. At the same time it is proposed to raise the present preference dividend from 5 to 6 per cent., and to offer the new shares and the existing 20,000 unissued preference shares to the ordinary shareholders, in the first place. The meeting was to be held yesterday (Thursday).

Smithfield Markets Electric Supply Co., Ltd.

The annual meeting was held on February 25th. Sir H. S. Leon, Bart., who presided, first referred to the death of Mr. Browne Martin, a director, and then, turning to the accounts, said that the profit showed an increase of about £870 and the amount carried forward was £300 higher. The cash reserves had been increased by £9,000, and the financial position was extremely satisfactory. The company was not affected by the recent legislation and, with reduced charges, it was hoped to at least maintain the present output and show good results. In reply to a shareholder, who thought that the dividend might have been higher, the chairman said that it was the board's policy to provide a reserve fund which would enable them to repay the share capital at par if the City Corporation decided to purchase the undertaking in 1932.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The report for 1925 records a net profit of £29,363, which together with £16,871 brought forward, gives an available balance of £46,234. Interim dividends absorbed £8,625, and it is proposed to deal with the balance (£37,609) as follows: To reserve for employés' superannuation, £10,000; preference dividends, £2,125; final dividend of 10s. per share on the ordinary shares (making 15 per cent. for the year), £10,500; leaving £14,984 to be carried forward. In common with the reports of other London companies, the report makes reference to the reorganisation schemes and states that the directors are taking steps to carry out the arrangements embodied in the London Electricity (No. 2) Act, 1925. The sum of £10,000 reserved for employés' superannuation is an initial sum. The meeting is to be held on March 18th.

German Companies.

The *Bavarian Telephone Works Co.*, of Munich, has carried forward the net profits of 6,300 marks earned in 1924-25.

The *Electric Supply Co., of Berlin*, reports that the net profits increased from 1,754,000 marks in 1924, to 2,078,000 marks last year, and the rate of dividend is advanced from 8 to 9 per cent.

The *Electric Light & Power Investments Co.*, of Berlin, which was unable to pay a dividend for 1924, proposes to distribute 8 per cent. for last year out of net profits amounting to 1,540,000 marks. The directors state that the associated manufacturing companies had a larger turnover, as compared with the preceding year and before the war, although the works were not producing at their full capacity, owing to the unfavourable general economic situation, as well as to taxes and social burdens.

French Companies.

The directors of the *Etablissements Electro-Industriels E. Rabet*, of Vessoul, report that the net profits for the six months ended with last December amount to 161,000 fr.

The *Compagnie Générale Parisienne de Tramways* reports net profits of 3,231,000 fr. for 1925, as compared with 3,091,000 fr. in the previous year. The priority shares are to receive a dividend at the rate of 16 fr. per share, the ordinary shares one of 13.50 fr., and the preference shares one of 3.50 fr. per share.

La Société de l'Energie Electrique du Nord de la France, of Paris, is increasing its capital from 70 to 100 million fr.

Spanish Companies.—The *Electra del Lima* concern, which belongs to a group of Spanish electrical companies, has issued over 16½ million pesetas in 6 per cent. bonds for the purpose of completing and extending its power and light works in Portugal, especially at Oporto.—*Reuter's Trade Service* (Madrid).

Cambridge Electric Supply Co., Ltd.—The report for the past year shows a total profit of £33,807. Out of this the directors have placed £15,000 to the depreciation fund and £10,000 to reserve, and recommend a dividend of 7 per cent. for the year, leaving a balance of £5,097 to be carried forward. To meet the demand the company has provided, and is providing, additional plant. It has been established that the Cambridge Corporation cannot acquire the company's works until 1935. The company successfully petitioned against the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Bill last session and secured a protecting clause. The report states that charges have not been reduced. The meeting is to be held on March 17th.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Ever-Ready Co. (Great Britain).—49,800 new ordinary shares of £1 each, fully paid, Nos. 449,001 to 498,800.

Isle of Thanet Electric Supply Co.—72,000 new six per cent. cumulative participating preference shares of £1 each, 10s. paid, Nos. 210,001 to 282,000.

Singapore Traction Co.—71,469 ordinary shares of £1 each, fully paid, Nos. 93,740 to 165,208; 47,110 seven per cent. cumulative preference shares of £1 each, fully paid, Nos. 152,891 to 200,000.

The undermentioned have been ordered to be officially quoted:—

Singapore Traction Co.—71,469 ordinary shares of £1 each fully paid, Nos. 93,740 to 165,208, and 47,110 7 per cent. cumulative preference shares of £1 each fully paid, Nos. 152,891 to 200,000.

Liverpool Overhead Railway Co.—The annual meeting was held on March 4th, Mr. T. D. Killey presiding. After the chairman had moved the adoption of the report shareholders criticised the board on account of its being again unable to pay an ordinary dividend. The chairman said that the success of the undertaking was dependent upon activity at the port, and prospects were much improved. A shareholder considered that the company would save considerable expense if a less frequent service was instituted. The board agreed to meet the shareholders in three months' time to discuss the position of the company, and a committee of three shareholders was appointed for that purpose.

London United Tramways, Ltd.—In the course of his speech at the annual meeting on March 3rd, the chairman (Mr. H. A. Vernet), referring to the deficiency of £29,149 incurred by the company, said that unless some measure of protection was afforded the company it could not continue to carry on. On the Uxbridge-Shepherd's Bush route omnibus competition had increased by no less than 550 per cent. since 1922. If they had to cease running what would be done for the 56,294,000 passengers who availed themselves of the company's services in the past year, 7½ millions of whom held workmen's tickets?

Commonwealth Edison Co.—The operating revenue for 1925 amounted to $58,691,583, and the net operating revenue to $22,429,174. After meeting various charges and adding other income of $937,239, there was a gross income of $15,867 905. The amount available for dividends was $10,766.786, and after paying these a balance of $3,563,844 was carried to surplus. The report states that the business expanded during the year. The amount of energy sold rose by about 11 per cent. to 3,091,424,000 kWh.

Ever-Ready Co. (Great Britain), Ltd.—At an extraordinary general meeting, held on March 1st, Mr. M. Goodchild presiding, a resolution was adopted authorising the capitalisation of £49,800 of the undivided profits of the company. The chairman said that there was an increasing demand for their batteries, and new avenues for further expansion were constantly being sought. The liquid resources of the company were very strong, and they proposed to issue the new capital in the form of £1 shares to the ordinary shareholders.

Mackay Companies.—The report for 1925 records an income from investments of $4,801,207. Regular quarterly dividends at the rate of 4 per cent. per annum on the preferred shares and 7 per cent. on the common shares have been paid. It is stated that the operating companies' business has continued to expand despite the competition of other methods of communication. The investments are valued at $94,294,549, against liabilities of $768 808. The issued capital is $91,380,400, giving a surplus of $2,145,341.

Shawinigan Water and Power Co.—The gross earnings during 1925 amounted to $6,702.034 and the net receipts to $2,366,338, as compared with $2 045,899 in 1924. After making the usual allocations and paying dividends at the rates of 7 per cent. for the first six months of the year and 8 per cent. for the latter half, a balance of $573.246 is carried forward. The working capital is shown at $3,398,083, as compared with $1,649,979 at the close of 1924.

Bell Telephone Co. of Canada.—The net operating revenues for 1925 amounted to $5,897,964, an increase of $361,150. In spite of this, however, the final result was a deficit of $8,712, as compared with a credit balance of $552,057 in the preceding year. The difference was due to a larger amount paid out in dividends.

Italian Company.—*La Società Italiana Metallurgica-Elettrotitica*, of Milan, is increasing its capital from 4,500,000 to 7,255,000 lire.

British Insulated Cables, Ltd.—A final dividend of 5 per cent. and a bonus of the same amount have been declared on the old ordinary shares, making 15 per cent. for the year. The new (bonus) ordinary shares are to receive a 5 per cent. dividend and a 5 per cent. bonus, making 10 per cent. £408,333 is transferred to reserve and depreciation, and £224,000 is carried forward.

W. Canning & Co., Ltd.—The report for the year ended December 31st last shows a profit of £43,297, to which is added £6,697 brought forward, making £49,994. It is proposed to pay a dividend of 10 per cent. and a bonus of 6d. per share upon the ordinary shares, to transfer £15,000 to reserve, to allocate £1,000 to the employés' benevolent trust fund, and to carry forward £4.228. The 1924 dividend was 10 per cent. Meeting: March 15th.

Davis & Timmins, Ltd.—The net profit for 1925 was £17,998, and to this is added £24,799 brought forward, making £42,796. A final dividend at the rate of 10 per cent., free of tax, is recommended on the ordinary shares (making 8 per cent., tax free, for the year), plus a bonus of 17 per cent., free of tax. A similar distribution was made in 1924. The carry-forward is £24,588.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.—The list for public applications for the issue of £400,000 five per cent. first mortgage debentures to bearer was closed at 11 o'clock on Saturday morning. Applications for renewals by existing debenture holders up to the amount of their present holdings must be received not later than March 15th.

Midland Electric Corporation for Power Distribution, Ltd.—A final dividend of 5 per cent., and a bonus of 5 per cent. are recommended on the ordinary shares, making a total distribution of 15 per cent. for the year, as in 1924. The directors propose to offer 70,000 new £1 ordinary shares to present shareholders at par.

Reduction of Capital.—Armorduct Cable Co., Ltd., and Reduced.—A petition for the confirmation of the reduction of capital of this company from £10,100 to £2,341 has been presented to the High Court, and will be heard in London on March 16th.

City of London Electric Lighting Co., Ltd.—The directors recommend the payment of final dividends on the 6 and 8 per cent. cumulative preference shares, and one of 2s. per share on the ordinary shares, making 15 per cent. for the year.

Vickers, Ltd.—The final dividends have been declared on the preferred stock and preference shares, but no dividend is to be paid on the ordinary shares which were recently reduced from £1 to 6s. 8d. each.

Clarke, Chapman & Co., Ltd.—A final dividend of 2½ per cent. has been declared on the ordinary shares, making 5 per cent. for the year. £6,259 is transferred to reserve and £2,192 carried forward.

Western Telegraph Co., Ltd.—The directors have declared the second quarterly interim dividend of 5s. per share, free of tax, for the year ending June 30th, 1926, being at the rate of 10 per cent. per annum.

Globe Telegraph and Trust Co., Ltd.—The usual quarterly dividend of 1½ per cent. has been declared on the ordinary shares.

Brazilian Traction, Light and Power Co., Ltd.—A quarterly dividend of 1½ per cent. has been declared on the preference shares.

Eastern Telegraph Co., Ltd.—Final dividend for the year ended December 31st, 1925, of 2½ per cent. free of tax, on the ordinary stock, making 10 per cent. free of tax.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Final dividend for the year 1925 of 5s. per share, free of income tax.

Central Electric Supply Co.—The £800,000 5½ per cent. secured and guaranteed notes will be redeemed at par on April 1st.

British Columbia Electric Railway Co., Ltd.—The company is making an issue, for public subscription in Canada, of $1,500,000 six per cent. preferred stock.

Stocks and Shares.

Monday Evening.

New York has been passing through a financial panic and subsequent recovery, which have left their mark upon prices of various utility stocks and shares in companies that operate in Mexico, Canada and Brazil. So far as active interest amongst investors in this country went, Brazilian Tractions provided the most interesting storm centre. The price fell from 97 to 91, rallying sharply to 94. Points were sheared off the prices of Montreal Light, Heat & Power, Pennysylvania Water, Shawinigan, and others of this description. American Telephones gave way and there was a general offering amongst American industrials of all kinds, following the slump which

overtook the shares of the United States railroad companies. As soon as the force of the panic had blown itself out, reaction set in, and prices swung up again. The effect of this particular excitement on London might have been disastrous had there been any open account on this side in American shares, but, interest being so limited, the proceedings from Wall Street have been watched with an attention mainly academic.

The City of London Electric Lighting Co. has announced a final dividend of 2s., making 15 per cent. for the year, and this completes the tale of the dividend announcements by the London electricity supply companies. In every case the distribution is to be at the same rate as that for 1924. The directors evidently consider it judicious to fortify reserves, and to strengthen the financial position of the companies, rather than to distribute earnings upon the scale which they could have done had they chosen to have been less conservative. The prudent policy is likely to turn out the best for shareholders. Anticipation now looks forward to the time when the capitals shall be re-organised in accordance with the terms of the Bills passed by Parliament last year. London Power 5 per cent. debenture stock has risen to 7/16 premium, and is likely to go better when the stock is settled into permanent investment hands.

The India Rubber, Gutta Percha & Telegraph Works Co. has offered £400,000 5 per cent. first mortgage debentures to bearer at 93, redeemable 1936. This issue is made solely for the purpose of repaying an existing amount of similar extent. Holders of the expiring debentures receive preference in allotment and £7 difference between the redemption price of their existing stock and the issue price of the new. No underwriting was considered necessary, and this confidence became justified by prompt over-subscription of the stock.

Changes in the prices of electricity supply shares are almost negligible. The only alteration that is worth noting is a rise, in partial recovery of the dividend, in St. James' & Pall Mall shares to 15⅞. London Electric preference are a shade harder, and the ordinary shares at 32s. are also a little better, allowing for deduction of the dividends in both cases. Midland Counties ex dividend are 22s. 3d. The Midland Electric Corporation for Power Distribution is about to offer 70,000 new ordinary shares to its proprietors in the proportion of one new share for every four shares held. The existing price of the old shares is 53s., and the company's 7 per cent. preference stand at 25s. middle. Metropolitans remain at 39s. 6d., the dividend being at the rate of 16 per cent., to make 11 per cent. for the year, the same as that for 1924. The net receipts for the twelve months show an increase of £31,000.

Underground Railway stocks are steady, Metropolitans and Districts being quoted ex dividend last week. Taking these deductions into account, the prices are but little changed. The fear of an engineers' lock-out and a strike in certain other trades are deterrents against investment and speculation in Home Railway stocks. Underground Electric ordinary and "A" shares are both firmer. The company's report shows that net receipts for last year were £678,000 against £703,000 in the year before. Substantial economies were effected in expenditure, but the traffic showed a decline, not very surprising in view of the fact that the figures went against those of the first Exhibition year.

Cable stocks and shares are neglected, an eighth fall in Western Telegraphs being offset by a similar improvement in Eastern Extensions. It is worth noticing that the latter now stand 7s. 6d. higher than Westerns Both companies pay the same dividends, namely, 10 per cent. for the year, the Western having declared its usual quarterly distribution a few days ago. Eastern ordinary remains at 177½. Chili Telephones are 5/16 up at 6⅞, the rest of the telephone group holding its prices.

Wireless shares are dull, and, although Marconis are called nominally 23s. 9d., the market in them is heavy. Burndept preferred strengthened to 15s. 9d. Radio Corporation Common fell to 6½ on the slump in New York, but recovered part of the drop, being now quoted at 7½. The preferred are 9¼ xd. Telephonic communication having been established with New York, the Stock Exchange and Wall Street markets can exchange vocal greetings. Business between the two centres has yet to revive.

Amongst manufacturing shares, Edison-Swans gave way to 8s. 6d. Electric Constructions are lower at 32s. 6d., English Electrics weakened to 19s. 6d., Brush to 27s. General Electric ordinary and preference are both down. The disposition has been to let prices droop in the absence of fresh support from investment, and the apprehension of renewed strikes. British Insulated continue steady at 3, on the dividend and bonus, making 15 per cent., the same as last year, when, however, the capital was considerably less than it is to-day. It may be recalled that the British Insulated distributed a share bonus of 33⅓ per cent. some few months ago.

The engineering group is marking time, with Babcocks 53s. 9d. Rubber shares are in a state of suppressed excitement. The panic in America caused a drop in the price of the raw stuff, but, in spite of this, buyers of shares came forward on this side, and the market looks more cheerful than it has done for the last few weeks There is a noticeable demand for shares in the best class companies, and with rubber close to half-a-crown per lb., confidence is beginning to return.

Share List of Electrical Companies

	Nom.	Dividend. 1923	1924.	Price Mar. 8, 1926.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	13	14	62/-	—	4 10 4
Brompton Ordinary	£1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	£1	14½	15	45/9	—	6 11 2
do. do. 4½ Pref.	£1	4	4½	17/-	—	5 5 11
Chelsea	£1	12	12	2⅛	—	5 12 11
City of London	£1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	£1	6	6	22/6	—6d.	5 6 8
Clyde Valley	£1	8	8	30/-	—	5 6 8
County of London	£1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	£1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	£1	7	7	24/-	—	5 16 8
do. 7% Pref.	£1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	£1	10	10	32/6	—	6 3 0
Kensington Ordinary	£5	14	15	14¼	—	5 5 3
Lancs. Light and Power	£1	7½	7½	27/-	—	5 11 1
London Electric	£1	10	10	32/- xd +6d.		6 5 0
do. do. 6% Pref.	£5		6	5⅝xd.	+1/16	5 11 7
Metropolitan	£1	10	11	39/6	—	5 11 4
do. 4½% Pref.	£1	4½	4½	17/6	—	5 2 10
Midland Counties	£1	5½	6	22/3xd.	—	5 7 10
Newcastle-on-Tyne Ordinary	£1	6	7	23/9	—	5 17 11
do. 5% Pref.	£1	5	5	18/9	—	5 6 8
do. 7% Pref.	£1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	£10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	£1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	£5	17½	17½	15 7/16xd.	+¼	5 13 10
South London	£1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	£1	7	7	1 5/16	—	5 6 8
Urban Ordinary				19/6	—	4 2 1
do. 6% Pref.	£1	6	6	1	—	6 0 0
Westminster Ordinary	£1	15	15	45/-xd.	—	6 13 4
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	£1	8	8	29/-	—	5 10
Home Rails.						
Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	4	5	66½xd.	+½	7 10 5
do. District	,,	3½	3½	47xd.	—	7 12 2
Underground Electric Ordinary	£10	Nil	Nil	2½	+⅛	Nil
do. do. "A"	£1/-	Nil	Nil	8/-	+6d.	Nil
do. do. Income	Bonds	6	6	97xd.	—	*6 3 9
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	£1	3	6	52/-	—	2 6 2
Chili Telephone	£5	6	5	5⅞	+5/16	*3 12 9
Cuba Sub. Ord.	£10	5	5	6⅜	—	7 8 2
Eastern Extension	£10	10	10	18⅜	+⅛	*5 10 4
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	£10	10	10	18½	—	*5 9 7
do. do. Pref.	£10	6	6	10⅞	—	5 10 4
Great Northern Tel.	£10	22	22	32	—	6 17 6
Indo-European	£25	7	8⅜	45½	—	*4 13 5
Marconi	£10	10	23/9	—	8 8 6
Marconi Marine	£1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	£1	12	12	2⅛	—	*5 12 11
United R. Plate Tel.	£5	8	8	7⅞	—	5 1 7
Western Telegraph	£10	10	10	17¾	—⅛	*5 12 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3 3/16	—	8 12 6
do. do. 2nd Pref.	£5	6	6	2⅝	—⅛	10 8 8
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	117½	—	5 2 2
do. do. 6% Pref.	,,	6	6	107	+1	5 12 2
Brazil Traction	£100	4	4	94	—3	5 6 5
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	103½	—	*4 11 9
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4¼	4¼	78	—1	5 9 0
London & Sub. Trac. 5% Pref.	£1	2½	Nil	5/6	+6d.	Nil
London United Tram. Deb.	Stock	4	4	48	+3	8 6 8
Mexico Trams, 5% Bonds	—	5	5	60½xd.	—	8 5 4
Mexican Light Common	£100	Nil	Nil	32½	—	Nil
do. Pref.	£100	Nil	Nil	64½	—	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	£1	5	—	15/-xd.	+6d.	6 13 4
Manufacturing Companies.						
Babcock & Wilcox	£1	12	12	2 1/16	—	*4 9 5
British Aluminium Ord.	£1	5	10	38/9	—	5 0 2
British Elec. Transformer Pref.	£1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	£1	15	15	3	—	5 0 0
Brush Ord.	£1	10	10	27/0	—6d.	7 8 2
Callenders	£1	15	15	3½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	22/6	—	5 15 7
Crompton Ord.	£1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	8/6	—6d.	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	£1	10	10	32/6	—1/3	6 3 1
Enfield Cable, Pref.	£1	7½	7½	1½	—	6 0 0
English Electric	£1	5	5	19/6	—6d.	5 2 7
do. do. Pref.	£1	6	6	20/-	—6d.	6 0 0
Gen. Elec. Pref.	£1	6½	6½	23/6	—6d.	5 10 8
,, Ord.	£1	5	7½	31/3	—9d.	4 16 0
Henley	£1	15	16	3⅝	—	4 7 3
do. 4½% Pref.	£5	4½	4½	4½xd.	+2/-	5 6 0
India-Rubber	£1	5	5	1½	—	*4 0 0
Johnson & Phillips	£1	10	10	2 1/16	—	3 8 3
Met.-Vickers, Ord.	£1	8	8	27/-	—	5 18 6
do. Pref.	£2	8	8	2 7/16	—	6 11 3
Siemens Ord.	£1	—	7½	31/3	—	4 16 0
Telegraph Construction	£12	20	10	29	—	*4 2 9

*Dividends paid free of Income Tax.

The Ideal Home Exhibition.—II.

Electrical Features at Olympia.

In this issue we are able to reproduce some views of the Electric House " which has been arranged at Olympia by the ritish Electrical Development Association (*vide* our last issue, 403). These give a good impression of what an all-electric me should be, and contrasted with Mid-Victorian " horrible amples " (for which we have no space) the brightness and mosphere of well-being of the apartments are considerably hanced. The first view shows the exterior, which is attrac-ely decorated, with a specially dressed bay window, an elec-ical " address," and a small lawn with an electric mower. g. 2 depicts the laundry and is illustrative of the labour-sav-g attributes of electricity. Fig. 3 shows the bathroom and emplifies the convenience and cleanliness of electrical

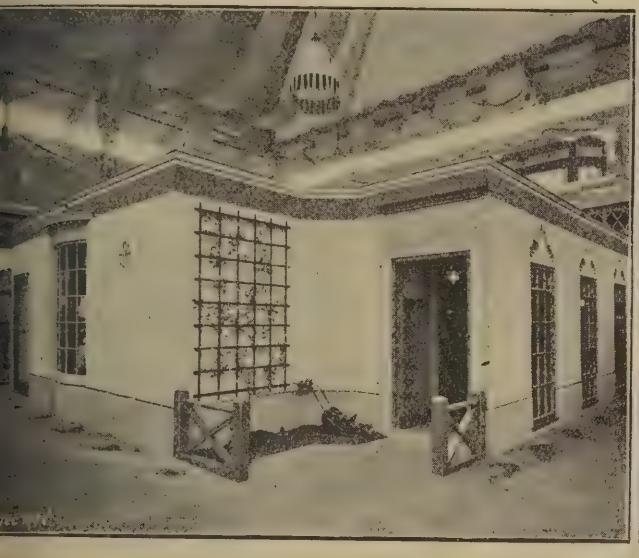


Fig. 1.—An Exterior View.

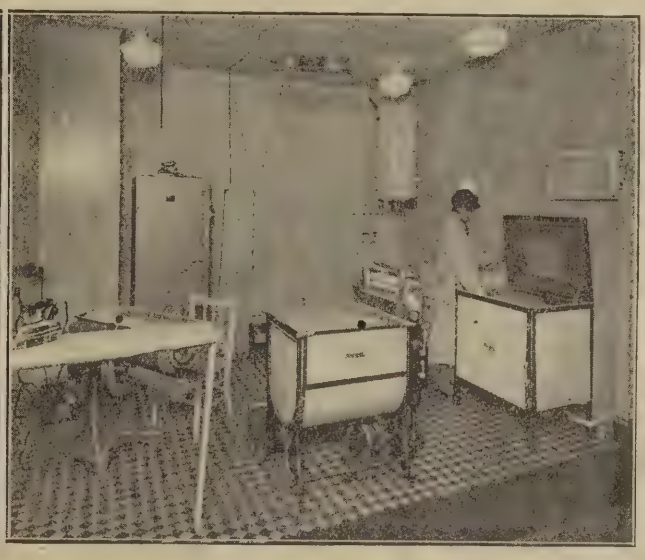


Fig. 2.—The Laundry.



Fig. 3.—The Bathroom.



Fig. 4.—The Sitting Room.

The Electric House at Olympia.

thods. The comfort of an electric home is impressed upon visitor by the sitting room, illustrated in fig. 4, with its itation coal fire, ample light where it is needed, a fan, and a endid radio set. One feature which will be noticed is the tch plug fitted beneath the table, which eliminates the ible lead from the lampholder which is usually required if le appliances are employed. The Electric House is of the main attractions of the Exhibition, and are bound to remark that it is the only electric house re. There are again a number of attractive model resi-ces open to the public, but, as usual, the only application electricity appears to be lighting. On the other hand, ong the " Kitchens of All Nations " which have been anged in the gallery there is an American type in which electric cooker has been installed. Generally speaking, part played by electrical firms in this year's exhibition is rger and more attractive one. The following notes indi-the principal electrical features which are to be seen :—

Hotpoint Electric Appliance Co., Ltd.

A wide variety of apparatus is displayed by this company. Among the appliances shown is the new " Falconette " cooker, which is very suitable for small dwellings. It has an oven measuring 9 in. by 10½ in. by 12 in., with a drop-down front. There is a bottom element and another one in the top which serves both for the oven and as a grill. The total loading is 3,000 W. A device which we think is new to this country is the " Toastmaster " (American) timed toasting appliance. Several designs are shown, but the main features are levers which lower the bread into the body of the appliance, and at the same time switch on. There is a timing device graduated in seconds, and until this is set the levers will not remain down. When the toasting time has elapsed the levers are released and bring the bread out. Another type of cooker shown is fitted with the new " quick-service " boiling rings which can be substituted for the older patterns. An " Aerobell " washer, " Premier-Duplex " vacuum cleaners, toasters, kettles, irons, fires, &c., are also on view.

L. G. Hawkins & Co., Ltd.

This company again has a very comprehensive display of electric lighting, heating, cooking and labour-saving appliances. The lighting fittings, especially, are of a very high order, and comprise electroliers, standards, bowls, &c., of excellent glass and metal work. The appliances are too numerous to mention separately; it will suffice to say that there are few of the familiar devices absent. A part of the stand has been made into a small demonstrating theatre. There is seating accommodation, and upon a dais is mounted

a model electric kitchen in which Ald. Mrs. Hammer and Mrs. Pearmain, of Hackney, show and explain the use of the "Universal" cooker.

Belling & Co.

Electric fires form the main part of this exhibit. Several examples of "period" styles, including "Jacobean" and "Adam" patterns, are shown, and they are all of handsome appearance. A lighter reflector type appears, consisting of a sheet metal body with a coppered reflector, below which the elements are mounted horizontally. An effective contrast has been arranged between an electric fireplace and one of the ordinary coal variety with its concomitants of dust and trouble. Examples of double fires in art metal are also exhibited. The cooking exhibit includes a standard range with plug-in elements and a separate grilling and boiling table. Each element is controlled by a three-heat switch mounted on a separate board. Water-heating apparatus, kettles, irons, hotplates, and other appliances complete the exhibit.

Dowsing Radiant Heat Co., Ltd.

This company's show is also a widely-varied one ranging from an electric cooker to a cigarette lighter. The cooker is a Canadian design (McClary's), and its principal advantage is the way in which the elements are clipped into position. Apart from this the appliance is of very handsome appearance, and is mounted on legs of convenient height. The oven has a drop-down front, in which a dial thermometer is fitted. The "Sunrae" carbon arc lamp giving ultra-violet radiation and an artificial sunlight projector are other exhibits. In addition there are radiant heaters ("sausage" type), kettles, irons, branding irons, violet-ray apparatus, sealing wax heaters, glue pots, and many other appliances.

Standard Telephones and Cables, Ltd.

This stand is divided into two main sections. The first contains two sideboards upon which are arranged a number of electric table appliances—urns, percolators, toasters, &c., while upon the carpet with which the floor is covered the "Standard" vacuum cleaner is demonstrated. The other half is arranged as a model laundry in which are two "Western Electric" washing machines, an ironer and irons; these are continuously demonstrated.

International Electric Co., Ltd.

Intercommunication and other telephone equipment is shown by the company, including mining and G.P.O. automatic telephones. A radio receiving set and a new type of loud speaker are other exhibits.

Francis Polden & Co., Ltd.

A selection of Best & Lloyd lighting fittings is one of the notable features of this stand. In addition, the company shows examples of the "Frigidaire" refrigerator and the compact "Delco-Light" small generating set. Other exhibits are "Hoover" vacuum cleaners, electric fires of many patterns, portable radio sets, irons, kettles, and other domestic appliances.

Read & Morris, Ltd.

The speciality of this company is a radio receiver which works from d.c. mains and thus dispenses with batteries. A typical example shown is a 3-valve hospital receiver which is being supplied to the Millbank (military) Hospital under the *Daily News* scheme. The installation is capable of working 350 pairs of 'phones and seven loud speakers. Other sets on view are a 5-valve set with a loud-speaker range of 2,000 miles and a domestic set for use on d.c. mains.

Thorn & Hoddle, Ltd.

A part of this stand is arranged as a country residence power house. In it are a small "Pelapone" lighting set, together with an appropriate battery and switchboard. Another notable exhibit is a larger "Pelapone" set giving from 100 to 140 A at 80 V. Lighting fittings are also shown.

S. G. Brown, Ltd.

A fine collection of loud speakers appears on this stand. Among them are examples of instruments with beautifully-produced mahogany trumpets, cabinet patterns, "Crystavox" speakers for use with crystal sets, &c. An outstanding exhibit is the "P.Q." loud speaker with a long straight horn, designed for demonstration and outdoor purposes.

Electrolux, Ltd.

This company shows for the first time at an exhibition the ingenious refrigerating apparatus described in our issue of February 26th (p. 327), as well as the more familiar "Electrolux" vacuum cleaner.

Reliance Telephone Co., Ltd.

Two patterns of automatic telephone exchanges are to be seen on this stand, as well as many examples of intercommunication telephones of wall and desk patterns and different designs, and the "Cannon" burglar alarm, an electrical relay system.

Hammond Bros. & Champness, Ltd.

Among a display of lift equipment this company shows a working service lift fitted with push-button control.

Delco Light Co.

A number of examples of "Frigidaire" units and refrigerating cabinets are shown by this firm, in addition to its well-known "Delco-Light" small generating set.

Hurley Machine Co.

This firm shows the popular "Thor" washers in operation, both the revolving-cylinder and vacuum cup types, in addition to ironers and vacuum cleaners.

Beatty Bros., Ltd.

This company also has an electric washing display employing "White Cap" and "Red Star" washing machines and an ironer.

Other Exhibitors.

The following concerns also have stands at the Exhibition:—Electric Appliances Co., Ltd. ("Eureka" vacuum cleaners); Venetian Glass Galleries and A. Martelli (artistic lighting bowls); B.I. Syndicate, Ltd. ("Astro" reflectors); Mechanical Refrigerator Co., Ltd. (electrically-driven refrigerators); I. Calvete, Ltd. (electro-medical apparatus); British Vacuum Cleaner Co., Ltd. (the "Turbinet" electric vacuum cleaner); Hoover, Ltd. (vacuum cleaners); Betax Mfg. Co., Ltd. (fans, vibrators, bowl fires, &c.); A. W. Gamage, Ltd. (washing machines and vacuum cleaners); and Singer Sewing Machine Co., Ltd. (electrically-driven machines).

The Exhibition remains open until March 27th.

Electrical Power Engineers' Association.

N.W. Midlands Section: Annual Dinner.

The North-West Midlands Section of the Electrical Power Engineers' Association held its annual dinner at the Star and Garter Hotel, Wolverhampton, on March 3rd, when nearly one hundred members and friends were present, and Mr. D. J. Duffy, chairman of the Section, presided.

Mr. F. Forrest in proposing "The Association" conveyed a message of greeting from the president of the Institution of Electrical Engineers, who was unable to be present. In referring to the proposed national electricity scheme, he suggested that the Association would have to watch the Bill and see that the interests of its members were safeguarded. Mr. A. J. Ostler, past-president of the Association, in reply, said the progress of the Association had been due to the amicable working of the Joint Boards, the very pleasant atmosphere of which made good work possible.

Mr. S. T. Allen, chief engineer, Wolverhampton, proposed "The Joint Boards." He drew attention to the great debt which the industries of this country, and the electrical industry in particular, owed to Mr. Whitley for his scheme, out of which arose the joint boards and joint industrial councils which had preserved in the electrical industry comparative peace since their inception.

Mr. J. H. Legge replied for the employers' side of the joint boards, and said that, to his mind, it was quite wrong for the Government to have anything to do with an industry so young. The Government in its proposals appeared to be concentrating on generation alone, but much of the work to be done in this country was to develop the industry. In generation there was no country that could beat us on the figures we obtained, but we were too far behind in selling; more attention should be paid to that side. One difficulty he had in his undertaking was to obtain men with both commercial "kick" and sound engineering ability.

Mr. W. Arthur Jones, general secretary of the Association, replied for the employés' side of the joint boards, and referred to the very valuable work accomplished by the No. 5 District Joint Board, in particular with regard to the training-of-engineers scheme. He said the Association had not had a national dispute since the inception of the Whitley Council, and if that lesson was taken to heart it would be much better for industry generally.

Mr. F. J. Baldwin proposed "The Visitors," to which Mr. A. Whitehouse, J.P., responded, making special reference to the amicable relations between himself and the chief engineers with whom he had come in contact during the formation of the Joint Electricity Authority for the West Midlands area.

Mr. T. A. G. Margary referred to the valuable work of the entertainments committee, and specially mentioned Mr. P. M. Pinder, who in reply thanked all members for their co-operation.

An excellent and varied programme of entertainment was interspersed between the different speeches during the evening, the artistes being: Mrs. Thomson, Mrs. Whale, Mr. Brewer and Partner, and Messrs. Friend and E. J. Smith, to whom a vote of thanks was very heartily given.

The British Industries Fair.—V.

A Review of Electrical Exhibits.

Holden & Hunt.

A number of resistance welding machines were shown by this company. The principal one was a spot welder capable of dealing with iron and mild steel up to ¼ in. thickness with one setting and up to 5/16 in. thickness for occasional work. The rating is 12 kW and an automatic trip switch is fitted to guard against excessive loads. Operation, by a foot pedal, is effortless and within the capability of unskilled boys or girls. A hand-operated, 30-kW butt-welding machine was another exhibit. This appliance is water-cooled throughout and has an efficient heat-regulating arrangement. A chain-welding machine (5 kW) capable of dealing with from 10 to 20 links per minute, according to size, was also shown.

Jackson Electric Stove Co., Ltd.

This company, whose stand was prominent in the view of a part of the electrical display which was reproduced in our issue of February 26th, had a representative exhibit of its cooking and heating appliances. Fires of many designs were on view, including a number of elaborate "period" models and the "No. 589" general utility fire—a plain design with a cheerful appearance. The domestic side of electric cooking was represented by ten cookers to cater for families ranging in number from 2-3 to 10-14 persons. These were all fitted with the special elements which distinguish "Jackson" cookers. Commercial cooking apparatus was also given prominence. One of the appliances in this section was a large fish fryer with a pan measuring 18 in. by 14 in., designed to protect the elements from drippings. The total loading of this appliance is 4,900 W and it has hot-cupboards for storage purposes with a 350-W element. A large roasting oven was shown. This, with a loading of 10 kW, is capable of cooking from 150 to 200 lb. of meat at a time. The oven has a central lagged shelf dividing it into two parts. A collection of hot-plates and hot-cupboards (one of the latter being able to deal with 600 plates) formed a part of the exhibit. There were also a number of wash boilers in various finishes as well as water boilers, irons, kettles, toasters, and other appliances.

Electric Heating & Hardware, Ltd.

"Glowincoal" fires were the principal feature of this stand. This type of fire has a realistic imitation of glowing coals placed below a curved reflector. The elements are mounted horizontally at the foot of the reflector behind the "coal." A number of designs were shown, all of them of very attractive finish. In addition the company exhibited its "Komet" irons some of which were fitted with an automatically-released switch in the handles, while others had separate earthing terminals with a corresponding plug in the connectors.

Bastian Meter Co., Ltd.

The well-known "Quartzalite" element was in evidence here. Fires employing this tube of "solid" red heat were shown in various designs. "Bastian" storage geysers were another important exhibit. This appliance has been conceded special rates by a number of electricity supply authorities, several of which have adopted the geyser for their hiring schemes. An electrically-heated towel rail with the low loading of 660 W was another appliance shown, and the company also displayed small heaters, a small steel hardening furnace, an ozone generating machine, the "Pigmy" heater, small grills, and d.c. meters.

British Electric Transformer Co., Ltd.

This company's stand was one of the largest in the section; it had a frontage of about 70 ft. and was designed to show the firm's ability to supply large quantities of electrical appliances. To this end the back of the stand was almost entirely covered with an orderly array of fires, kettles, irons, toasters, &c. At each end of the stand small rooms were arranged to represent a sitting room, study, &c., and equipped with the company's "Sun Ray" radiators in various forms. These radiators, which have lamps as heating elements, diffuse a soft warm light and impart an air of cheerfulness to a room. Four types of "Tricity" cookers were shown, and the company's transformer business was represented by a number of photographs.

May & Padmore, Ltd.

This company also showed electric fires of various designs, many of them possessing a highly-artistic appearance. In addition to these, soldering irons, kettles and other devices were exhibited.

Veritys, Ltd.

Squirrel-cage and slip-ring motors formed the major part of this company's display, together with spare rotors and examples of windings. Rotor and stator starters, totally enclosed and ironclad with automatic features, and drum-type star-delta starters, were also shown. The "Orbit" fan, which has a wavelike reciprocating movement, was another exhibit, and upon this stand and that of the Birmingham Electric Supply Department, were a number of examples of "Maxlume" industrial lighting fittings.

Belling & Co.

A number of imitation coal fires with reflector backs, &c., were exhibited by this firm, including one model fitted into a standard grate. "Belling" cookers were shown in operation, and there were numerous examples of other domestic electrical appliances. One of the latter was a 400-W towel rail, the elements of which were contained in a removable cage.

Mouldensite, Ltd.

This company's exhibit included many samples of its phenolic condensation products, together with raw materials used in the process of manufacture. The samples included synthetic resins, moulding powders and impregnating varnishes, as well as numerous mouldings produced from "Mouldensite" powders, these being particularly suitable for electrical and radio apparatus. The mouldings possess a very high finish, which is maintained under practically all working conditions. The material is not affected by heat, moisture, water, oils, acids or petrol. In its finished form "Mouldensite" is claimed to possess very satisfactory dielectric and mechanical strength.

Hart Accumulator Co., Ltd.

This exhibit was devoted almost entirely to batteries for radio work. A feature of the l.p. patterns is the fact that they are assembled in pressed glass containers. Upon the insides of these are moulded ribs or grooves between which the plates rest, obviating the need for bottom blocks which tend to collect active material expelled from the plates, sometimes bridging the latter. The separators are of corrugated sheet ebonite. Celluloid-cased accumulators were also shown, as there is a large demand for these. In the "PLRG" h.p. battery, which was shown, the plates are contained in a moulded box provided with internal ribs arranged in such a manner that when a number of the cells are assembled together to form a battery the points of contact are reduced to a minimum, giving perfect insulation. The boxes are made of either ebonite or glass, and they are put up in teak crates. Another h.p. battery shown consists of circular glass boxes, each with a projecting rib which holds it in position on a perforated tray. There were also examples of house-lighting, vehicle, automobile, and central station batteries.

Henry Watson & Sons, Ltd.

A novel electric lawn mower appeared on this stand. The design of the machine is claimed to be unique inasmuch as the motor is effectively protected by being housed inside the main roller. The cutting cylinder is mounted on ball bearings and is driven by a train of helical gears running in an oil bath. The machine weighs less than 1 cwt. and is very compact. It will be understood that it is not *propelled* electrically but the electrical cutting gear facilitates movement.

G. Turnock.

This Birmingham firm showed, *inter alia*, an improved cable connector for jointing cables without solder, and also a device for taking a service wire off a main. Another exhibit was a novel method of winding heating coils, making it possible to confine 200 W in a tube 5 in. long by ⅛ in. in diameter. This is used for insertion purposes in the textile trades. A charging board for d.c. was shown. This had five circuits, the first of which was in series with the other four which were in parallel, to give various charging currents. Each circuit was provided with a separate 6-in. ammeter.

S. J. Daulby.

Upon this stand were exhibited a collection of d.c. motors and dynamos. These machines incorporate the Morgan patent, which consists principally of special ventilated pole pieces in conjunction with a fan, which creates an air swirl round the windings and through the pole pieces, keeping the temperature rise very low. The display included some small polishing motors ranging from 0.25 to 2 h.p.

E. H. Millington & Co., Ltd.

This company showed a wide range of shade and bowl fittings, plain and decorative, wall brackets, globe holders, ceiling roses, &c. A section was devoted to radio apparatus, and in this were "Lintaphone" crystal sets, two-valve sets, and a collection of components.

Rapid Magnetting Machine Co., Ltd.

This company exhibited examples of its electro-magnetic separators, some of which were of the rotary pattern with a revolving brass drum in which electro magnets are fixed, and over which the material to be treated is passed. Another pattern shown was of the shoot type, consisting primarily of an inclined plane having a series of powerful electro-magnetic bars of alternate polarity extending the width of the shoot, and magnetised throughout their length. This is particularly suited for the treatment of grain, as was demonstrated on the stand.

Wm. McGeoch & Co., Ltd.

Marine electrical fittings formed the bulk of this display. These included navigation lamps, switchgear, a special battery switchboard, lighting fittings for ships' use, navigation light indicators, and numerous accessories.

C. H. Parsons, Ltd.

In addition to their usual display of lampholders, tumbler switches, &c., Messrs. Parsons this year showed the "Ripplephone" headphones, for which they hold the sole manufacturing and selling rights. The switches shown included a number of shock-proof patterns with unbreakable composition covers. The tumbler switches exhibited were of a wide variety of finishes.

B.S.A. Radio, Ltd.

This new concern had a section of the stand of the Birmingham Small Arms Co., Ltd., and exhibited several examples of its radio sets, all of which were of very ornate design.

W. E. Burnand & Co.

One section of this exhibit comprised a.c. motors, including one for heavy work, having an extra large shaft, on which, for instance, a heavy band saw pulley could be mounted, and cast steel end frames. Examples of buffing and grinding motors were also shown. Another exhibit was an electric rivet heater capable of dealing with three $\frac{5}{8}$-in. diameter rivets up to $3\frac{1}{2}$ in. in length. An electric furnace was also shown.

Tok Switches, Ltd.

This was a very comprehensive exhibit of the firm's British-made rotary snap switches; numerous designs were shown, and one application which has met with the approval of engineers of supply companies was the "Aristocrat" interlocking switch plug for surface mounting, consisting of a double pole rotary switch with an external indicator, and a plug of the B.E.S.A. end-shield pattern fitted with an earthing terminal, capable of taking a wide range of cables.

London Electric Wire Co. & Smiths, Ltd.

A very comprehensive display of its wires and cables was made by this concern. Special prominence was given to "Glazite," the wire covered with many colours, for use in radio sets. Another radio product shown was the "Lewcos" inductance coil which is claimed to have a low h.f. resistance.

B.K.B. Electric Motors, Ltd.

A number of strongly-constructed fractional h.p. motors were shown by this firm, including an induction motor with a centrifugal switch device. An application of these motors in the form of the "Giljay" d.c. battery charger, the machine being fitted with a double-wound laminated armature and two commutators. A small switchboard with an ammeter is mounted on the frame of the machine and the whole forms a very compact and easily-operated equipment.

Magnetic Separators, Ltd.

This company's principal exhibit was a "Cascader" separator for extracting iron from granular or powdered materials and liquids. The machine is constructed in a series of steps, each step being undercut and having beneath it a magnetic field. As a result the lines of force from the pole shoes pass from a higher to a lower level across the undercut edge, developing a very strong magnetic field throughout the entire width of the magnet. Consequently as the flowing material falls over the pole shoes from a higher to a lower level any particles of iron, which would otherwise be carried along, are drawn into the angular spaces out of the path of the flow and retained there. Magnetic pulleys were another exhibit of the company.

Bulpitt & Sons, Ltd.

Among a collection of aluminium ware, this company showed a range of electric kettles, fitted with a loop-type immersion element and a patent safety device. The latter consists of a spring compressed into a small copper tube and retained in position by a plunger soldered with a special alloy into the open end. When the kettle is overheated the alloy melts and releases the spring, throwing off the connector.

Arora Co.

Several examples of its electric fires were shown by this firm. These were fitted with the firm's standard firebars which employ extra heavy tape-section strip for the coils, giving radiant heat at low current density. Cast-iron and sheet-metal frames were exhibited, and the types included the standard upright, bowl, reflector and other patterns.

Imperial Engineering Co.

This firm's exhibit was composed of a number of domestic appliances, including fires, irons, toasters, kettles, boiling rings, water heaters, &c. The "Imperial" iron, which was shown, has a number of special features. The fires included a number of sheet-metal and cast-iron patterns, some of which took the form of reflecting bowls mounted in ornamental frames. Several reflector types, as well as standard upright patterns, were also shown. A wash boiler with a loading of 3 kW and a capacity of $2\frac{1}{2}$ gallons, was exhibited, and another useful appliance shown was an electric bath water heater with a continuous loading of 200 W and a booster loading of $3\frac{1}{4}$ kW. The tank has a capacity of 10 gallons.

Bowen Instrument Co.

This company's principal exhibit was a number of electrical resistance pyrometers for measuring temperatures at a distance, together with accessories for these. The firm's "Polymeter" combines the indicator, multiple switch, and front cable terminals in one complete unit.

Tangyes, Ltd.

Engines and pumps constituted this company's exhibit. The former included a 47-b.h.p. cold-starting horizontal, heavy-oil engine, which is claimed to be very suitable for the driving of an electrical generator. There was also an 18-b.h.p. heavy-oil engine of the lamp-starting type. The pumps included a six-stage turbine pump, a 4-in. "A" type "Tangyro" centrifugal pump, and vertical single-ram patterns.

Steam Fittings Co., Ltd.

The scope of this company's exhibit is indicated by its title. A notable feature of the display was a range of automatic regulators, including all-metal relay thermostats suitable for controlling steam valves and maintaining temperatures up to 1,000 deg. F. This type is said to be so sensitive that when adjusted for room temperature it will operate a main steam valve when merely warmed by the hand for a few seconds. Boiler feed regulators, dial-indicating draught gauges, and dial thermometers fitted with contacts for operating electrical relays, were also included.

Reeves & Co.

This stand bore a large display of electrical accessories, including lamp-holders, tumbler switches, switch plates, galleries, &c.

Higgs Motors.

This display comprised component parts of a.c. and d.c. motors, assemblies of component parts, motor-generator sets, complete d.c. dynamos and motors, and one-, two-, and three-phase squirrel-cage and slip-ring induction motors. A notable exhibit was one of the firm's motors running under water.

Birkbys.

Upon this firm's stand were displayed numerous samples of "Elo" synthetic resin products. A particular feature was made of mouldings for radio and electrical work. Other compositions shown were insulating varnishes, synthetic resin in "lump" form, and moulding powders.

The London Fair.

Cousins & Co.

On this stand was shown the "Cousins' Perfect Electrical Waver" for Marcel-waving at home. This is an ingenious and convenient appliance, which is heated by electricity from the mains, but is disconnected before application to the hair. It was demonstrated in use.

The McClary Manufacturing Co.

This Canadian company showed electric cookers of several patterns, including the convenient bench type. An important change has recently been made by the adoption of a closed boiling plate, called the "Speediron," which is immune from injury by spilt fluids, &c. The plate is provided with prong terminals which fit into protected contacts underneath, so that, if necessary, it can be pulled out in a moment, without leaving any live metal exposed. Similarly the oven and grill elements are self-connecting. We understand that the "Speediron" is being fitted to all the McClary electric ranges. Other notable features were the use of a simple thermometer on the oven, showing four grades of temperature in bold figures, and an enamelled hob which cannot rust or peel.

Needham Bros.

The well-known portable electric fountain patented by this firm was shown in operation.

British Thomson-Houston Co., Ltd.

This double stand was furnished with the standard crystal and valve receivers, amplifiers, loud speakers, headphones, and valves with which the wireless world is familiar.

Clackson, Ltd.

Several new items appeared on this stand, such as the "Lowforma" coils and "Lowforma" crystal set; the latter was a very neat and compact arrangement, with provision for receiving Daventry, as well as the other stations. Other features were the "Triumph" two-coil holder, and the 5-in-1 coil mount, with which a variety of purposes can be met. Ebonite components are amongst the company's products.

Burndept Wireless, Ltd.

The leading feature of this exhibit was a seven-valve super-heterodyne set, with frame aerial. The company has entered the valve-manufacturing business, and showed a complete range of valves—one bright, and eight dull-emitters—of its own make. "Ethophone" specialities, the "Peter Pan" loud speaker, and everything required by the wireless experimenter, were shown.

Telegraph Condenser Co., Ltd.

This exhibit included condensers not only for radio work t also for power factor correction, the latter being manu-ctured on the large scale for voltages up to 6,000 V, in the rm of one-microfarad units which are built up in frames, and mersed in oil-filled steel tanks. Box-type condensers for dividual motors, suitable for any voltage between 200 and 0 V, are made. The range of Mansbridge-type condensers s been extended to 10 mF. For radio, both the Mansbridge ndard condensers and mica moulded condensers were shown, th having duplex terminals, which provide facilities for ewed or soldered connection at will; the former are made th a solid metal top. The series-parallel mica condenser s a new feature, made in sizes from 0.0001 to 0.0009 mF.; it ables the grid leak to be put in series or parallel with the ndenser without changing the wiring of a circuit. Another eresting item was the "silent salesman"—a cabinet made to resemble a T.C.C. Mansbridge condenser, and holding supply of 50 assorted sizes.

Receiving Sets.

Messrs. Wates Bros., Ltd., showed receiving sets, batteries, d loud speakers; British Radio Corporation, Ltd., cabinet eiving sets and components; Elven Mains Receiver Co., s operated from the mains, a.c. or d.c., without batteries; lcyon Wireless Supply Co., Ltd., portable sets without ials or earth connections; Read & Morris, Ltd., receivers rked from a.c. or d.c. mains, and other types; Ashley Wire-s Telephone Co. (1925), Ltd., "Claritone" loud speakers d headphones.

Permec, Ltd.

An ingenious micrometric crystal detector—the 1926 Permec type—was shown here, which enabled 200 different spots on a crystal to be touched by the cat's whisker, safeguarded the parts from frictional or other damage, and enabled any particular adjustment to be returned to with precision. Complete crystal sets were also shown.

The Formo Company.

Amongst the exhibits at this stand, items of special interest were a condenser described as the "straight-line frequency ultra low-loss" type, with special patented features, including a "micro-vernier" 200-to-1 dial, and a series of high-efficiency coils for tuning and coupling systems, with bank-wound turns on skeleton formers, of very ingenious design. Shrouded transformers and choke capacity couplers, plugs and jacks, &c., were also shown.

Radio Accessories, Components, &c.

A number of stands were devoted mainly to displays of wireless components and accessories; amongst these were the following firms:—Western Laboratories, Ltd., coil-holders, condensers, and crystal sets; Watmel Wireless Co., Ltd., grid-leaks, condensers, chokes; J. J. Eastick & Sons, collapsible frame aerials, coil mounts, variometers; Beard & Fitch, Ltd., gear wheels, "Success" transformers, and other accessories; Finston Manufacturing Co., Ltd., coils, condensers, mouldings; Lisenin Wireless Company, plugs and sockets, terminals and other components; North London Valve Co., Ltd., valves, X-ray tubes, and experimental apparatus.

Electro-Farming.

The Applications of Electricity to Agriculture.

By R. BORLASE MATTHEWS, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

e paper deals with the progress that has been made since e author's previous one on the same subject,* being also a uel to the report of the I.E.E. Committee on Electricity Agriculture.†

t is strange that one of the most backward countries in s development is the United States of America. Out of 788 million h.p.-hours per annum used on American farms, y 850 millions are supplied electrically. However, the matter eing taken up most energetically, and large sums of money being expended upon full-scale experimental work.

The Rural Distribution System.—Attention is drawn to the portance of dealing with satistics on the basis of route les, and not the area supplied. It is claimed that where quarter of the area is arable land, the supply will be fitable. Even in the towns the facts are much better repre-

Pracstical experience indicates, at the present stage, that in order to provide a remunerative electricity supply, from a quarter to a third of the area must be arable or rich dairy land. The point is not so much whether electric ploughing is to be employed or not—it will probably not be used in many districts for a few years—as the fact that a farmer with a good proportion of arable land needs to treat, in some way, the crops which he produces, or else he has to prepare food for stock. The amount of power necessary for these purposes has a direct relation to the area of land under the plough, and also to the fertility of the soil. In some of the more fertile parts of Europe the consumption of electricity is already 100 units per acre, without taking into account any current actually employed on the land for ploughing or other purposes. Ploughing and cultivation would have consumed an additional 60

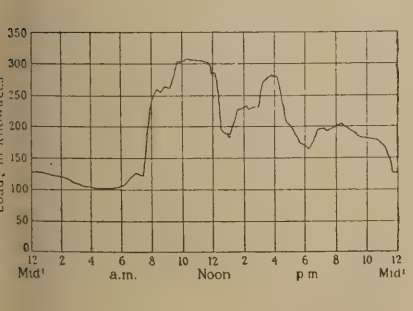
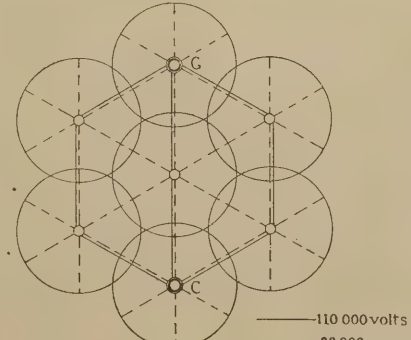


Fig. 1.—Load Curve of English Rural Distribution Line.



G C = generating stations 50 miles apart.
Sides of triangles represent distances of 25 miles.

Fig. 2.—Example of E.H.P. Rural Distribution.

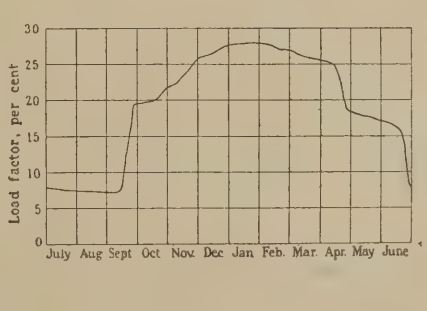


Fig. 3.—Load Factor of Mixed Dairy Farm.

ted by considering cable route-miles instead of square miles supply area; in the country there are already routes whereon consumption per mile of 10,000-volt distributor without ughing is equal, or more than equal, to the urban figure, the possible revenue per route mile of rural line is, at t, as large as that from the usual town load known to be fitably supplied. It must be remembered that villages and al industries will take a considerable supply in addition that consumed by the farms. Anything over 5,000 units annum per mile is profitable; the important matter is to rcise economy in construction work.

units per acre, while treatment and the handling of crops would absorb up to 40 units per acre. Over and above all this, there is a very important load that has not yet been touched, *viz.*, that of haulage, estimated at about 75 units per acre. Thus, under ideal conditions, it is possible to conceive a consumption of 275 units per acre, based upon present practice. In this country alone, assuming that its 57 million acres of land were all suitable for agriculture, on the above basis of consumption the requirements would be about 16,000 million units per annum, whereas the present output of all the generating stations in the country, including the output for railway work, is only 7,415 millions.

The e.h.p. lay-out of the line only differs from the usual practice in that additional tappings have to be provided

* Elec. Rev., April 7th, 1922, *et seq.*
† *Ibid*, September 4th, 1925.

en route. It will often be found advisable to utilise two (or even three) distinct routes at some considerable distance apart. One route might be the most direct between the towns; the second (and third, if required) should go through the centres of gravity of the anticipated rural demand.

The distribution system in the initial days of rural supply, in order to reduce line construction costs, will undoubtedly be worked with a greater voltage-drop during the day-time than would be permissible for city work. Fig. 1 is a typical load curve for an English rural distribution line.

On the Continent l.p. supply seems to be settling down to 380 volts, three-phase, 50 cycles, for power, with 220 volts between one-phase and neutral for lighting; in Great Britain favour is given to 400 volts, three-phase, 50 cycles, with 230 volts for lighting. The possibilities of single-phase rural distribution and the use of galvanised steel conductors are receiving very considerable attention.

To maintain the above-mentioned voltages, the countryside has to be set out in circular adjoining areas of approximately three miles diameter, each supplied from a 10,000-volt sub-distribution system, connected to the main e.h.p. distribution of 30 to 220 kV. At present a 25- to 50-kVA transformer is usually sufficient for each of these sub-stations. In most countries there is an average of 1¼ farms and 2 other consumers per mile of l.p. distributor. Each 10,000-volt transformer station will supply about 22 farms and 30 to 40 other consumers, including motors totalling up to 200 h.p. Though the load factor per motor is low, that per farm (the more important matter) is high, based on its maximum demand. It averages at present 35 per cent., giving a consumption of 90,000 units per annum, *i.e.*, 43,000 units per route mile of 10,000-volt distributor. As an example of e.h.p. distribution, assume two super-power stations, G and C, situated 50 miles apart, fig. 2, and connected by a 110,000-volt line. If the district was arable there would be an area of supply of about 2,000 sq. miles. On the basis of estimates made for city conditions, it would seem almost hopeless to think of attempting to supply such an area. However, if the work is carried out on the lines suggested in this paper, basing the distribution on the route length, it will be found that an annual consumption of 96 million kWh can be supplied by increasing the length of e.h.p. line to 200 miles. In addition, there would have to be provided five open-air sub-stations, 375 miles of 33,000-volt sub-transmission lines, and 500 miles of 10,000-volt feeders to the local l.p. sub-stations would also be needed. For the scheme set out in fig. 2, one e.h.p. line would go by the shortest route between the cities and two others would also be provided, one parallel on one side at an average distance of, say, 15 miles, and the other a similar distance away on the other side. Thus the five 110,000/33,000-volt sub-stations may be situated at the centres of gravity of the local demands.

It is assumed that the l.p. distribution network (380/220 or 400/230 volts) will be supplied by the local communities; hence, the power supply undertaking would have to consider only the cost up to and including the 10,000-volt sub-stations. Such a lay-out only requires one mile of 110,000-volt line per 30 sq. miles (19,200 acres) of land, plus a mile of 33,000-volt line per 8 sq. miles (5,120 acres) of country, plus a mile of 10,000-volt line per 6 sq. miles (3,840 acres) of ground. Ample provision of 33,000-volt lines is suggested, with a view to the supply of the ploughing and threshing loads.

Amongst the details that reduce the cost of overhead lines the matter that requires careful watching is so to design the line that most of the construction work on the poles, insulators, &c., can be done in the factory, not on the road-side where labour is so much more costly. The high cost of tapping e.h.p. lines at intermediate points is perhaps the greatest difficulty. Undoubtedly the best plan is to provide a sub-transmission line at, say, 33,000 volts, connected at both ends to the e.h.p. lines, giving in effect a ring main. From this 10,000-volt feeders can supply the 50-kVA sub-stations at 3-mile intervals along the rural routes. Very often it is advisable to employ intermediate distribution lines at 1,500 or 3,000 volts. Heavy loads which move from farm to farm or field to field as the work is finished are probably better connected to the 33,000- or 10,000-volt lines than to the low-pressure distribution system; the switches, protective gear, meters, &c., would be contained in portable transformer wagons.

In several parts of the Continent it is permissible to connect these temporary loads by hooks on to 33,000-volt lines. Excellent foolproof temporary connections are now availabl for 1,500 to 3,000 volts and also 10,000 volts, which can easil be used by the more intelligent farm hands. Their use mean a considerable saving in transformer iron-losses, the trans formers being cut out of circuit when not required.

The Farm Installation and its Uses.—Whilst the use o electricity is still a novelty in this country, nearly a millio farmers in other countries are employing it; over 500 Britis farmers are utilising it, and the number is fast increasing Over 200 uses for electricity have already been found o farms; the author has 67 on his own 600-acre farm at Eas Grinstead. Farm electrification means much more than bei ing a standard industrial motor to the existing agricultura machines.

The best insulated conductor for farm purposes, in th experience of the author, is "Maconite." This well with stands stable fumes and high temperatures such as that o a dairy steam boiler. When used in the open air, howeve exposure to the sunshine seems to dissolve out some of th gums in the composition.

To avoid accidents the type of hand lamp to be used shou be specified, and outlets for electric motors should be of a interlocked type, so that a plug cannot be removed o inserted unless the socket is dead. In Europe there is no an agricultural electric motor quite distinct from the indu trial type. Since the war such a large proportion of th output (75 to 90 per cent.) of electrical manufacturers' moto shops has been of the agricultural type, that such moto are now often supplied for industrial work, to the advanta of the factory using them.

The requirements are those of a mining motor, at the co of an industrial one. As lubrication is erratic, ball bearing should be used. A simple built-in overload circuit-breake should be provided, and any starter should also be enclose in the frame. The windings should be vacuum-impregnate so as to be moisture-proof. To keep down first cost, a internal ventilation system is essential. To avoid speci fixed wiring, a plug connection should be used for the cable The motor must be capable of working in an inverted o vertical position. The outside should be smooth and easi cleaned. Most farm motors can be started light, so tha they can be of the squirrel-cage type; it is quite commo to fit centrifugal clutches or sliding rotors to make startin still easier. Particularly in the larger sizes, wound-roto motors with automatic short-circuiting and brush-lifting d vices are useful, as they combine the advantages of both type

A 5-h.p. motor is the largest needed on most farms, excep for ploughing, provided the supply engineer is in a positio to recommend suitable farm machinery. If the farmer cann be persuaded to use small farm machines which can b operated by a 5-h.p. motor, he usually goes to the oth extreme and uses very large ones, such as a threshing machi combined with a straw presser, requiring a 25- to 40-h.p motor. When such a motor is used on a much smaller loa its power factor is very poor. To improve this, it may b fitted with a star-delta switch for the stator, the star positio being marked, say, "light load" and the delta positio "heavy load."

There are now a number of agricultural-type motors on th market which, by the use of self-contained compound-reductio gearing, can be coupled direct to the machine to be drive This saves much time by avoiding belts, which, in the han of farm labourers unused to them, give endless trouble. F motors of 5 h.p. and under, friction drives can be used inste of gear wheels.

Homestead equipment should be of the most robust an practical character. On some parts of the Continent to-da it is rare to find a farm without its electric washer, but has cost one-fourth the price of the admittedly better ty of washer available in this country. Electric cookers ha not yet reached the simplicity of the better-class gas cooke though hire and hire-purchase schemes have helped. Wat heaters are required in the kitchen and in the dairy; it advantageous to couple them with an auxiliary fuel-fir heater, and a small direct-coupled electric blower would assi in lighting a fire.

It is wise to submit to the farmer suggestions that enab him to improve his load factor and thus purchase electrici on the most favourable terms, *e.g.*, multi-way switchin whereby, when the current is in use on one important pie of apparatus, other current-consuming devices cannot

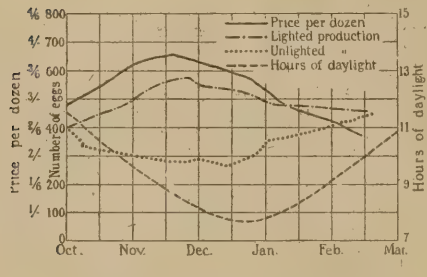


Fig. 4.—Gain in Egg Production due to Electric Lighting.

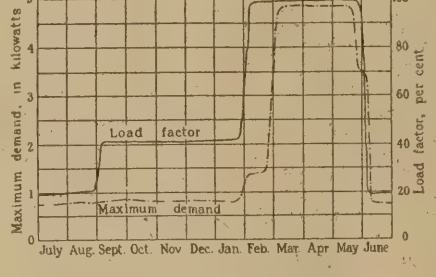


Fig. 5.—Load Factor of Poultry Farm.

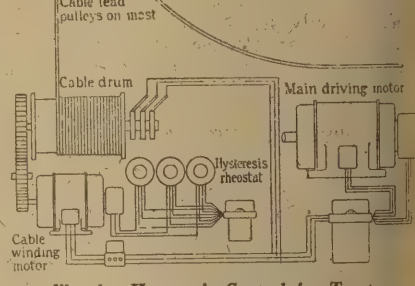


Fig. 6.—Hysteresis Control for Tractor-winding Motor.

switched on. When other appliances are not in use the current can be switched on to the water boiler; when the larger appliances are in use in the house, the motors in the farm buildings should be switched off. There is no practical objection to doing this, especially on the smaller farms, as it only requires a little rearrangement of the farm work.

At least half-an-hour per day per man can be saved in the feeding of live stock by the aid of a good light. Poultry-house lighting is now a recognised commercial practice, for the very good reason that there is an increase of 15 to 43 per cent. in the egg production during the winter months, when prices are highest, fig. 4. Contrary to the popular idea, the birds are not in any way strained as they get 10 hours' sleep each night. They are simply allowed ample time for feeding, instead of being partially starved owing to the long winter nights in this country. Fig. 5 shows typical curves of poultry-farm maximum demand and load factor.

The author has recently obtained new results of commercial importance to the market gardener in connection with the transplanting of seedlings, and one-night treatment of greenhouse plants to obtain more rapid progress.*

A novel application, which is still in the experimental stage at East Grinstead, is the electric lighting and heating of bees in the early spring. The hives are all placed inside a house, instead of being kept in the open air in accordance with the usual practice in England. The basis of the idea is that, by this treatment, strong hives are obtainable at the time when the orchards are in bloom, thus about an additional 17 lb. of honey can be obtained per hive per annum.

Earth currents, one of the earliest applications of electricity to agriculture, has lately been revived in a novel manner by M. Christofleau, in France. Confirmatory tests are at present being conducted in the author's garden. Further experimental work is, however, necessary to confirm the results obtained so far.

Work on the Land and Haulage.—So large a proportion of the power on a farm is used on the land that all parties should consider very seriously the best methods of cultivation by electrical means. If electric ploughing is carried out on a large scale, the power required is so great that for an economical distribution system the voltage must be fairly high. This is a point overlooked in most discussions on rural electrification; one very successful equipment uses 5,000-volt motors. Most of the successful plants are of large size, capable of ploughing up to 27 acres a day (a horse can plough barely an acre a day). The capital cost is high, and such an equipment is only suitable for contractors or co-operative societies. In practice an electric plough can be kept fully occupied for at least 200 days in the year, and this is quite a reasonable period over which to spread interest and depreciation.

Small electric ploughs are still in an experimental stage; the author has formed a clear idea of the most suitable type for the individual farmer. It must be controllable by one man and should be of the tractor type to obviate anchorages. Two electric motors should be fitted, one of about 25 h.p. for the main drive, and the other of about 2 h.p. for winding in the cable when it becomes slack.

Fig. 6 illustrates a very ingenious system of hysteresis control for a cable-winding motor, which is successfully employed on the Continent. The cable-winding drum is operated by the motor through a friction drive. When the tractor is driven away from the source of supply, the cable is drawn out against the friction drive, and when the tractor returns the cable is slackened. As the resistance to the motor drive is thus removed, the motor comes into operation and winds up the cable until it reaches a predetermined tautness. Owing to the hysteresis control, the operation of the motor is automatic; further, it will not burn out when the tractor stops or the cable drum reverses.

Major A. MacDowell has recently developed in Scotland an original form of single creeper tractor for ploughing, with which is incorporated a novel method of side-stepping the whole machine ready for the next furrow and also a new way of handling the flexible cable.

One of the practical difficulties experienced in connection with electric ploughs is that of transport from field to field, and also the fact that they cannot be used for general haulage work on public roads. The author's proposal is to equip a creeper-tractor with batteries and thus employ it as a vehicle for haulage on public roads, and also for haulage of timber and crops when it is not convenient to connect to an overhead line. Ploughing is the principal load on the farm. A tractor can also accomplish much other work, such as cultivating, harrowing, rolling, seed drilling, harvesting, &c., and nearly all the existing farm implements except harvesting machinery can be used.

Quite a new development is to reduce the resistance of the soil to the ploughshare by passing a current of electricity between the coulter† and the ploughshare. An actual lubrication effect is secured by making use of a special property of soils to produce, by electrical means, a film of water between the furrow slice and the mould-board of the plough. The water in the soil seems to move from the positive electrode towards the negative. This property has, in fact, been used as a preliminary method of removing water from peat, preparatory to drying in the usual way. The idea is due to the work of Messrs. E. M. Crowther and W. B. Haines, of the Rothamsted Experimental Station, who have carried out a good deal of laboratory work in this connection, and eventually a full-scale series of tests at Greater Felcourt Farm, East Grinstead. Laboratory tests have shown that the friction under favourable conditions can be reduced by as much as one-third. These results have also been corroborated by Captain B. J. Owen in connection with mole draining.

It is impossible to say whether or not ploughing is actually an essential operation in farming, and there are now a number of machines in existence which attack the problem in quite another way. Just as the milling machine has superseded the planing and shaping machines in the engineering workshop, so it seems likely that the rotary tiller will have very many advantages. Certainly the action of ploughing seems very unmechanical in that really the ground is wedged over, which has a tendency to produce the very pan to which so many farmers object; also the rotary tiller lends itself conveniently to an electric drive. The earlier designs of these machines produced a fine tilth, which was apt to set down solidly after the first shower of rain; however, improvements in the construction of the tines, or teeth, enable both weeds and manure to be buried and the soil left in the form of clods.

Then there are many ways in which, by the aid of electricity, the farmer can circumvent the clerk of the weather and expedite work generally, and a few years ago a commencement was made in the manuring of Swiss fruit farms by means of stand pipes in the orchards, supplied by underground pipes and electric pumps from a tank adjoining the main buildings. The author's opinion at that time was that although this method might suit orchard or market-garden practice, the installation would be too expensive for ordinary farm work. The process, however, saves so much labour, both of horses and of men, that it is being adopted in general farm practice. The mains thus used for manuring the fields with liquid manure can, of course, also be employed for watering them in exceptional seasons of drought. The consumption of electric current for liquid-manuring and watering in accordance with this process amounts to 90 units per acre.

To obtain the utmost advantages from electricity the farmer will have to be asked to do many things in new ways. It is of vital importance to the whole nation that agriculture should be placed on a sound basis, and on this account alone the question is well worthy of the most serious investigation by the electrical engineering world.

* See Elec. Rev., October 30th, 1925.

† The coulter is either a disk wheel or a cutting wedge which opens up or cuts the surface of the soil to facilitate the work of a ploughshare in turning over a furrow.

Rural Electrification in France.—An investigation concerning the utilisation of electrical energy in rural districts and its possible development has been made on behalf of the Ministry of Agriculture by M. Froust, engineer, of Grenoble, in the case of the Isère department. This region comprises 564 communes, of which 280 were provided with a supply of electricity in 1920, while constructional works are now proceeding in a further 200 communes. The annual consumption for lighting purposes varies between 15 and 17 kWh per inhabitant. Certain hamlets which are outside the area of general distribution propose to bear the cost of the erection of supply lines. The use of electric motors for various operations on the farms is increasing for cutting straw, pumping, sawing, elevating, and for the driving of thrashing machinery, the size of the motors being usually from 2 to 3 h.p. The number of hours of use per annum is very small, averaging about 100. As a result of the growing extension of electricity supply a development is taking place in silk weaving, where besides weaving mills having from 20 to 30 looms, domestic weaving is carried on with from two to ten looms, although mostly with six. The development of domestic weaving is said to be encouraged by the employers; the motors used for these purposes are from 0.33 to 0.5 h.p. for individual drive and of larger powers for groups of looms, although the individual drive is said to be usual. The annual use of these motors represents about 2,000 hours or 20 times that of motors employed for agricultural requirements. The extension of domestic weaving tends to keep the female population from migrating to the towns. It is further stated by M. Proust that the development of electricity supply has been the means of the establishment of a new industry in the form of the manufacture of electrical apparatus, for the production of which small factories of about 12 workmen each have been opened at Pont en Royans, Choranche, Rencurel and Chapelle-en-Vercors.

Steel Production Direct from the Ore.—A large steel furnace is being completed at the Swedish works of the Uddeholm Company, with the assistance of the Swedish Iron-masters' Association, for the production of electric steel from iron ore, according to a method devised by Mr. Flodin, and it is expected that the furnace will be set in operation in March. This engineer read a paper on his process at the meeting of the Iron and Steel Institute in London last September, when it was suggested during the discussion that the method was only suitable for the production of the highest qualities of steel, and that the high charges for electric power in Great Britain would render it impossible to use the process in this country. The actual capacity of the new furnace has not yet been disclosed, the directors of the company preferring to await the working results before giving any information on the subject.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Improved Circuit Breakers.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has recently introduced a new range of R.A.T. circuit breakers, specially designed for the efficient protection of lighting and power circuits of up to 100-A loading at up to 660 V. They embody the usual automatic overload and no-volt releases and are made in the open type (fig. 1), mounted on enamelled slate bases, or in the factory type (fig. 2), enclosed in asbestos-lined cast-iron cases with inspection windows and external operating handles in either single-, double-, or triple-pole patterns.

The no-volt coil is claimed to operate when the pressure is reduced to 65 per cent. or less of its rated value, or with the

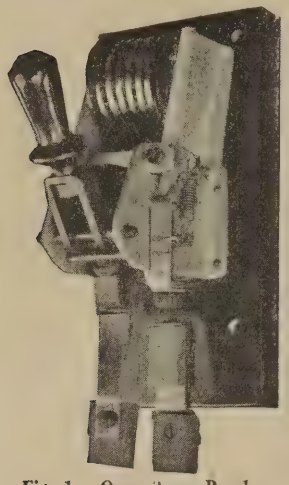


Fig. 1.—Open Type Breaker.



Fig. 2.—Factory Type.

rated frequency maintained it will release when the pressure drops to 75 per cent. It is self-resetting with the pressure value at 90 per cent.

These breakers can be set to operate on currents up to 100 per cent. above normal, the scale being marked at three points which represent normal, and 50 per cent. and 100 per cent. above normal. A loose-handle provision prevents the breaker being held closed against abnormal conditions, and an anti-hesitation device ensures that the handle must be carried through the whole travel into the full-on position, when closing the circuit breaker, otherwise the latter will immediately open if there is any hesitation in closing.

A Novel Electric Water Heater.

The accompanying illustrations, figs. 3 and 4, show an electrically heated boiler which has been recently marketed by Messrs. Jackson Boilers, Ltd., 83, Kirkstall Road, Leeds. It is designed for self-feeding, direct from the main water

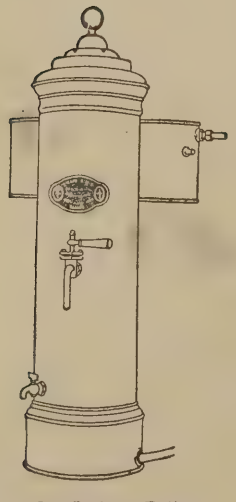


Fig. 3.—Jackson Boiler.

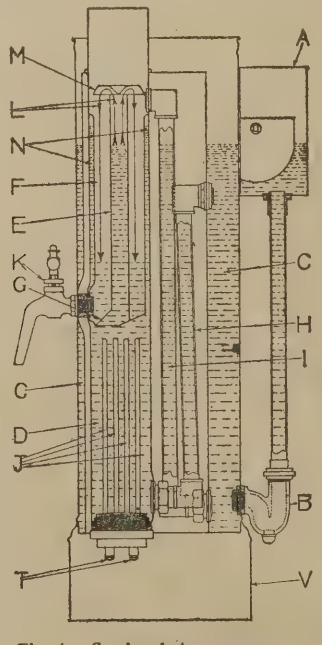


Fig. 4.—Sectional Arrangements.

supply, and to give an immediate supply of boiling water in quantities sufficient for the reasonable requirements of the catering trades. The supply water is controlled by a standard ball-tap valve, and by an ingenious combination of boiling-water-storage and pre-heating arrangements, boiling water in reasonably large quantities, it is claimed, is always available. Fig. 4 shows sectionally the arrangements of the boiler. The water is fed from the ball-tap cistern A, *via* the trap B, the shell C, and the feed pipe H to the boiling chamber D, in which are located the blades J of the immersion heater.

When it is raised to boiling point the water ascends the expansion pipe E and is deflected by M into the collecting chamber F. Boiling temperature is maintained here by the jacket N, an extension of the boiling chamber. The bottom of the collecting chamber and top of the boiling chamber, G, is specially shaped to deflect steam to the jacket N and to the expansion pipe.

If the water is not drawn off as it boils it fills the collecting chamber and overflows through the pipe I to the bottom of the outer shell C, thus heating the contents of the outer shell so that a bulk of hot feed water for supplying the boiling chamber is available when required. The supply leads are taken to the immerser terminals T through a hole in the base V.

It is claimed that very large quantities of boiling water can be maintained simply by increasing the capacity of the outer shell. With a loading of 4½ kW boiling water is said to be obtainable in four minutes after switching on, and afterwards at the rate of 72 pints per hour when the whole contents of the boiler are fully heated.

A New Electric Lighting Fitting.

A new range of electric lighting fittings, cylinder units, has been introduced by Messrs. Smith & Ansell, Ltd., Stockfield Road, Acocks Green, Birmingham. This fitting is designed to embody the advantages and eliminate the disadvantages of the bowl and enclosed types of fittings. Fig. 5 shows one pattern of the range, SA-3,202; it is suitable for a 40- to 100-W gasfilled lamp. The cylinder is 6 in. in diameter, and that of the white vitreous-enamel finished reflector is 15 in. The feature is a glass cylinder which surrounds the lamp vertically, and is supported by means of an external flange at its top. The cylinder is of special diffusing glass for about two-thirds from the bottom, the upper portion being clear. Various forms of reflectors and suspension gear are used in other models, and the principle of cylinder lighting can be employed in decorative forms if desired. The advantages claimed for this type of fitting are that dirt collection is largely obviated, glare is avoided, a minimum of light is lost through absorption, immediate access to the lamp is provided, and there are no loose parts. A neat and convenient means of suspension is offered by means of a ceiling plate fixed direct to the conduit box, &c., affording an easy inspection of connections and rapid erection. A central wireway suspending chain is provided.

An Emergency Igniter.

An interesting and simple device, the auto-igniter, designed to serve the motorist as a stand-by means of ignition in the event of a complete break-down of the usual electrical ignition, has been marketed by Messrs. F. A. Wilkinson & Partners, Ltd., Gretton, near Kettering, Northamptonshire. It consists of a number of units, fig. 6 (corresponding to the number of cylinders) one of which is screwed into each cylinder in the place of the sparking plug or into a tee piece between the plug and the cylinder, so that the two devices can be used in conjunction. Each unit or cup is fitted with a special type of electric heating element contained in a screw-in cap fitted with the necessary terminals. The element is connected

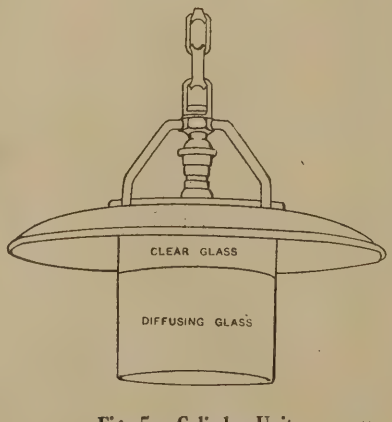


Fig. 5.—Cylinder Unit.



Fig. 6.—Emergency Igniter.

through a switch to the car or other battery, which can be switched off when the sparking plug commences to function. The device should be particularly valuable for motorists when touring, and for isolated generating plants in the country or Colonies.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

"Electrical Freedom."

As a contractor who has been in business for over 25 years, I am just as amused at Mr. L. L. Robinson's article as he appears to be at the pamphlet issued by the Electrical Contractors' Association.

Most contractors would be very pleased to accept work at 20 per cent. on cost. What does Mr. Robinson mean by this? Does this 20 per cent. cover establishment charges as well as profit, or is he offering 20 per cent. profit after establishment charges have been added?

What is the cost? Who knows it until the job is finished? We all do our best to estimate the cost, which is a very different thing.

The trouble is that the supply authorities think wiring is an easy job and estimating easier, whereas the experience of most contractors is that estimating to be correct can only be done after years of experience.

I may quote an example in my town, where they have recently opened an electrical showroom and are hiring out cookers; the city engineer has been offering cooker wiring to contractors at a price at which the work required cannot be done, and when an interview was sought with the city engineer he admitted that the price he fixed for the work was not quoted out of any data at all. It was merely a figure which they thought would be satisfactory, and in any event the offer to do a certain amount of free wiring was more or less "a sprat to catch a mackerel." Is this fair trading? The showrooms now being fitted up by municipalities cannot in themselves be run as commercial concerns. If contractors could force municipalities to keep their costs for running the showroom, including establishment charges, proper apportionment for rent, supervision, &c., and salaries of staff, we would soon show who could do the work cheaper. Mr. Robinson cannot run a showroom and carry out wiring cheaper than a well-organised electrical contractor who has reasonable establishment charges.

As regards Mr. Robinson's statement that contractors put wires in so small to lighting points that irons, kettles, cleaners, and radiators cannot be used, we have yet to learn that an iron or kettle or a cleaner cannot be used on 1/.18 or 3/.029 wires.

In conclusion, the article obviously shows considerable bias.

Fair Does.

March 2nd, 1926.

The article which appears in your current issue under the title of "Electrical Freedom," by L. L. Robinson, M.Inst.C.E., will probably be commented upon and should not pass unnoticed. One is inclined to ask: "When is it possible for Mr. Robinson to speak well of the electrical contractor?" At all events, it is high time that this engineer should encourage the efforts made by the E.C.A. and others to raise the standard of contracting work. The attitude taken is more likely to arouse a controversial spirit antagonistic to the end which he himself has in view. Granted that the pamphlet referred to has a streak of humour—the levity shown in his own article does not help to create the correct understanding of the difficulty.

We will allow that this supply engineer is making a satisfactory advance with the sale of "juice"—but we will not admit that he is equally successful in selling electrical goods. Are the goods sold price-maintained? Are the goods bought at factors' prices or ordinary trade terms? What is the equity of the sale in comparison with a ratepayer offering the same article? Mr. Robinson may claim that he sells the article and so increases the call for current—but will he also answer to the claim that he has closed his eyes to the usual trade observance as between manufacturer and retailer—or, in plain English, does he cut out the middleman? The local conditions may or may not be desirable; that hardly concerns the public. We simply point out that any difficulties at Hackney do not call for a wholesale condemnation of the electrical contractor.

It is well to remember that there is a large number of electrical contractors throughout the country, firms of standing who have large staffs with attendant heavy wages accounts—these are established firms of integrity and resource who would scorn the impeachment of undersized cable and other mean and underhand practices. These firms would find more prosperity and sound business if the station engineers would confine themselves to electricity supply, reducing their steam-raising costs, works costs, and supply services, in order that electric current should be popularised.

The supply engineer invariably gives encouragement to the blatant and showy advertiser whatever the merits of the article he desires to sell—vacuum cleaners, kettles, and other consuming devices. Why blame the contractor for neglecting this source of income? The contracting firm has a host of competitors—the large stores, the furniture dealers, and others, as well as the "hucksters" and "trade touts" who call daily upon the householder.

The supply engineer who follows in the path clearly shown by the late chief engineer of the Glasgow Corporation will develop electricity supply and establish his own reputation by realising that the established electrical contractor is the surest agency for this development. May we appeal to our supply authorities to employ established firms who have a reputation to lose and who have the resources to carry out any class of installation work, in place of pandering to the cult of the "bottom price" and indifferent workmanship?

The station engineer has apparently forgotten that in bygone days he also has proved a hindrance to the advance of electricity supply and has harassed the contractor by framing regulations which have served no useful purpose. Finally, we trust that the present intention to compete for the trade of the contractor will be defeated. It is unthinkable that Parliament will permit a station engineer to act as the inspecting authority to the electrical contractor who is a ratepayer in the district whilst the supply authority is in direct competition for the same business.

"The Pilgrim."

March 2nd, 1926.

I was much amused by Mr. L. L. Robinson's magnificent article in the current REVIEW, but I quite fail to get his meaning.

In arguing the case for municipal retail trading, Mr. Robinson completely ignores the vital objection, that of a municipal body entering into competition with its own ratepayers, and blatantly defends his position by implying that electrical contractors are incompetent, inefficient, and generally out to swindle would-be consumers.

As proof, Mr. Robinson tells us he lives up in the air and cites the case of his water supply; apparently his plumber did those things he ought not to have done and left undone those things he ought to have done, with the result that when Mr. Robinson says "Let there be water," there is not water, or, if there is water, it is in the wrong place.

I freely admit that this is a very good argument in favour of municipal supply authorities selling 27 vacuum cleaners per week, but, also, is it not a clear case of accepting the lowest tender from anywhere, or anyone, instead of having a correct specification drawn up by someone duly qualified?

As a matter of fact, I live on the ground floor, in quite a nice little house—with the possible exception that the wife thinks the wallpaper in the second bedroom rather bright—and all our water work was carried out by an existing plumber—I should hate to have work done by a plumber who did not exist—with the result that when the bath tap is turned, out comes the water, beautifully clear, warm, and wet, and not a drop runs into the bath of Jones on the other side of the road. This, according to Mr. Robinson, is a clear case against the practice of retail trading by municipal supply authorities.

Mr. Robinson states that "in my area the united efforts of the retailers did not connect four vacuum cleaners per month to my mains." Is Mr. Robinson absolutely certain this should not read five? I only mention this because I once sold a vacuum cleaner, it was quite a long time back—before the war really—and, believe me (of course, this is in strict confidence) to this day our supply authorities are unaware that that cleaner was ever "connected to their mains."

Try to visualise an electrical contractor connecting even one vacuum cleaner to the mains of Mr. Robinson, M.Inst.C.E.: what a subject for Mr. Robinson H.E.A.T.H.

Bleats Mr. Robinson (the M.Inst.C.E. one), "Who is going to sell my product fast enough to make it ever cheaper? The contractors have not done it in the past." "ROT!" shouts Mr. Contractor, "I have built up the industry for you, and for fifty years have consistently advertised and sold your product, making your stations what they are to-day."

Mr. Robinson very definitely implies that all contractors put in wires too small, therefore, I can only infer that all municipal supply authorities who undertake wiring, carry out their work flagrantly against all rules devised for public safety, namely, generally wire houses and even business premises with unprotected rubber-covered cables threaded through the joists between floors and ceilings, as described by a disgusted wireman, on the "one knit and two purl" principle, the only protection accorded the whole system being casing and capping for actual surface runs, presumably to prevent consumers using the cables for airing purposes.

At least, that is how thousands of premises are wired by our municipal supply authorities, the same kind of work being carried out by local contractors, not because they prefer to skimp, but simply because such work is recognised as the standard for house wiring by the municipal authorities themselves.

Yes, Mr. Robinson, thousands of houses wired with unprotected rubber cables run through the joists, and the work carried out by one of the cannot-do-wrong, all-for-public-safety, municipal suppliers; and, because the work is carried out by such, it is passed by fire insurance offices, offices which flatly refuse to pass similar wiring for a 1-kW plant outside our supply area "because it is not safe."

For goodness sake, Mr. Robinson, get a piece of india rubber—and rub yourself out.

Registered Contractor.

March 2nd, 1926.

I envy Mr. Robinson his temperament. How delightful a place must appear this unhappy world to one who can find humour in the struggles for existence of his fellow workers. The spider, merry fellow, gloating in a corner of his web, no doubt finds humour in the quaint antics of the enmeshed

fly. The jolly murderer, standing on the bank, hands thrust deep in his fur-lined coat, probably finds the floundering of his victim in the ice-cold water excruciatingly funny. Mr. Robinson, not content with laughing at him, throws verbal brickbats at him. He tells him—the electrical contractor—in effect that he is slow, inefficient, greedy, and not too scrupulous. He sneers at the title of the E.C.A. pamphlet, at its very colour.

What is his objection to "Electrical Freedom" as a slogan? Would he deny to the unfortunate contractors the freedom to earn their living? It is all they ask. Does he consider them so very unreasonable in pleading for freedom from the artificial, unfair, rate-aided competition of public suppliers of electricity; for the same freedom to ply their trade as other ratepayers have?

Mr. Robinson argues both ways. He argues that water being an absolute necessity must obviously be a public supply. Nobody is likely to contradict him. He also argues that electricity, *not* being an absolute necessity, must also be a public supply. On the same reasoning the French have made railways and matches public supplies. The fatal results, so far as railways are concerned, can be read in every other day's paper; and, as for matches, any man brave enough to smoke French tobacco—another State monopoly—must keep a candle-end burning to light it as we did in the dug-outs.

Since anything, according to Mr. Robinson, which either is or is not a necessity may fairly be made a public supply, then are the Bolsheviks justified! So is the policy of our own Communists. Water, gas, electricity? Why not coal—as nearly a necessity as artificial light? Why not railways and general transport? Why not land and all the means of production? Why not, in short, the whole programme of Socialism?

Mr. Robinson's argument goes on thus: Granted electricity supply should be in the hands of public authorities, then they are justified in seeking control of all subsidiary services. They are not only entitled to have the monopoly of supplying electricity, but of supplying the installations to which their supply is supplied; and the vacuum cleaners, and the fittings, and the lamps, and the pretty little silk shades. (Beware, ye drapers! 'Tis but a step from silk "flounces" to silk petticoats!) One wonders why they should stop at installation work and fittings. The obvious logical development is to *manufacture* the wire and conduit and fittings necessary to the installations necessary to the supply; and, a little further, vacuum cleaners, fans, motors, generators, turbines, boilers and—well, pretty well everything!

I do not know who Mr. Robinson is, but I gather from his article he is a public supply engineer, perhaps in the Metropolitan area: one of the vast and ever-growing army of bureaucracy which is slowly strangling British enterprise and independence. Democratic bureaucracy is but another aspect of Socialism; so that his opinions are natural enough to one in his position. But they are not yet, thank heaven, the opinions of the bulk of the British public; nor, I venture to say, of any but a small, self-interested minority of your readers. The others—not only the thousands of contractors to whom the Review has always been the standard of freedom of, at least, opinion—but the wholesalers, and the manufacturers, and everybody else connected with the electrical trade whose prescience foresees the threatened monopoly of the municipalities: all these, if they are wise, will energetically support the contractors' modest plea for the right to exist. They are in the van of the fight against communistic competition. They need—they deserve—the support of all who are not Bolsheviks, nor bureaucrats.

The E.C.A. pamphlet makes, to my mind, too great a concession to the public supply engineers in professing the belief that the supply of electricity should be under State or semi-State direction or regulation. Under State discipline, yes, as is, ultimately, every enterprise in the kingdom. But not, necessarily, under State or municipal monopoly. On the contrary, private companies can and do supply electricity as efficiently as any corporation, with all its adventitious aids and non-commercial advantages.

Conceding to Mr. Robinson, however, as much as have the E.C.A., it does not follow as axiomatically as he seems to think it should, that they should concede to him control of their own work. If he can prove that "the municipalities give the cheapest and most efficient supplies of electricity," he has still to prove that "they or the companies" can "likewise supply the cheapest and most efficient installations and service to consumers." It is a very different matter. He asks for "any sound reason" to the contrary. There are a score that the E.C.A. could adduce; but it is for him, first, to find any reason, beyond the mere greed and self-sufficiency of Bumbledom, for curtailing the already restricted field of the electrical contractor.

Mr. Robinson builds what case he has on the alleged deficiencies of certain contractors. He says: "Do not contractors for electrical wiring . . . put in wires so small to lighting points that . . . they are found wanting," and so on. He accuses them—those, at least, in his area—of slackness and inefficiency, of timidity, of lack of energy and imagination. These sweeping criticisms may, or may not, be true of the contractors in his area—the probable explanation being that the wiser contractors have long ago left it; they may be true of certain "contractors" elsewhere—I have said harder things myself, in your pages, of the jerry wireman; but they are not true of electrical contractors as a whole. They are as able, and as likely, to wire a building adequately as any spoon-fed municipal wiring department, in spite of the fact that they have to do so in the face of competition from which the department is usually exempt. The contractor's canvasser is as keen as any municipal employé to sell vacuum cleaners and other electrical devices. The contractor himself is at least as anxious to secure new business as any supply engineer can be. Human nature being what it is, which has the greater incentive to do so: the contractor whose profit, whose very existence, depends on his energies; or the public employé, with fixed salary, whose interest—on behalf of his nebulous paymasters, the ratepayers—is only a varying function of his sense of duty?

I hold no brief for the E.C.A., with whose policy I sometimes find myself in imperfect sympathy, and I have no doubt the pens of their experts are already dealing more adequately than I can with Mr. Robinson's attack. I write simply as one who, after a quarter of a century's experience in the contracting trade, sees its very existence threatened by the strangle-hold of rate-aided municipal Socialism. But I venture to suggest, from my experience, one or two questions that the E.C.A. could, with advantage, put to Mr. Robinson.

For instance: Is the specification of the work he gives out to registered contractors in his area in accordance with the I.E.E. rules? If not, how far does it fall short of them? I have known corporation wiring work standardised on the lines of unprotected V.I.R. cables run through bored joists.

What is his calculated cost per average lighting point? What, if any, allowance does he make therein for rent, rates and taxes, salaries, and other standing charges? What is the price per point at which he offers this work to contractors?

If there is, as he says, a margin of 20 per cent. profit thereon, why is he not consistent? Why does he not have the work done by his own men, and so save the profit for his ratepayers? If, on the other hand, there is *no* margin of profit—and that seems to be the opinion of his local contractors—why is he so surprised and aggrieved that they don't "scramble" for his orders? There's some nigger in the woodpile. Contractors turn up their noses at 20 per cent. profit no oftener than supply engineers make them a present of it!

Finally, Mr. Robinson boasts a little of his selling successes—it would be interesting to know how many washing machines and bath water heaters he has *sold*—not hired—during the last year. It is possible that the actual figures will prove less impressive than the bare names; unless the consumers in his area have either fuller pockets, or softer heads, than they have, for instance, in the Eastern counties.

I have no doubt that Mr. Robinson, personally, can give perfectly satisfactory answers to all these questions. I put them down haphazard, with nothing, in my ignorance of himself, his area, or his activities therein, to guide me as to the possible answers. But this I know, and so does every member of the E.C.A.—not one in ten of the other supply engineers throughout the country who compete with their local contractors could, within the limits of truth, satisfactorily answer that short catechism.

H. R. Taunton.

Norwich, *March 2nd*, 1926.

Proofs of the above letters were forwarded to Mr. Robinson, so that his reply could be published simultaneously. He writes as follows:—

I have read the correspondence relative to my article with a sense of great disappointment.

My article was intended to be provocative—I hoped it would bring forward some really useful suggestions for the good of the electrical industry—some suggestions for wholesome co-operation—a change from the old attitude of so many of the numerous but less important contractors which is by no means the attitude of the few and better class contractors, to one which would lead to the supply industry helping the contractors and to the contractors lending their loyal support to the supply industry, both bearing in mind that their first duty is service to the public.

Instead of this the correspondence is composed mainly of senseless vituperation and little pin-prick details—a discussion on the pros and cons of municipal trading.

This is not a question of municipal or private trading.

The real question is whether a supply undertaking, whether company or municipal, should carry its service right through to the consuming apparatus in order that the consumer may receive perfect results or whether it should stop short at the meter.

The experience of the gas companies at home and of the electricity companies abroad, especially in America, is that the supplier of the electricity or gas must see his job right through. (*a*) by co-operation with the contractors if they will co-operate on reasonable terms, or (*b*) without them if they won't.

Mr. Taunton's letter illustrates an unfortunate attitude of mind. He says: "What is his objection to 'Electrical Freedom' as a slogan? Would he deny to the unfortunate contractors the freedom to earn their living? It is all they ask. Does he consider them so very unreasonable in pleading for freedom from the artificial, unfair, rate-aided competition of public suppliers of electricity; for the same freedom to ply their trade as other ratepayers have? To this I reply: Why deny to the electricity supply authorities the freedom to accelerate the rate of the development of their electric supply? Is not that what the Government and all of us ought to be out for?

To conclude, may I reiterate that so far as I am concerned this is not a question of municipal or private trading. For my

ns, I suppose, I happen to be a municipal engineer, but this as not biased me in favour of municipal trading. I am a nareholder in many company undertakings. On the contrary, feel sure that we workers in the industry would have been etter off if there had been less municipal trading in electricity ıpply, though statistics show that probably the public would ave had to pay more for their electricity. But I say that if is wrong for the municipal suppliers to give service right up the consuming devices, then it is wrong for them to have nything to do either with supply, service, or equipment. lowever, if municipal trading in electricity is what the public ant, then to be as nearly perfect as possible the municipal ıppliers must have electrical freedom to give the consumer eir best and unrestricted service.

L. L. Robinson,
Borough Electrical Engineer.

Hackney, *March 6th*, 1926.

I have been amused to read Mr. L. L. Robinson's article on Electrical Freedom—The Contractors' Creed," in your issue February 26th.

As a direct consequence of intensive installation and retail les competition on the part of his undertaking, Mr. Robinson as very largely succeeded in driving electrical contractors out his territory. To-day he turns round and complains that ntractors in his area are not up to the mark—that they are ing no business! I know, of course, how Mr. Robinson ughs up his sleeve at the whole position; but the laugh is t all on his side.

Has Mr. Robinson heard of the position in Glasgow, Manester, Birmingham, or the North-East Coast? In all these eas there are crowds of electrical contractors doing excellent siness. They are working hand in glove with the municipal ithorities and power company (Newcastle) concerned. How mes it about that the *reverse* situation prevails in Hackney? as Mr. Robinson never put the question quietly and seriously *to himself?* And has Mr. Robinson been privileged to hear hat the general electrical trade (manufacturers and wholelers) think of the Hackney situation as compared, let us say, ith the Glasgow situation? I am afraid, Sir, that you would e unwilling to print some of the expressions employed!

Mr. Robinson disputes the illustration used in "Electrical reedom" concerning the sale of pipe-lines, kettles, baths, and on, by existing water boards and authorities. Not content point out that water is an "absolute monopoly," Mr. Robinon proceeds to condemn existing plumbers and all their works. n support of this he describes certain bad plumbing (executed y private firms) in his own third-floor flat. Surely, however, ie plumbing work in Mr. Robinson's flat was designed by the rchitect or builder? Why blame the plumber (probably opering on a cut price) for the shortcomings of the architect, conltant, or builder? The point is of great importance because dvocates of the Robinsonian point of view are for ever deanding better (more convenient) installations, and at the me time, are for ever demanding that the cost of installations all be reduced to lower and lower levels. How can we have enty of "convenience" outlets, multiple switching, and more copper in house-wiring" (as recently advocated) unless ie consumer (ultimately, or by some means) is prepared to ay for them?

Mr. Robinson says that he is anxious to put wiring work in rivate hands, such work to show "at least" a 20 per cent. rofit on *his* costs. Will Mr. Robinson please publish his costs gether with his schedule of prices for the general edification nd, perhaps, instruction) of the trade?

Awaiting these figures,

T. E. Alger,
President, The Electrical Contractors' Association (Inc.).

London, *March 3rd*, 1926.

[Mr. Alger's letter, though dated March 3rd, was not ceived until March 6th; it was therefore too late to be plied to in the above communication by Mr. Robinson.—DS. ELEC. REV.]

Engineers' Salaries.

I was very interested in the recent discussion in your lumns on the salaries of combustion engineers, and I should ry much like to have your readers' opinions on the follow-g:—

I am an engineer in charge of a factory not far from ondon. I am responsible for the running, upkeep, and aintenance of steam, electrical, and Diesel plant, and all her machines in the factory.

The horse-power of prime movers equals 1,300 h.p. In addion, I have under me a large staff of fitters, carpenters, inters, labourers, &c., about 40 men in all.

I have had a wide experience in mechanical and electrical ngineering. I have had a few years at sea, 14 years' centralation work as chief and assistant, and I have been in my resent position nearly 10 years.

I have as a so-called assistant a man some years younger an myself, who knows very little about steam plant, nothing out electrical machinery, and, from my point of view, is very little use to me. Moreover, he has only been with e about two years, having been engaged not by me, but by ne of the firm. Recently, I learnt by accident that he was in ceipt of a salary only £70 a year less than I am receiving.

What do your readers think my salary should be in view of the above experience, and what would they consider a comparative figure for my assistant?

A. C.

London, *March 6th*, 1926.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

The Electricity Bill.—On March 8th, Mr. BALDWIN stated that before the House separated for Easter he was very anxious to get the Electricity Bill through its second reading. The earlier the Bill got through that stage the better, because there would be an enormous amount of work to be done in the Committee stage. If they could not get to the second reading before the end of the month there ought to be no difficulty in getting to it immediately the financial business was out of the way.

Mr. RAMSAY MACDONALD said that it was absolutely essential that the House should have full time to consider such a measure as the Electricity Bill. The second reading should only be given after very generous time for debate.

Cable Contracts.—On March 8th, Sir W. DAVISON asked Col. Ashley whether the Ilford Council had recently placed orders in Germany and Belgium for electric cables and if such orders should not be kept in the country in view of the state of employment.

Col. ASHLEY said that he had no information on the subject.

Mr. DUNNICO said that the difference between the lowest British tender and that accepted amounted to £1,000 representing a halfpenny rate in the district. He considered that the Cable Makers' Association was exploiting the country.

Municipal Electrical Trading.—The electrical contractors are again opposing, in the present session of Parliament, the insertion of a clause in municipal Bills giving power to municipal electrical authorities to provide and deal in fittings and apparatus, and to wire premises. A similar clause was opposed last year by the contractors in the case of one or two Bills (see ELECTRICAL REVIEW for August 7th, 1925, p. 214).

In the present session the clause has been inserted in the Doncaster, Swindon and Guildford Corporation Bills, and petitions have been deposited against these Bills by electrical engineers and electrical contractors, and other ratepayers in the three boroughs. On March 3rd the Court of Referees of the House of Commons, over which Mr. J. FitzAlan Hope (Chairman of Ways and Means) presided, was to have considered an application by the Corporations concerned for a ruling that the petitioners had no *locus standi* and should not be allowed to oppose the Bills. By the time the matter reached the Court, however, agreements had been come to in all three cases. The Corporations concerned had admitted the right of such of the petitioners as were electrical contractors to be heard on the question of competition only, but denied the right of individual ratepayers to be heard. The Court was therefore asked to register the agreements, and this course was agreed to.

Railway Bills.—On March 4th, Mr. BARNES, a Labour member, moved the rejection of the London Electric and Metropolitan District Railway Companies' Bill, and criticised the administration of the railway and the fares charged in the East End of London.

Mr. KIRKWOOD urged the Government, in conjunction with the railways, to convert the underground railway system of Glasgow, where the motive power was steam, into an electrical system for 30 miles in and around the city. This, he said, would give employment to a number of engineers, and make the underground journeys more congenial.

Mr. FIELDEN said that that question was having the attention of the London, Midland and Scottish Railway Company. Such a scheme would undoubtedly help unemployment. He could not say, however, that the change-over from steam to electricity would take place in the immediate future.

After some discussion the Bill was read a second time, as was also the London, Midland & Scottish Railway Bill.

Legal.

Bonnella v. Espir.

MESSRS. ARTHUR BONNELLA and George Thomas Bonnella, electrical engineers, of 11, Bucknall Street, Bloomsbury, W., applied in the Chancery Division on March 5th, before Mr. Justice Russell for an interim injunction till trial to restrain Camille Espir, of 19, Hanover Square, from infringing the English letters patent, No. 26,635 of 1913, for electrical hanging switches.

The plaintiffs, said their Counsel, Mr. Cripps, were very considerable manufacturers of electrical fittings, manufacturing under this patent ever since it was created. Their switch contained a spring plunger terminal and other parts which were fitted into a hollow cylinder.

Mr. TREVOR WATSON replied that the defendant sold something substantially different as agent for the foreign-made

switch which was in question, and if he were restrained his business would be taken away and his agency would go elsewhere. Defendant's experts made out a *prima facie* case that there was no infringement and that the patent was limited to certain definite integers, and these were not to be found in the defendant's switch. The defendant's switches did not have spring plunger terminals.

Mr. Justice Russell said that to succeed with an interlocutory application the plaintiffs must establish a strong *prima facie* case, both with regard to validity and infringement. As to validity they succeeded. As to infringement, in none of their affidavits was to be found a direct allegation of infringement, and the defendant's expert, on the other hand, had established a *prima facie* case that the plaintiffs' patent was a limited patent. Plaintiffs had failed to discharge the onus laid upon them to secure an interim injunction, and there would be no order except that the costs in the motion should be costs in the action.

Empson Centrifugals, Ltd., v. Chadburn and the De Laval, Chadburn Co., Ltd.

An action brought by the plaintiffs against Mr. W. Roy Chadburn and the De Laval Chadburn Company, Ltd., to recover damages for alleged libel, came before the Lord Chief Justice and a special jury on March 3rd.

The plaintiffs alleged that in a letter to a firm of solicitors the defendants libelled them by stating that there was a doubt about their financial status and in two pamphlets to customers the defendants endeavoured to injure and disparage the plaintiffs' business by implying that the plaintiffs were fraudulent traders who sold goods which they knew to be worthless.

The defence was that the letter was privileged and that the pamphlets did not refer to the plaintiffs at all.

Mr. Raynor Goddard, K.C., for the plaintiffs, said that the parties were manufacturers of a centrifugal machine for extracting water and impurities from heavy used oils and were serious trade rivals. Mr. A. W. Empson had been agent for the defendants and afterwards opened business on his own account. He complained that Mr. W. R. Chadburn wrote:—"We have very great reason to doubt the *bona-fides* of your client's intentions due to the fact that since leaving us his affairs have not progressed satisfactorily and we believe the company he founded is not sound financially." Counsel said that Mr. Chadburn did not now say that that allegation was true.

Mr. Jowitt, K.C., for the defendants, said that the litigation was between two friendly trade rivals. If in the pamphlets or the letter words had been used that threw doubt upon the integrity, honour and good faith of Mr. Empson or the plaintiff company the defendants would at once withdraw them. A juror was then withdrawn and the case concluded.

Russell v. Schiskha.

In the Mayor's and City of London Court on March 5th, Mr. L. C. Russell, Holborn Viaduct, manufacturers' agent, sued Mrs. E. Schiskha, Brondesbury, for £26 10s. balance of an account for goods supplied. The plaintiff stated that he supplied two electroliers and other fittings to the defendant. One of the electroliers was damaged and he arranged to have it repaired. He denied that, as defendant alleged, he had promised to bear the cost of the repairs. The defendant's husband, giving evidence, averred that the plaintiff had undertaken to defray the cost of the repairs.

Judge Shewell Cooper accepted the plaintiff's evidence and gave him judgment for the amount claimed, with costs.

Porn v. Chandos Court Mansions, Ltd.

In the Mayor's and City of London Court, on February 26th, before Deputy Judge Hinde, Mr. M. Porn sued the defendants for damages for breach of contract. Counsel for the plaintiff said that his client received an order for two lifts, which were to be installed by a given date. Owing to delay in building operations the plaintiff was unable to do that. By the contract he was to receive an order for a further two lifts within a period of eight months. By that time, however, the cost of labour and material had so increased as to preclude the plaintiff's obtaining any profit, and he alleged that an agreement for a higher price was obtained from a Mr. G. Ravenshore, acting for the defendants. Mr. Ravenshore later denied having entered into that arrangement, and the order was never placed. In the meantime there was an amount due for the original lifts, which was included in the present claim.

For the defendants, it was stated that the delay in the installation of the lifts was not due to any delay in building operations, but to plaintiff's inability to obtain the lifts from the manufacturers in Milan. With regard to the other two lifts, the defendants would have been willing to pay a higher price, but they would not consent to alter the terms of payment as suggested by the plaintiff, and the order went elsewhere.

The Deputy-Judge held that plaintiff had been delayed by the building operations, but he was not satisfied that a binding contract had been made for the latter two lifts to be supplied at a higher price. The plaintiff was entitled to damages for breach of the original contract, and he awarded him £75. To this was added £60 for work done, and £38 4s. 6d. for items set out in the particulars of the claim, making £173 4s. 6d., together with costs.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

11,706. "Induction reaction motors." Sangamo Electric Co. December 18th, 1923. (226,479.)

21,345. "Automatic telephone exchange mechanism." A. Watts. September 10th, 1924. (247,243.)

23,814. "Induction motors with phase compensation." Deutsche Werke Akt.-Ges. October 8th, 1923. (223,234.)

23,927. "Telephone systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd) (Western Electric Co., Inc.). October 9th, 1924. (247,247.)

23,955. "Induction electricity meters." S. Z. De Ferranti. October 9th, 1924. (247,248.)

25,068. "Electric resistance furnaces." G. E. Taylor and Electric Furnace Co., Ltd. July 20th, 1925. (247,254.)

26,483. "Thermionic valves." Radions, Ltd., and H. J. Osborn. November 6th, 1924. (247,260.)

26,537. "Electrically illuminated advertising apparatus." Scintillating Sign Co., Ltd., and H. S. Coleman. November 6th, 1924. (247,262.)

26,899. "Charging of electric accumulators." J. W. Burleigh and Rotax (Motor Accessories), Ltd. November 11th, 1924. (247,279.)

26,912. "Starters for electric motors." British Thomson-Houston Co., Ltd., G. O. Watson, and W. L. Wise. November 11th, 1924. (247,280.)

26,914. "Loud-speaking telephonic apparatus." E. A. Graham. November 11th, 1924. (247,281.)

27,071. "Electric fuses." C. W. Cox. November 13th, 1924. (247,289.)

27,146. "Rheostats." Lissen, Ltd., and R. P. Richardson. November 13th, 1924. (247,294.)

27,227. "Production of electric oscillations." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). November 14th, 1924. (247,297.)

27,325. "Magnetic cores or other magnetic bodies, and the manufacture thereof." Callender's Cable & Construction Co., Ltd., and J. F. Watson. November 15th, 1924. (247,301.)

27,419. "Ignition apparatus for internal-combustion engines." F. H. Royce. November 17th, 1924. (247,304.)

27,659. "Ignition devices of internal-combustion engines." F. H. Royce. November 19th, 1924. (Addition to 198,014.) (247,306.)

28,063. "Electric switches specially applicable to electric motor starters." F. B. Cox. November 24th, 1924. (247,317.)

28,882. "Electron discharge devices." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). December 2nd, 1924. (247,331.)

29,335. "Electric signalling systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). December 6th, 1924. (247,333.)

30,904. "Apparatus for heating liquids by electricity." A. Torriani. December 23rd, 1924. (247,345.)

1925.

315. "Electric drive, more particularly for hoisting apparatus." Schindler and Cie. August 29th, 1924. (239,158.)

829. "Selecting switches for use in telephone systems." Siemens and Halske Akt.-Ges. and F. Döring. January 10th, 1925. (247,350.)

1,490. "Coil holders for wireless receiving sets." A. J. G. Robinson. January 17th, 1925. (247,360.)

1,734. "Sound-amplifying horns." G. G. De Andia-Yrarrazaval. January 20th, 1925. (247,361.)

2,282. "Variable condensers for use in connection with wireless telephony and telegraphy." J. B. Collingburn. January 26th, 1925. (247,365.)

3,637. "Means for balancing telephone cable circuits." A. H. de Voogt. October 29th, 1924. (Addition to 225,229.) (242,217.)

5,760. "Electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. March 3rd, 1925. (247,401.)

6,609. "Aerial masts for wireless signalling." J. Smales. March 11th, 1925. (247,410.)

7,423. "Crystal detectors for use in connection with wireless apparatus." G. H. Comery and H. Rose. March 19th, 1925. (247,413.)

7,972. "Switchgear for automatic reversing electric motors." J. G. Stirk. March 25th, 1925. (247,419.)

8,751. "Means for illuminating the dials of switchboard instruments." Rotax (Motor Accessories), Ltd., T. Sparkes, and E. Hill. April 1st, 1925. (247,423.)

8,911. "Testing and calibrating apparatus for electric meters." F. H. Rogers (Zera). April 3rd, 1925. (247,424.)

9,840. "Spring clip for electrical conductors." National Carbon Co., Inc. September 17th, 1924. (240,120.)

12,985. "Vacuum tube arrangement." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). May 18th, 1925. (247,440.)

14,683. "Electrical connector boxes." Soc. Genevoise D'Instruments de Physique. June 28th, 1924. (236,186.)

14,790. "Electrically-heated irons." H. B. Jackson. June 8th, 1925. (247,442.)

15,285. "Compensation of asynchronous machines by shunt commutator machines connected in cascade." Sachsenwerk Licht-und Kraft-Akt.-Ges. December 30th, 1924. (245,410.)

15,597. "Electron discharge apparatus and circuit arrangements therefor." British Thomson-Houston Co., Ltd. July 11th, 1924. (236,911.)

16,660. "Electric heaters for heating liquids." L. H. Veronneau. June 29th, 1925. (247,454.)

18,031. "Electric arc-welding apparatus." Harms & Co. December 20th, 1924. (244,703.)

19,054. "Thermostatic devices." Metropolitan-Vickers Electrical Co., Ltd. August 14th, 1924. (238,532.)

22,545. "Wireless signalling." Soc. Française Radio-Electrique. September 10th, 1024. (239,856.)

22,996. "Protective arrangements for alternating electric current systems." International General Electric Co., Inc. September 20th, 1924. (240,157.)

24,417. "Sparking plugs for internal-combustion engines." C. J. E. Isaksson and H. T. Tillquist. July 2nd, 1925. (247,491.)

28,657. "Electric power-factor indicators." H. Müller. November 13th,

Teachers' Vacational Courses.—Arrangements are being made by the Board of Education for short instructional courses in engineering science and electrical engineering for teachers in recognised technical schools, to be held at Oriel College, Oxford, commencing July 17th next. Application to attend the courses must be made to the Board of Education, on a special form, before March 26th.

The

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National Electricity Supply.

AT last we have before us the Electricity (Supply) Bill, 1926, which is to bring about a new era in the history of the electrical industry in this country, and thereby to assist in restoring prosperity to the whole community. As we have previously indicated—and as Mr. Stanley Baldwin himself admitted in his forecast of the measure—a cheap supply of electricity in itself is not a panacea for our industrial disorders; but that it should, and will, play a leading part in re-building our constitution and hastening the return of healthy conditions we have no doubt whatever, provided that its development and use are cultivated on sound commercial lines. Preliminary utterances on the part of those acquainted with the proposals that were laid before the Government led us to fear that costly enterprises would be undertaken which, however advantageous they might prove to the next generation, held out no prospect of material benefit in the immediate future, and our fears were shared by many prominent members of the electrical profession; we are glad, therefore, to find that the reality is less alarming than the anticipation. In many respects the provisions of the Bill are admirably conceived, and may be cordially welcomed, though there are certain features which will require the most careful and critical examination. That this will not be lacking is evidenced by the Prime Minister's desire to obtain the second reading before Easter, so that there may be ample time for the detailed investigation of the proposals in Committee which he clearly foresees.

The outstanding feature of the Bill is the creation of a "Central Electricity Board" for the whole country, whose principal function is to buy and sell electricity on the most advantageous terms; to enable it to do this effectively, it is to be empowered to exercise complete control over the generation of electricity at certain "selected" stations, which must either be extended by the owners to comply with its requirements or sold outright to the Board. The owners of stations who consider the Board's requirements "unreasonable" are granted the right of appeal not only to the Electricity Commissioners, but, in this case only, beyond them to the Railway and Canal Commission. New stations will be erected by arrangement with the Board, or if this cannot be done, the Board will take the matter into its own hands; but in any case, the Board is not to operate any station, new or old, unless there is no alternative.

Having at command an unlimited supply of electricity, the Board must provide facilities for retailing it; for this purpose it is to prepare a scheme, and after it has been confirmed "as respects any area," to construct transmission lines connecting the "selected stations with one another and with the systems of authorised undertakers in accordance with the scheme *so far as it relates to that area.*" That is entirely commendable. The words which we have italicised imply that the crude idea of covering the country with a "gridiron" of high-pressure mains, as a first step towards cheapening electricity (save the mark!), put forward by Lord Weir's Committee, has been prudently pigeon-holed, and that area development on normal lines has taken its place—for which relief we are grateful. The same inference can be drawn from the clause regarding the standardisation of frequency, which is permissive only, and says that the Board "may require" undertakers to alter the frequency "if and so far as such alteration is required" under the scheme, or to effect such standardisation as it "may think expedient." There will not, then, be a storm of standardisation to afflict the country, at a time when economy is a first necessity—be it remembered that the abolition of the frequencies of 25 and 40 cycles is needed solely for the purpose of interconnection, and that the outlay is wholly unremunerative in itself. Further discussion of that question must be deferred for the moment.

Our next point concerns the sale of the electrical energy thus obtained and distributed to authorised undertakers. The latter need not take it if they can generate more cheaply themselves, and thus the interests of consumers are safeguarded in areas already enjoying a cheap supply—cheaper, in some cases, than the Board can hope to offer. The owners of the "selected" stations appear to be at a disadvantage, in that they have to sell to the Board the whole of their output at the cost of production, and repurchase energy for their own undertakings at a price which appears almost certain to be higher, for it has to bear "a proper proportion of the Board's expenses"; alternatively, the price is the Board's general tariff, which is framed to cover its expenditure plus capital charges, with a margin. The conclusion seems inevitable that the cost will be increased—unless an improved load factor results from the operations of the Board, more than sufficient to wipe out the additional burdens. To soothe the owners' natural apprehensions, they are protected for the first seven years against paying more than the cost that they would have incurred without the Board's assistance.

That such an improvement in load factor will be obtained is the argument that has been put forward to justify the adoption of this "middle-man" system. We sincerely hope that it will prove well-founded, though there is little evidence before us to that effect. The success of the scheme is largely dependent upon this consideration. It is a case of "making the best of a bad job." Because past legislation has thrown electricity supply mainly into the hands of local authorities, amalgamation of the distributors, which would have been possible if they had been companies, cannot be effected; nor will the local authorities permit companies to take over their undertakings. Had the conditions been otherwise, companies could have been formed to generate electricity in large power stations, transmit it to the various townships, and distribute it to the consumers, without any middleman. This would have been the most satisfactory and business-like method of dealing with the problem, and is not only in full force abroad, but is also practised in this country most successfully by such power companies as have been able to come to terms with the local authorities in their areas.

An important provision is that which enables the Electricity Commissioners to require undertakers who refuse a supply in bulk from the Board to reduce their charges to consumers by the amount by which their cost of production exceeds the bulk price offered by the Board. This should result in the closing of inefficient generating stations, as the alternative, in the case of a municipality, is a call upon the rates; the case of a company does not arise, as no company would refuse a cheap bulk supply.

The Central Electricity Board is to be deemed to be an "authorised undertaker" within the meaning of the Electricity Acts in many respects, but will also fill the office of a "super" Joint Electricity Authority, with all Britain for its District, as we surmised in our issue of January 29th. So far as it follows the policy of developing electricity supply in the existing Districts it will be working on the lines which we have advocated. It is not clear, however, that it is under any obligation to extend the supply into areas at present unprovided with electricity—yet it appears that the rural demand is largely relied upon to improve the load curve and to produce the resulting economies which are to pay for interconnecting mains, the standardisation of frequency, and the expenses of the Board. The scheme is incomplete, and the Bill will probably emerge from Committee materially changed from its present aspect. Whilst there are many points in it which we have not here touched upon, such as the nature, constitution and authority of the Board, a matter which is giving rise to criticisms in important quarters, there are also serious omissions, and we especially regret that neither railway electrification nor the question of improved facilities for wayleaves is so much as mentioned in the Bill.

The South American Market.

In this issue we review two reports issued by the Department of Overseas Trade, both relating to South American countries. In the search for new outlets for our goods and the endeavour to strengthen established trade relations, there seems to be no doubt that, apart from the British Dominions, Latin America is the market which should receive the closest attention.

Argentina is an old and important customer for British goods, but it is not sufficient to rely on this fact to sell more of our products. Competition is very keen—keen enough to overcome all sentimental attachments, and if we are to retain and strengthen our connection with Argentina, continued study of the country and its people is essential. For this reason we welcome Mr. Chalkley's report, which brings before British traders some ideas and suggestions for meeting the competition of United States and Continental producers. In some respects the market is an easy one; Argentina is one of the countries which, being least hit by the war, was able to recover sooner, and the knotty problem of long-term credits is not met with there. In the electrical branch, in particular, Great Britain is not unfavourably placed, and in two of the main sections supplied more in 1924 than in the preceding year.

With regard to Brazil, the position is not so satisfactory. There the price factor appears to be more in evidence, and although the sterling merits of British goods are recognised, they are hard put to it to combat the competition of Continental products. The existing conditions in Brazil also raise the question of long credits. One important matter mentioned by Mr. Hambloch is the fact that the most important contracts emanate from the Federal and State Governments and municipal authorities. It is pointed out that unless a firm has an agent on the spot, such opportunities are almost certain to be lost. It is stated that at present Great Britain supplies only about 14 per cent. of the electrical goods which Brazil imports, but intense American and German competition has to be dealt with if this quota is to be increased.

Bringing Electricity Within Reach.

Although of some importance from its position in the Port of London, as well as from an industrial point of view, Gravesend is a modest town, and does not often figure in the newspapers. Recently, however, it has made a move which should bring it into greater prominence in electrical circles. This is the introduction of a system of charging for electricity which is one of the most favourable to electrical development that we have heard of. It is

a rateable-value tariff requiring the payment in advance of 2½ per cent. of the assessment of premises per quarter, the "unit" charge being ¾d. To realise the value of the new system, it has to be borne in mind that it is an "overall" method of charging for lighting, heating, cooking, &c., and there are no conditions as to the use of appliances, &c. So far we have come across only one undertaking with a similar system—Watford—but here the fixed charge of 2½ per cent. only applies during the summer quarters; it rises to 5 per cent. in the winter. The lowest flat rate charge, for heating and cooking only, in the Greater London area (which is fairly representative of the country as a whole) is 1d. per kWh, but the new Gravesend charge beats this when the consumption, in the case of a house with an average assessment, rises above 400 kWh per quarter. The latter figure is easily attainable where heating and cooking are done electrically. In this particular town the price of gas is very high, and if the new electricity tariff is given sufficient publicity—backed up by demonstrations of cooking, &c.—the Electricity Department should be overwhelmed with applications for supply. Plant extensions are already in hand, and more should soon be required. We congratulate the Gravesend Electricity Committee and its engineer (Mr. C. F. McInnes) upon their determination to provide a really "cheap and abundant supply" of electricity, and call upon other undertakings to take a similar forward step. We have always said that it could be done, and we are confident that the policy will be justified by the results.

The North-East Coast Counties.

In our series of maps showing the present position of electricity supply in this country, this week we reach the counties of Northumberland and Durham, which include almost (but not quite) the whole of the area served by the Newcastle-on-Tyne and Associated Companies. This is of exceptional interest at this time, when the Electricity (Supply) Bill is before the House of Commons, for it is an example of the development which can be brought about by the operations of companies endowed with wide powers over large areas. As we point out in our leading article, co-ordination of this type is not practicable where the business is in the hands of municipal authorities. In this area the annual consumption of electricity is about 500 kWh per head of population; in the Metropolitan area, in spite of the large demand of the electric railways, the consumption is less than half as much. Until recently the companies in the latter area have been prohibited by Parliament from combining, and thus although they are responsible for two-thirds of the output of electricity, they have been in no better case in this respect than the municipalities. Under the new conditions, amalgamation is rapidly taking place, and we hope in a very few years to see a vast improvement effected in London and the home counties. "Electrical Freedom," the contractors' slogan, might equally serve for the electricity suppliers.

In other districts besides Tyneside, where the power companies have enjoyed a fair degree of freedom, as in Yorkshire, the North Metropolitan Company's area, and on Clydeside, rapid progress has been made.

It will be observed that in the North-Eastern area there are very few power stations; those of the companies are sited on rivers, near the denser loads, and no part of their area is more than about 30 miles from one of them. The North Tees station is, we believe, unique in that it is a non-statutory one, owned by a subsidiary company. The average revenue of the companies, per kWh sold, is about ¾d.

The Report of the Coal Commission.

Last week the voluminous report of the Royal Commission on the Coal Industry was issued, and was received with mixed feelings by those interested in this important subject. The most general impression was that the Report afforded abundant material for thought, and that time was necessary to allow of its digestion before it could be adequately discussed. Certainly our compliments are due to the Commission, which, under the able chairmanship of Sir Herbert Samuel, has carried out a most thorough and impartial investigation into the economic position of the industry and has embodied the fruits of its labours in a treatise of some 300 pages which deserves the highest commendation.

We are glad to find that the Royal Commission definitely turns down the proposal that the mines should be nationalised, and considers that the industry should remain under private enterprise; it recommends, however, that the mineral rights should be acquired by the State and administered by a Coal Commission under the Secretary for Mines. Another important recommendation is that many of the small mining properties should be amalgamated, if possible by voluntary action, but in cases where unreasonable opposition is met with, by compulsory transfer.

Research should be largely extended, and a closer connection between mining and the allied industries is advocated; the Commission holds that the development of electricity supply under the new proposals of the Government should be closely co-ordinated with the generation of electricity at the mines, and proposes the establishment of a National Fuel and Power Committee which should maintain a constant survey of the heat, power, and light requirements of the country.

The most emphatic decision of all is that no further subsidy shall be allotted to the industry, which must stand upon its own economic basis.

Railway Electrification.

An important announcement, which appears to have escaped the attention that it deserves, was made by the Chairman of the Southern Railway in his speech at the annual general meeting—namely, that the overhead contact system on the Central, or Brighton, section of the railway, is to be scrapped, in order to bring that section into line with the Eastern and Western sections, which are both operated with direct current at 600 volts, third rail. While it is undoubtedly awkward to have a non-standard system sandwiched between two which are standard (as recommended by the Advisory Committee of the Ministry of Transport six years ago) we confess to some feeling of dismay that a system which has given satisfaction, which only recently has been considerably extended, and which is similar to that widely adopted in other countries, should be abolished in favour of something not very different from the first efforts in electric traction. We hope it is not to be inferred that the Southern Railway has abandoned all intention to proceed with main-line and long-distance electrification, for to confine electrical operation to suburban traffic would be to derive from it less than half the benefit of which it has been proved capable. As we have pointed out, it is very important that we should have at least one single-phase railway in operation in this country, in order to assist our manufacturers in developing and improving the design of a.c. motors, and we greatly regret the prospect of the adoption of a low-pressure system which, however well adapted for suburban service, is certainly not suitable for main-line operation.

The Report of Lord Weir's Committee.

Simultaneously with the issue of the text of the Electricity (Supply) Bill, the Report of the "Committee appointed to review the national problem of the supply of electrical energy," generally known as the Weir Committee, was published (H.M. Stationery Office, price 2s. net). Although this report was presented to the Minister of Transport on May 20th last year, it has hitherto been withheld from the public, for reasons which may readily be surmised; and in now issuing it, the Minister points out that the Government has not accepted all the proposals of the Committee.

The Report is a very interesting document, and will be reviewed at length in a later issue.

Distilling Plant for Central Stations.

The Kestner Distiller at the Comines (France) Power Station.

By THEODORE RICH.

The question of the use of distillers for boiler-feed work first became a matter of importance in the Navy. The necessity of independence of port water supplies, furthered by the development of the water-tube boiler, made distilling plant a very necessary piece of apparatus in the modern war ship.

Early in the day, when electric power stations began to get out of the *régime* of small belt-driven units, the desirability of good feed water became manifest; nowadays, owing to the increased evaporation per square foot of grate area and heating surface, and the expense and loss of revenue when boilers and economisers have to be laid up for cleaning, let alone the loss of efficiency through the existence of scale and excessive upkeep costs, the necessity for clean and chemically harmless feed water has become more important than ever.

Numerous types of external water-softening and internal deposit-collecting devices have been brought out from time to time, but where the water is really bad, solids usually enter the boiler which are better left outside. At some large installations abroad, for instance at Comines,* distilled water is used not only for boiler purposes, but also for various coolers where a deposit would lead to trouble. It is naturally important that the potential energy in any steam used should be as far as possible utilised. In marine practice, where weight is of great importance, it is usual to evaporate by means of high-pressure steam, which circulates inside tubes bent to a convenient form, the water to be evaporated being outside the tubes; with such a high temperature to start with, the water evaporated per square foot is high, which tends towards the deposition of hard scale; with low-grade steam any deposit on the outside of the tubes is of a soft nature. Further, by the use of high-pressure steam that part of the heat energy in the steam which might have been used for the purpose of running prime movers is lost, and the evaporative capacity of the boilers primarily intended for the generation of power is reduced to that extent. It may be pointed out that this heat if not used for such motive power is not totally lost, as it goes into the water to be evaporated through the distiller tube walls, yet unless the vapour produced is condensed by means of feed-water circulation or similar means by which the heat is recuperated, part of this extra heat will also be lost. A much more efficient system, taken as a whole, is to use bled steam from a turbine or exhaust steam from steam-driven auxiliaries; by this means part of the energy in the steam performs useful mechanical work, the remainder of the heat (with certain small losses) being used for evaporation.

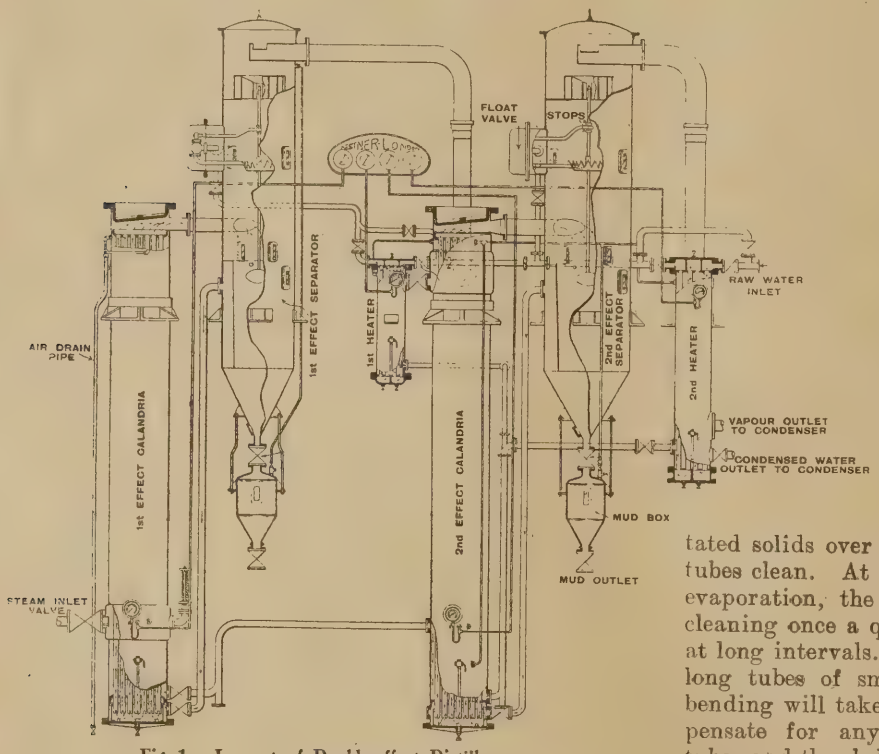


Fig. 1.—Lay-out of Double-effect Distiller.

At Comines the feed pumps are steam turbine driven, the exhaust being turned into the distillers, which are of the Kestner climbing film type. This type of apparatus, which has been used for a number of years for industrial processes, has certain interesting features.

Suppose a long tube in an upright position is jacketed with steam, and water under a low head is introduced into the tube at the bottom; then, provided a certain ratio exists between the length and the diameter of the tubes, the bubbles of vapour as they rise will tend to carry with them a film of liquid up the inner tube walls to the top; if this liquid flows into a separator along with the vapour, the unevaporated water can be returned to the bottom of the tubes again, and an active circulation will be kept up. This is the principle of the Kestner climbing film evaporator. It is found that if vertical tubes 2 inches in diameter and 7 metres between tube plates, about 23 ft. long, are used, a climbing film action will take place under suitable conditions of head. The velocity of the film in the tube is high, and as the film is very thin, the rate of heat transmission is high, and further than this, the high velocity tends to carry the precipitated solids over into the separator, and thus keep the tubes clean. At Comines, where there is multiple effect evaporation, the tubes of the first effect only require cleaning once a quarter, and the remaining effects only at long intervals. There is the further point that with long tubes of small diameter, sufficient bow-shaped bending will take place between the tube plates to compensate for any differences of expansion between the tubes and the shell.

When the latent heat in the water which is evaporated by the primary steam in one set of tubes is used to evaporate water in another set, then we get what is known as double effect, and if this is repeated a second and third time we get what is known as quadruple effect. The advantage of a multiple effect is that much more water can be evaporated per pound of steam used than if a single effect only is adopted. For instance, with quadruple effect about 3.4 lb. of distilled water can be produced for each 1 lb. of exhaust steam from the turbine-driven feed pumps; on triple effect 2.6 to 2.8 lb. is produced, the latter under favourable conditions. At Comines the plant was originally designed to work triple effect with one spare effect, while on emergency it could also be worked with one or two effects; however, owing to the fact that the plant required so much less cleaning than was anticipated, the spare effect has been used as a preliminary one and quadruple effect has been worked. To explain the operation fig. 1 shows the lay-out of a distiller arranged for double effect, each effect made up with evaporator, separator and heater; the distiller shown is one supplied by the Kestner Company to a power station at Cawn-

* Electrical Review, Jan. 8th, 1926, p. 59 *et sqq.*

pore. The feed water comes into the separator under control from a valve regulated by a float; it flows over a serrated tray, as shown. When the water in the separator falls the valve opens. The water flows down into the evaporator termed the "Calandria," and is heated inside the tubes by the low-pressure or live steam which flows into the surrounding chamber.

In evaporating, the vapour rising carries with it a film of water upwards; this flows into the separator, and after being freed from entrained water it flows into the jacket of the second calandria, part flowing through a branch to a small heater. The precipitation of solids in the feed water is assisted by the water meeting the upward current of vapour from the calandria, and further precipitation takes place in the body of the separator itself; the solids tend to settle down and are removed from time to time with the aid of the sludge boxes below. Thus the bulk of the deposit takes place in the first effect.

The steam, in this case bled from a steam turbine, which heats up the first calandria, is condensed, and flows as water into the jacket of the second calandria through a valve. Owing to the lower pressure in this, a good deal flashes off temporarily into vapour; when condensed it passes through the jacket of No. 1 heater, having been joined by the water condensed in the second calandria, and thence to the feed tank.

Fig. 3 is a diagram of a double effect distiller, showing what sort of results can be obtained; the vapour from the second separator passes through a heater and then flows into the main condenser, the resulting water being returned to the hot well with the turbine condensed steam that was not by-passed. As can be seen, 2,885 lb. of steam at 157 deg. F., 4.4 lb. per sq. in. absolute, passes into the apparatus through the jacket of the first effect calandria; and 5,640 lb. of raw water at 60 deg. F. is pumped through the feed heaters into the two

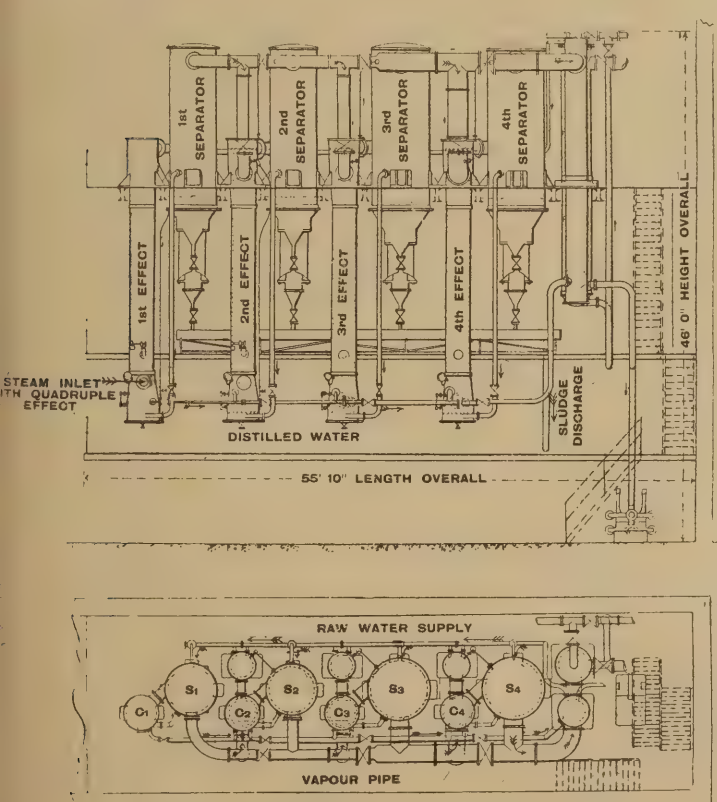


Fig. 2.—Distilling Plant at Comines, France.

separators, part into each. Part of the steam (5,831 lb.) is condensed and passes out as distilled water at 130 deg. F.; the remainder (2,554 lb.) passes as vapour into the condenser. The impurities in the incoming raw water are drawn off through the sludge boxes.

Fig. 2 shows a diagram of the plant at Comines. The raw water drawn from the River Lys is pumped into the fourth heater, and its temperature is there raised to approximately that of the boiling point of the fourth effect, and by means of float valve control a quantity of water corresponding to the evaporation in this effect is fed into the separator. Part of the remainder, under similar control, passes to the third heater, where a temperature higher than that in the second prevails, and then the process is repeated.

The three heaters are heated by means of vapour from the three separators. The water entering the separators is heated up by the vapour from the calan-

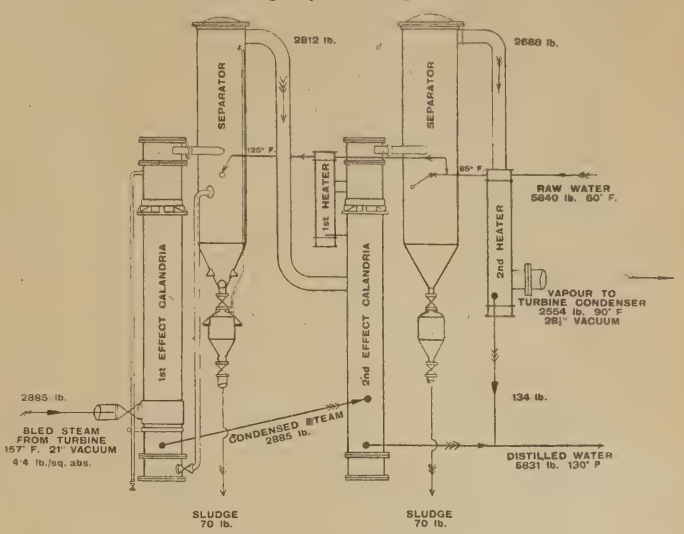
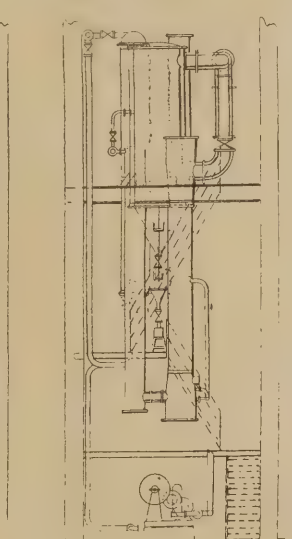


Fig. 3.—Diagram Showing Results Obtained.

drias and flows down into the latter and circulates until it is evaporated by means of the climbing film action.

The vapour which is not condensed from the final effect is passed into a condenser which is cooled by the main feed water; the heat therefore is not lost. There is a further small condenser which cools any incondensable gas before it passes to the vacuum pump. The operating steam is at about 29 lb. pressure absolute.



Naturally, when a multiple effect is used and the initial pressure is only about 15 lb. above atmosphere, there must be a fall of temperature and pressure with each effect, and the smaller the difference in temperature between the vapour on the one side and the water to be heated on the other, the larger the surface of the tubes must be to deal with a given quantity of water to be evaporated. It is claimed, however, that with the Kestner climbing film evaporator the film is so thin and the velocity is so high that the surface required, even with multiple effect, is lower than that which would otherwise be necessary.

To operate the plant there are three pumps on one shaft driven by a motor: an air pump to ensure the vacuum which enables evaporation in the lower effects to take place at a pressure below that of the atmosphere; a distilled-water extraction pump; and a feed pump which pumps the raw water into the different evaporators. At starting, these pumps combined take about 40 h.p., but in normal working 27 to 30 h.p. only is required. The sludge which accumulates in the bottom of each separator is emptied from time to time by means of valves into sludge boxes, as may be seen from the diagram, and when the top valve is closed again the sludge can be discharged into a trough running below the four separators. As can be seen from the cycle of operations, apart from radiation losses, there is practically no heat loss at all. At times when there is insufficient steam from the feed pump turbine exhausts, live steam can be used, either alone or to assist the existing flow.

Sight holes are arranged in separators and sludge boxes so that the operation can be watched. In normal operation one unskilled man controls the apparatus.

Thanks must be given to the Kestner Evaporator and Engineering Co., London, for assistance in the preparation of this article.

Electricity Supply in Great Britain.—XIII.

Northumberland and Durham.

Statutory powers for general supplies of electricity have been granted in respect of the hatched areas on the accompanying map, with the exception of Darlington Rural District and Seaham Harbour Urban Dis-



Electricity Supply in the Counties of Northumberland and Durham.

trict, for which areas applications have only recently been lodged by Darlington Corporation and Seaham Harbour Urban District Council respectively.

The areas* of the Newcastle-upon-Tyne Electric Supply Company and its Associated Companies have not been shown hatched, except where statutory powers for general supplies are held or have been applied for, as mentioned above. This group of companies holds various statutory powers under its Acts for the supply of energy, and also for interconnection, &c., with private companies, one of the most important of these being the Tees Power Station Co., Ltd. The generating station (North Tees) of this non-statutory undertaking is situated at Billingham, and is indicated on the map by a square dot.

Although the development of the electricity supply industry in the North-East Coast Area (Area No. 16) has been tremendous, it would seem from the following figures (extracted from the annual publication of the Electricity Commissioners†) that railway electrification in the London Area (Area No. 7) has enabled the latter to maintain the rate of increase in the number of units generated per annum, whilst the former has slackened pace.

Year ending March 31st.	kWh generated. Area No. 16.	Area No. 7.
1922 ...	692,658,577	1,382,462,122
1923 ...	849,694,538	1,561,814,992
1924 ...	985,911,020	1,768,070,741
1925 ...	1,041,659,090	1,949,825,578

The following is a list of the existing authorised undertakers:—

Local Authorities.

Amble Urban District Council.
Annfield Plain Urban District Council.
Crook Urban District Council.
Darlington Corporation.
Newcastle-upon-Tyne Corporation.
South Shields Corporation.
Stanley Urban District Council.
Stockton-on-Tees Corporation.
Sunderland Corporation.
Tanfield Urban District Council.
Tynemouth Corporation.
West Hartlepool Corporation.

Companies.

Cleveland and Durham County Electric Power Co.
County of Durham Electric Power Supply Co.
County of Durham Electrical Power Distribution Co., Ltd.
Hexham and District Electric Supply Co., Ltd.
Houghton-le-Spring and District Electric Lighting Co., Ltd.
Newcastle and District Electric Lighting Co., Ltd.
Newcastle-upon-Tyne Electric Supply Co., Ltd.
Northern Counties Electricity Supply Co., Ltd.
Urban Electric Supply Co., Ltd.

The 1921 Census gives the following particulars for the Administrative Counties of Northumberland and Durham and their associated County Boroughs:—

	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Northumberland	1,291,515	746,096	160,252	12,563
Durham... ...	649,244	1,479,033	313,791	16,109
Total	1,940,759	2,225,129	474,043	28,672

The map§ is reproduced by permission of the Controller of H.M. Stationery Office. The original was prepared by the Ordnance Survey Department for the 1917 Boundary Commission. The following alterations of areas, &c., have been made since 1917:—

(1) The Parishes of Bebside, Cowpen, Horton and Newsham and South Blyth have been united to form the new Parish of Blyth.

(2) The boundary line between the Seaton Delaval Urban District and Parish and the Whitley and Monkseaton Urban District and Parish has been altered.

(3) Parts of the Parishes of Healeyfield and Knitsley have been added to the Urban District and Parish of Consett, and part of the Parish of Knitsley has been transferred to the Parish of Healeyfield.

(4) Part of the Parish of North Seaton has been added to the Urban District and Parish of Newbiggin-by-the-Sea.

(5) The Parish of Seaton Carew has been merged into the Parish of West Hartlepool, which is now co-extensive with the County Borough.

(6) Part of the Parish of Hawthorn has been added to the Parish of Haswell.

(7) Part of the Parish of Pelton has been added to the Urban District and Parish of Chester-le-Street.

(8) The County Borough and Parish of South Shields have been extended so as to include parts of the Parishes of Harton, Whitburn and Boldon. The remainder of the Parish of Harton was added to the Parish of Whitburn.

(9) The Urban District of Washington has been created, comprised of the Parishes of Barmston, Usworth and Washington.

(10) Blyth Urban District has been created a Municipal Borough.

(11) Billingham Parish has been created an Urban District.

* See also No. XII of this series, Elec. Rev., March 5th, 1926, p. 365.

† "Generation of Electricity in Great Britain." H.M. Stationery Office, price 1s. 6d.

§ 1917 Boundary Commission Maps (Scale: four miles to one inch) are obtainable, price 6d. each, from Messrs. Edward Stanford, Ltd., Long Acre, London, W.C.2.

The Economical Loading of Power Plant.

The Use of the Willans Line.

By J. S. PILLANS, A.M.I.Mech.E.

Shift and other engineers who are in charge of steam-driven generating machinery, of which two or more sets are run in parallel, are frequently of the opinion that a saving of steam will invariably follow the giving of as large a proportion of the load as possible to the set which originally showed the lowest steam consumption per kW on test.

This belief, more especially when carried into practice, is undoubtedly praiseworthy, as in the majority of cases it will have the desired effect. At the same time, however, it is interesting to note that for reasons which will be entered into more fully, it does not necessarily follow that the bearing of the major part of the load by the most efficient of the paralleled sets will result in any saving whatever.

The point may be summarised as follows:—Assuming two identical turbo-driven sets, paralleled to the main bars and sharing the load; assuming also that steam and other operating conditions are alike in all respects, and further that their original consumption characteristics were similar; but that their sole difference consists of a pass-out gear fitted to Set 1, by means of which a constant quantity* of steam is drawn for process work, the Willans lines for the two sets will then lie parallel if plotted to a common base, as in fig. 1 (p. 452), though separated by a distance corresponding to the amount of pass-out steam.

It will be seen that in this and similar cases where the Willans lines lies parallel, the combined steam consumption per kW for the two sets is independent of the load distribution.

By way of example, the full load F C (fig. 1) may be taken as carried by Set No. 1, Set No. 2 running light. Then the combined steam consumption in lb. per hour will be given by AC plus EF.

*Conditions which, on the ordinary run of pass-out turbines will not be attainable. The assumption is, however, justifiable in order to illustrate the contention.

If now the load is wholly transferred to Set 2, with Set 1 running light, we have the combined steam consumption equal to BC plus DF, and hence for all variations of the load distribution AC plus EF equals BC plus DF. This shows that for paralleled power plant, the Willans lines of which under actual operating conditions are separated by a constant difference, the load distribution is immaterial.

In the case of, say, two paralleled engine-driven sets, of which one is less efficient than the other by reason of badly-fitting piston rings, at no load, the difference in steam consumption will be relatively small, increasing rapidly with rising mean effective pressure, a state of affairs shown by the Willans lines in fig. 2; as before, it may be assumed that the leakage mentioned constitutes the sole difference between the sets, although the issue is dependent only on the Willans lines and not upon the determining factors of these, such as capacity of plant, &c.

Applying the same reasoning as in the former example, it will be seen that economy of operation will vary with the proportion of load carried by Set 2, and that this condition will be shown by divergence or convergence of the Willans lines.

Naturally, under the normal conditions of station operation, the sets will be subject to widely different conditions, such as initial efficiency of design, state of repair, normal vacuum, distance from boilers, generating efficiency, &c., all of which, however, may conveniently be combined and correlated by drawing the Willans lines to a common base; whether the sets be large, small, turbo or engine driven, old or new, &c. Such a case may be depicted in fig. 3 for a medium-sized station equipped with turbines, but having reciprocating stand-bys. If a chart of this kind is drawn up by individual stations, it constitutes a valuable guide for the shift engineer who, by visually comparing the lines of the sets he is running, is enabled to form an accurate judgment of the advantage to be gained by loading up to the maximum desirable the set or sets which show a Willans line having the smallest angle of inclination to the horizontal. As heretofore, the question which set or sets he shall run will depend on local conditions; the chart makes no attempt to govern this, but only to enable the running sets to be used to the best advantage.

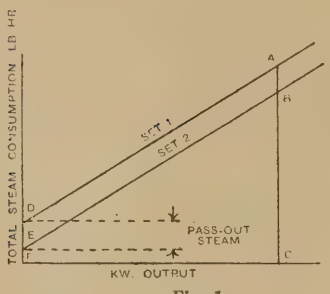


Fig. 1.

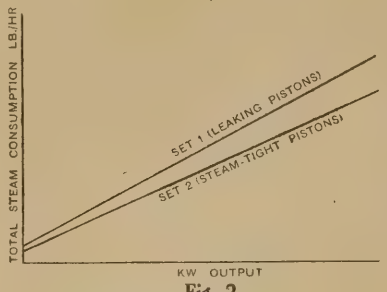


Fig. 2.

The Use of the Willans Line in Parallel Operation.

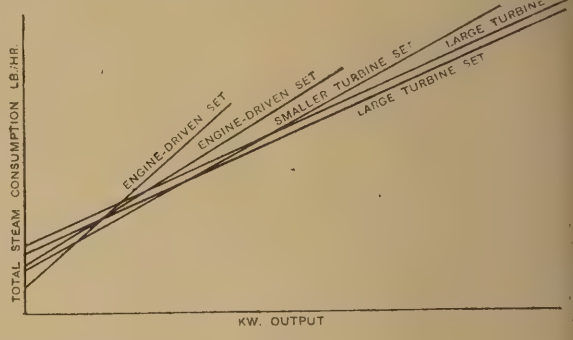


Fig. 3.

In certain cases such as will occur when impulse turbines are fitted with governors of the overload nozzle disclosing type, the Willans lines will not run straight. Under these conditions, obviously, it will be necessary to judge the slope of the line between the required limits of the load.

It is suggested that a chart of this description showing the Willans lines of all sets in the station, under normal conditions of working, could with advantage be displayed in every control room and switchboard gallery, and should prove of material value in the economical working of the station.

The Birmingham Electric Club.

Annual Dinner.

The fifteenth annual dinner of the Birmingham Electric Club was held at the Grand Hotel, Birmingham, on March 12th, and many representatives of the various electrical organisations in the Midlands were present. The company numbered about 250, and Mr. A. E. Cunningworth (President) occupied the chair.

The dinner coincided with the publication of the Government Electricity Bill, and severe criticism of it was voiced by Mr. P. J. Hannon, M.P., in proposing the toast of the "Electrical Industries and Electricity Supply." A serious side of the Bill, he said, and one to which all who were familiar with the direction of electricity schemes would have to give considerable thought, was the fact that out of the 40 clauses of the Bill, there were no fewer than 39 instances in which the work of the National Central Board—composed of the very best minds of the country—became subject to the approval of the Electricity Commission. This, in his opinion, almost amounted to a tragic blunder on the part of the Government, although the present Electricity Commission was efficient, impartial, and competent to deal with the great cause placed in its trust. It would seem to him that the Electricity Commission should prepare the schemes and leave it to the National Board to adopt them, limit them, or cut them down. Real success in the distribution of electricity for the benefit of the nation, the advancement of industry, and the welfare of the people, could never be obtained with the interference of bureaucratic authority.

With regard to the suggested expenditure of 33¼ million pounds on the schemes, the test of the efficacy of the measure was—how much it would cheapen the supply of electricity for power and light to the consumer, and to what extent it would enable districts hitherto deprived of power, through geographical or other reasons, to enjoy sources of electrical power. He had been unable to discover in the Bill any suggestion that Birmingham or similar centres were going to obtain cheaper and more abundant supplies of electricity.

Mr. R. A. Chattock, M.I.E.E. (President of the I.E.E.), responding, said that it was well known that the electrical industry in this country was in a flourishing condition, and he thought they should all be thankful for it. They all hoped that the black cloud that was at present overshadowing the engineering industry of the country would break and that they would soon see a settlement of the trouble which had been threatened. With regard to the Electricity Bill, he quite agreed with Mr. Hannon in his indictment of it so far as the question of control was concerned. He did not think any body of men should be called upon to take the responsibility of determining those enormous issues on which the progress of this country so largely depended, and they all hoped that further consideration and discussion of the clauses of the Bill would direct the Government along the proper lines and that they would eventually get something that would benefit the country and the industry. From conversations that he had had with representatives of electricity supply undertakings he felt that they were looking for something much better than had been described to them. Regarding the statement that a sum of 33¼ millions was to be placed at the disposal of the Board, Mr. Chattock thought that it was quite impossible to say off-hand what finance would be required. Apparently certain stations were to be selected to carry on the supply. Others would undoubtedly have to be established, and it was not clear how these were to be financed and how they were to be worked into the scheme generally. There was very little wrong with many of the existing undertakings as regarded their generating capabilities. They could not want anything better than the station at Manchester. He could not but believe that a

certain eminent electrical engineer had been misreported when he stated the other day that the new Government scheme would have the effect of making it possible to supply electricity for lighting, power, heating and railways at a cost of a farthing per kWh. It was a great pity to lead the people to expect a result of that kind, because he thought it was obvious that the cost, especially for lighting, must exceed that figure very greatly. He thought that what was referred to was the cost of generation. He was glad that it was proposed that a representative of the railways should sit on the Board; he felt that railway electrification was going to be a material factor in the progress of electricity in this country. With regard to the matter of frequency, that had been one of their nightmares in Birmingham. If it was decided to couple up a big district like Birmingham with another district it was possible to do so by means of frequency-changers. New plant should be designed to take into consideration the low-temperature carbonisation of coal. There had been a lot of discussion on the subject of late and methods were being developed which, he thought, would solve the problem. So far they had not had anything which had been commercially possible, but experiments were going on in America on a large scale which they were watching very closely and which bade fair to show good results. He hoped that any scheme developed by that Board would take that into consideration.

The toast of "The King" was proposed by Mr. F. W. Martin, the secretary of the club; the "City of Birmingham," by Prof. W. Cramp, D.Sc., M.I.E.E. (Birmingham), and responded to by Councillor H. K. Beale (Chairman, Birmingham Electricity Supply Committee); the "Birmingham Electric Club" by Mr. H. Berry, and replied to by the President (Mr. A. E. Cunningworth); and "The Visitors," by Mr. F. R. Unwin, A.M.I.E.E., and responded to by Mr. A. D. Phillips, M.I.E.E. (Derbyshire and Notts. Elec. Power Co.).

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

"Electrical Freedom."

Reiterated fallacies are treated seriously at times, and Mr. Robinson's article has not been challenged generally, although when stripped of all personal references, among other myths the spectre of Nationalisation is apparent, for he appears to demand complete control of every industry employing electricity, and suggests that the centralisation of control incurs no additional cost, and gives complete efficiency with economy.

Many newspapers have taken this view, and the following is a fair sample of what is written:—

"Mr. Baldwin's electricity scheme has had a very good Press, all sections have welcomed it. It is hoped that in many districts current will be obtained at less than ½d. per unit."

In addition to the cost of generating current at the station, however, there are other services, and total costs should surely be counted! But is the cost of connecting cables, the new department created, the cost of meter reading, and collection of accounts, &c., included in this figure?

Relieved of financial stringency and given sufficient scope, the manufacturer using steam in process work does not convert from steam to electric drive very readily; on the contrary and under certain circumstances, he cannot afford to buy energy from an outside source.

Mr. Robinson writes: "Surely if the supply of electricity is cheap and abundant, the installations must be cheap and abundant also." What do we find cheap in large installations?

1. A costly cable.
2. A specially built transformer house.
3. Transformer.
4. Main switchboard.
5. Motors, &c.
6. New shafting and drives.
7. New laws and regulations.

These are a few of the difficulties some contractors have to compete with, at least up in this part of the Kingdom, where I am happy to say the supply engineer generally heartily co-operates with the contractor, who is acknowledged to be the unpaid traveller, and commands respect accordingly.

Private enterprise is not finished with, and the contractors may yet be busy fitting up self-contained plants for customers who are experienced in buying "cheap" electricity from outside sources.

A more enlightened policy might, with advantage, take the place of the suggested misdirected one.

L. E. Wilson.

Manchester, *March 8th*, 1926.

If you are not overburdened with correspondence on this subject, may I mention my recent experience with a supply undertaking which obtained an important wiring contract in competition with a reliable independent member of the N.R.E.I.C. The company's tender was slightly higher, but was accepted by the clients, against advice, on the ground that they were good customers of their own. During procedure it came to light that the company were neither complying with the specification on which they tendered nor even complying with their own regulations. Naturally the whole of the wiring had to be pulled out, and this in the case of a company supplying a large area of importance and certainly one with fully competent engineers at the head, who, however, probably think that installation work is as well left to any of the staff who have proved themselves incompetent on the switchboard.

May one reiterate that Mr. Robinson shows so much bias in his statements that most thinking men would be suspicious of his deep reasoning and unlikely to accept his didactic statements without careful examination of the facts from all points of view.

Not a Contractor.

London, *March 12th*, 1926.

In this week's issue Mr. Robinson has received some well-earned rebuffs, and it is to be noted that this humorous (?) engineer now states that this is not a question of municipal trading. The latter statement would point to the fact that the article by Mr. Robinson is inconsistent, as the whole article was crammed with boost for municipal trading. I desire to associate myself with the concluding remark of "Registered Contractor" where india-rubber is mentioned.

Why should supply authorities be allowed to poach in the electrical contracting field when their time should be fully occupied on the supply side of the industry? This growing menace to the electrical contracting industry is but a form of Municipal Socialism, and one might as well say that municipalities should set up business in all trades and thus effectively stop all private enterprise. Who has a better opportunity of making a high-class show of electrical appliances than municipal authorities with the ratepayers' purse? They can generally pick out the best site in a city for a highly extravagant showroom and are in the happy position of being able to use up the kilowatts for demonstration purposes without having to worry about a heavy current bill. Is it to be wondered at, then, that they can sell a few more vacuum cleaners and hair driers than the (according to some people) inefficient contractors? Your correspondents in the current issue have a good grasp of the situation, and it is hoped that something effective will be done in this session of Parliament to put a stop to this municipal poaching. It certainly seems to be the desire of certain individuals to get us "washed out" but—we are waterproof.

Contractor.

Glasgow, *March 13th*, 1926.

The Metering of Electricity.

In your issue of the 12th instant you published an article by Mr. S. H. Penning on the above subject.

In this he explains that a few months ago he devised means whereby both the fixed charge and the low running charge per unit, in a two-part tariff, can be measured by the same meter, and he goes on to describe the means whereby this result is attained.

We think we ought to point out that we have been engaged on this problem for a good many years, and as long ago as March 8th, 1922, we took out our first patent, No. 198,772. The system has also been patented in the United States, Germany, and other countries.

Claim 1 of the patent in question reads as follows:—

"A Motor Electricity Meter in which the rotary element rotates on no load provided with a direct connection between the rotary element and the counting train so that the meter registers continuously at a certain pre-determined rate when no load is being taken in the consumer's circuit."

The Electrical Apparatus Co., Ltd.

R. Amberton, *Director.*

London, *March 12th*, 1926.

Country House Fires.

Your recent article on the above subject has particularly interested me, for only a few weeks ago I was asked to test a private installation with a view to its being turned over to a public supply. The installation, I was informed, was put in only a few years ago and was supposed to have been carried out on the lead-covered system.

On testing, several circuits were found very low, and on proceeding to investigate the cause, I found in one of the bedrooms, near the switch, a single core lead-covered cable, together with a twin flexible, tucked away at the side of the door frame; these passed into the picture moulding and were run along two sides of the room, eventually terminating in a bracket over the bed. On making further investigation, lead-covered cables were observed on the surface of one of the corridor walls, and to all appearances looked as if they passed through the wall into a cloak room, but on making an examination in this room no such wires appeared. In order to locate the direction of these wires, some of the plaster was cut away, and much to one's astonishment, the wires were found bunched and tucked away in a previously made hole which had been filled in with plaster of Paris. Still further investigation revealed some of the wires run along the surface under the picture mouldings and protected by wood casing. At one point where they radiated from a distribution board on the first floor landing, a 12-in. by 12-in. wood pattress was fixed, on which was mounted the distribution board. On removing the screws holding the pattress, a hole was found chiselled out in the plas-

ter and brickwork and the *joint*, as sent herewith, found. In another part of the house a nail driven through the capping and lead-covered cable was located.

As already stated, there were 60 points in the house; not one single junction box was found, all joints having been made in the manner of the sample sent you, and in each case buried.

Needless to say, an adverse report had to be given and the house is now being entirely re-wired.

I thoroughly endorse the remarks regarding the inspection and testing of installations—new and old—by the Insurance Companies, and add that they should be Engineering Insurance Companies which employ a competent electrical staff.

A. Douglas.

Stoke-on-Trent, *March 10th*, 1926.

[The tangle of flexibles, lead-covered wires, bonding wires, and tape which we have received from Mr. Douglas, beats anything that we have previously seen in the shape of a "joint"; we could not have believed that any sane person could have perpetrated such a job. It has one redeeming feature: it shows the inherent safety of electric lighting, for it has been in use for some years, presumably at 50 or 60 volts, without burning out. This must be an exceptionally bad case, but it emphasises the necessity of examining old installations.—Eds. Elec. Rev.]

I have followed with interest the correspondence by Mr. F. J. Moffett in connection with the above subject, and think his suggestion of inspection by the Fire Offices worthy of the fullest consideration.

A considerable number of the leading Insurance Companies have engineering departments which undertake the insurance of motors, generators, transformers, &c., against breakdown, which service includes a quarterly inspection and test.

I see no reason why this service should not be extended to electrical installations generally, the wiring being insured against "Faults," and the service to include a quarterly inspection and test of the whole of the installation. In the case of new work the service would provide for a number of inspections during the course of erection. If this scheme were put into force the person insured would be safe in the knowledge that his electrical work had been carried out in a thorough and workmanlike manner and in accordance with the I.E.E. wiring rules, and it would at the same time reduce the fire risk from the "fusing of electric wires" to a minimum.

C. A. Besley.

Cardiff, *March 12th*, 1926.

Ready-made Showcards.

If manufacturers and suppliers were to provide artistically designed show-cards (of a size suitable for each article) stating clearly the price, use, consumption in watts or units, catalogue number, &c., of the different pieces of apparatus which they supply (for instance: Electric iron, weight —— lb., consumption —— watts, price £——, Cat. No. ——, &c.) we consider that it would materially assist in increasing business.

We suggest that these should be supplied, or sold at a nominal price, to contractors, who would display them with the apparatus in their windows, &c. The cost of making and printing these cards would be low, if a number were produced, but the expense and trouble to a contractor of getting out individual cards is considerable.

J. & T. Robinson.

Croydon, *March 9th*, 1926.

A Bootle Wiring Contract.

Our attention has been drawn to a paragraph in the issue of your journal of the 13th instant, referring to a contract for the electrical installation at the Cleaver Sanatorium, Heswall. The paragraph states that by a majority of the West Derby Board of Guardians (28 votes to 22), it was resolved to apply to the Ministry of Health for a judicial inquiry to be made into the contract.

As the contractors concerned, you will readily understand that our mouths are sealed, and that it would be highly improper for us to refer to the matter in any way until after the proposed inquiry has been held.

Under these circumstances you will, we are sure, be disposed to suspend any judgment on the matter for the present.

The Knowsley Electrical Co., Ltd.
D. McKinnell, *Secretary.*

Liverpool, *March 15th*, 1925.

Electricity Generation in Switzerland.—Our correspondent in Switzerland states that the net production of energy in Swiss power stations at the end of 1925 was 520,000 h.p., a figure which is expected to be increased to 1,850,000 h.p. when all the hydro-electric power houses are fully equipped. Forty-six per cent. of the energy is produced by private enterprise, 17 per cent. by cantonal stations, and 11 per cent. by the C.F.F. stations. The large generating stations at Rempen, Siebnen, Klosters, Chancy-Pougny, Massagno, Näfels, and Turtmann were in full working order during the past year.

Reviews.

Electrical Estimating for Industrial Lighting Installations. By J. C. Connan, B.Sc., A.M.I.E.E. Pp. 214; 33 tables and five appendices. London: E. & F. N. Spon, Ltd. Price 12s. 6d. net.

Mr. Connan has written a book upon a subject which has been neglected in the past, but one which is of vital importance to the prosperity of electrical contracting businesses. From time to time it has been pointed out in the Electrical Review that quotations for lighting installations and similar contracts have shown such great variations in any one case as to lead to the almost inevitable conclusion that most of these quotations were based upon anything but sound estimates. The plague of price cutting which causes so much embarrassment to well organised firms and bankruptcy to their "rule-of-thumb" and slipshod competitors, can only be eradicated if the trade is willing to be educated into better ways, both of organisation in general and of costing and estimating in particular. It is therefore with considerable interest and hope that Mr. Connan's book will be received.

The title of the book is scarcely comprehensive of its contents, for not only does the author indicate very fully what are presumed to be his own methods of estimating, but he discusses at length the theory and practice of illumination and electrical wiring for lighting installations. Thus we find that out of 200 pages of text, 114 are devoted to the following subjects:—Definitions and laws, the theory of illumination, the factors to be considered in choosing the nature and the quantities of the illuminant, systems of wiring and accessories, and the size of conductors. Nothing but praise can be given for the lucid and able description of these subjects, and for the admirable blending of theory and practice contained in the first part of the book, except perhaps that the author sets out in too confident a manner to enlist the support and interest of a certain section of the industry. In the preface it is stated that one of the objects of the book is to enable the contractor who is deficient on the theoretical side to obtain this knowledge without undue waste of time. Another object is to draw the attention of architects, engineers, and others responsible for, or interested in, installations to the subjects treated in order to eradicate the too frequent absence of specifications, or the issue of faulty or incomplete specifications. Both these are laudable objects, and it is to be hoped they will, in the interest of all concerned, be achieved. However, in considering the object first stated in conjunction with the first page of the text, one can imagine the "practical" contractor being a little overwhelmed by such statements as these: "The steradian is given by the formula: $\omega = 2\pi(1-\cos\alpha)$ and luminous intensity by $I = d_F/d_\omega$." There is wisdom in beginning a book with definitions, but if they are stated thus, one is fearful of some of those for whom the book is intended not getting beyond the first page. As a handbook, it ought to be found on the desk of every large contractor, but in the case of the smaller contractor we suggest that he should skip most of the earlier part of the book until he has thoroughly digested the latter part.

In the latter part is to be found an immense amount of data compiled for the use of contractors and, if used with caution, there is no doubt that this information would be of the greatest assistance.

Installation and running costs are discussed, and many tables are included, giving the "equivalent" hours required for a large variety of operations. The installation costs are divided into material, labour, freight and packing, overhead and extras; the very necessary item of profit is also dealt with. The running costs are divided into fixed charges, maintenance charges, and the cost of energy, and each division is considered separately. Checking of quantities, and prices, preparation of the estimate and quotation and an example of a completed estimate and tender then follow.

The "self-cost" prices in loose leaf form, advocated by Mr. Connan, are highly commended, and we repeat the author's words concerning them: "*Every* contractor should prepare for himself a loose leaf book containing the 'self-cost' to him of *all* material he commonly uses *and* should keep the book up to date as the prices change."

There are, however, several important matters in which we find ourselves at variance with the author.

The method of treating labour costs presents what would be in the hands of anyone less capable than the author, a somewhat dangerous means of arriving at estimates of labour costs. This section should be read very carefully and thoroughly understood before it is acted upon. The assessment of "equivalent" hours would be the most convenient method of dealing with labour costs if they could, in their original form, be used upon all occasions, but the author himself gives twelve reasons why this cannot be so. One has to have standard conditions only before their use is justified, and if the actual conditions do not coincide with the basic standard, one is asked to rely upon percentage additions to the standard equivalent hours for each contingency. We distrust these percentages, for in them all the original accuracy of the standards is apt to be lost. Rather than attempt to tamper with the sound standards by the use of elusive and hypothetical percentages, we suggest that the actual hours of work that have been carried out, under conditions that do not approximate to the standard conditions, should be used wherever possible as the basis of

estimates. Estimates are bound to contain some judicious guesswork, when they relate to work that has not previously been attempted, but let the greatest possible proportion of estimates be the reflection of actual practice. It is much safer to work things out for the actual conditions under review than to juggle with figures based upon entirely different conditions and make them do.

The list of overhead expenses and the notes relating to them are comprehensive and of great utility, but here again we cannot see eye to eye with the author, so far as his method of distribution is concerned. In every branch of every trade overhead expenses are the most troublesome part of costs, and therefore of estimates, and we cannot find sufficient theoretical argument in favour of the adoption of any one of the methods suggested. We ourselves fancy quite a different means of distribution.

The author commits an arithmetical error when, on page 160, he endeavours to subtract percentages of two different quantities from a third in order to arrive at the percentage saving in yet a fourth. It just cannot be done so easily. Contractors should certainly be able to demonstrate with actual figures the advantages to be gained by the adoption of their recommendations, but we would plead for accuracy in the figures they use, and thus for their adherence to the advertiser's slogan: "Truth in advertising."

We are in full agreement with the author's dictum on page 170, that thorough practical experience and technical training are necessary qualifications of the estimator. In the same chapter good use is made of a sound system of checking, which will repay careful study.

The section dealing with the completed estimate and the tender might be apt to frighten one who has never taken great care over his estimates. This is, however, the culminating point in the book, and it is sincerely to be hoped that many contractors will actually be frightened by it, but nevertheless take it seriously to heart and endeavour to place their industry upon a higher plane, by making their estimates representative of really sound practice, so that tenders may in future not be discredited owing to their wide disparities.

We must congratulate Mr. Connan upon the production of a book dealing so fully with this very important subject, and, though we cannot agree with some of his basic methods, we think that every contractor who reads the book will find much that will aid him in attempting to estimate and quote more reliable prices.

The Mathematical Theory of Electricity and Magnetism. By J. H. Jeans, D.Sc., LL.D., F.R.S. Fifth Edition. Pp. viii + 652; figs. 140. London: Cambridge University Press. Price, 21s. net.

The work is so well known, and its reputation so widely, indeed universally, acknowledged, that it will not be necessary in this review of its fifth edition to do more than point out to our readers the particulars in which it differs from preceding editions, and describe the new features which have been added so that they may be in a position to judge in what respects the new book is different from that with which they are already familiar. The last edition, though reprinted in 1923, remained unaltered from the form in which it first appeared in 1920, and the changes and additions the author now deems expedient arise in the main from the great advances which have been made in the elaboration and application of the theory of Quanta and the Relativity theory, during the last six years. Thus, in the introductory division of the subject into three branches: Electrostatics, Magnetostatics, and Electrodynamics, it was stated in the fourth edition that Maxwell's hypothesis (*viz.*, that electrostatic and magnetostatic phenomena might be stresses and motion of a medium, consistently with the laws of dynamics) would be dealt with in the body of the book, "an alternative possibility being considered in the last chapter." In this edition the statement becomes: "As will be seen later, recent developments call for at least a drastic modification, and more probably for the complete abandonment of the whole hypothesis." In the first chapter, on "Physical Principles," the section on the "Modern View of Electricity" has been considerably amplified and amended, to bring it in touch with recent developments of theory, but the "summary" has not been altered. There is no further change of importance until Chapter VIII, in which some alterations in the treatment of Ellipsoidal Harmonics are introduced; slight alterations in section 601 and section 620 of Chapter XVIII, again refer to the growth of evidence that a "new system of dynamics and a new electron theory are needed."

Sections 635 and 636, Chapter XIX, on the Zeeman Effect, have been re-written; and section 647 of the same chapter, on the field set up by moving electrons, has been much enlarged. The following three sections dealing with the motion of electrons, and with the radiation of energy, have also been amended; and to section 651 is appended a paragraph, pointing out that the development of the new dynamics makes it clear that the theories of Maxwell and Stokes do not suffice to explain X-radiation.

The really important changes in the new edition consist of additions, at the end of the book, designed to supply in some degree the theoretic developments, the need for which has been indicated from point to point in the body of the work. The fourth edition ended with section 701 of Chapter XX. To this chapter are now added five more sections, treating of Generalised Relativity, Weyl's Electromagnetic Theory and matters cognate: and the new edition contains also an additional chapter, Chapter XXI, dealing with the Electrical Structure of Matter.

It is in this chapter that readers will naturally be most interested, but it is not here possible to reproduce in a few bright, well-chosen words, the substance of what Dr. Jeans, in his concise and lucid style of writing, takes a whole chapter to accomplish. It might be as well, however, to remind the reader as the author does from time to time, of the immensities of magnitude and minuteness which are represented by those little figures so easily written at the right-hand top corner of another symbol. Theoretic investigations do not lead to practical results unless they are thoroughly understood, and it needs a very special effort to really understand dimensions of a magnitude our senses are not fitted to perceive. Mere manipulators of symbols are apt to forget that. Our notions of force, also, are derived primarily from our experience of gravitational forces, amid which we live and move and have our being. "The electric force of repulsion outweighs the gravitational force of attraction in the ratio of 4.2×10^{42}," as the author finds occasion to state in section 28.

A kilogram of electrons, crammed together in cubical piling, would occupy a space measuring about the thousandth part of an inch across each way, while two grammes of electrons, that is to say, two bodies occupying but one thousandth part of the first bodies, would, if placed a metre apart, "repel one another with a force equal to the weight of 3×10^{23} tons." Compare the weight of the earth. We leave our readers with the problem of conceiving the forces which would be required to hold the electrons thus crammed together. Such are the forces with which electricians have to do.

Coils and Magnet Wire. By C. R. Underhill. Pp. xi+494; figs. 197. London: McGraw-Hill Publishing Co. Price, 20s. net.

In view of the widespread use of coils in so many and various types of electrical apparatus, it is rather surprising that there have not been more books written on the arts of their design and manufacture. Mr. Underhill is well known as a writer on magnets, and he has had considerable experience in coil construction. In the present volume he has some useful things to say on the subject, but, unfortunately, he has taken the opportunity to say a number of other things which are by no means so valuable and are but distantly connected with his main theme. In this way he has swollen his book inordinately. For instance, in discussing "Temperature and its Effects," he devotes a paragraph to the liquefaction and solidification of hydrogen, while his references to absolute temperature are much too extensive for the purpose in view. The usual methods of manufacturing magnet wires are described and very complete tables of the properties of bare copper wire and of the space factors, &c., of different kinds of insulated wire are given. These tables refer almost entirely to American wire gauge, however, and therefore have little interest for most British readers. As an example of the author's prolixity we may quote a passage from the chapter on "The Basic Principles of Coils." "The length of the insulated conductor is equal to the length of the bare conductor. The length of the conductor is equal to any of the following: (1) The product of the average girth and the number of turns. (2) The ratio of the volume of bare conductor to the cross-section of the bare conductor. (3) The ratio of (*a*) the product of the coil volume and the space factor, to (*b*) the cross-section of the bare conductor," and then, in case we have not understood, three numerical examples are given and the whole section occupies about one page. As another example of the same fault we may quote two pages given up to a string of the names of devices in which coils occur. Surely electrical engineers do not require to *buy* a list of this sort! Much of the book is on this level and it is difficult to imagine for what type of reader it has been intended.

The forms of coils used for various purposes and methods of winding them are dealt with fairly fully, but a more detailed description and discussion of automatic winding machines would have been welcome. A considerable section of the book is devoted to Insulation, Varnishes, Treatment and Impregnation. Most of the section is of the nature of a symposium to which numerous authorities on these subjects have contributed directly or indirectly. In such a symposium there is necessarily much repetition and the opinions expressed on some points are not all identical. Here we feel we should like to call upon the author's experience in deciding between them, but he fails us. The volume terminates with a useful chapter on testing.

The author has read widely and has spent immense pains on his book; there is a vein of good material running through its pages and if this had been separated from the rest and published at 7s. 6d. it would have been worth the money.

Engineering Apprentices' Competition.—The London Association of Foremen Engineers, in conjunction with the London County Council, has established a scheme for the award of prizes to approved students of mechanical engineering who submit finished pieces of work for competition in accordance with specified conditions. Prizes of £5 and a gold medal, £2 and a silver medal, and £1 and a bronze medal, and a silver shield to the Institution presenting the winner of the first prize, will be awarded.

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Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The Threatened Engineering Lock-out.—Last week the National Committee of the Amalgamated Engineering Union instructed the 900 employés of Messrs. R. Hoe & Co., Ltd., who struck work without the Union's sanction, to return to work, stating that if they failed to do so "disciplinary action" would be taken against them. It was expected that the men would accede to this instruction and thus avert the lock-out which was due to commence this week-end, which would have enabled the questions at issue between Messrs. Hoe and their employés to be dealt with officially by the Union.

In consequence of the alteration in the position, the London District Committee of the Electrical Trade Union decided to defer further action in the matter of holding up electricity supply in the event of a lock-out until to-day (Friday), when a meeting is to be held.

The strikers refused, however, to obey their Union's instructions, and it was expected at the time of our going to press that they would either be expelled from the Union or alter their attitude at the last moment. In any event it was not anticipated that the employers' lock-out notices would be acted upon.

Irish Free State Electrical Imports.—From trading returns issued recently, dealing with the Free State imports and exports for the whole of 1925, it appears that electrical goods to the value of £403,585 were imported, as compared with £393,987 worth in 1924.

British Capital in Poland.—The British Overseas Bank, which is largely interested in the Anglo-Polish Bank (of Warsaw), the Polish sugar industry and electricity undertakings in Poland, has arranged a credit for £250,000 for the construction of electric railways and tramways for the suburb of Warsaw.—*Reuter* (Warsaw).

Electricity in "Weir" Houses.—At its next meeting, Glasgow Corporation Electricity Committee is to consider the request of the local branch of the Electrical Trades Union that the Corporation should refuse to supply electricity to Weir housing schemes. Meanwhile, Mr. Mitchell, the electrical engineer, is to investigate Messrs. Weir's methods of executing electrical work for these houses.

Metal Trades Benevolence.—This week a special appeal has been issued by the Lord Mayor to 30,000 firms connected with the metal trades in Great Britain, calling upon firms and individuals to assist the funds of the Royal Metal Trades Pension and Benevolent Society, which holds its 78th anniversary festival on June 1st next with the Prince of Wales present. It is desired to increase the income by £10,000 per annum so as to advance pensions above the pre-war basis and to help cases which have at present to be refused. Mr. A. K. Steven (McDowall, Steven & Co., 2, Upper Thames Street, London, E.C.4), is chairman of the board of management.

Reunion of the Ex-British Westinghouse Association.—Over 130 ex-British Westinghouse men attended the eighth annual reunion dinner at the Holborn Restaurant, London, on March 5th. Mr. O. H. Baldwin presided. In proposing the toast "The Association," he said that the attendance was the best since the first reunion in 1919. The toast was coupled with the names of Mr. L. S. Richardson, the hon. secretary, and Mr. W. E. Warrilow, assistant hon. secretary, who both acknowledged. The "Silent Toast," also given from the chair, included references to the members of the Association (Messrs. E. R. Myers, Max. Halder, F. Suffield, E. Chambers), who have joined the great majority during the past year. "Absent Friends," submitted by Mr. C. T. Allan, was honoured at 10 p.m. Mr. M. M. Gillespie did full justice to the toast of "The Chairman," and Mr. Baldwin, in reply, was full of reminiscences, anecdotes and narratives. The entertainment, under the direction of Mr. H. S. Aspinall, included items of song, story and legerdemain. An important event of the evening was the ballot for life membership of the Association. The gathering included a number of ex-B.W. men who had specially travelled from South Wales, the Midlands, Lancashire and Scotland. The Association is, we understand, in a flourishing condition and the ninth reunion will be held in London on March 11th, 1927; Mr. L. R. Morshead, who is a member of the original committee, has kindly agreed to occupy the chair on that occasion.

Australian Radio Exhibition.—The N.S.W. Electrical Employers' Federation is organising an exhibition of radio apparatus to be held in Sydney for a week commencing May 3rd.

New Australian Companies.—The Western Electric Co. (Australia), Ltd., was recently registered in Sydney, with a nominal capital of £100.

Town Lighting Ltd., is the name of a company recently registered in Sydney, with a capital of £10,000, to acquire a concession to supply electricity in the municipality of Bombala (N.S.W.).

British Industries Fair.—Correction.—The Imperial Engineering Co. asks us to state that its wash boiler mentioned in our last issue, in connection with the Birmingham Fair, has a capacity of 10½ gal., not 2½ gal. as stated.

Foreign Samples Exhibitions.—During 1925 the Department of Overseas Trade organised 41 foreign samples exhibitions in London and provinces, mainly with the assistance of local Chambers of Commerce. The number was nine greater than in the preceding year, but the attendance was lower owing to a new policy of restricting invitations to firms known to be directly interested in the goods displayed. A total of 10,247 samples were loaned as well as 16,621 foreign catalogues, among which were publications dealing with electrical goods. The work of the Foreign Catalogue Library continues to increase and the collection now numbers 16,254.

Unemployment.—There was a further reduction (18,660) in the total of registered unemployed persons during the week ended March 1st. The total was also 128,518 less than at March 2nd, 1925.

Hackney Electricity Department: A Protest.—Rather late in the day the Council of the Hackney and Stoke Newington Chamber of Commerce has passed a resolution protesting against the Hackney Electricity Department selling fittings and conducting wiring contracts by direct labour and in competition with traders in the borough. The Council, among other things, expresses the view that the showrooms should be used for the display of goods and not for the sale thereof. The resolution does not say whether those who receive the orders as the result of this display will be prepared to bear their fair share of the cost of the upkeep of the showrooms.

An Engineering Merger.—It is announced that the boards of Mirrlees, Bickerton & Day, Ltd., and the Mirrlees Watson Co., Ltd., have decided to recommend the amalgamation of the two companies between which there exists a close association. The merger will be effected by the sale of the assets of the Mirrlees Watson Co. to the other company for a consideration of 244,000 fully-paid ordinary shares in Mirrlees, Bickerton & Day, Ltd. This and shares already held and £50,000 to be retained will enable the Mirrlees Watson Co. to allot to its shareholders seven new shares for each five held, together with a capital repayment of 5s. per share in the event of liquidation and distribution of assets. Mirrlees, Bickerton & Day, Ltd., will make the necessary increase of capital, and holders of ordinary shares in the company will receive a bonus of 2s. 6d. per share.

Proposed European Cable Syndicate.—It is stated that the idea of re-establishing the former Central European cable syndicate has been brought forward. A disposition to the joint regulation of prices is said to exist between makers in Hungary and Austria, but the cable works in Czecho-Slovakia have already declined to co-operate. An official proposal has so far not been placed before the German works, although it is considered that the syndicate of the latter will not readily surrender the position which it has regained in the world markets. The reconstitution of the international syndicate is said to be rendered difficult not only by the negative attitude assumed by the English cable makers, but also by so-called "dumping" by French firms as a result of the depreciated franc. The situation in the international cable market is characterised by the results of the recent competition thrown open by the Brussels city authorities, when the prices quoted showed a difference of up to 50 per cent., the lowest tender having been submitted by a German works (the Cologne Land and Marine Cable Company)

Disclaimer.—Messrs. Kershaws, Cheetham Hill Road, Manchester, ask us to state that neither they nor their senior partner, Mr. A. Kershaw, are in any way connected with the firm of Kershaw & Wood which was mentioned in our "Bankruptcy Proceedings" last week.

Lead.—Messrs. James Forster & Co., reporting on March 13th, stated: "Closing prices yesterday were £31 11s. 3d. for March and £31 18s. 9d. for June, against £32 7s. 6d. and £32 11s. 3d. respectively at the end of last week. There is no material change in the position this week, except that supplies are not quite so plentiful as recently. However, prompt lead ex ship is easily obtainable, and there is a prospect of considerable arrivals of lead during the next six weeks. Consumption remains on a restricted scale in this country, while in Germany there is little or no improvement. The rate of consumption of lead in America has fallen from its recent high level, this being reflected in the constantly falling price in that country."

The Hiring of Apparatus.—The burgh electrical engineer of Greenock has sent us a copy of a pamphlet which is being issued to consumers—actual and potential—setting out the charges for the hire and hire-purchase of electrical apparatus. The Corporation's scheme covers cookers, fires, kettles, irons, and water-heating appliances and the terms are very reasonable.

Feed-Water Regulators.—During the past two months Messrs. James Gordon & Co., Ltd., have received orders for over 70 equipments of Copes automatic feed-water regulators. Amongst these are included eight for the Oldham Electricity Works and eight for the Synthetic Ammonia & Nitrates Co., besides a number for export.

New Italian Companies.—Among the electrical companies recently formed in Italy are La Società per Intraprese Trazione Elettrica, of Asti, capital 75,000 lire; La Società Italiana per Istrumenti Elettrica Pizzi e Trovero, of Milan; La Società La Centrale per Finanziamente Imprese Elettriche, of Leghorn, capital 1,000,000 lire; La Società Lombarda Applicazioni Elettriche, of Voghera, capital, 200,000 lire; La Società Astese Filovie Elettriche, of Asti, capital, 10,000 lire; La Società Radio-Elettro-Mecannica Bruno Bamoli & Co., Bologna, capital, 300,000 lire; La Società Industrie Elettriche Carolei (Cosenza), capital, 600,000 lire; and La Società Metallurgia-Elettrica, "S.I.M.E.," Milan.

Austrian Power Exhibition.—Arrangements are in progress for the holding of an "Energy Economy Exhibition" in Vienna in 1927. Sections will be provided for electricity, coal, gas, oil, and water power.

Trade Announcements.—MESSRS. WALKER, CROSWELLER AND Co. have removed from Strand, W.C.2, to 54-58, Queen Elizabeth Street, London, S.E.1. Telegraphic address: "Instrukemi, Boroh, London"; Telephone No.: "Hop 5786."

MESSRS. HAMNETT & ANDREW, insulating material manufacturers, have moved to larger premises at Devonshire House, Rusholme Road, Manchester. (Telephone: Ardwick 3802.)

MR. H. A. ANDREWS, formerly assistant engineer with Messrs. W. Coates & Sons, Dublin, and manager of the Electrical Department of Exchange Buildings, Dublin, has now commenced business as an electrical contractor at 17, Kildare Street, Dublin.

BROOKHIRST SWITCHGEAR, LTD., announces that it is transferring, at the end of the present month, its Birmingham office from Corporation Street to Essex House, Temple Street. Here, a fully-equipped showroom will be opened for the purpose of demonstrating the latest developments in its electrical control gear. The company already has showrooms in London and Glasgow. A showroom in Manchester will be opened shortly, and others are in preparation in Leeds, Bristol, &c.

ELECTRO-MECHANICAL SUPPLIES, LTD., Midland agents for the London Electric Wire Co. & Smiths, Ltd., have moved to larger premises at 44, Bayley Lane, Coventry.

THE BRITISH THOMSON-HOUSTON CO., LTD., has acquired new premises at 10 and 11, Snow Hill, Birmingham, to which the Birmingham branch will be transferred on March 22nd. A showroom is being arranged for the display of lighting fittings, radio apparatus, and domestic appliances. The telephone number is "Central 8301" and the telegraphic address "Asteroidal, Birmingham."

MESSRS. FREDK. THOMAS & Co. announce that the Castle Engineering Co., Ltd., is not now acting as their agent for Lancashire. The territory has been taken over by Messrs. P. Adair, Ltd., St. John Street Chambers, Deansgate, Manchester, who are carrying stocks of electric light fittings and alabaster bowls.

CAPT. I. MACKINTOSH, for the past six years technical assistant to Mr. G. Stephen Corlett, consulting engineer, has decided to commence practising on his own account. He is opening an office at Midland Bank Chambers, Wigan, and will be pleased to receive catalogues from manufacturers.

PHILIPS LAMPS, LTD., has opened a branch office at 16, Clarence Street, Belfast, to serve Northern Ireland.

TWISS ELECTRIC TRANSMISSION, LTD., has transferred its registered offices to Culford Works, Kingsbury Road, Dalston, N.1, thus consolidating the whole of the business in the premises acquired last November.

Catalogues and Lists.—MESSRS. L. G. HAWKINS & Co., LTD., 30-35, Drury Lane, W.C.2.—An illustrated folder describing the new "Universal" portable oven cooker.

MESSRS. PETTERS, LTD., Westland Works, Yeovil.—A well-illustrated catalogue of the company's 1926 models of oil engines, including generating sets.

THE HENDON ELECTRIC LAMP CO., LTD., 104, Southampton Road, W.C.1.—Two illustrated and priced leaflets dealing with an electric iron, and voltmeters and ammeters respectively.

MESSRS. GENT & Co., LTD., Faraday Works, Leicester.—Leaflet 85B, illustrating and describing the "Tangent" visible and audible staff locater.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—A pamphlet advertising "Duff" governor-controlled self-lowering jacks.

METRO-VICK SUPPLIES, LTD., Trafford Park, Manchester.—Five priced and illustrated booklets dealing respectively with the "Cosmos" home iron; electric lighting fittings; shop-window reflectors; "Cosmos" fires; and automobile and battery lamps.

MESSRS. W. CHRISTIE & GREY, LTD., 4, Lloyd's Avenue, E.C.3.—A pamphlet dealing with the prevention of the transmission of noise and vibration.

THE PERRY PREHEATER CO., Imperial Buildings, 56, Kingsway, W.C.2.—A pamphlet containing full details of the "Perry" system of preheating air by the use of waste gases.

THE ROYAL INSURANCE CO., LTD., 1, North John Street, Liverpool, has issued a 1926 edition of its illustrated motor insurance pamphlet: "Road Risks Illustrated."

THE WEINBAU INCANDESCENT & ELECTRICAL CO., 327-335, Commercial Road, E.1.—A net trade price list of electrical supplies.

MR. J. H. HEATHMAN, Parson's Green, Fulham, S.W.6.—Illustrated leaflets advertising ladders, trucks, fire-fighting accessories, &c.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A folder advertising the company's "easy-to-read" dial thermometers.

FOSTER INSTRUMENT CO., Letchworth, Herts.—Catalogue No. 42, a brochure dealing with pyrometers of various types, including methods of using them. Fully illustrated.

MOULDENSITE, LTD., Darly Dale, Derbyshire.—A catalogue of plastic moulding preparations, impregnating varnishes and enamels, lacquers, cements, &c.

THE KARTRET SWITCHGEAR CO., LTD., 7, Carteret Street, Broadway, S.W.1.—A well-illustrated catalogue containing particulars and prices of the company's switch- and fuse-gear.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—March stock list of motors and dynamos.

MESSRS. J. J. EASTICK & SONS, 118, Bunhill Row, E.C.1.—An illustrated pamphlet describing "Eelex" standardised plugs and sockets for radio connections, terminals of various kinds, coil holders, h.p. batteries, frame aerials, &c. Priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue of electric lighting accessories and pamphlets dealing with a hole cutter and switch- and fuse-gear. Illustrated and priced.

Deeds of Assignment.—R. E. LOWES, electrical and radio engineer, Victoria Chambers, Laura Street, Sunderland.—Particulars of claims to the Trustee, Mr. A. J. Gray, 3, Manor Place, Sunderland.

A. G. SMITH, electrician, 122, Titchfield Street, Kilmarnock.—Particulars of claims to the trustee, Mr. J. A. Carson, 8, Duke Street, Kilmarnock, by March 27th.

Bankruptcy Proceedings.—C. G. HOFMAN (trading as W. J. Chambers & Company), radio component manufacturer and electrical engineer, Cowthorpe Street, Wandsworth.—An application for an order of discharge was made on March 5th, to Mr. Registrar Francke, at the London Bankruptcy Court, on behalf of this bankrupt, who failed last July, with ranking liabilities of £3,497 and assets of £192. The failure was attributed to ill-health and consequent falling away of business and to lack of capital. The discharge was granted subject to a suspension of two years.

J. F. CARR, 89, Aston Avenue, Fallowfield, Manchester, electrical goods agent.—The public examination of this debtor was held on March 12th at the Court House, Manchester. The statement of affairs showed ranking liabilities of £1,995, while the assets, amounting to £32, were insufficient to cover the balance due to secured creditors. The examination was closed.

W. N. SMART, electrician, late of 17, 19 and 19a, Cross Street, Oldham.—Receiving order made March 5th, on debtor's own petition.

YOULL, FRASER & Co., LTD., electric lamp factors, Bertram Chambers, 6, Hunter Street, Liverpool.—Receiving order made March 4th, on creditor's petition.

H. TIDSWELL (H. Tidswell & Co.), electrical engineer, 11, Bazaar Street, Pendleton.—Receiving order made March 6th, on debtor's own petition.

H. R. ALTHORP, electrical engineer and contractor, 13, Wellington Crescent, Shipley, Yorks.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released February 25th.

H. A. BIRLESON (Birleson & Co.), electrical engineer, Clarence Buildings, Fazackerley Street, Chorley, Lancs.—Trustee, Mr. H. Parker, 11, Winckley Square, Preston, released February 26th.

S. J. WATSON, lately carrying on business with H. Rothwell and F. C. Jinks, as The Vulco Magneto Co., 11, Long Acre, W.C.—Last day for proofs for dividend, March 27th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

J. HUMPHREYS, plumber and electrical engineer, the Yard, behind the Plough Inn, Oldham Road, Rochdale.—Last day for proofs for dividend, March 24th. Trustee, Mr. J. G. Grant, Official Receiver, Byrom Street, Manchester.

J. A. A. BARDSLEY, electrical contractor, 91, Old Hall Lane, Withington, Manchester.—Receiving order made March 8th on debtor's own petition.

A. RICHARDSON, electrical engineer, 36, School Road, Sale, Chester.—Receiving order made March 8th, on debtor's own petition.

G. R. SPARROW, electrical engineer, late of 6, Trelawn Road, Brixton, S.W.—Receiving order made March 8th, on debtor's own petition

W. M. HORSFALL, electrical engineer, 7, Redcross Street, Liverpool.—Second dividend of 5½d. in the £, payable March 19th, at the offices of the Official Receiver, 11, Dale Street, Liverpool.

S. A. WARDELL, electrical contractor, 83, Raleigh Road, Richmond, Surrey.—First and final dividend of 3½d. in the £, payable March 29th, at the office of the Official Receiver, 29, Russell Square, W.C.1.

S. H. BARDWELL (Bennett, Bardwell & Co.), electrical engineer, 22, Church Street, Basingstoke.—First and final dividend of 5s. 11½d. in the £, payable March 24th, at the Official Receiver's Office, Midland Bank Chambers, High Street, Southampton.

Company Liquidations.—GAS AND ELECTRIC SECURITIES, LTD., 14 and 16, Cockspur Street, S.W.—Under the compulsory liquidation of this company, accounts have been lodged showing total liabilities of £19,512 (unsecured £18,293), assets valued at £2,521, and a deficiency of £15,824, with regard to contributories, the issued capital being only three ordinary shares of £1 each. Mr. E. T. A. Phillips, Official Receiver and Liquidator, reports that the company, which was promoted by Mr. F. W. Salisbury-Jones, was registered as a private company

on February 2nd, 1923, with a nominal capital of £1,000, and was formed to deal generally in securities and investments of every kind. No business was done until August, 1923. The failure of the company is, in the opinion of the Official Receiver, due, generally, to the fact that it had not in reality any independent existence and particularly to its assumption of liability in connection with another company.

Charles Bell, Ltd., electrical and mechanical engineers, Bradford.—A meeting of creditors was held recently, at the offices of Mr J. Lund, Darley Street, Bradford, the liquidator appointed in the voluntary liquidation of the company. A statement of affairs was submitted which disclosed liabilities of £6,733, all due to unsecured creditors. The net assets amounted to £3,135, leaving a deficiency as regarded the creditors of £3,598. The issued capital amounted to £12,003, so that there was a total deficiency of £15,601. A deficiency account was submitted which showed that there had been a loss of £9,011 on the trading from January 1st, 1922, to February 13th last. The liquidator reported that the business was commenced in 1874 by Mr. Charles Bell. He died in 1890, and his two sons, Lazarus Bell and T. Bell, continued. The latter died in 1916 and the business was then continued until 1921, when the company was formed The trading had resulted as follows: 1917, profit of £3,466; 1918, profit of £1,164; 1919, loss of £776; 1920, profit of £2,594; and 1921, profit of £1,277. The company took over the business in December, 1921, and at that time the business had a capital of £12,000, after taking into consideration £4,000 in respect of goodwill. The account for 1922 disclosed a turnover of £25,000 and a loss of £1,888. For the following year the turnover was £16,467, and there was a loss of £1,119. In 1924 the turnover was £17,471, and the loss £1,718, and for 1925 there was a further loss of £3,526, on a turnover of £17,592. The accounts to February 13th last showed a further loss of £758. It was decided that application should be made to the Court for the appointment of Mr. S. S. Tadman as joint liquidator with Mr. Lund, and a committee of inspection was also nominated. The following are creditors:—

	£		£
Bradford Corporation	116	Dawson, F.	159
Brocklehurst, W. H.	150	Taylor & Son, J.	208
British Thomson-Houston Co., Ltd.	141	Dyson, J.	412
British Insulated Cables, Ltd. ...	104	Scattergood & Johnson	511
Liverpool Electric Cable Co., Ltd.	132	Douthwaite, L. W.	577
Baxendale & Co., Ltd.	373	Dixon, Powner & Co.	72
Bottomley, T. A.	78	Electromotors, Ltd.	66
Bell, Lazarus	580	Philips Lamp Co., Ltd.	135
Bell, Leonard	125	Falk, Stadelmann & Co., Ltd....	60
Casperson, G.	61	General Electric Co., Ltd. ...	74
Cryselco, Ltd.	95	Laidlaw & Robson	67
Inland Revenue	721	Greatorex, Saml., & Co.	74
Watford Lamp Co.	118	W. T. Henley's Telegraph Works Co., Ltd.	390
		Igranic Electric Co., Ltd. ...	87

Oco Electrical Appliances, Ltd.—Winding up voluntarily. Liquidator, Mr. C. D. Britten, Prince's Chambers, 16, John Dalton Street, Manchester. A meeting of creditors was called for March 15th; particulars of claims to the Liquidator by April 20th.

"Radioelectric," Ltd.—A meeting of members is called for April 12th, at the offices of Messrs. Reeve, Parker & Co., 2, Coleman Street, E.C., to hear an account of the winding up from the Liquidator, Mr. A. G. Parker.

Pressland Electric Supplies, Ltd.—A petition for the winding up of this company has been presented to the County Court of Surrey by Burndept Wireless, Ltd., of Aldene House, Bedford Street, Strand, W.C., creditors, and will be heard at Kingston-on-Thames on April 30th.

Lyme Regis Electric Light & Power Co., Ltd.—A meeting of members is called for April 13th at Basildon House, Moorgate, E.C.2, to hear an account of the winding up from the Liquidator, Mr. L. W. Hawkins.

Ingleby & Co., Ltd., Leeds.—First and final dividend of 6⅝d. in the £.

County of Dorset Electric Supply Co., Ltd.—A meeting of members is called for April 13th, at Basildon House, Moorgate, E.C.2, to hear an account of the winding up from the Liquidator, Mr. L. W. Hawkins.

Electrolite, Ltd.—Mr. T. Gourlay, Official Receiver and Liquidator, 29, Russell Square, W.C., released March 9th.

Northumberland & Durham Radio Engineering Co., Ltd.—A meeting of members is called for April 9th, at Bank Chambers, 24, Grainger Street West, Newcastle-on-Tyne, to hear an account of the winding up from the Liquidator, Mr. J. Mitchell.

Private Arrangements.—J. E. Kimber and J. Kimber, lately trading as S. Kimber & Sons and The Croydon Electric Co., late of 81 and 81a, Whitehorse Road, Croydon, electrical engineers and jobbing builders.—A meeting of the creditors of the above was held recently at the offices of Messrs. Brown, Peet and Tilley, C.A., Mark Lane, E.C., when the chair was occupied by the representative of the Credenda Conduits Co., Ltd., the largest trade creditors. A statement of affairs was presented as at January 31st, which showed liabilities of £2,155, all due to unsecured creditors. There was a fully secured creditor for £650, and the security held totalled £1,000. The net assets were £1,078, leaving a deficiency of £1,077. Mr. Peet said that the debtors carried on two businesses, one an electrical business and the other that of jobbing builders. The electrical business was commenced about 2½ years ago. According to a profit and loss account, for the year ended December, 1924, there was a net profit on the electrical side of £209 and a loss of £31 in connection with the building business. Mr. Peet said that there were no accounts for 1925, but according to information received the sales for the electrical business only were £4,200 and the gross profit was £819. The net profit, if any, could not be ascertained. Continuing, Mr. Peet said that the debtors disposed of the business at the beginning of the year for £300, being heavily pressed by creditors. During the month of February the business had been carried on by the new owner, but Mr. James Kimber had signed orders for goods and some of the creditors present did not know that the business had been disposed of at the time the orders were given. Mr. Peet had been approached by a gentleman who was prepared to assist the debtors by making an offer of 5s. in the £. After some discussion Mr. C. Latham proposed that an offer of not less than 10s. in the £ should be paid within fourteen days, or that the purchaser should surrender the assets on equitable terms, failing which the estate should be dealt with in bankruptcy. The resolution was carried. It was also resolved that a committee should be appointed, consisting of three of the creditors, with power to recommend the acceptance of any proposals in the foregoing resolution, or any modification thereof. The committee consisted of the representative of Credenda Conduits Co., Ltd., Mr. King, and Mr. C. Latham. The following are creditors:—

	£		£
Eaton & Sons	43	Wardle Engineering Co.	30
Credenda Conduits Co., Ltd. ...	253	Wenham Lighting Co.	32
Seraphan & Wood	53	Lighting, Heating and Glass ...	50
William King	176	Edison Swan Electric Co., Ltd....	40
Vulcan Electric Co.	59	Sanders & Co.	97
Metallic Flexible Tubing Co. ...	103	Harris & Bailey	48
Cable Accessories Co., Ltd. ...	131	Stantons, Ltd.	23

Domestic & General Electrical Co., Ltd., Hampden House, Kingsway, W.C.2., electrical engineers.—A meeting of the creditors was held on March 10th. No statement of affairs was presented, but the secretary of the company said that the liabilities amounted to approximately £458 and the assets totalled £251. The company was incorporated in December, 1924, with a nominal capital of £1,000, of which £150 was put up in cash. The company took over the business from a Mr. Purdie, and paid as consideration £500, for which shares were taken. The creditors passed a resolution requesting the shareholders to meet at the earliest opportunity and pass the necessary resolution for voluntary liquidation and they recommended that Mr. W. Osborne, of Messrs. Corfield and Cripwell, Balfour House, E.C., should be appointed liquidator in the voluntary liquidation of the company. The following are creditors:—

	£		£
General Electric Co., Ltd. ...	92	Robert Hornby, Ltd.	53
St. Helens Cable Co., Ltd. ...	66	"The Power Laundry"	47
Macintosh Cable Co., Ltd. ...	26	Capel & Co., Ltd.	52
Sun Electrical Co., Ltd. ...	29	Purdie, H. A.	26

F. R. Hodges and S. V. Styles, trading as The Yorkshire Electric Supplies Co., Canning Street, Hull.—A meeting of creditors was held recently at Hull, when a statement of affairs was presented, which showed liabilities of £672, all due to unsecured creditors. The assets were estimated to produce £534, leaving an estimated deficiency of £138. It was resolved that the estate should be dealt with under a deed of assignment in favour of Mr. H. E. Pettingell, accountant, Hull, and Mr. P. Hodgkinson, accountant, Bradford, as joint trustees. The following are creditors:—

	£		£
Ace Battery Co.	25	Edison Swan Electric Co., Ltd.	66
General Cable Manufacturing Co., Ltd.	251	J. Dyson	70
J. H. Stewart & Co., Ltd. ...	50	Chloride Electrical Storage Co., Ltd.	37

Dissolution of Partnership.—Crockatt & Co., electrical engineers, 182, West George Street, Glasgow.—Mr. H. A. McQueen and Mr. G. B. Crockatt have dissolved partnership. Mr. McQueen will attend to debts and carry on business on his own account as H. A. McQueen & Co. at 182, West George Street. Mr. Crockatt will shortly commence business as Crockatt & Co. at an address to be intimated.

Our Foreign Trade.—February Figures.—The following were the values of imports and exports of electrical goods and machinery during February, 1926:—

	Feb., 1926.	Inc. or dec.	2 months, 1926.
Imports.	£	£	£
Electrical goods and apparatus	252,042	− 91,586	−172,534
Machinery	945,542	+ 10,750	+ 62,742
(Electrical machinery) ...	52,034	− 19,749	+ 476
Exports.			
Electrical goods and apparatus	987,494	+ 24,409	−242,098
Machinery	4,207,786	+319,159	− 54,364
(Electrical machinery) ...	591,048	+106,520	+ 8,815
Re-exports.			
Electrical goods and apparatus	15,218	− 11,856	− 21,765
Machinery	96,334	− 23,683	+ 2,963
(Electrical machinery) ...	4,719	+ 1,160	+ 41

New French Company.—A new company has recently been formed in Paris (13, Rue de Quatre Septembre) with a capital of 500,000 fr. and the title La Société Electro-Chimique "Phoebus," to manufacture dry batteries and electro-chemical apparatus.

Local Exhibitions.—BRIDLINGTON.—An electrical exhibition was opened by the Mayor on behalf of the Corporation at the Victoria Rooms, Bridlington, on March 8th.

EVESHAM.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. is holding a demonstration of electric service for the home and business, at the Public Hall, Evesham, from March 22nd to 27th inclusive.

KEIGHLEY.—The Corporation Electricity Department is to hold a public exhibition of electrical appliances at the Municipal Hall, from April 12th. Leading British electrical firms and some American producers will be among the exhibitors.

Book Notices.—"Sell's Directory of Registered Telegraphic Addresses." Pp. 2,944. London: Business Dictionaries, Ltd. Price 45s.—This is the forty-first edition of this very useful guide, which is compiled from information received by the General Post Office. The original edition contained about 40,000 names; there are now 100,000, and the classified trades section has expanded correspondingly. In addition to the main object of the publication, a great amount of other useful commercial information is included.

"*The Engineer* Directory and Buyers' Guide, 1926." London: The Engineer, Ltd.

"Military Engineering" (Technical Training). Vol. II: Electrical Engineering.—A set of some 70 amendments to this volume has been issued by the War Office, and can be obtained from H M. Stationery Office, price 2d. net.

"*The Transactions* of the South African Institute of Electrical Engineers." Vol. XVI, Part 12. January, 1926. Price 2s.

For Sale.—Bexhill Corporation Electricity Department has for disposal four Babcock & Wilcox boilers, two condensers, two Weir pumps, induced draught plant, &c. Messrs. Allan Arthur & Ure invite offers for a duplicate electric lighting and power generating plant now in use in Ireland. Manchester Corporation Electricity Department has for disposal six induction motor-generating sets. Aberdeen Corporation Electricity Department invites offers for two 250-kW and one 100-kW Peebles-La Cour motor converters, one 30-kW Westinghouse motor-generator, six 220-V d.c. motors, &c. (See our advertisement pages to-day.)

Radio Development in Ecuador.—*Commerce Reports* quotes an "unofficial" statement to the effect that the Government has approved the proposal of a Guayaquil firm granting it the exclusive right to import radio-telephone apparatus for a period of five years, and to erect broadcasting stations at Quito and Guayaquil. The net profits accruing are to be divided equally between the concessionaires and the Government.

The A.E.G. Report.—Supplementing the information given in our issue of February 19th concerning the activity of the Allgemeine Elektricitäts Gesellschaft during the year ended September 30th, 1925, we find from a copy of the report which is now available that the directors state that the conditions of the times are difficult and the future cannot be foreseen. Although the necessity for electrification throughout the world is no longer in doubt and the electrical industry is therefore in a better position than many other industries, it is naturally dependent upon the general economic situation both in Germany and abroad. Exportation is difficult and rendered unprofitable by the protection policies of over-industrialised countries. In oversea countries the competition of all other countries is being experienced. On the other hand, Russia is a promising market, but the business can only be extended gradually and in accordance with the availability of funds in that country. Dealing with the company's activities, the report states that among the orders executed by the large machine works was one for four 29,000-kVA, 12,000-V generators for Norway, which were the largest machines hitherto produced. In the Oberspree cable works extensions of the plant were made for the manufacture of telephone and telegraph cables, although a good demand also prevailed for light and power cables. The manufacture of 60,000-V cables according to the principle of "metallised cores" was taken up and the production of larger cable lengths undertaken. The development of long-distance cables made notable progress in both the technical and economical respects. Concerning the turbine department the report states that it was possible to increase the size of turbo-generators running at 3,000 r.p.m. to 30,000 kVA. In central station work the most important order was one from the Berlin municipal electricity supply works for the establishment of a complete power station at Rummelsburg of an initial capacity of 240,000 kW. In this station there will be installed three generating sets. Steam will be supplied by 16 boilers fired with pulverised coal. Transformers will be installed to step up the pressure from 6,000 V to 30,000 V. After referring to other turbo-dynamo equipment in hand the report mentions that orders have been received for h.p. transformers up to an individual capacity of 44,000 kVA, while the total capacity of the transformers ordered in 1924-25 exceeded 1,000,000 kVA, and contracts were also booked for extensive switching installations for power and converter stations for pressures up to 100,000 V. In the electrical distribution branch the company carried out for various undertakings the construction of h.p. long-distance lines and the selective protection afforded by the Biermann distance relay was put into service in numerous cable and overhead line networks and had fulfilled expectations. The report also refers to orders on hand for ships' plant of a total of 50,000 h.p.; the construction for the Phœnix Steel Works of a reversing train drive of a capacity of 25,000 h.p. for the ingot mill at Ruhrort, which is more powerful than any hitherto carried out; and orders for electric steel furnaces on the Fiat system representing a total of 64,000 kVA.

The Value of Trade Fairs.—Modern fairs and exhibitions differ widely in outward appearance from those of the Middle Ages, but the fundamental aims and methods of their conduct remain much the same. Although the development of transportation and other means of communication has tended to limit somewhat the importance of fairs as media for the distribution and sale of certain commodities, such as raw materials, they continue to be important in the distribution of manufactured articles and in the dissemination of advertising propaganda. New lines are quickly introduced at fairs and exhibitions, and the manufacturer is enabled to determine the market possibilities of his product at a minimum cost and with the least possible delay.—*Commerce Reports.*

The Newcastle Lighting Service Bureau.—The North-East Coast Lighting Service Bureau is doing very satisfactory work at Newcastle. Considerable interest has been aroused in the district and lectures are being attended by institutions and associations of various kinds, chambers of trade, shop-



Lecture Room at the Newcastle Lighting Service Bureau.

keepers, domestic science students, &c. During last week an exhibit was made at an electrical exhibition at Thirsk. We reproduce herewith a photograph of the lecture room at the Bureau.

Jugo-Slavian Electrical Imports.—The total importation of electrical machinery into Jugo-Slavia during 1924 was valued at approximately £267,000.

The Italian Electrical Market.—The French Commercial Attaché in Italy has been investigating the prospects for the sale of electrical machinery and apparatus in that country, and the results of his inquiries were the subject of a recent article in the *Moniteur Officiel du Commerce et de l'Industrie*. The following is a summary of some of the chief points of the report:—

The Italian electrical manufacturing industry, although it has improved its position during the past few years, is not very prosperous. It uses a large quantity of sheet iron, steel, and special castings, on which, in many instances, import duties are levied. As a result, the industry pays dearly for much of its raw material. The comparatively strong position of the wire and cable makers who employ little iron or steel is quoted as evidence of the burden which the heavy electrical industry has to bear owing to the import tariff. Consequently the Italian builders of large generators and motors do not find it easy to quote competitive prices, and Germany has been rapidly regaining her position in the Italian market, which was temporarily held by Great Britain and the United States.

Two German electrical manufacturing firms have reopened branches which were closed during the war, and are now able to give quick deliveries. There is a good sale for motors suitable for textile mills. At the same time, the exports of generators and motors have been increasing.

Italy's imports of transformers are considerably in excess of her exports. In 1925 (seven months) 783 tons came in from abroad, compared with 666 tons in the previous twelve months, whilst exports totalled only 99 tons during the seven months, as against 177 tons in the year 1924 and 359 tons in 1923. Prior to 1920 no exports were recorded. There is a growing importation of accumulators, but a decreasing exportation. Numbers of Italian makers have specialised in the production of accessories, such as switches, valves, and regulators. Imports of measuring instruments are, however, large. Italy is a large producer of copper conductors, plates, and bars for electrical purposes, imports being to a large extent restricted to material supplied to concerns in Italy under the control of foreign capital. Nickel-chrome wires and plates

are supplied by Great Britain and the United States, with a good deal of competition from Germany. France also has hopes of capturing some of this trade. In insulated wires, importation is difficult in the face of the home production. About 1,500 tons of porcelain insulators were imported last year, against 2,290 tons in 1924, Germany being the chief supplier.

The Leipzig and Cologne Fairs.—*Reuter* reports that the number of visitors to the Leipzig Fair considerably exceeded expectations, being estimated roughly at 140,000, including 20,000 foreigners. The number of exhibitors amounted to 10,300. The business done turned out in many branches substantially better than had been hoped in view of the economic situation. In particular, the export business in the technical section and in china, glass, stone and wooden goods was in some cases fairly good. Home trade, at any rate so far as the main articles of consumption were concerned, still showed a quiet appearance, which was attributed to unemployment and the country's poor purchasing power. On the other hand, a later report states that an official notice issued by the management of the Cologne Fair says:—"As the Leipzig Fair has served only to confirm the prevailing export crisis in German industries, the Spring Fair in Cologne will be cancelled. Only one fair will be held in 1926, the Autumn Exhibition, opening on September 12th and continuing till September 19th."

Chinese Notes.—The Foochow Electric Co. is installing a suburban lighting system extending from the company's station to Tamensiang, Siaomensiang, Howyusiang, Kushan, and Kweikisiang. The last place is 20 li (about 7 miles) from Foochow.

Work has been commenced upon a telephone service between Shanghai and Sungkiang, a distance of 21½ miles, and is expected to be completed during April or May.

Twelve Years at the Equator.—The Sultan of Zanzibar has had a Hart electric lighting battery in use at the Royal Palace for the past twelve years. It is noteworthy that a battery should continue to give satisfactory service after a long period so near to the Equator.

Lighting and Power Notes.

Amble.—Electricity Charges.—The Urban District Council is to introduce the following new tariff for heating and cooking:—A fixed charge of 20s. for each winter quarter and 10s. for each summer quarter, plus 1d. per kWh for all electricity consumed. The charge for lighting is to be reduced by 1d. per kWh as from April 1st next.

Australia.—Corowa (N.S.W.).—The electricity supply for the district was formally inaugurated by Sir J. Monash, chairman of the Victorian Electricity Commission, on February 1st. This marks an important stage in the development of the Yallourn scheme, the distance from the point of generation at Yallourn to the distributing area in New South Wales being 277 miles. The transmission line to Albury is nearing completion. The length of the line will be 290 miles.

Bacup (Lancs.).—Electricity Extensions.—The Town Council proposes to borrow £13,000 for mains and services.

Barnes.—Electricity Extensions.—The electrical engineer has submitted to the Urban District Council a programme of e.h.p. and l.p. feeder and distribution main extensions to be carried out during the forthcoming summer, involving an expenditure of £11,126.

Beckenham.—Electricity Supply.—At a recent meeting of the Electricity Committee the electrical engineer reported that within the next year it would be necessary to install additional turbine plant, but before the necessary sanction was obtained it was incumbent upon the Council to inquire of the Joint Electricity Authority whether it was in a position to afford a partial or bulk supply on more advantageous terms. The Committee has authorised its officials to make the necessary inquiry.

Electricity Charges.—The Committee has agreed that power consumers shall be allowed to consume an equivalent of 10 per cent. of their quarterly power consumption for lighting at power rates, provided that the power consumption during the quarter is not less than 2,000 kWh.

Bristol.—Electricity Extensions.—In consequence of the increasing demand for electricity at Avonmouth, the Corporation Electricity Committee states that it is necessary to lay additional mains or to raise the pressure of the existing ones, and has recommended that the pressure from Feeder Road be raised to 11,000 V. The cost of transformers, switchgear, and equipment necessary amounts to £24,300, to which must be added the sum of £17,687 for connecting up the existing distributing centres in accordance with the model scheme, making a total of £41,987. The Committee also reports that it is necessary to increase the pressure of certain feeders between Feeder Road and the Ashton district from 6,000 V to 11,000 V. The estimated cost of the work is £2,941. The Committee has recommended that the works be carried out and that it be authorised to apply for sanction to the borrowing of £41,987 and £2,941 respectively.

Continental.—Denmark.—*Commerce Reports* states that there were 479 power stations operating in Denmark during the fiscal year 1923-24, according to a recent survey prepared by the Danish Statistical Department. Of these 121 were city plants and 358 were situated in rural areas. Although practically all of the city plants were constructed prior to the war, nearly one-third of the rural plants were erected during or since the war. The capacity of the plant installed increased from 190,000 to 228,000 h.p. during 1923-24. Of this increase steam installations accounted for 26,000 h.p. and Diesel plant for 12,000 h.p. During the year under review the output amounted to 231,000,000 kWh.

Spain.—The Barcelona correspondent of the *Daily Mail* reports that the Minister of Public Works states that 14,000,000 h.p. is available in the River Ebro basin and the State will undertake works which will make the river navigable, harness the water, and irrigate lands. The Government will spend 300 millions spread over ten years, with the object of obtaining more than 1,000,000 h.p. and enabling 2,000,000 acres to be irrigated. The electrical energy will be used for railway electrification.

Czecho-Slovakia.—According to *Commerce Reports* there was increased activity on the part of the Government and the municipalities of Czecho-Slovakia in the development of the water-power resources of the country during the past year. The 1926 programme of the Ministry of Public Works includes the completion of the hydro-electric stations in Nymburk, Kolin, Prelouc, and Mirejovice, as well as the construction of a reservoir on the Elbe near Verde, and the building of a dam and a hydro-electric station in Uzhorod. Other work will also be undertaken in various sections of the Republic. An appropriation of 25,000,000 crowns has been set aside for this work.

France.—A concession has recently been granted for the establishment of a hydro-electric station at La Llau in the Eastern Pyrennees to utilise the water power of the River Coumelade.

Italy.—Concessions in respect of new hydro-electric stations have recently been granted to a syndicate at Civetella Roveto (province of Aguila) to utilise the water power of the River Fucino to the extent of 10,250 h.p. and to the Società Idroelettrica Cisalpina to utilise the River Mara to the extent of 29,960 h.p. at Villa di Chiavenna (Sondrio province).

It is reported from Rome that in order to encourage the more rapid development of the hydro-electric resources of Southern Italy, Sicily and Sardinia, the Italian Government proposes to grant a subsidy of 60 lire per nominal h.p. in respect of any new power stations put in hand before the end of 1928. A subsidy of 40 lire per h.p. is also to be offered in respect of new hydro-electric plants in other parts of the country.

Dewsbury.—Electricity in Bulk.—The Town Council has decided to take a bulk supply of electricity from the Yorkshire Electric Power Co. for the Ravens Lodge housing site.

Doncaster.—New Plant.—The Town Council has approved a scheme submitted by the Electricity Committee for extensions to the generating station, including the provision of a 6,000-kW turbo-generator with condensing plant, &c., boiler house extensions, water tube boilers and high-pressure switchgear and cables, at an estimated cost of £57,135; and a 1,000-kW converter with h.p. and l.p. switchgear and cables (£5,915). Application is to be made for sanction to the borrowing of these sums for the purposes mentioned.

East Ham.—Electricity Extensions.—The Electricity Committee is to lay two feeder cables to Manor Park at an estimated cost of £14,500.

Gravesend.—New Electricity Charge.—The Corporation has approved a recommendation of the Electricity Committee that from January 1st, 1926, the following new tariff shall be introduced:—A fixed quarterly charge of 1/40th of the annual rateable value of a house, plus ¾d. per kWh for all electricity consumed.

Loan Sanctioned.—The Corporation has received sanction to a loan of £40,000 for plant extensions at the electricity works.

Holbeach (Lincs.).—Electricity Scheme.—The Urban District Council has approved a draft agreement with the Boston and District Electric Supply Co., Ltd., for a supply of electricity to the town. The Council has an option to purchase the undertaking at the end of 21 years.

Irish Free State.—Castlerea (Co. Roscommon).—The town is without street lighting as the Castlerea Lighting & Milling Co. has declined to light the street lamps any longer at a loss. The ratepayers paid 6d. in the £ to defray the cost of the public lighting, while the sum of £60 was contributed for the purpose by the Castlerea Power Trustees annually. The contract with the company for the lighting of the street lamps was £130 a year. The trustees are not now in a position to contribute more than £20 a year, and the ratepayers decline to pay more than 6d. in the £. The company states that it was carrying out the lighting of the streets at the minimum figure, and could not now do so at a loss of £40 a year.

Leeds.—Loans.—The Corporation Finance and Parliamentary Committee has under consideration a recommendation of the Electricity Committee that sanction be sought to borrow £50,000 for sub-station equipment and £10,000 for the erection of a new sub-station.

Lincoln.—Loan.—The Town Council has applied for sanction to a loan of £17,400 for electricity purposes.

Liverpool.—Electricity Supply Progress.—Members of the Electric Power and Lighting Committee recently inspected the Lister Drive power station and saw the buildings being prepared for the reception of five new turbo-alternators, one of which, rated at 25,000 kW, is now in service. The cost of the work, when completed, apart from the machinery, will be

£500,000. The chairman of the Committee stated that additional demands received during the past month for electricity for lighting, heating, cooking, &c., had averaged 1,000 kW per fortnight. There were now 1,344 cookers in operation. During the past six months 550 extensions of mains had been approved at an estimated expenditure of £140,000, while £30,000 had been approved for h.p. mains and £75,000 for mains on housing estates. The number of consumers connected was 41,160, and total connections, excluding tramways, were equivalent to 110,195 kW.

London.—Hammersmith.—The Electricity Committee has recommended to the Borough Council that the following two alternative schemes for the wiring of premises be adopted:—(*a*) Hire scheme: A fixed quarterly charge varying from 3s. 6d. for 4 points to 9s. for 16 points for lighting supply, and from 2s. 6d. for 1 point to 7s. for 5 points for power supply. (*b*) Hire purchase scheme: A fixed quarterly charge based on actual cost of installation, plus 10 per cent., together with interest at 5 per cent., per annum, on balance outstanding. The standard rates for electricity consumed will be charged in addition to the fixed quarterly charges. The Committee has also recommended that a sum of £1,000 be set aside out of the accumulated profits of the undertaking for financing the scheme.

St. Pancras.—The Electricity and Public Lighting Committee has considered a report from the borough electrical engineer on proposed additional plant to meet the increased demand for electricity, and has recommended to the Borough Council that the consent of the Electricity Commissioners be obtained to the installation of three 2,500-kW motor converters and one 10,000-kW generating set, with accessories, at a total estimated cost of £72,500; the provision of an additional sub-station at an estimated cost of £25,000; and that £2,500 be provided for contingencies in connection with the sub-station. The Committee has also recommended that the Crown Estate Paving Commissioners and H.M. Office of Works be informed that the Council is prepared to provide, maintain, and light 176 street lamps in the neighbourhood of Regent's Park and Primrose Hill, at an annual charge of £4 7s. 6d. per lamp, subject to an agreement being entered into covering a period of 10 years. The estimated capital cost of the scheme is £3,135.

Newport (Mon.).—Wiring of Small Houses.—The Electricity Committee has adopted a scheme of assisted wiring for small houses submitted by the electrical engineer.

Meter Rental Charges.—The Committee has also approved a recommendation that the meter rental charges for lighting be reduced to pre-war basis, and that the meter rental charges for heating and cooking purposes be discontinued.

Normanton.—Loan.—The Urban District Council is applying for sanction to a loan of £15,600 for sub-station plant, mains, services, and meters.

Northern Ireland.—Coleraine (Co. Londonderry).—The Urban District Council has decided to apply for sanction to a loan for £22,000 for an electricity scheme for the town, and an agreement is to be drawn up with Mr. A. Leigh, consulting engineer.

Padiham.—Electricity in Bulk.—The Town Council met recently to decide upon the operation of the Electricity Order. Mr. Wood, electrical engineer, of Bolton, attended, and he advised on three alternative schemes. The Council decided to take a supply in bulk, and to carry out the distribution of electricity itself.

Preston.—Electricity Supply.—At a meeting of the Town Council on March 11th, consideration was given to the question of a transmission line between Preston and Blackpool and the Council confirmed a resolution that the cost of this line should be increased from £66,000 to £87,500. The Chairman of the Electricity Committee said the first scheme was to give effect to a load of 10,000 kW. At that time the Blackpool station was becoming loaded up and the demand for electricity on the coast was increasing. Difficulties had been overcome and an agreement had been arranged with Blackpool for the next 20 years which provided that the seaside town should take at least 5,000 kW. With a possibility of growth, Preston was faced with the alternative of having to duplicate its line within a few years, and so it had decided to make better provision at the present time. The ultimate total cost would reach £125,000 but this would be the only expenditure required for some years, and Blackpool was willing to pay half the extra cost.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Monaghan.—Lighting: From 1s. 2d. to 1s. per kWh.

East Ham.—Private lighting: From 6½d. to 6d. per kWh.

Salford.—Power: A reduction of approximately 8 per cent.

Dover.—Lighting: From 8½d. to 7½d. per kWh.

Sandwich.—Electricity Supply.—The Town Council is to approach Messrs. Pearson & Dorman Long, Ltd., with regard to a supply of electricity for the town from the power station at Stonar.

Scarborough.—Electricity Supply.—The Council is to apply for powers to supply electricity for all purposes within the borough and adjacent districts. The maximum price for electricity is to be 10d. per kWh.

Spalding.—Electricity Supply.—The Boston and District Electric Supply Co., Ltd., has offered to give the Urban Council a supply of electricity in bulk at £4 10s. per kVA of maximum demand per annum, plus .75d. per kWh. This offer is to be considered by the consulting engineer, together with one from the Peterborough Corporation.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following: The Weston-super-Mare and District Electric Supply Co., Ltd., for the supply of electricity in the parish of Uphill; Mr. J. A. Purves, for the supply of electricity in the urban district of Burnham-on-Crouch, and certain parishes in the rural district of Maldon.

The Gainsborough Urban Council has received intimation from the Electricity Commissioners that its application for a Special Order has been granted.

West Bromwich.—Electricity Supply.—The Town Council has decided to proceed with the laying of main transmission lines in connection with the West Midlands Electricity District at an estimated cost of £17,926, including boxes, transformers, temporary buildings, &c. The mains and equipment will be transferred to the Joint Authority.

Tramway and Railway Notes.

Aberdeen.—Purchase of Undertaking Declined.—In connection with the proposed purchase of the tramway undertaking of the Aberdeen Suburban Tramways Co., by the Town Council, the Tramways Committee decided at a recent meeting that no further action should be taken in the matter.

Bradford.—Railless Cars.—The Tramways Committee is applying to the Ministry of Transport for sanction to the erection of overhead equipment in Brewery Street for the contemplated Lidget Green and Clayton railless-car service.

Through-Car Services.—The Tramway Committee has decided to experiment on the Shelf and Bailiff Bridge routes with through-car services. The scheme will, it is expected, make it possible to put fewer cars on the long-distance routes and more cars on the short distance and more crowded routes, and if proved successful will be extended to other routes.

Canada.—New Electric Railway.—According to *The Times*, the Ontario Hydro-Electric Commission is conferring with the municipalities concerned on a proposal to construct a high-speed radial railway from Toronto to Hamilton at a cost of $11,000,000.

Continental.—Switzerland.—With the addition of a fifth unit at the Amsteg power station of the Swiss Federal Railway authorities the completion of the programme of construction covering the power requirements for railway electrification up to 1928 has been achieved, in so far as the Amsteg-Ritom group of generating stations is concerned. In order to fully utilise the Barberine reservoir, the erection of the power station at Chatelard is being followed by one at Vernayaz. The plant will include three 14,000-kVA generators. An interconnecting line operated at 130,000 V will link up the Amsteg-Ritom and the Barberine-Vernayaz systems.

Belgium.—The Société Nationale des Chemins de Fer Vincinaux, of Brussels, proposes to electrify an additional number of its lines in the province of Antwerp during the present year as well as to construct a number of new short electric railways, including one from the existing terminus at Hoogboom to the frontier at Putte. In the eastern part of the province the first line to be electrified will be that between Antwerp and Schilde. Plans are also being prepared for the electrification of the Antwerp-Malines and Boom-Pierre local railways.

Heywood.—New Route.—According to the *Manchester Guardian*, it is proposed to construct a tramway connecting the municipal service at Hopwood and the Manchester Corporation tramway at Middleton.

India.—Railway Electrification.—The electric train service of the Great Indian Peninsula Railway from the Victoria Terminus, Bombay, to Bandra, was inaugurated on February 3rd.

London.—Underground Junction Completed.—According to *The Times*, a scheme which will have the effect of doubling the most important section of the Inner Circle was completed by the Metropolitan Railway on March 15th. A duplicate service of electric trains is thus provided for the first time over lines hitherto operated solely by steam trains. The Metropolitan Railway has been engaged for some months in constructing a junction to a point east of Euston Square, to link up a length of disused tunnel extending to King's Cross. It is now possible to switch over Metropolitan trains from the Inner Circle to the widened lines and thus secure an alternative route to Moorgate. The widened lines from King's Cross to Moorgate, over which the steam trains of the Great Northern section of the London and North-Eastern Railway and the Midland section trains of the London, Midland and Scottish Railway now run, have been electrified. Control of the junction of the new line with the existing Metropolitan track near Euston Square will be effected by means of electrical apparatus in a signal box at King's Cross, nearly 700 yards away. From this box also will be worked the junction points with the L. & N.E. and the L.M.S. Railways. With the opening of the new junction a number of through Metropolitan trains can be diverted over the widened lines to Moorgate. This enables the through trains to be expedited in both directions.

L.C.C. Tramcar Improvements.—The Highways Committee of the L.C.C. has recommended, with a view to eliminating the swaying motion of the four-wheeled type of tramcar, that 188 cars be equipped with an improved form of suspension gear at an estimated cost of £5,250.

Manchester.—Proposed Underground Railway.—The Manchester *Daily Dispatch* reports that it is expected that the report of the Underground Railway Committee of the City Council will be issued shortly. For the last two years this committee has been considering the city's traffic problem. It is not known at the moment what form the recommendations of the Underground Railway Committee will take, but it is expected that a scheme for linking up London Road, Central, Victoria, Exchange, and perhaps Oxford Road stations with an inner circle of electric underground lines, to form the nucleus of a bigger system, will be advanced. The first development of this will probably be extensions to Chorlton, Didsbury, Withington, and, on the other side, to North Manchester suburbs. The total cost of the scheme would be over £4,000,000.

Kent (Surrey).—Light Railway Inquiry.—According to the *Daily Mail*, proposals for a light railway 15 miles in length, to connect Orpington, near Chislehurst, Kent, with Sanderstead, near Croydon, Surrey, were outlined at a Ministry of Transport inquiry at Orpington recently. Col. H. M. Midder, for the promoters, said it was expected that the railway would develop the district as a residential suburb of London. The Southern Railway was willing to work the line and run electric trains from and to Charing Cross and London Bridge. Sir Herbert Walker, general manager of the Southern Railway, said that if an order were made and the promoters and the Southern Railway came to a satisfactory working agreement his directors would guarantee the interest on the debentures, £300,000. The capital would be about £300,000, and included in it was the cost of electrification, which was between £130,000 and £140,000. His board would find the capital for the electrification and take payment of it in shares, either preference or ordinary, as might be decided.

Telegraph and Telephone Notes.

Australia.—Naval Radio-Telegraphy.—With a view to improving the wireless communication services of the Royal Australian Navy, short-wave, continuous-wave apparatus is undergoing preliminary tests. A proposal that a strong naval communications reserve should also be formed is being considered. Though no definite action is likely to be taken for some time, it is likely, says the *Sydney Morning Herald* that the naval authorities will invite experienced amateurs who have pioneered short-wave work in Australia to join the naval wireless reserve.

Canada.—Marconi Operators' Strike.—The Marconi operators, through their Union Committee, have been assured of the continuance of the existing wage rate until April 1st, 1929. An agreement to this effect has been signed by the Marconi Company.—*Reuter* (Montreal).

Chile.—Telegraph Service.—The Chilean Government is reported by *Commerce Reports* to be interested in the purchase of the Commercial Telegraph Co.'s properties. That the report may be well founded is apparent from the fact that, at a meeting of the board of directors of the Commercial Telegraph Co. it was agreed to authorise an individual to enter into an *ad referendum* contract for the sale of the properties for $8,250,000 (paper). It is understood that the Government hopes to combine with the State telegraph service certain lines of the Commercial Telegraph Co. and in other places to avoid competition by these lines.

China.—Foreign Cable Dues.—With reference to the recent decision of the foreign Cable Companies not to accept any but Government telegrams dispatched from the administrations in the Yangtse Valley provinces, which may be handed over to the Companies by the Chinese Telegraph Administration in Shanghai, unless such messages were accompanied by cash, *Reuter's* correspondent is informed that the Chinese Telegraph Administration is now settling accounts half-monthly. So long as such settlements continue, telegrams will be forwarded in the usual way.

Empire Communication.—Press Union Resolutions.—A meeting of the Council of the Empire Press Union was held on March 12th to consider the resolutions adopted at the Imperial Press Conference held in Australia last autumn. Sir Robert Donald, chairman of the Council, presided, and he was supported by Lord Burnham, president of the Union. Regret was expressed at the delay in the erection in England of "beam" radio stations. Reference was also made, says *The Times*, to the Pacific Cable Board's intention to employ "loaded" cables in duplicating the Pacific channel, and the decision of the Western Union Telegraph Co. to lay a new "loaded" cable across the Atlantic; in view of the increased capacity afforded by "loaded" cables, it was decided that the Imperial Government be requested to take early steps to lay a new "loaded" cable across the Atlantic, and, in the meantime, to hire two channels from the Western Union Telegraph Co., so that full advantage might be taken of these new facilities. The motion to refer the resolutions to the Union's standing committee on cable and wireless communication was carried, and a special committee was appointed to watch the development of broadcasting and to co-operate with the standing committee.

Radio-Telegraphy.—West End Office.—A new telegraph office was opened on March 15th by Marconi's Wireless Telegraph Co., Ltd., at 20, Duke Street, Piccadilly, where telegrams may be handed in for transmission by high-speed wireless telegraphy to France, Spain, Austria, Switzerland, Canada, the United States, Bulgaria, Jugo-Slavia, and other parts of the world. The new office will conveniently serve the telegraphic requirements of the West End of London.

Switzerland.—Telephone Service.—The telephone service between Switzerland and France has been much improved this year, thanks to the opening of several new circuits. Since January no fewer than three new cables have been put at the disposal of Geneva, with a view of facilitating communication with the League of Nations, thus affording three wires for direct calls between Paris and Geneva. Berne, too, can now 'phone direct to Paris, except during certain hours, and for three weeks or so Zurich has had direct communication with Paris, much to the advantage of business men. As soon as the cable linking up Paris, Strasbourg, and Bâle is available to the public, further improvements in the Swiss service may be expected, and the new automatic 'phones are giving universal satisfaction. The public is being asked to criticise the present arrangements, and with but few exceptions little or no criticism is forthcoming.

The Telephone Service.—London-Germany Service.—A preliminary night telephone service was inaugurated on March 15th between London and Berlin, Hamburg, Bremen, Cologne, and Frankfurt. As the Continental sections of the lines to these towns are utilised for other purposes during the daytime, the service will be restricted to the hours 6 p.m. to 7 a.m. The charges for a three-minute call are considerably less than the normal day rates.

United States.—Telephone Timing.—A novel long-distance telephone economy has been adopted in the United States, where the canvassing of customers in distant parts by means of the telephone is now a recognised commercial practice. Salesmen of the H. J. Heinz Company, food manufacturers, use a small minute glass which they reverse as soon as telephonic contact with the client has been established. By this means they are able to regulate their calls so that full advantage is taken of every second, and the extra three-minute charge for a sentence or two is avoided. The glass is much more convenient and less distracting than the seconds hand of a watch. It costs only a few pence and saves many pounds a year.

Radio Notes.

Australia.—Licence Fees.—Since the inception of broadcasting in Australia about 18 months ago the amounts collected in licence fees are: New South Wales, £88,986; Victoria, £61,882; Queensland, £6,119; South Australia, £12,691; Western Australia, £8,960; Tasmania, £1,679.—*Reuter's Trade Service* (Melbourne).

Licences.—Number and Revenue.—Sir W. Mitchell-Thomson, Postmaster-General, in reply to a question in the House of Commons, said the total amount of fees for receiving licences collected up to the end of February, 1926, was approximately £2,147,000. The amount already paid to the British Broadcasting Co. was £1,114,000. The number of licences in force on February 28th last was approximately 1,906,000, as compared with 1,258,000 on February 28th, 1925.

Russia.—Manufacturing Output.—The radio sub-section of the Supreme Economic Council has had considerable difficulty in fixing the capacity of the Soviet market for wireless material owing to the absence of previous years' experience, but, after a study of the various branches and of the Western Europe and American markets, the value (according to present prices) of the output of radio articles in the Soviet Union is estimated as follows:—For the year 1925-26, 20,163,000 roubles; 1926-27, 29,732,000 roubles; 1927-28, 40,058,000 roubles; 1928-29, 53,115,000 roubles; and for 1929-30, 68,625,000 roubles. Owing to reduced costs of production, the amounts for 1926-27 are expected actually to be lower. In order to attain this output it will be necessary to extend the existing works, open the Nizhni Novgorod workshops as from 1926-27, and build a new works for the mass production of simple receiving sets to start activity in 1928-29.—*Reuter's Trade Service* (Moscow).

Wave-length.—Readjustment.—On March 11th, the following wave-length alterations were made at the instigation of the International Radiophony Bureau, Geneva, in order to avoid interference between stations:—

England.—Newcastle from 404 to 407 m., and Bournemouth from 386 to 387 m.

Austria.—Graz from 397 to 402 m.

Germany.—Breslau from 418 to 417 m.; Münster from 410 to 412 m.; and Hamburg from 395 to 392 m.

Irish Free State.—Dublin to 397 m.

The changes are not necessarily permanent, their retention depending on the working of the rearrangement.

Porcelain Insulator Manufacture.

Impressions of a Visit to Messrs. Taylor, Tunnicliff & Co.'s Staffordshire Factories.

(*Concluded from page* 384.)

It will have been gathered from the first instalment of this article that, as compared with ordinary potting, the business of insulator-making is highly technical, necessitating the use of specially-prepared clays, special machinery, and most accurate workmanship; in fact, a large staff of skilled mechanics is kept constantly employed in constructing and renewing machinery, the size of the busy tool room being more suggestive of the engineering trade than of the ceramic industry. Testing facilities are, of course, an essential feature of such an organisation, for they afford the means of determining whether the potter's products have been rendered homogeneous throughout and thoroughly well vitrified in order that, apart from more mechanical strength, their electrical insulating properties may be depended upon under diverse climatic and other variable conditions, irrespective of the glaze.



Fig. 15.—A View of the Extra-high-pressure Testing Department.

In contrast to the transformer outfit (capable of furnishing a maximum pressure of only 60,000 volts) in use when we described the works 18 years ago,* the extra-high-voltage equipment installed at the Hanley factory now includes a 300-kVA, 300,000-volt, single-phase Ferranti transformer (figs. 15 and 16) fed from a 70-h.p. G.E.C. motor-generator that is capable of furnishing 150 kVA for short periods. A pure sine wave is obtained at frequencies of from 25 to 100 cycles per second. The G.E.C. control board is enclosed in a wire cage, the doors of which are interlocked with the oil switches for the protection of the operators. Some of the results obtained by the application of high electrical pressures are indicated by the accompanying reproduced photographs: Fig. 18 is a view of a 66,000-volt pin-type insulator flashing over dry at 165,000 volts; figs. 19 and 21 show 300,000-volt dry flashovers on a string of five 7-in. diameter suspension units, and the influence of arcing horns on the flashover path will be noted; fig. 20 shows a string of six similar units under artificial rain, the voltage in this case being about 200,000 volts.

Suitability of electrical design is gauged by dry and wet flash-over tests. In the latter case, samples are subjected to artificial rain equivalent to one inch in five minutes, directed downwards at an angle of 45 deg.; both the temperature of the water and its specific resistance are important factors. To determine the dielectric strength, insulators can be punctured under oil, and this test can be made, if necessary, at any temperature up to 100 deg. C., arrangements being available to heat the oil to this temperature and to heat the insulator previous to immersion; the oil tank used for this test can be seen in fig. 17. Other electrical equipment includes a high-frequency outfit (100,000 volts at from 50,000 to 200,000 cycles per second) of the oscillator pattern similar to a spark radio-telegraph transmitter. This outfit is illustrated in fig. 22, the motor-driven rotary spark-gap being visible on the right-hand side in front of the condenser box.

Fig. 23 shows porcelains for 10-in. suspension insulators undergoing a high-frequency test (80 kV), and it will be noted that the insulators are inverted in water, the reflection indicating how the discharge clings to the porcelain.

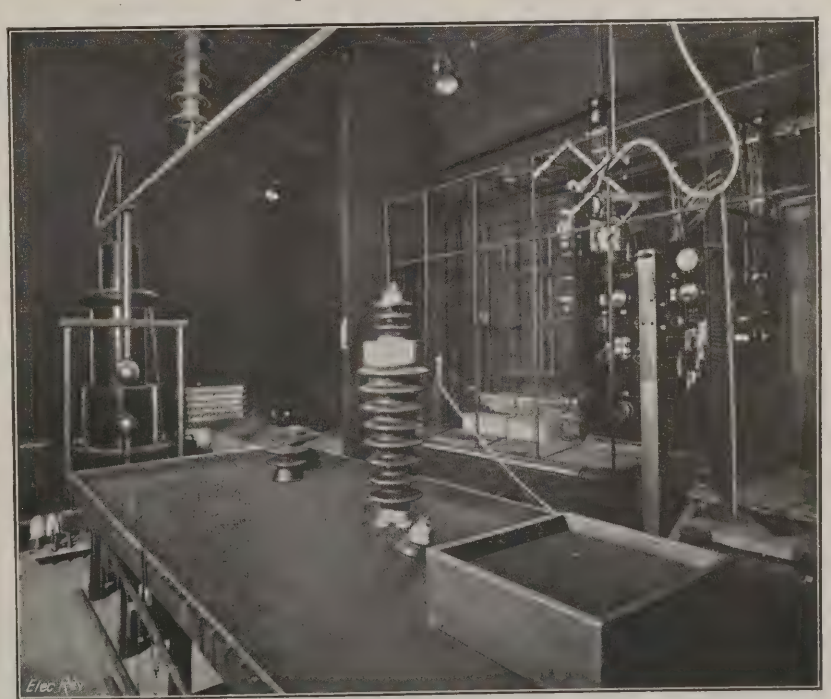


Fig. 16.—Testing Department, showing Switchboard and 300,000-V Transformer.

The current an insulator will allow to pass from the conductor to the earthed metal work under the influence of an alternating voltage is made up of the leakage (i) over the surface, (ii) through the body, and (iii) the capacity current through the porcelain dielectric. Nor-

* See Elec. Rev., March 6th, 1908, pp. 401 to 405.

mally, these currents are very small, but, since a spark is a conductor, they become excessive when a flash-over occurs. A well-designed porcelain insulator will always flash over without damaging itself and without puncturing. The chief factor governing the flash-over voltage and path is the distribution of the electric field and its relation to the contour of the insulator. When the insulator is correctly designed there is no appreciable formation of corona prior to flash over. In general, the best distribution results when the contour of the main "trunk" of the insulator conforms to one of the lines of force of the dielectric field, while the surface of the sheds follows the equipotential planes at right angles to the lines of force.

Other tests are also made to prove the suitability of the porcelain: One of them is known as the test for inherent stresses, and consists of immersing the insulator, or insulators, for one hour in water at 50 deg. C., followed by a similar period of immersion in ice and water, after which the dry flash-over test is applied. The insulator is only considered satisfactory if it can stand this test being repeated three times. It is important to know whether the porcelain shows any sign of porosity, and the test for this consists of immersing broken pieces in a 0.5 per cent. alcoholic solution of fuchsin dye under a pressure of 2,000 lb. per sq. in. for 24 hours; good porcelain shows no sign of penetration.



Fig. 19.—A 300-kV Dry Flash-over.



Fig. 20.—A 200-kV Wet Flash-over.

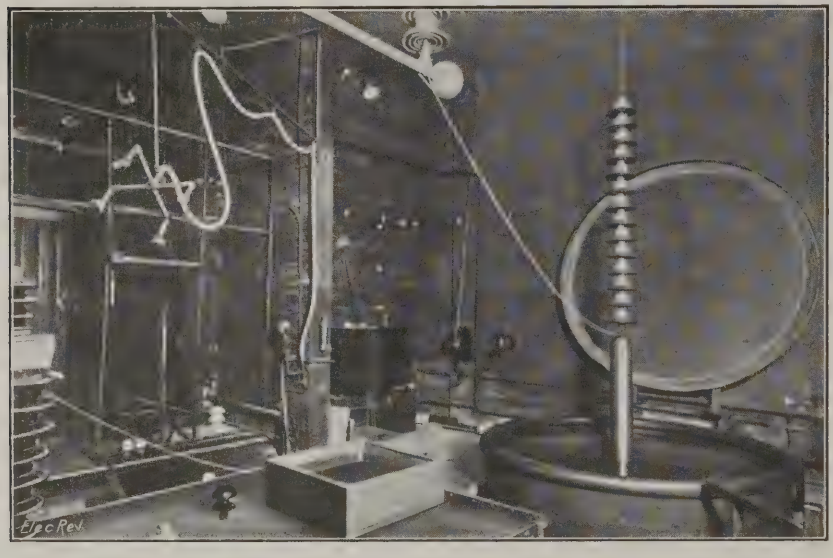


Fig. 17.—Oil Tank for Puncture Tests.

work, coal-fired Lancashire boilers are installed at all the factories, but before the steam is utilised for heating purposes it is passed through horizontal reciprocating engines which drive some of the machinery and vertical high-speed engines which drive d.c. generators for lighting and feeding motors in the works. At the Hanley works the power requirements are in excess of the steam demand, the difference being met by the use of town's gas engines. Thus it may be said that power and electricity are generated almost as by-products, but the subject is receiving attention at the moment, and it is probable that in the near future all the electricity needed will be purchased from the local municipal undertaking.

Although steam and electric power have been and are being utilised to a considerable extent, the first, and one of the most important, operations in the manufacture of an insulator dates back to one of the oldest, if not the oldest, handicrafts in the world, namely, the potter's wheel. English manufacturers

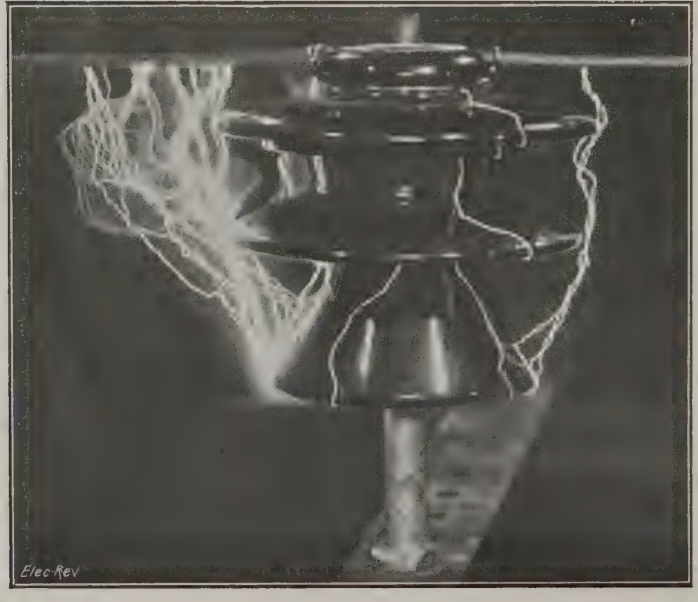


Fig. 18.—A 66-kV Pin-type Insulator Flashing Dry at 165 kV.



Fig. 21.—A 300-kV Dry Flash-over.

In conclusion, reference may be made to the works power supply. Steam being a necessity in the process

maintain that insulators made by this process are, without doubt, superior to the cheaper pattern, which is not "thrown" on the potter's wheel. The "thrower" uses no tools in making the insulator, he simply spins and forms the article entirely with his hands as he sits over his wheel, which manipulation is identical with that practised 50 centuries ago.

These facts, however, by no means imply that a long-established concern must necessarily be old-fashioned in its methods, for apart from the great improvements that have been made in the process work, labour-saving devices and machinery have been introduced with considerable advantage from the point of view of both workmanship and cost reduction.

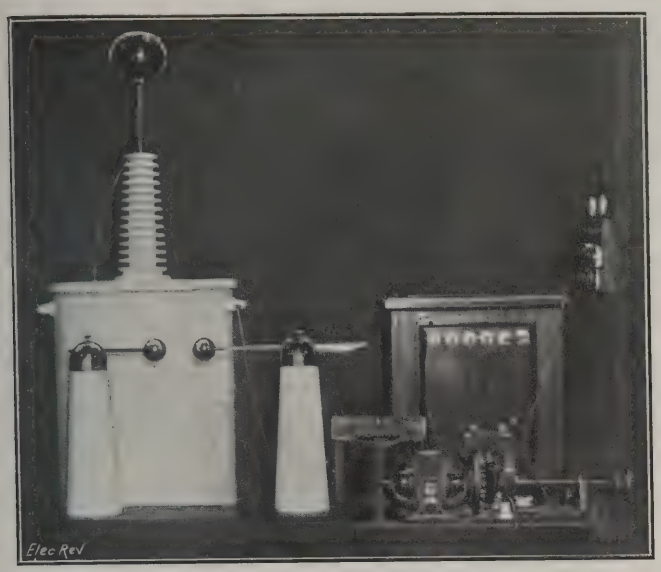


Fig. 22.—High-frequency Testing Outfit.

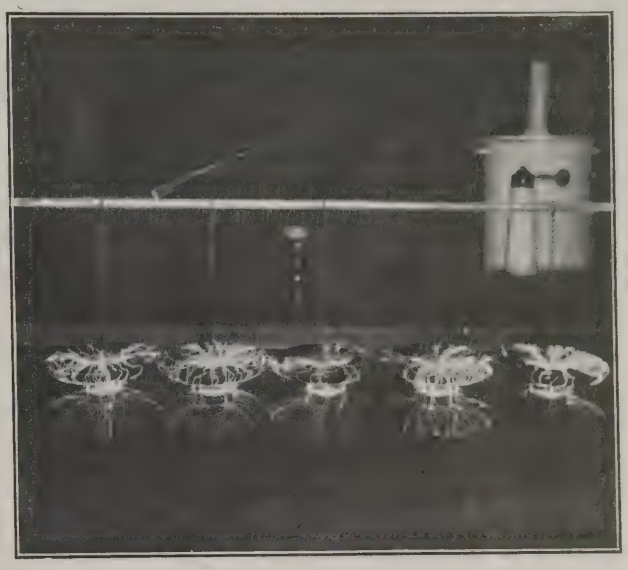


Fig. 23.—High-frequency Test at 80 kV.

We are indebted to the directors for the loan of some of the photographs reproduced in this article, and for the facilities placed at our disposal on the occasion of our visit to their factories.

The Flood-Lighting of Niagara Falls.

A particularly interesting and successful illumination scheme has recently been carried out at the waterfalls of Niagara. The project provides batteries of searchlights, placed in towers erected at the rear of the falls, which are arranged so as to flood-light the waters, resulting in the wonderful spectacular illumination illustrated in fig. 1.

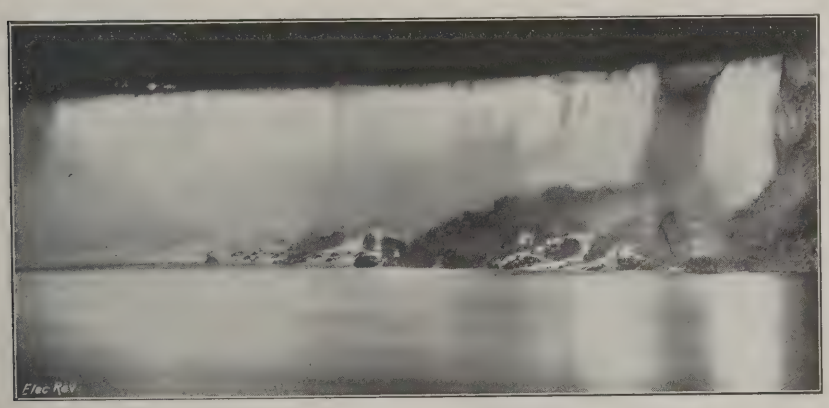


Fig. 1.—Niagara Falls, Illuminated.

Fig. 2 shows one of the batteries, which consists of 24 36-in. medium-intensity searchlights. The lamps are of the horizontal d.c. arc type, and are equipped with silvered glass mirrors. Each has a single feed and an automatic magnetic control. The lamp working pressure is 45 volts, when the loading is 20 A. The lights are focused by means of a single lever and handle, the manipulating gear extending below the base of the searchlight. The rheostat is built up of resistance tubes, and is provided with an 8-way switch for adjusting the current taken by the lamp. The illumination in beam candle-power immediately in front of each light is 4,500,000 c.p. This should be distinguished from the measurement of open-arc illumination. The beam candle-power takes into account the character of the reflecting mirror, and the brilliancy of the crater in the positive carbon, as well as the quality of the glass in the front door, and is a direct measure of the effective illumination provided by the searchlight. It will be recalled that it was arranged when the scheme was first authorised that the Government, U.S.A., should pay one-third of the cost, $60,000, of installing the plant and maintaining it for the first year, the remainder to be borne by Niagara Falls, New York and Ontario, and the Government of Ontario.

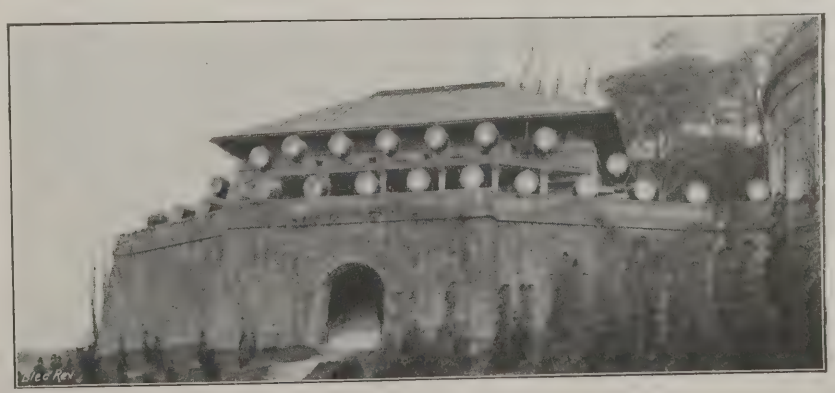


Fig. 2.—Searchlight Battery.

Remote-Control Sub-Stations.

The New Tramway Sub-Stations at Croydon.

What are claimed to be the first two remote-control sub-stations to be used on tramway traction in this country have recently been put into commission at Croydon, one at Thornton Heath and the other at South Croydon, in connection with the through running of the L.C.C. tramcars to Croydon. The two installations are practically identical, both in equipment and operation, and it will be sufficient to describe only the one at Thornton Heath. A 3-phase, 50-cycle, 6,000/6,600-V supply is received from the Croydon generating station at Factory Lane, from where the sub-station is controlled, and is converted to d.c. at 560/575 volts, which is fed to a section of the tramway overhead system. The main equipment consists of the incoming e.h.p. switchgear, fig. 1, made by Messrs. Reyrolle, a British Electric transformer, a 500-kW, 600-V rotary converter of Messrs. Mather & Platt's manufacture, the necessary starting and regulating panel, which is equipped for the Shuttleworth-Thomas system of remote control, supplied by Messrs. Bertram Thomas, and a d.c. switchboard with Bertram-Thomas switchgear. In addition, a control panel is provided at the operating station. The Shuttleworth-Thomas remote-control system, which was originated by Mr. Shuttleworth, of the Hull electricity undertaking, employs a small number of pilot wires between the control and sub-stations. At the start the operator, by placing the controller handle in position, sends a small d.c. out from the generating station. It is received by a small motor situated at the foot of the starting panel, fig. 2, which, in a series of operations performed by a crank and connecting rod to which it is geared, operates the remote-control equipment. A 3-pole switch, short-circuiting the starting pony-motor, is first thrown into the open position, while the field rheostat of the converter, placed above the starting panel, is set to its starting position. A small multiple change-over switch is then operated and diverts the controlling energy to a motor on the e.h.p. switch panel. This closes the switch, and the supply, through the transformer, is connected to the pony motor. This is directly coupled to the converter, and

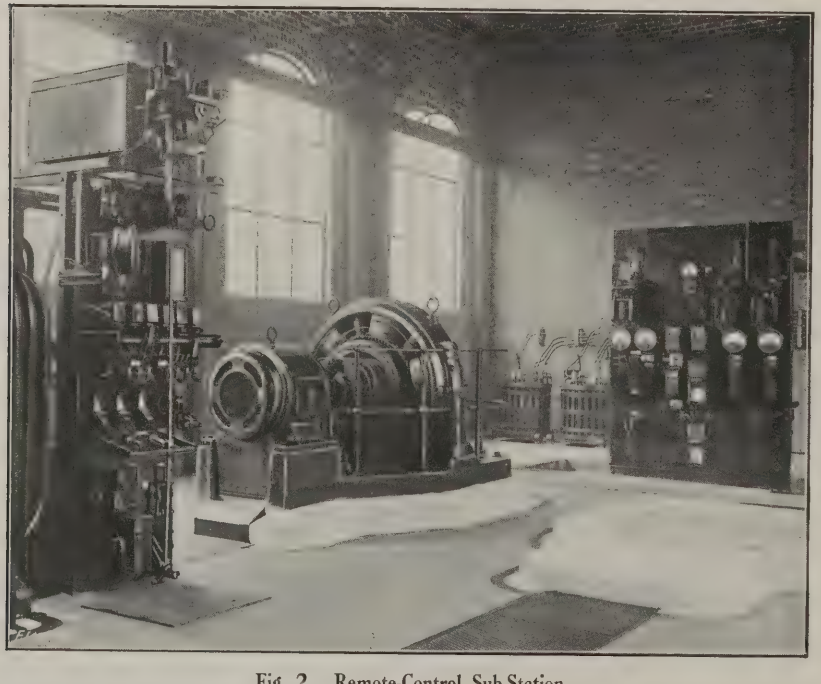


Fig. 2.—Remote-Control Sub-Station.

the machine starts and runs up to speed. The converter is self-synchronising by virtue of the very high starting torque of the motor and the reduction of the slip to a particularly low figure, which at the same time considerably increases the synchronising torque. The pony motor has a double winding and the same number of poles as the converter. The latter pulls quickly and quietly into step and remains steady until the normal operating pressure is reached, when the start-

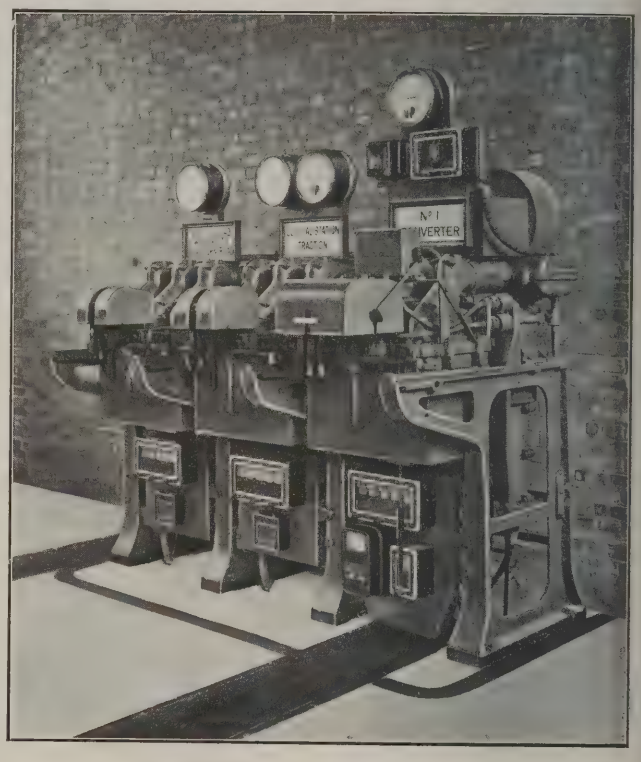


Fig. 1.—E.h.p. Switchgear.

ing motor is cut out of circuit. The last operation is effected by the small motor on the control panel, to which the operating current is re-diverted after the operation of the e.h.p. switch. It now closes the machine switch, and the converter is ready for load. The multiple switch is again operated, this time diverting the pilot wires from the control panel to the d.c. side of the machine, and all further operations are controlled by the machine's own energy. The voltage regulation is effected by a system of relays at the top of the control panel. The relays are operated by the engineer at the main station by "tapping" a relay switch, each tap moving the rheostat one notch forward or backward as the case might be. When the pressure is correct the machine circuit breakers on the d.c. board are operated from the main station, and the machine is put on load. The d.c. switches can be operated from the main station, independently of the a.c. equipment, and the whole sub-station can be shut down immediately at any time. The installation was subjected to an interesting and somewhat drastic test on completion. A heavy feeder was run direct to the trolley wire just outside the station, and this was "shorted" to the rails; the machine stood the test and did not flash-over.

In conclusion, we are indebted to Mr. A. C. Cramb, M.I.E.E., for permission to inspect the installation, and to Mr. Eustace Thomas, of Messrs. Bertram Thomas, Ltd., for his assistance in the preparation of the above notes.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—BUENOS AIRES.—April 12th. Public Works Department. Rock drilling installation, including steam shovel, aerial transporters, 170-h.p. electric generating plant, &c.*
May 3rd. Electric travelling crane, capacity 1½ metric tons.*
Department of Sanitary Works. May 26th. Two 1,000-kW Diesel-engine generating sets.*
May 27th. Electrically-driven centrifugal sewage pumps.*

Australia.—BRISBANE.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company, Boundary Street, Brisbane.
MELBOURNE.—May 11th. P.M.G.'s Department. Telephone jacks.*

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (See this issue.)

Barnes.—Electricity Department. E.h.p. and l.p. cables. (See this issue.)

Basingstoke.—April 6th. Electricity Department. One 600-b.h.p. heavy-oil engine and direct-coupled dynamo. (See this issue.)

Belfast.—April 3rd. Electricity Department. One 1,000-kW rotary converter, with transformer, l.p., a.c. switchgear, &c. (March 12th.)

Brazil.—RIO GRANDE DO SUL.—April 15th. Port and Bar Management. 10 electrically-operated portal cranes, capacity 2,500 kilos; 2 ditto, 5,000 kilos capacity; and 7 electric winches or capstans.*

Brentford.—March 30th. Board of Guardians. Wiring, &c., at the Institution, Warkworth House, Isleworth. (See this issue.)

Cardiff.—March 22nd. Electricity Department. Grit-collecting plant, 100-kW, 400-V alternator, &c. (March 5th.)

Colwyn Bay and Colwyn.—April 8th. Electricity Department. Stores for 12 months, including cables, joint boxes, cut-outs, house-service meters, &c. (See this issue.)

Edinburgh.—April 12th. Electricity Department. Four water-tube boilers, economisers, and mechanical stokers or alternatively, boilers, economisers, air heaters, and mechanical stokers, or boilers, economisers and powdered fuel plant. (March 12th.)

Egypt.—CAIRO.—April 27th. Egyptian Government. 1,100 desk telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Erith.—March 27th. Electricity Department. 1,000 yd. (approx.) h.p. 3-core cable. (See this issue.)

Grimsby.—March 29th. Electricity Department. One 2,000-kW converter, one 1,000-kW ditto, l.p. switchgear, cable work, &c. (March 5th.)

Hallaton, Market Harborough.—Wiring and installation of electric lighting plant at Village Hall. (See this issue.)

Hazel Grove, near Stockport.—April 13th. Hazel Grove and Bramhall U.D.C. 2,300 yd. armoured cable. (See this issue.)

India.—March 30th. India Store Department. Complete equipment for one rotary-converter sub-station, three separate rotary-converter sets and track sectioning switchgear for the G.I.P. Railway electrification. (February 26th.)
March 24th. 30-line automatic and 10-line manual telephone equipment. (March 12th.)
April 19th. Goods lift for the Imperial Record Offices at Raisina, Delhi. (A.X .2,904.)*
April 2nd. Cable. (March 5th.)
April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (March 5th.)
April 13th. 23 electric passenger locomotives. (February 26th.)
May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

Kettering.—March 23rd. Electricity Department. Transformers, e.h.p. and l.p. switchgear, one 1,500-kW rotary-converter equipment, and one steam turbo-boiler feed pump. (February 26th.)

Leyton.—April 9th. Education Committee. Installation of electric lighting and central heating at the Sybourn Street new school. (March 12th.)

London.—LONDON COUNTY COUNCIL.—March 23rd. Wiring and fittings for electric lighting at St. Paul's Road elementary school, Bow, E. (March 5th.)
METROPOLITAN ASYLUMS BOARD.—March 24th. Installation of electric lighting at the Southern (Lower) Hospital, Dartford. (March 5th.)
ISLINGTON.—March 29th. Borough Council. Two 3¼-ton electric refuse-collecting vehicles fitted with steel tipping bodies (March 12th.)

Luxembourg.—The municipal authorities of Luxembourg have invited tenders for the supply of 2,300 metres of 700-V armoured cables.

Manchester. — March 22nd. Electricity Department. 3-phase, 420-V sub-station switchgear, 3-phase, 6,600-V and 11,000-V ditto, three 500-kVA static transformers, and one 7,500-kVA forced-air-cooled transformer. (February 19th.)
March 22nd. One 5-ton electric tipping wagon and one 10-ton electric tractor with trailer. (February 26th.)
April 6th. 3-phase, 6,600-V sub-station switchgear. (March 12th.)
March 26th. One 10-ton hand-operated overhead travelling crane and gantry, Blackley sub-station. Form of tender from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.
March 23rd. Tramways Committee. Copper bonds for tramway rails. Forms of tender from Mr. Henry Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly.
PROVINCE OF EAST LANCASHIRE.—Wiring, &c., Masonic Temple, Manchester. (March 12th.)

Mountain Ash.—March 22nd. Electricity Department. Two 500-kVA transformers. (March 5th.)

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*

Otley.—March 30th. Wharfedale Isolation Hospital Committee. Electrical installation at the Isolation Hospital, Menston. (March 5th.)

Pentre, Rhondda.—March 27th. Rhondda U.D.C. Electricity Department. 12 months' supply of house-service a.c. ordinary and prepayment meters, cable, joint boxes, compound, cut-outs, &c. (March 5th.)

South Africa.—JOHANNESBURG.—April 12th. S.A. Railways and Harbours. Electrification of Cape Town Suburban Railway. Supply and erection of the overhead equipment of the permanent way and overhead transmission and distribution lines. (February 12th.)
May 6th. Two electric goods lifts.*

Stirling.—March 26th. Corporation. Electrical work at 38 houses. Specifications from Burgh Surveyor.

Sutton Coldfield.—March 24th. Electricity Department. E.h.p. underground mains, distributors, feeder pillars, and network fuse boxes. (March 5th.)

Walthamstow.—March 24th. Electricity Department. 12 months' supply of l.p. cables and v.i.r. wires. (March 12th.)
April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (March 12th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Andover.—Town Council. Accepted:—
Installation of electric pumping plant at the sewage pumping station.—Edwards & Armstrong, Ltd.

Australia.—Sydney City Council has decided to accept the Cockatoo Dockyard's tender of £666,000 for the construction of power-house plant on Cockatoo Island.—*Reuter* (Sydney).

Aylesbury.—Town Council. Accepted:—
H.p. transmission lines and services for the extended area of supply (£37,822).—Craven and District Electrical Construction Co., Ltd.

Bradford.—Baths Committee.
Installation of electric lighting apparatus at Lapage Street school baths.—F. Draycott.

Tramways Committee.
32½ tons of hand-brake shoes (£325); 45 tons of track-brake blocks (£446).—Cole, Marchent & Morley, Ltd.
6 miles of 4/0 round copper trolley wire (£584).—F. Smith & Co., Ltd.

Cardiff.—At a meeting of the City Council last week, the recommendation of the Electricity Committee to accept a Belgian tender for low-pressure cables was referred back.

Darlington.—Town Council. Accepted:—
Four additional trolley 'buses (£6,312).—Clough, Smith & Co.

East Ham.—Electricity Committee. Accepted:—
1,000-kW motor-converter (£4,044).—Bruce Peebles & Co., Ltd.
Switchgear (£173).—A. Reyrolle & Co., Ltd.

London.—WANDSWORTH.—L.C.C. Education Committee. Recommended:—
Electrical installation at Technical Institute:

F. G. Minton, Ltd. (Recommended.)	**£1,573**
Pinching & Walton	1,721
Malcolm & Allen, Ltd.	1,730
H. J. Cash & Co., Ltd.	1,752

The chief engineer's comparable estimate is £1,620.

CAMBERWELL.—Works Committee. Recommended:—
Maintenance of electric lighting, heating and power installations, &c., at public buildings.—Commercial Telephone & Electric Co., Ltd.

St. Pancras.—Electricity Committee. Switchgear for Grafton Road sub-station :—

British Thomson-Houston Co., Ltd. (Recommended.) ...	**£2,826**
English Electric Co, Ltd.	2,826
Metropolitan-Vickers Electrical Co., Ltd	3,008
Ditto (alternative)	3,166
Ferguson, Pailin, Ltd.	3,019
Reyrolle & Co.	3,050
Switchgear & Cowans, Ltd.	3,050
B. Thomas	3,050
General Electric Co., Ltd.	3,075
Whipp & Bourne, Ltd.	3,271
Johnson & Phillips, Ltd.	3,275
Park Royal Engineering Co., Ltd.	3,320
Ditto (alternative)	3,150
New Switchgear Construction Co., Ltd.	3,398

Shoreditch.—Electricity Committee. Accepted :—

Cable (£919).—W. T. Glover & Co., Ltd.

St. Marylebone.—Electricity Supply Committee. Recommended :—

Avery one-ton automatic hopper weigher (£904).—Babcock & Wilcox, Ltd.
Duplicate synchronising equipment (£78); earth resistance for e.h.p. supply (£198).—Ferguson, Pailin, Ltd.
Spare grab for the coal crane (£206).—W. Goodacre & Sons.

Ferrybridge (Yorks.).—Yorkshire Electric Power Co., Ltd. Accepted :—

Corrugated copper expansion pieces required in connection with the circulating water piping at the New Ferrybridge power station (£873).—Empress Coppersmiths & Engineers, Ltd.

Portsmouth.—Electric Lighting Committee. Accepted:

Steel-frame turbine house at the generating station, Gunwharf Road (£7,174).—Tanner Bros.
Electric travelling 60-ton crane (£2,442).—Royce, Ltd.

Preston.—Electricity Committee. Accepted:—

Supply and erection of towers and overhead transmission line (£38,456).—Callender's Cable & Construction Co., Ltd.

Swansea.—Health Committee. Accepted:—

Re-wiring Corporation stables (£72).—W. H. Norman Kirk.

Weymouth.—Electricity Committee. Accepted:—

Distributor cable (£212).—Johnson & Phillips, Ltd.
Two boilers of 20,000 lb. capacity each (£16,350); two 1,500-kW turbines and alternators (£13,520); two condensing plants (£3,866); two 500-kW rotary converters, with switchgear, &c. (£6,495); circulating system (£230).—English Electric Co., Ltd.

Forthcoming Events.

Institution of Engineering Inspection.—Friday, March 19th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7.30 p.m. Paper on "Lubricating and Allied Oils," by Mr. E. A. Evans.

British Electrical Development Association.—Friday, March 19th. At the Hotel Cecil, Strand, W.C. At 7 for 7.30 p.m. Annual dinner.

Manchester Electro-Harmonic Society.—Friday, March 19th. At the Albion Hotel, Piccadilly, Manchester. Monthly concert.

City & Guilds of London, Central & Finsbury Engineering Colleges Old Students' Associations (Northern Section).—Friday, March 19th. At the Engineers' Club, Manchester. Annual dinner.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, March 20th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Discussion on "The Control and Distribution of Electricity in Mines," by Mr. I. Jones.

Willesden Polytechnic Electrical Engineering Society.—Saturday, March 20th. At Reggiori's Restaurant, Chapel Street, Edgware Road, W. At 6.30 p.m. Annual dinner.

Electrical Trades Commercial Travellers' Association.—Saturday, March 20th. At the Manchester Hotel, Aldersgate Street, E.C. At 7.30 p.m. Grand carnival dance.

Electrical Power Engineers' Association (London Western Section).—Saturday, March 20th. At Stewart's Restaurant, Victoria Street, S.W. At 7 p.m. Annual dinner.

(Kent Section).—Saturday, March 20th. At Hollingworth Hall Church Institute, Maidstone. At 6 p.m. Lecture on the "Brush-Ljungström Steam Turbine," by Mr. J. R. Hutchings.

Royal Society of Arts.—Monday, March 22nd. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture on "Thermometry," by Mr. W. F. Higgins (Lecture II).

Institution of Electrical Engineers.—Informal Meeting.—Monday, March 22nd. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Performance of Mercury Arc Rectifiers," to be opened by Mr. G. Rogers.

(North-Eastern Centre).—Monday, March 22nd. At the Armstrong College, Newcastle-on-Tyne. At 7 p.m. Paper on "Developments in High-power Fuses," by Mr. L. C. Grant.

(North Midland Centre).—Tuesday, March 23rd. At the Yorkshire Cinema Exchange, Queen's Arcade, Leeds. At 7 p.m. Paper, "Some Notes on the Installation of a Modern Power Unit," by Mr. J. W. J. Townley.

(East Midland Sub-Centre).—Tuesday, March 23rd. At the University College, Nottingham. At 6.45 p.m. Paper on "Power Factor," by Messrs. C. C. Sutton and J. H. R. Nixon.

(North-Western Students' Section).—Tuesday, March 23rd. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Ordinary meeting.

Royal Institution.—Tuesday, March 23rd. At 21, Albemarle Street, W.1. At 5.15 p.m. Lecture on "The Growth of Crystals," by Prof. C. H. Desch.
Friday, March 26th. At 9 p.m. Lecture on "The Radiation from Atomic Nuclei," by Sir Ernest Rutherford.
Saturday, March 27th. At 3 p.m. Lecture on "The Rare Gases of the Atmosphere," by Sir Ernest Rutherford.

Radio Society of Great Britain.—Wednesday, March 24th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Lecture on "Fading," by Prof. E. W. Marchant.

Institution of Production Engineers.—Wednesday, March 24th. At 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Works System," by Mr. J. T. Konworthy.

Institution of Welding Engineers.—Thursday, March 25th. At Caxton Hall, S.W. At 8 p.m. Paper on "Electric Welded Construction," by Mr. J. Caldwell.

British Electrical Development Association Conference.—Friday, March 26th. At Caxton Hall, Westminster, S.W. At 9.30 p.m. Paper on "Progress and Prospects of Commercial Electric Cookery," by Mr. J. J. McKenna.

Birmingham Electric Club.—Friday, March 26th. At the Grand Hotel, Birmingham. At 7 p.m. Lecture on "Telephone Repeaters."

Physical Society of London.—Friday, March 26th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

National Association of Supervising Electricians.—Saturday, March 27th. At the Holborn Restaurant. Annual dinner.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

Excellite insulating board.
Fortifix quick drying cement.
Small galvanic machines operated by the insertion of a coin.
Omni-Volt electric irons.

Notes.

Smoke Abatement Recommendations.—In a topical talk on "The Smokeless Age" from the London station of the British Broadcasting Company on March 9th, Dr. J. S. Owens, M.D., A.M.Inst.C.E., hon. secretary of the Advisory Committee on Atmospheric Pollution, outlined the recommendations contained in the final report of Lord Newton's Smoke Abatement Committee, on which, he said, the Smoke Abatement Bill to be introduced into Parliament shortly by Mr. Neville Chamberlain, Minister of Health, might probably be constructed. The Committee suggested a general tightening up of all existing smoke-prevention laws, and the placing of a legal obligation on all manufacturers and users of engines or plant of any description to adopt the best practicable means of avoiding the pollution of the air by smoke; also certain changes in the administration of the law, under which smoke-makers would be punished by much heavier penalties than those in vogue at present. In dealing with domestic and kitchen smoke, it was recommended that every encouragement should be given to the cheapening of the supply of gas and electricity, while municipal authorities should not make profits out of their gas and electricity undertakings in order to relieve the rates. The Committee also proposed that the Central Housing Authority should decline to sanction any housing scheme unless the plans provided for the adoption of smokeless methods of heating and cooking.

Artificial Sunlight Exhibition.—An exhibition of artificial sunlight apparatus was held at the Middlesex Hospital, London, from March 11th to 16th, when an excellent display was seen. We are unable to deal with the matter in this issue owing to pressure upon our space.

Fatality.—While operating a coal-cutting machine at the No. 2 Pit, Hucknall, last week, a collier named Arthur Allsopp, was killed owing to the breaking of the connecting cable.

Late Legal.—Armorduct Cable Co., Ltd.—In the Chancery Division on March 16th, Mr. Justice Eve confirmed a reduction of capital of Armorduct Cable Co., Ltd., by cancelling 18s. on each ordinary £1 share and cancelling the deferred shares altogether. Mr. Gedge, for the company, explained that between £7,000 and £8,000 of the loss was upon trading.

The New Electricity Board.—Tuesday's edition of the *Financial Times* contains an article embodying the views of a leading municipal engineer in London, of Col. Morcom and Mr. D. N. Dunlop, of the B.E.A.M.A., and Mr. M. J. Railing, of the General Electric Co., Ltd., regarding the provisions contained in the Electricity Bill with reference to the constitution and authority of the proposed Central Electricity Board. In the main these all express dissatisfaction with the proposed constitution. A powerful industrial executive was expected from the speech delivered by Mr. Baldwin at Birmingham, whereas the idea conveyed in the Bill is that there will be what is tantamount to a second group of Electricity Commissioners under the domination of the existing Commission.

Speaking at the Royal Colonial Institute luncheon at the Cannon Street Hotel, London, on March 16th, when Mr. J. Sandeman Allen, M.P., presided over some 70 members and guests, Sir Philip Dawson, M.P., said the subject was of national importance, and he had given it much attention. The consumption of electricity per head of population in this country was between one-fifth and one-sixth of that in other countries; in London it was just half the Berlin figure. From a given size of station the output in Germany was twice what it was in this country. In England they suffered from an excess of inefficient stations, and what that meant was obvious from the coal consumption and heat efficiency figures. In most stations there was also an excess of spare plant; for instance, assuming the maximum demand to be 100,000 h.p., the station should contain 25,000-h.p. generating sets with two sets (or 15 per cent.) as spare plant; one set being available in case of breakdown, while the other was being overhauled. To-day, however, between 60 and 70 per cent. of the total plant installed in this country was spare. The remedy for that state of affairs was not new; it was in use in America and in Europe, and was the interconnection of the principal stations. Why was legislation necessary to carry such a scheme through? Simply because common-sense was the most uncommon sense, jealousy between undertakings preventing them from co-operating. Private undertakings, such as collieries and steel works, were prepared to supply their

excess power into the public network as was being done on the North-East Coast, where nearly a quarter of the total supply was furnished by waste heat. His recent investigation in Germany also showed that a great deal could be done with waste heat. There surplus blast-furnace and other gases were either converted into electricity or supplied direct as gas into the public mains. Water power would also be of assistance, and, although it might be surprising to some, there was quite a number of fair-sized water powers available in this country.

Regarding the criticism that transmission losses and transmission-line costs would be too heavy to make such a scheme worth while, it should be remembered that the saving in spare plant would more than pay for such lines, and at the voltages that were now being used (from 100,000 to 200,000 volts), the line conductors could be very small. Although he believed that an Electricity Bill was essential, it did not mean that power would be available to the general public at ½d. per kWh; that was impossible, except in the case of certain chemical works which carried on continuous processes. Nevertheless, a Bill would materially improve present conditions.

After quoting an article in a German newspaper to indicate the interest which our principal rivals were taking in the measure, he approved of the idea of the Bill, which he characterised as sound, both technically and economically. He had the greatest admiration for the Electricity Commissioners, and was certain that they had the interest of the industry at heart, but the consumer and prospective consumer should be considered before the producer and manufacturer. Whilst it was desirable to preserve the freedom of private enterprise, the supply of electricity was a public utility service and, as such, must be under public control. The only criticism he had to offer was in that connection: The present intention was to make the National Central Board the servant of the Commissioners; that was totally wrong. The Commissioners should be no more than advisers to the Board, and unless the Board were composed of business men, totally independent of all political influence, it might do harm. If any appeal against the decision of the Board were necessary (and he thought there would be very few appeals) it should be to Cæsar—in this case the House of Commons.

E.A.W. Activities.—A meeting is to be held in the Lord Mayor's Parlour, Town Hall, Manchester, on March 25th, at 3.15 p.m., to inaugurate the Manchester District Branch of the Electrical Association for Women. Tea will be provided at 4 p.m., by the courtesy of the Manchester Corporation Electricity Department. The work of the branch will be outlined by the director, and the local officers and Council will be formally elected at the meeting. Miss G. L. Entwisle, A.M.I.E.E., is acting as hon. secretary. Lady Brooks, Mr. R. A. Chattock, and the Director will address a public meeting under the auspices of the Birmingham branch on March 29th, in the Council Chamber, Birmingham.

Association of Special Libraries and Information Bureaux.—A business meeting at which it is proposed formally to inaugurate the Association of Special Libraries and Information Bureaux will be held at the Institution of Mechanical Engineers, Storey's Gate, London, at 2.30 p.m. on Monday, March 29th, 1926. All who are interested are invited to attend. The Association is being formed to facilitate the coordination and systematic use of sources of information in science, industry, commerce, and public affairs generally; when fully developed it will function as a clearing house for those wishing to get into touch with specialised knowledge. The Association's first activity is to be the compilation of a Directory of Special Libraries and Information Bureaux in the British Isles. The Carnegie United Kingdom Trustees, in addition to setting aside the sum of £1,500 to assist the Association in the first two years of its work, have generously undertaken to defray the cost of compiling the Directory. Those willing to collaborate with the Association in building up the Directory are asked to communicate with the organising secretary (38, Bloomsbury Square, W.C.1), from whom further information may be obtained.

Liverpool Engineering Society.—It is interesting to note that this Society attained its jubilee in November of last year, having been founded by six pupils of Mr. G. F. Lyster, engineer-in-chief to the Mersey Docks and Harbour Board, in November, 1875. In a paper read on March 3rd, Mr. W. E. Mills reviewed the history of the Society from its commencement; the author himself has been associated with it for 46 years, and was president in 1885. Many distinguished engineers have occupied the presidential chair or have been members of the Society, which last year had a roll of 866 members.

International Congress of Engineers' Councils.—The third International Congress of Engineers' Councils will meet at Warsaw on May 13th.—*Reuter* (Warsaw).

Research in France.—At the last meeting of the French Union des Syndicats de l'Electricité it was reported that the Wire and Cable Committee was engaged on a consideration of the question of tension and bending tests for rubber-insulated cable. The Transformer-Oil Committee has also drawn up a draft scheme of the research work to be entrusted to the Ecole Supérieure du Petrole, in Paris, which, thanks to subscriptions which have been received, can be put in hand at once.

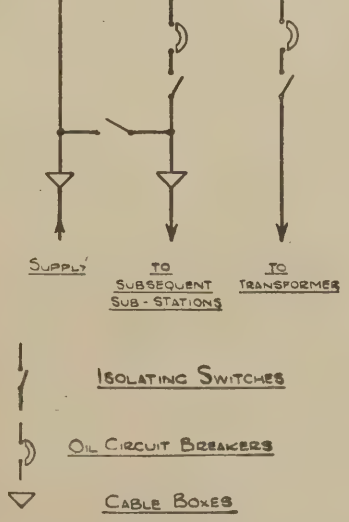
A series of new regulations for the installation, starting, and dismantling of transformers has lately been drawn up by the French Chambre Syndicate des Constructeurs de Gros Matériel Electrique.

A Peculiar Explosion of an Electric Boiler.—Some time ago a case occurred in Canada of an electric boiler exploding, wrecking the house in which it was installed. Difficulty was experienced in tracing the cause of the explosion, but as the result of investigations carried out by Prof. J. W. Shipley and Mr. A. Blackie it has been established that gases of an inflammable and explosive nature can be generated electrolytically in electric water heaters, and the explosion was probably due to this cause. The experiments carried out established without doubt (according to the Canadian *Electrical News*, which publishes a description of the tests) that single-phase, 60-cycle alternating current at either 110 or 220 V will generate gases in aqueous electrolytes, and that these gases are generally of an explosive nature. One typical analysis gave the following results:—Carbon dioxide 10.4 per cent.; oxygen 1.4 per cent.; hydrogen 49.8 per cent.; and nitrogen 38.4 per cent. This mixture was found to be inflammable, and when mixed with 70 per cent. of air was explosive. It is apparent from the composition of the gases generated that their nature depends upon the composition of the electrodes used in the experiments. The metals evolved very little, if any, hydrocarbon gases, while the carbon electrodes gave a considerable percentage of these gases. It was found that the rate of evolution of gas depended upon the spacing of the electrodes, the relation of the electrodes to the shell, the current flowing, the temperature of the electrolyte, and the depth of immersion of the electrodes. The composition of the gas was also found to be a function of the manner of operation of the system; that is, the surge between the electrode chamber, the radiating system and the expansion tank.

In suggesting means for safeguarding against explosions of gases in electric boilers, the investigators consider that it is risky to rely upon the automatic venting of the chamber gases, and all installations of such water heaters should be provided with a water-gauge glass whereby the accumulation of gases retained within the electrode chamber could easily be detected.

A New Element.—It has been announced by the University of Illinois that Dr. B. S. Hopkins, Professor of Inorganic Chemistry, claims, with his assistants, to have isolated from rare earths one of the five elements whose places in the scale of atomic numbers have not, up to the present, been filled. Its place is the 61st in the scale, says *The Times*, the discovery being the result of more than five years of research with special X-ray apparatus.

Simple Sub-station Protection. — The accompanying illustration shows the arrangement of the high-pressure system in each of the sub-stations of the Morecambe Corporation which deal with a 6,600-V, 3-phase bulk supply from the Lancaster Corporation. It will be noticed that the high-



Method of Sub-station Protection.

pressure incoming feeder to each sub-station is taken to the bus-bars merely through a set of isolating switches, the protection for this feeder being at the outgoing end of the previous sub-station. An arrangement of links is provided so that the whole of the high-pressure gear in each sub-station can be isolated for cleaning purposes. The supply is maintained by closing a set of isolating switches which short-circuit the sub-station, as shown on the diagram. The sub-station equipments were supplied by the General Electric Co., Ltd.

The British Association.—The 1927 meeting is to be held at Leeds, and Sir Arthur Keith, Hunterian Professor in the Royal College of Surgeons, is being nominated for the presidency.

An All-Electric Hotel Kitchen.—An interesting all-electric domestic installation, representing 100 kW of total connected load, is to be found at the Greyhound Hotel, High Street, Croydon, where the kitchen has recently been equipped entirely with electrical cooking apparatus. The installation consists of a 24-kW boiling table, made up of twelve double-section plates of equal loadings; one medium-size boiling table of 16-kW loading, comprising eight 2-kW plates; one large double-oven roasting range of 10-kW loading for each oven; and a fish fryer. The last-mentioned apparatus has two pans, each of 6-9-kW capacity. Two bains-marie, of 6.5-kW loading each, are also installed, and a two-compartment, 7.2-kW grill and a ten-gallon, 6-kW stock pot complete the installation. Although it is at present too early to obtain any useful consumption figures, we understand that the hotel



An All-Electric Hotel Kitchen.

management is well satisfied with the results obtained so far. The following figures give the approximate number of meals dealt with weekly by the equipment at present, but these by no means represent the full capacity of the apparatus:—Luncheons and suppers, from 1,000 to 1,500; dinners, from 500 to 700; and staff meals from 500 to 700. The whole of the apparatus was supplied by the Jackson Electric Stove Co., Ltd.

Institution Notes.

Institution of Electrical Engineers.—Informal Meeting.—At the informal meeting on Monday, March 8th, Mr. M. Whitgift was in the chair, when Mr. F. Creedy opened a discussion on "A Recent Development in A.C. Apparatus." The title of the paper did not convey the full significance of the subject, for Mr. Creedy for the first time made public a new type of rotary converter that he has designed, which may have quite notable results. He called it a "Binary Converter" because it combined the two principles of d.c. and induction in one machine. It consists of a stator with a shunt winding and an a.c. basket winding. The armature tapped at three equidistant points forms a short-circuited wound rotor which is rotated by the a.c. winding operating in a d.c. field. The rotor has a commutator and delivers direct current. The ingenious design eliminates induction in the d.c. field coils by having the length of the a.c. pole pitch double that of the d.c. The machine has only been made in small sizes at present, but for the range of ½ kW to 5 kW remarkably good efficiency is claimed. It has been installed for lift work, and it may be made with the drooping characteristic of welding generators. It may be connected without a transformer to any voltage up to 6,000 V to deliver d.c. at any voltage possible to the commutator. A lively discussion followed.

Students' Lecture.—A lecture and demonstration on "The Art of Illumination" is to be held at the Lighting Service Bureau, Electric Lamp Manufacturers' Association, 15, Savoy Street, W.C.2, for Student members of the I.E.E., on April 28th, at 7 p.m. The demonstration will be preceded by a free tea at 6.30 p.m., and each member may invite one friend. Early application for tickets should be made to Mr. J. W. Moffatt, hon. assistant secretary, 21, Lanier Road, Lewisham, S.E.13.

Institution of Civil Engineers.—Annual Dinner.—At the annual dinner of the Institution on March 10th, the Prince of Wales was the principal guest, and proposed the toast of "The Institution," of which he is an honorary member. In the course of his remarks, the Prince referred to the great achievements of British engineers which he had seen in all parts of the world, and recalled the occasion, three years ago, when he opened the capital power station at Rotherham. This station was named after him, and has maintained a high record for efficiency.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. Charles Whillis, M.I.E.E., who for the last five years has been in charge of the Technical Section of the Northern District Superintending Engineer's office and was formerly in charge of the Newcastle South and Carlisle Sections, left Newcastle on March 10th to take charge of an important branch of the Engineer-in-Chief's Office, G.P.O., London. Mr. Whillis's departure took place at short notice, but a large number of members of the staff of the Northern District Engineering Department met in the superintending engineer's office to bid him good-bye and to present him with a bureau of the Chippendale period. The chair was taken by Mr. J. R. M. Elliott, M.I.E.E., superintending engineer of the Northern District. Mr. Elliott recalled the changes which had taken place since Mr. Whillis entered the P.O. service over 30 years ago. Messrs. Baldwin, Andrews, Motyer and Cook expressed the congratulations of the staff. Mr. Baldwin called attention to the fact that Mr Whillis was the second officer from the Northern District who, within the last three months, had been called to take up an important position on the headquarters' staff.

The St. Pancras Electricity Committee recommends granting three months' leave of absence to Mr. Baynes, the chief electrical engineer, upon medical advice.

M. Jan Sramek has recently been appointed the Minister of Posts and Telegraphs for Czecho-Slovakia in place of Dr. E. Franke, who has resigned.

Mr. W. T. Hodgson, electrical engineer, Horsell, has been elected a member of the Woking Urban Council.

The Derby Town Council has increased the salary of its electrical engineer, Mr. T. P. Wilmshurst, from £1,250 to £1,400 per annum.

In view of the growth of the undertaking, the Douglas (Isle of Man) Corporation Electricity Committee recommends increasing the salary of Mr. Bertram Kelly, the electrical engineer, from £500 to £550.

Mr. J. Conrad Fuller, A.M.I.E.E., of the Posts and Telegraphs Departments of the Federated Malay States, has arrived in London on long leave. He is staying at the Engineers' Club, Coventry Street, W.1.

Mr. J. W. Longley, a consulting civil and electrical engineer and chairman of the Bradford Corporation Electricity Committee, was on March 8th unanimously elected to the aldermanic bench to fill a vacancy created by a recent resignation.

Senatore Marconi is reported to be making a good recovery from an operation for internal trouble which he underwent in a London nursing home last week.

Mr. William Hainsworth, commercial assistant in the Stoke-on-Trent Electricity Department, who is leaving to take up a similar position with the Croydon Municipal Electricity Department, has been presented by his colleagues with a silver cigarette case.

Mr. Joseph A. Forde, electrical engineer, has been re-elected, unopposed, a member of the Broadstairs Urban Council.

St. Marylebone Electricity Supply Committee recommends that the salary of Mr. C. H. Smyth (chief electrical engineer), be increased from £1,500 (inclusive) to £1,700 (inclusive) per annum; that the salary of Mr. F. B. Leonard (chief assistant engineer) be increased from £900 (inclusive) to £1,000 (inclusive) per annum; and that the salary of Mr. F. Selley (mains and sales engineer) be increased from £750 (inclusive) to £850 (inclusive) per annum, all as from April 1st, 1926.

Mr. A. Baxendale, depôt superintendent, Rawtenstall Corporation Tramways and Motor Bus Department, has been appointed rolling stock and works superintendent to the Wallasey Corporation Tramways. Mr. Baxendale has been eight years at Rawtenstall, and previous to this, was at Bolton Corporation Tramways.

Obituary.—Mr. W. R. Cooper.—It is with feelings of very deep regret that we learn of the death, which occurred on Monday last at his residence in Tulse Hill, of Mr. William Ranson Cooper, M.A., B.Sc., M.I.E.E., A.M.Inst.C.E., consulting electrical engineer and electrochemist, of Westminster. Mr. Cooper was under the late Prof. W. E. Ayrton at the Central Technical College for three years, after which he was at the Richmond electric supply station. Later he was with Messrs. Latimer Clark, Muirhead & Co., and after a year in the Chemical Department at King's College he joined the staff of Mr. James Swinburne, subsequently becoming a partner in the firm of Swinburne, Cooper & Baillie, consulting engineers. For thirteen years he was editor of the *Electrician*. He was also editor for three years of *Science Abstracts*. Mr. Cooper had served on the Council of the Institution of Electrical Engineers, was a vice-president of the Faraday Society, honorary treasurer of the Physical Society, a member of the Electro-Culture Committee of the Board of Agriculture, and of the Conjoint Board of Scientific Societies. He was the author of numerous books, papers, and contributions to the Press, and was regarded as an authority on the subject of primary cells If we may pay a personal tribute it shall be that we invariably found him a most courteous and amiable colleague. He had been in failing health for some time past, and the end came somewhat suddenly after a seizure. He was 58 years of age.

New Companies Registered.

Eirco, Ltd. (N.I.309).—Private company. Registered in Belfast on February 23rd. Capital, £5,000 in £1 shares. Objects:—To acquire the business of electrical engineers carried on by L. Scop, W. Coulson, and F. A. Newell as the "Electrical Installation and Repairing Co." The directors are:—L. Scop, A.M.I.E.E., 37, Gandore Avenue, Belfast, electrical engineer; W. Coulson, 595, Oldpark Road, Belfast, electrical engineer; F. A. Newell, B.Sc., Templepatrick, Co. Antrim, electrical engineer. Qualification, 100 shares. Registered office: 40, Berry Street, Belfast.

West Insulating Co., Ltd. (212,261).—Private company. Registered March 8th. Capital, £1,500 in £100 shares. Objects: To adopt an agreement between J. Borer and J. R. West, and to carry on the business of agents, brokers, importers and exporters, shippers and manufacturers of or dealers in electrical and mechanical materials, &c. The first directors are:—J. Borer, Bretonbac, Switzerland (president of the Fabrique Suisse d'Isolants, Bretonbac); J. R. West, 45, Brondesbury Villas, Kilburn, N.W.6. The directors for the time being of the Fabrique d'Isolants, Bretonbac, Switzerland, may appoint one director. Qualification (except such nominee), 500 shares. Secretary: E. G. Misani. Solicitors: Castle & Co., 31, Gracechurch Street, E.C.3. Registered office: 31, Gracechurch Street, E.C.3.

H. E. Messmer, Ltd. (212,287).—Private company. Registered March 10th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers' agents, dealers in machinery, scientific and electrical apparatus and instruments, testing apparatus, electrical, power and lighting installations, metal, paper, wood, rubber, glass, textile goods, parts, fittings, &c. The first directors are:—H. E. Messmer, 18, Arthur Street, New Oxford Street, W.C.2, manufacturers' agent (permanent managing director); and Mrs. Alice Messmer, 18, Arthur Street, New Oxford Street, W.C.2. Qualification, 1 share. Solicitors: Dalston, Sons & Elliman, 21, Southampton Street, Bloomsbury, W.C.1. Registered office: 18, Arthur Street, New Oxford Street, W.C.2.

H. D. Douglas & Co., Ltd. (212,323).—Private company. Registered March 11th. Capital, £1,000 in £1 shares. Objects: To carry on business as electrical, mechanical and general engineers, manufacturers, importers and exporters of and dealers in machinery, machine tools, implements and electrical, mechanical and scientific apparatus and accessories, manufacturers of and dealers in electrical insulation fabrics and tapes, oiled silks, linens, cottons and other fabrics, rubber-proofed fabrics, &c. The subscribers (each with one share) are:—H. D. Douglas, 42, Bromley Road, Catford, S.E.6, engineer; and H. C. Rose, 67, Hervey Road, Blackheath, S.E.3, merchant. Solicitors: Frank Simmons & Carter, 98, Salisbury House, London Wall, E.C.2.

West Wales Electric, Ltd. (212,310).—Private company. Registered March 10th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, motor, gas, mechanical, wireless, structural, heating, lighting and general engineers and inventors, constructors and installers of transmission systems, garage proprietors, manufacturing opticians, makers of scientific instruments, &c. The subscribers (each with one share) are:—L. G. Walker, Carregfelen, Portmadoc, electrical engineer; J. N. More, Crown Lodge, Harlech, surveyor; and A. Stokes, Portmadoc, solicitor. L. G. Walker is the first permanent director. Qualification, £50. Remuneration, not more than £50 each per annum. Secretary: L. I. Morgan. Solicitors: Breese, Jones & Cassen, Portmadoc.

Peerless Electrical Manufacturing Co., Ltd. (212,353).—Private company. Registered March 12th. Capital, £10,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical or mechanical or other kitchen and household equipment, food preparing machinery and labour-saving devices, including refrigerating and ice-making machines, ice cream freezers, potato peelers, mincing machines, cake and other food mixers, breaking, making and sausage machines, &c. The first directors are:—F. H. Wright, 1, Golders Green Crescent, N.W.11; and E. Shrubsole, 47a, Regent's Park Road, N.W.1. Qualification, 100 shares. Solicitors: T. V. Howells, 3, Rathbone Place, W.1. Registered office: 167 and 169, Great Portland Street, W.1.

Radioland, Ltd. (212,365).—Private company. Registered March 12th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical and mechanical engineers, manufacturers of and dealers in apparatus, appliances and material relating to or used in connection with radio, or other telegraphy and telephony, gramophones and all kinds of talking machines, &c., to acquire the trade mark "Radiolys." The subscribers (each with one share) are:—E. S. M. Perowne, 7, Great James Street, Bedford Row, W.C., solicitor; F. G. Buckland, 49, Lavender Avenue, Mitcham, clerk; and G. F. Heard, 23, Harewood Road, Colliers Wood, S.W.19, managing clerk. The first directors are to be appointed by the subscribers. Solicitors: Perowne & Co., 7, Great James Street, W.C.1.

Barnes Brothers (Radiex), Ltd. (212,345).—Private company. Registered March 12th. Capital, £3,000 in £1 shares (1,500 10 per cent. preference and 1,500 ordinary). Objects: To acquire the business of scientific instrument manufacturers carried on by P. J. Barnes and F. S. Barnes, trading as Barnes Brothers, at Radiex House, Heygate Avenue, Southend-on-Sea, and to carry on this and the business of radio and general electrical and mechanical engineers, &c. The first directors are:—P. J. Barnes, 10, Beedell Avenue, Westcliff-on-Sea, Essex; and F. S. Barnes, "Trenholme," Thorpe Hall Avenue, Thorpe Bay. Qualification, 50 shares. Secretary: F. S. Barnes. Solicitor: H. B. Snow, 51, High Street, Southend-on-Sea. Registered office: "Radiex" House, Heygate Avenue, Southend-on-Sea, Essex.

Silgolum, Ltd. (212,335).—Private company. Registered March 11th. Capital, £500 in £1 shares. Objects: To acquire the trade mark "Silgolum," to adopt an agreement with R. Wellesley, and to carry on the business of electrical, hydraulic and mechanical engineers and contractors, producers and suppliers of electrical energy, manufacturers of machinery, &c. The first directors are:—C. R. Watson, 8, Sherwood Road, Wimbledon, S.W.19, accountant (permanent chairman), and H. C. Wright, 9, Mincing Lane, E.C.3, incorporated accountant. Qualification, £10. Remuneration as fixed by the company. Secretary: H. C. Wright. Registered office: 9, Mincing Lane, E.C.3.

Official Returns of Electrical Companies.

Robert Crust, Ltd. (184,087).—Capital, £1,000 in £1 shares. Return dated September 22nd, 1925. All shares taken up. £699 paid. £301 considered as paid. Mortgages and charges, nil.

Dartmoor Electric Supply Co., Ltd. (110,871).—Capital, £2,000 in 10s. shares. Return dated November 5th, 1925. All shares taken up. £2,000 paid. Mortgages and charges, £4,000 of 4½ per cent. first debentures; £3,950 of 6 per cent. second debentures (£3;550 held by bank as collateral security).

John Spencer, Ltd. (56,764). — Capital, £75,000 in £5 shares (10,000 preference and 5,000 ordinary). Return dated May 21st, 1925 (filed February. 17th, 1926). 10,000 preference and 1,027 ordinary shares taken up. £55,135 considered as paid. Mortgages and charges, £25,000.

Herbert Smith & Jones, Ltd.—E. H. Smith, of 24, Sedgeford Road, Old Oak Road, London, was appointed receiver and manager on February 24th, 1926, under powers contained in debenture dated May 4th, 1925.

W. E. Booton, Ltd.—Mortgage dated February 22nd, 1926, to secure £3,000 charged on warehouse and premises, No. 9, Wanlip Street, and three messuages adjoining numbered 3, 5 and 7, Wanlip Street, Leicester. Holder: H. Pratt, Nicholas Street, Leicester.

Electrical Specialities Co., Ltd.—F. C. Young, of 45, Bank Street, Sheffield, ceased to act as receiver or manager on March 2nd, 1926.

Coates & Co. (Sheffield), Ltd.—F. C. Young, of 45, Bank Street, Sheffield, ceased to act as receiver or manager on February 28th, 1926.

W. J. Tough & Partners, Ltd.—E. J. Barnes, of 24, Cambridge Road, W.4, ceased to act as receiver or manager on October 21st, 1925.

Interchangeable Electric Signs, Ltd.—Particulars filed of £4,380 debentures, authorised February 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Underground Electric Railways Co. of London, Ltd.

Lord Ashfield presided at the annual meeting on March 11th, and in presenting the report and accounts said that an agitation had sprung up among the independent omnibus proprietors in opposition to the proposals of the Minister of Transport to restrict the number of omnibuses upon the streets of London. That was a matter of serious importance to men who had perhaps invested all their savings in their omnibuses. As there was no provision for compensation under the London Traffic Act, the Minister had suggested that omnibus owners should set up a voluntary fund from which assistance could be provided for those who suffered financial loss from the restrictive methods. The company was agreeable to participate in such a fund. The chairman then reviewed the past year's working of the companies in which the company was interested, including the North Metropolitan Electric Power Supply Co., stating that the income from investments had declined by £53,000. The total capital of the companies was now £66,430,000, and of this the public held 68 per cent. and the company and its associates 32 per cent. Dealing with the company's capital, Lord Ashfield referred to the fact that when the 4½ per cent. bonds and 6 per cent. income debenture stock were issued, with the interest paid free of tax, the income-tax was only 1s. in the £, whereas it was now 4s., apart from the disparity between the British and American exchanges which had occurred in the meantime. For 24 years £5,000,000 of the capital invested in the company had received no return whatever. He was prompted to believe, however, that there were better times ahead; the company was getting into a position in which the chances of a dividend were distinctly encouraging. The amount carried forward was £146,000, and it had grown slightly each year. The prospects of the subsidiary companies were growing brighter, and the conservative policy which had been followed in past years was beginning to bear fruit. They had to straighten several things out before they commenced paying an ordinary dividend, for once that was commenced they wanted to continue it. At the moment he had no definite capital reorganisation scheme to lay before them, but the matter was receiving serious consideration.

County of London Electric Supply Co., Ltd.

The balance available for 1925, after meeting all expenses and adding £74,399 brought forward, is £798,218. Debenture interest and sinking fund absorbs £72,795; £70,000 is carried to contingencies reserve; £150,000 is placed to reserve for depreciation, renewals, &c.; £335,000 is transferred to general reserve; leaving a balance of £170,424, to which is added £108,337 interest on share capital chargeable to "Barking Supply," making £278,761. After providing for preference and interim ordinary dividends, it is proposed to pay a final dividend of 10 per cent. on the ordinary shares (making 15 per cent. for the year), and to carry forward £24,098. The applications received during the year amounted to the equivalent of 25,187 kW in respect of general business and bulk and railway supplies, making the total at December 31st 166.394 kW. The amount of energy sold increased from 78,840,134 kWh to 93,845,622 kWh. The total number of consumers supplied directly or indirectly by the company shows an increase for the year of 8,391, and the total is now over 70,000. The report makes reference to the opening of the Barking station by H.M. the King; the issue of £2,000,000 of 6 per cent. cumulative preference shares; the passing of the London Electricity Supply (No. 1) Bill; the appointment of Mr. A. Page, M.I.E.E., as an additional director, &c. The meeting is to be held on March 23rd.

Para Electric Railways and Lighting Co., Ltd.

The report for the year ended November 30th last shows that the net revenue was £60,311, as compared with £33.664 in the preceding year. After deducting London expenses and debenture interest the result is a net profit of £17,354, as compared with a deficit of £11.209. During the year debenture interest payments were brought up to date; the sinking fund is still three years in arrears. The Para Municipality has sanctioned a revision of fares, and the outlook is said to be more hopeful.

British Insulated Cables, Ltd.

The directors' report for the year ended December 31st last records a profit of £670,000, to which is added £221,710 brought forward, making £892,010. After deducting directors' fees, debenture interest, preference and interim ordinary dividends, &c., and allocating £75,000 to depreciation and £333,333 to reserve, there remains a disposable balance of £358,251. As we have already reported, the directors recommend a final dividend of 5 per cent., and a bonus of the same amount on the old ordinary shares (making 15 per cent. for the year), and a dividend of 5 per cent. and a similar bonus on the new ordinary shares, leaving £224,918 to be carried forward. The directors state that the substantial increase in profit is due to a number of causes, including increased turnover, new plant and buildings, enhanced efficiency, and the satisfactory completion of some long-term contracts. Reference is made to the capitalisation of £333,333 of the reserve and its issuance in the form of ordinary shares as a bonus. The meeting is to be held in Liverpool on Monday next.

Brompton and Kensington Electricity Supply Co., Ltd.

The revenue account for 1925 shows a balance of £57,633, to which is added interest amounting to £347 and a balance of £4,982 brought forward, making £62,962. The payment of the interim dividends left £48,081, which it is recommended should be dealt with as follows:—To depreciation account, £4,463 (making £100,000); to reserve fund, £28,700 (making £58,700); final preference dividend, £270; final ordinary dividend at the rate of 10 per cent., free of tax (making 10 per cent., free of tax, for the year); carried forward, £33. The connections (35-W lamp equivalent) rose from 561,559 to 591,768, and the number of consumers from 9,389 to 9,723. The average price obtained per kWh fell from 4.91d. to 4.86d. Reference is made in the report to the reorganisation schemes. The meeting was to be held yesterday (Thursday).

Bristol Tramways and Carriage Co., Ltd.

The revenue for the past year amounted to £1,041,410 and expenses to £937,122. The net revenue, including the balance brought forward, is £108,925. Debenture interest and preference and interim ordinary dividends absorbed £65,510, and it is proposed to deal with the balance, £43,414, as follows:—Final dividend of 4 per cent. on the ordinary shares (making 7 per cent. for the year); £10,000 to reserve for contingencies and renewals; leaving £5,414 to be carried forward. The reserve fund now stands at £360,332. The receipts of the tramway department showed an increase of £16,413 and those of the carriage department one of £47,146. The number of passengers carried during the year rose from 91,484,503 to 99,846,603. The report refers to the death of Mr. H. F. Cooper, who had been with the company for 40 years, 25 as secretary. The meeting was to be held yesterday (Thursday).

Metropolitan Electric Supply Co., Ltd.

The report for the past year records a gross revenue of £732,842 and expenses amounting to £309,044, leaving net revenue of £423,798, as compared with £392,372 in 1924. To this is added a balance of £10,806 from the previous account and interest, &c., amounting to £26,074, making £457,678. From this £200,000 is placed to the depreciation and reserve account, and, deducting debenture interest, pensions fund provision, preference and interim ordinary dividends, &c., there remains £91,750. It is proposed to pay a final dividend of 8 per cent. on the ordinary shares (making 11 per cent. for the year, as in 1924) and to carry forward £11,750. The total connections increased by 13,780 kW during the year, bringing the total to 95,479 kW. £392,807 was spent on capital account.

Clyde Valley Electrical Power Co.

The report for the year ended December 31st last records a balance of profit of £291,741, to which is added £63,878 brought forward, making £355,619. After paying the preference and interim ordinary dividends, and transferring £90,000 to the contingency fund and £46,500 to the second preference share special reserve, there remains a balance of £145,369, which it is proposed to allocate as follows:—Final dividend on the 6 per cent. preference shares, £9,000; final dividend of 5 per cent. (making 8 per cent. for the year) on the ordinary shares, £53,250; writing off balance of 1924 share issue, £695; provision for altering and furnishing new offices and showroom, £15,000; carried forward, £67,424. The additional 25,000-h.p. turbo-alternator referred to in the previous report is about to be put into operation at Clyde's Mill. The construction work at the Falls of Clyde is progressing satisfactorily, and it is anticipated that the power stations will be in operation in about 12 months' time. A clause protecting the company's interests was obtained in the Glasgow Boundaries Act, 1925. The meeting is to be held on March 24th.

German Companies.

The *Elevated and Underground Railway Company*, of Berlin, states that the net profits for 1925 amounted to 8,800,000 marks, as compared with 6,110,000 marks in the preceding year. The dividend is increased from 5 per cent. to 7 per cent.

The *German Telephone Works and Cable Industry Company*, Berlin, reports that although the degree of activity in 1924-25 was not uniform, it was satisfactory on the whole. The accounts show net profits of 476,000 marks and permit of the payment of a dividend at the rate of 6 per cent. No distribution was made in the previous year.

The *Electro-Works Company*, which is owned by the Reich, states that the extension of the works was continued in 1925, and after the completion of the developments in hand the total capacity in Zschornewitz and Lauta will amount to 400,000 kW. The total production showed a satisfactory increase, while the mines turned out 3,800,000 tons of crude lignite. The net profits increased from 4,450,000 marks in 1924 to 5,000,000 marks last year, and the dividend is increased from 7 to 8 per cent.

The *Siemens and Halske Company* reports gross profits and balance forward amounting to 9,591,000 marks for 1924-25, as compared with 3,321,000 marks in the previous year. The net profits are returned at 8,894,000 marks, as against 2,649,000 marks in 1923-24. It is proposed to pay a dividend at the rate of 6 per cent. No distribution was made in the preceding year.

The *Electricity Company* (*late Schuckert*), of Nuremberg, records receipts totalling 2,806,000 marks as against 1,088,000 marks in 1923-24, and a net profit of 1,979,000 marks, permitting of the distribution of a rate of 4 per cent. as compared with *nil* in 1923-24.

Belgian Company.—*Société Internationale d'Energie Hydro Electrique.*—This company issued during the week an advertisement, in compliance with Stock Exchange requirements, setting forth particulars of its constitution and objects. The latter are to found, acquire, operate, &c., transport or allied undertakings. It has important holdings in the Barcelona Traction, Light and Power Co., Ltd., the Mexico Tramways Co., Ltd., the Mexican Light and Power Co., Ltd., and the Société d'Electricité de la Région de Malmèdy (Serma). It has an authorised and issued capital of 162,500,000 fr., in addition to 40,000 founders' shares of no nominal value.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Hopkinsons.—350,000 ordinary shares of £1 each, partly paid and fully paid, Nos. 350,001 to 700,000. 360,000 7 per cent. cumulative preference shares of £1 each, partly paid and fully paid, Nos. 1 to 350,000.

The undermentioned have been ordered to be officially quoted:—

Singapore Traction Co.—71,469 ordinary shares of £1 each, fully paid, Nos. 93,740 to 165,208, and 47,110 7 per cent. cumulative preference shares of £1 each, fully paid, Nos. 152,891 to 200,000.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the register at the expiration of three months unless cause is shown to the contrary:—

Blooms (Wireless), Ltd.
Broadcast Wireless Co., Ltd.
Car Electrical Service, Ltd.
Electricians, Ltd.
Expert Electrical Co., Ltd.
Magniphone Co., Ltd.
Manchester Wireless Installation Co., Ltd.
Wilton Wireless Co., Ltd.
Wireless Telephones, Ltd.

Imperial Tramways Co., Ltd.—After paying debenture interest and the interim preference dividend the balance available from 1925 is £14,686. The remainder of the 6 per cent. preference dividend is to be paid, £6,048 is transferred to the reserve for depreciation and contingencies, and a balance of £3,838 is carried forward. A dividend of 7 per cent. was received by the company in respect of its holding of ordinary shares in the Bristol Tramways & Carriage Co., Ltd., but the London & Suburban Traction Co., Ltd., was unable to pay any dividends. The meeting is to be held to-morrow (Saturday).

Newcastle and District Electric Lighting Co., Ltd.—After meeting debenture and loan interest, allowing £20,000 for depreciation, and adding £6,000 to general reserve, there is a net profit of £16,380 for the past year. To this is added £15,834 brought forward, making £32,214. The directors recommend the payment of a dividend of 7 per cent., leaving a balance of £15,544 to be carried forward. A further amount of £4,300 of the second mortgage debentures was redeemed and loans amounting to £2,994 were repaid during the year. Meeting: To-day (Friday).

Arbroath Electric Light and Power Co., Ltd.—The annual report states that the profits for the past year were £6,759, to which is added £1,212 brought forward making £7,971. The directors proposed to apply £2,000 to reserve and renewals fund, making the amount £24,500; to pay a dividend of 8 per cent. per annum on the ordinary shares; to pay an additional dividend of 1 per cent. on the preference shares, making 6 per cent.; and to carry forward to next year's accounts £1,654. The meeting was held on March 12th.

British Electric Transformer Co., Ltd.—The directors propose to pay the preference dividend of 7 per cent. for the two years ended June 30th, 1925. (Six months' dividend already paid.)

Notting Hill Electric Lighting Co., Ltd.—Final dividend of 10s. per share, free of tax, on the deferred shares, making 14s. for the year, as in 1924.

British Aluminium Co., Ltd.—Final dividend on the ordinary shares at the rate of 12 per cent. (making 10 per cent. for the year), and a bonus of 2½ per cent.

Chelsea Electricity Supply Co., Ltd.—The profit for the past year was £67,062 and the addition of the balance brought forward and interest makes a total of £76,854. Debenture interest and interim dividends absorbed £16,283 and it is proposed to deal with the balance (£60,571) as follows:—To reserve for renewals &c., £17,000; to reserve fund, £24,000; final preference dividend, £900; final dividend at the rate of 15 per cent. on the ordinary shares (making 12 per cent.), £18,539; carried forward, £132. The amount of energy sold rose by 561,013 kWh to 7,092,550 kWh. The report refers to the passing of the London Electricity (No. 2) Act and to the death of Major W F. Woods, a director, whose place has been taken by Mr. P. D. Tuckett. The meeting is to be held on March 24th.

Woking Electric Supply Co., Ltd.—The report for 1925, which was presented at the annual meeting on March 10th, showed a balance of £33,422; the addition of £1,963 brought forward made available £35,386. After meeting taxation and debenture interest and paying the dividends on the three classes of preference shares, there remained a balance of £24,546, which it was decided to allocate as follows:—To depreciation and renewals fund, £8,000; to reserve account, £8,000; to change-over account, £4,000; dividend of 10 per cent., free of tax, on the ordinary shares; carried forward, £1,825. The number of consumers rose from 3,218 to 3,451, and the lamps connected from 261,489 to 275,602. The report made reference to the death of Mr. J. Ashby, a director.

Tynemouth and District Electric Traction Co., Ltd.—The total revenue for 1925 was £46,123 and the expenditure (including £5,000 for renewals) was £39,450. To the balance is added £1,862 brought forward, giving £8,535. It is proposed to pay the 5 per cent. preference dividend and one of 10 per cent. on the ordinary shares, leaving £2,369 to be carried forward. Meeting: March 22nd.

Bruce Peebles & Co., Ltd.—The profit for 1925, including the balance brought forward (£9,141), was £58,131. It is proposed to transfer £5,000 to taxation reserve, £5,000 to depreciation reserve, and £10,000 to general reserve; to pay a dividend of 10 per cent. on the preference and ordinary shares and a bonus of 5 per cent. upon the latter (as in 1924); and to carry forward £8,655.

Tees Power Station Co., Ltd.—The company's profits for 1925 were £85,693, and the addition of £1,231 brought forward makes £86,924. After meeting debenture interest and transferring £20,000 to reserve, the directors recommend a dividend of 3¾ per cent., leaving a balance of £1,764 to be carried forward. The previous dividend was at the rate of 2¼ per cent. The meeting was held on Wednesday last.

Hastings and District Electric Tramways Co., Ltd.—The report for 1925 shows a profit of £11,430, to which is added £1,284 brought forward, making £12,716. It is proposed to pay a dividend of 2½ per cent. on the ordinary shares, to allocate £2,500 to depreciation and £500 to the reduction of the suspense account, and to carry forward £1,562.

County of Durham Electrical Power Distribution Co., Ltd.—A profit of £44,764 was made during 1925. Debenture and loan interest, &c., absorbs £12,542, and a balance of £2,119 from the last account is added, making £34,341. It is proposed to pay a dividend of 6 per cent. and to carry forward £2,242.

Alley & Maclellan, Ltd.—The preference shares are to receive their second half-year's dividend, but the directors do not recommend any distribution on the ordinary shares. £10,317 is allocated to depreciation and £12,332 is carried forward.

Western Union Telegraph Co.—A quarterly dividend of $2 per share has been declared. The company proposes to increase its capital by $5,000,000 in connection with the employés' stock subscription scheme.

Metropolitan-Vickers Electrical Co., Ltd.—A dividend of 8 per cent. is recommended on the ordinary shares, as in 1924. The meeting is to be held on March 23rd.

Stewarts & Lloyds, Ltd.—Out of the past year's profits the directors propose a dividend of 7½ per cent. on the deferred shares, as against 12½ per cent. in 1924.

Manila Electric Co.—A dividend of 50 cents per share has been declared on the common capital stock for the quarter ending March 31st.

Stocks and Shares.

Monday Evening.

The dividends and reports of the companies dealing with electricity supply and electrical power distribution in respect of the year 1925 may be considered as extremely satisfactory. The reports are now virtually all issued, the dividends announced and, in some cases, the meetings held. On all hands the tale is the same; increased demand, willingness on the part of the public to use the "juice"; opportunities that open up fresh developments in every direction. There are very few branches of industry in this country that command anything like the same amount of hopefulness as the electrical trade has done, and is doing.

The County of London Electric Supply Co., Ltd., increased its net revenue from £650,500 to £723,800, and again paid 15 per cent. dividend on the ordinary shares, the same rate as that distributed in each of the two preceding years. For 1926 the dividend will be limited to 10 per cent. on the shares, but the reserves are to be capitalised, of course, and parcelled out amongst the shareholders, dividends on such capital being duly paid. Shareholders who look for no diminution in their income are not likely to be disappointed. City of Londons are lower at 45s. 9d., Bournemouth & Poole went back to 60s. 9d. A few sixpenny falls occurred in other shares, amongst them being Clyde Valley at 29s. 6d. The Clyde Valley report shows that the revenue from sales increased last year about 3½ per cent., and the company retained a fair amount, the dividend on the ordinary shares being kept at 8 per cent., in spite of the extra capital now ranking.

The Newcastle & District Lighting Co., of course, has nothing to do with the Newcastle-upon-Tyne Supply Company, being confined to the city and a few suburban areas. The dividend of 7 per cent. is ½ per cent. higher than that of last year, and compares with 6 per cent. for 1923. The ordinary shares stand at 20s., and the Company's 4½ per cent. mortgage debenture stock at 80.

The Tees Power Station is a subsidiary of the Newcastle-on-Tyne Supply Company, and has increased its dividend from 2¼ per cent. to 3¾ per cent. The Company's 6 per cent. first mortgage debentures are quoted at 102. The Newcastle-on-Tyne Electric Supply Company repeats its previously paid 7 per cent. on the ordinary capital, now much larger than it was a year ago. The profits for 1925 were £701,700, or £41,000 higher than those of 1924.

The Eastern Telegraph Company has declared its usual dividend of 2½ per cent. tax free for the quarter, and the Eastern Extension Company the same. Both of these are the final dividends for the year. Eastern Extensions are ½ down at 18, while Eastern ordinary shows no change at 177½. Westerns are dull at 17⅝. Anglo-American deferred is a little lower at 23⅝. A florin fall in Automatic Telephones reduced the price to 50s. Orientals are easier at 2 1/16. Weakness in Marconis reduced the price to 22s. 6d., the market failing to make any headway against the continual stream of sales which filters in from holders disappointed at the incessant sagging of the price. Radio common are 7½, the preferred 9½, and Canadian Marconis 4s. 4½d.

British Insulated ordinary at 3 3/16 have risen the fraction, and there has been substantial buying of the shares during the past few days. India Rubber shares are a little lower at 1 3/16, from which it might appear as though some of the proprietors had been selling their shares in order to apply for the company's 5 per cent. first mortgage debenture, issued at 93 and redeemable in 1936. The debenture stock is an excellent investment and pays—oddly enough—better interest on the money for the time being than the shares afford, though it is scarcely necessary to say that expectation looks for a higher dividend on the latter in the future. Small declines occurred in Siemens, Metropolitan-Vickers ordinary and Babcocks, owing to the fear of the threat of an engineers' lock-out being put into effect, although the latest news suggests a hope that it may not take place after all. British Aluminium are good at 39s. 6d., and Callenders strengthened to 3 9/16.

A prospectus has been circulated of a new issue of Electric Light and Power Extension capital of 8 per cent. cumulative preference shares in the Wareham Electric Supply Co., Ltd. Another of the same sort is the prospectus of the South Midlands and Berkshire Electric Light and Power Co., in which preference shares and debentures are offered. These are both parts of the same group of companies which we have criticised on previous occasions, the chairman of each being Sir Charles B. H. Soame, Bart. Investment should give the issues a wide berth.

Lord Ashfield, at the meeting of the Underground Electric Railways of London, caused disappointment by not outlining a scheme for the reorganisation of the Company's capital. The shares had risen on the anticipation that he would propound such proposals, but the prices, while reacting from the best, retain improvements on balance. His Lordship did definitely declare, however, his hope that next year there may be at last a dividend on the Company's ordinary and "A" shares. Metropolitans and Districts are both lower. The tramway issues hold their rises of last week, but have made no further progress. British Electric Traction has risen 5 points. Of the foreign shares, Brazilian Tractions are unchanged at 94. Para Electric Railways & Lighting shares have stiffened to 5s. on a report which shows the Company to have secured a profit last year of £17,300, against a loss of £11,300 in 1924.

Mexican Utilities are weak, the position in Mexico appearing to become worse instead of better. The various American Utilities, which underwent sharp falls in the New York panic of a fortnight back, have regained most of their declines. Rubber shares are higher, thanks to a recovery to half-a-crown per lb. in the raw product. The infusion of greater cheerfulness into the market, caused by this improvement, has not led to any great expansion of business. It may be said, in point of fact, that all markets in the Stock Exchange are suffering from want of public orders, the reluctance to deal being mainly due, of course, to the very unsettled state of affairs that prevails in too many directions at home and abroad.

Share List of Electrical Companies.

	Nom.	Dividend. 1923	Dividend. 1924.	Price Mar. 15. 1926.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	13	14	60/9	—1/3	4 12 2
Brompton Ordinary	1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	1	14½	15	46/6	+9d.	6 9 0
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2 3/8	—	5 12 11
City of London	1	15	15	45/9	—1/3	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	2 5/6	—6d.	5 8 6
County of London	1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—1/-	6 1 9
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	14	15	14½	—	5 5 3
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-xd	—	6 5 0
do. do. 6% Pref.	5		6	5 3/8xd.	—	5 11 7
Metropolitan	1	10	11	39/6	—	5 11 4
do. 4½% Pref.	1	4½	4½	17/-	—6d.	5 5 11
Midland Counties	1	5½	6	21/6	—9d.	5 11 7
Newcastle-on-Tyne Ordinary	1	6	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	1£7/xd.	—	5 13 10
South London	1	15	15	2 5/16	—	5 17 1
South Metropolitan Pref.	1	7	7	25/6	—9d.	5 9 10
Urban Ordinary				19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	45/-xd.	—	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	29/-	—	5 10
Home Rails.						
Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	4	5	65	—1½	7 13
do. District	,,	3½	3½	45½	—½	7 13 10
Underground Electric Ordinary	10	Nil	Nil	2 3/8	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	8/6	+6d.	Nil
do. do. Income	Bonds	6	6	97xd.	—	*6 3 9
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23 3/8	—⅛	6 7 0
Automatic Telephone	1	8	6	50/-	—2/-	2 13 0
Chili Telephone	5	6	5	6 7/8	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—⅛	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 9 7
do. do. Pref.	10	6	6	10⅜	—¼	5 12 11
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	22/6	—1/3	8 17 10
Marconi Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	2 1/16	—1/16	*5 16 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17⅜	—⅛	*5 13 6
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 3/16	—	8 12 6
do. do. 2nd Pref.	5	6	6	2 1/16	—1/16	11 3 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	122½	+5	4 18 0
do. do. 6% Pref.	,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	94	—	5 6 5
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	103½	—	*4 11 9
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4¼	4¼	78	—	5 9 0
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	60½xd.	—	8 5 4
Mexican Light Common	100	Nil	Nil	30½	—2	Nil
do. Pref.	100	Nil	Nil	61½	—3	Nil
do. 1st Bonds	—	5	5	68½	—1	7 6 0
Yorkshire (West Riding)	1	5	—	14/-xd.	—1/-	7 2 10
Manufacturing Companies.						
Babcock & Wilcox	1	12	12	52/-	—1/9	*4 12 4
British Aluminium Ord.	1	5	10	39/6	+9d.	4 14 1
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3 3/16	+ 3/16	5 0 0
Brush Ord.	1	10	10	26/3	—9d.	7 12 4
Callenders	1	15	15	3 1/16	+1/16	4 4 3
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/3	—	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/6	—	5 2 7
do. do. Pref.	1	6	6	20/-	—	6 0 0
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
,, Ord.	1	5	7½	31/3	—	4 16 0
Henley	1	15	16	3 5/8	—	4 8 3
do. 4½% Pref.	5	4½	4½	4½xd.	—	5 6 0
India-Rubber	1	5	5	1 3/16	—1/16	*4 4 3
Johnson & Phillips	1	10	10	2 1/8	—	3 8 3
Met.-Vickers, Ord.	1	8	8	26/3	—9d.	6 1 11
do. Pref.	2	8	8	2 7/16	—	6 11 3
Siemens Ord.	1	—	7½	30/6	—9d.	4 18 4
Telegraph Construction	12	20	10	29	—	*4 2 9

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price March 16th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5½d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,, ,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			...
Grade I	per ton net.	£266	£2 inc.
Grade II	,, ,,	£186	...
Grade III	,, ,,	£102	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9/16d.	¼d. dec.
c ,, Tubes (solid drawn)	,,	1/- to 1/0¼	...
c ,, Wire, basis	,,	10¼d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£66	5/- dec.
d ,, ,, Sheets	,,	£143 10s.	...
a ,, ,, Wire Rods	,,	£76	25/- dec.
d ,, ,, H.C. Wire	per lb.	9 5/16d.	...
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/2½	1½d. dec.
i Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£32 15s.	15s. dec.
g Mercury	per bot.	£14 10s. to £14 15s.	5s. dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings		1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/3½	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	,,	7¾d.	...
n Tin, Block (English)	per ton.	£295 15s. to £296 15s.	£3 inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	2d. inc.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Recrystallisation of Electrolytic Iron.—The stamping and drawing of metal sheet into various, and sometimes rather complicated, shapes plays a very important part in manufacturing operations. Low-carbon steel or open-hearth iron sheets are usually employed commercially for this purpose, but electrolytic iron sheet has recently been advocated as a very suitable material for such operations. Preliminary annealing of the sheet prior to stamping or drawing is necessary; in addition, intermediate annealing between different stages in drawing, in order to remove the "work hardness" and enable the sheet to withstand the deformation of subsequent stages, must often be resorted to. As a bearing on this problem a study has recently been carried out by the Bureau of Standards of the recrystallisation temperature of cold-rolled electrolytic iron and open-hearth steel strip; the mechanical properties of the cold-rolled materials after annealing at various temperature intervals up to 700 deg. C. (1,290 deg. F.) were determined and the microstructural changes were studied. The results showed that the electrolytic iron sheet of the composition used was noticeably lower in its recrystallisation temperature than the open-hearth steel sheet which was compared with it. A marked recrystallisation was noted in severely cold-rolled electrolytic iron sheet after it had been annealed for half-an-hour at 500 deg. C., together with pronounced softening of the work-hardened sheet, whereas a similar change in the open-hearth steel sheet was not noted until after it had been annealed at 600 C. for half-an-hour. This difference in the recrystallisation temperatures of the two materials (100 deg. C.) may prove to be a factor of considerable importance in promoting the use of electrolytic iron sheet.—*Reuter's Trade Service* (Washington).

The Need for Statistics of the Electrical Industry.

By HARRISON DENT.

Adequate statistics are essential to efficient production and marketing. The electrical industry, in common with most industries in Great Britain, lacks a central source of classified statistics. There are many bodies which carry out development work on behalf of sections of the industry, but as yet their activities have been confined to limited attempts at recording useful data and movements.

Recently the B.E.A.M.A. has been developing this work, the E.D.A. has attempted to carry out investigations in Great Britain, and the E.L.M.A. has fostered the use of electric lighting through researches. In addition, the Electrical Review independently publishes and analyses data on foreign markets for electrical goods and on annual growth of electrical exports.

It would seem, however, that there is a need for a centralised bureau which should act for the whole industry, collect and classify data, issue reports on growth, and trend and carry out studies of home and foreign markets.

When we turn to U.S.A. we find that there is far more knowledge for trade consumption about the development of the electrical industry and about the markets for electrical merchandise.

Consider the home market for domestic electric appliances. It is obviously inefficient to advertise these goods in districts where electricity supply is lacking, very little developed, or too costly for the economical operation of common domestic appliances. It is equally inefficient to produce such appliances in quantity and to attempt to sell them in localities which constitute "unknown markets" in the sense that the degree of usage of electrical power and of electric domestic appliances is unknown, and the trend of growth uncharted.

If we attempt to apply engineering methods to marketing and distribution, and this surely is most essential, we shall look round for some gauge or yardstick which may indicate where the best market lies and where we should avoid setting up a distribution point.

In attempting to plan a scientific analysis of the market, we must obtain true indices; the number of supply authorities in a given area, the total private consumption of electrical power, the total domestic consumption of electrical power, the number of private consumers of electricity, consumption *per capita*, development programmes of the authorities, the number of electrical retailers, and the quantity of various electrical appliances sold per annum. These are figures which will tell us what we want to know about our market, and if we can obtain them over a period of years, we shall have valuable indices of growth and trend for each area considered and overall. Apart from this information purely relating to the industry, it is advisable to obtain data of a more general character concerning population, its classification, density, and distribution, and general indices of richness of the community such as rateable value per head of population, &c. Further essential data are the cost per unit of each supply undertaking for light and for power, and the local cost per therm or per 1,000 cubic feet of gas supply.

Given this collection of figures, we can analyse it and determine by logical means where the most favourable markets lie and where we should attempt to sell our merchandise.

We have arrived at a point at which we have tabulated the categories of desired data, and our search for these data commences.

Where are the data?

Much of this information is systematically collected by the Electricity Commissioners, and appears in their periodical reports.

Supply authorities are recorded also in "Garcke's Manual," in "The Electrician Annual Tables," and in "The Electrical Engineers' Year Book," and figures of consumers are most fully recorded at the back of the last-mentioned publication, although partially recorded in the other two publications. However, there are gaps in all of them, for it appears that certain supply authorities refuse to give these figures for public consumption, although the reason for this reticence is difficult to understand (if there is a reason).

All these available records must be combined and built up into figures which shall represent territory units, for they are not classified under counties. The total consumption for private supply is recorded in the *Electrical Times* supplements on supply authority results, but there is no separate record kept by companies of domestic consumption, and such records are not practicable universally. The only gauge of this factor is the load increase above normal, which supply authorities receive who have specially developed the domestic business.

Per capita consumption is an index of the degree to which electrical power is consumed by the individual consumer, and is more an index of industrial electrical development than domestic. However, it is logical to assume that in districts where the industrial load is very high, the cost per unit to the individual consumer is likely to be low, and hence the inducement to purchase on the part of the domestic consumer will be strong.

Records of electrical retailers in districts are contained in "The Electrical Engineers' Year Book." Concerning the quantities of various electrical appliances sold, this information cannot be gathered without employing the questionnaire system and circularising all retailers as to quantities, makes, and types sold. Given a good response to such circularisations, this method is most valuable to enable manufacturers and retailers to estimate the trend of consumption and taste throughout the country.

Statistics relating to the price of electricity and gas are of great value for competitive purposes. It is estimated by the E.D.A., after considerable test, that electricity can compete on costs with gas when the ratio of cost per therm to cost per kWh is about 8:1. In the instance of cost of gas being recorded in 1,000 cubic feet, the ratio should be about 30:1. These figures provide a guide from the view point of economical operation alone, and it is obvious that in instances when gas is slightly cheaper to use than electricity, the advantages of the latter as a form of power must outweigh the difference in cost.

It is admitted that apart from purely statistical considerations, an exhaustive study of any given locality should include a study "on the spot" to determine the local taste, local activities of electrical undertakings, &c., which will exert a bias on the conclusions derived from a purely mathematical analysis. However, this statement does not imply any doubt as to the value of such an analysis. The "local characteristics" study is a supplement and not a substitute.

We see that the work of securing these all-important data is considerable, for it involves reference to many sources, questionnaire methods, and the laborious compilation of numerous statistics into statistics representing counties or similar areas. This work forms part of an electrical development campaign, and is worth investigating by a central body for the benefit of the trade.

We have taken the domestic appliance field as one example, but the illustration is typical of the methods that could be applied to every other branch of electrical manufacturing and merchandising. For foreign

markets we need data on imports of the lines concerned, and on power development in a parallel manner.

The supply of useful data for gauging markets at home and abroad is carried out by many other bodies, the activities and resources of which are not fully appreciated. The Board of Trade, and that most useful and energetic department, the Department of Overseas Trade, work continually on behalf of the British manufacturer and trader. Import and export statistics for Great Britain and every other country are available for all British inquirers. Special information concerning agents and traders abroad, special studies of particular trades or commodities, reports on economic conditions abroad—these are a few of the manifold activities of the Department of Overseas Trade.

Another body which carries out a wide service for industry and trade is the Federation of British Industries. The *Bulletin* of the F.B.I., apart from its trade data, includes an economic forecast which is very valuable. Special reports on conditions abroad are a notable feature of the Federation's work, including foreign prices, activities of foreign competitors, methods of merchandising, local customs, and similar important information.

Again, there are libraries which contain essential data for the service of all who care to investigate. The Patent Office Library has a most exhaustive collection of technical works, and the British Museum Library contains a fine collection of reference volumes. Perhaps the least known, and yet most valuable of all libraries for many purposes is that of the London School of Economics. This remarkable library is open to any one who needs information, and its reputation abroad is, curiously enough, far higher than in Great Britain, where its huge resources are not generally appreciated. Special investigations are carried out by the staff of this library, and it contains many important volumes not obtainable in any other library in the country.

It is apparent that manufacturers and others who need information have sources to supply them with what they want, but the information is not centralised, and much time and labour must be spent to secure it. Each industry has special needs, and the value of the data that would be obtained would certainly justify the setting up of a research institution or body by the electrical industry, and its centralised nature would make for efficiency in operation. If the cost of upkeep were distributed over members of the industry, the cost to each member would be insignificant compared with the value of the work carried out.

While there is at yet no particular body in being which actually does carry out researches of the type indicated, the B.E.A.M.A. has already instituted a production index, and it seems that this body might be in a position to investigate market potentialities, distribution methods, &c., for the industry.

The whole question, embracing as it does manufacturing, distribution and selling, forms part of the wider category known as "Business Research." In U.S.A. this science, for it is incontestably a science, has been slowly developing, and we await the birth of a technique here as in other sciences and professions.

The application of scientific principles and methods to every process involved in the conduct of an individual business and of the industry of which it forms part may be new, but it is none the less desirable. We would be more correct in saying that it is essential. Of all the industries, surely the first to realise this must be the industry of engineers, and in this industry, the electrical engineering group should take the lead.

Conditions in South America.

Reports on Argentina and Brazil.

ARGENTINA.

Mr. H. O. Chalkley, C.B.E., Commercial Secretary to the British Legation, Buenos Aires, has presented a report (to September, 1925) upon the financial, commercial, and economic conditions in the Argentine Republic to the Department of Overseas Trade.*

In his introduction, Mr. Chalkley stresses the importance of the trade between this country and Argentina in which the latter State has the better share, the income from British investments being insufficient to redress the adverse balance against Great Britain. Mr. Chalkley says that if British exports have not benefited to the extent hoped for, it is not due to the state of trade in Argentina, or to diminished purchasing power, but to the prices of British goods and the greater intensity of foreign competition. In spite of divergences in most other aspects of trade, every agent and importer admits that it is easy to sell British goods when their prices do not exceed those of foreign products.

Electrical Imports.

It is stated that imports during the first half of 1925 remained at about the same level as in the first six months of 1924. The principal items, in their order of importance, were electric wire and cables, dynamos and motors, insulating tubes, electric batteries, battery materials, insulators, electrical material and accessories in general, and incandescent lamps. In electric wire and cables German and British manufacturers held the trade, the former leading slightly. Americans practically monopolised the market for batteries, which were principally of the automobile pattern. German manufacturers supplied over 50 per cent. of the dynamos and motors. In tubes British firms held the lead, followed closely by German suppliers who specialise in Bergmann tubing. British manufacturers were also the principal suppliers of battery materials—mainly for the British-owned railways. In porcelain insulators Germany secured 80 per cent. of the trade, while the lamps came principally from Holland and the United States. Electrical material and accessories in general were divided between German, American and British manufacturers. An appendix to the report contains detailed statistics of the electrical imports during 1923 and 1924. These show that in 1924 Great Britain made a considerable advance as a supplier of wire and cables and dynamos and motors.

*Stationery Office, 2s. 6d. net.

Power Developments.

The report says that some interest has been revived in the scheme for the utilisation of the Iguazu Falls, some 700 miles from Buenos Aires, on reports from New York that it is considered feasible to convey 300,000 h.p. from the falls to supply Buenos Aires with electricity at a cost not exceeding 60 per cent. of the present price. The cost of the scheme has been estimated at $50,000,000 (American).

The Government has granted the company supplying electricity to Buenos Aires a concession to reclaim land in the vicinity of the new port works for the purpose of erecting a projected new power station with a capacity of 500,000 kW. It is estimated that the consumption of coal at this new station will be 4,000 tons a day and it is proposed to install a pulverising plant.

Tramways.

The five tramway companies operating in Buenos Aires showed, in the aggregate, an improvement in receipts during 1924. The only company whose revenue declined was the Port and City of Buenos Aires undertaking. The receipts from the surface tramways during the first five months of 1925 showed a slight decrease, indicating that motor-omnibus competition is beginning to make itself felt. The delay in reaching an agreement between the municipality and the tramway companies has led to the postponement of active measures for relieving the traffic congestion of the city. Reference is made to the scheme of the Anglo-Argentine Tramways Company for the construction of two new subways, one from north to south, connecting the principal railway termini, the other connecting the centre of the city with the north-eastern suburbs. The invitation for tenders for the construction of a new electric tramway system for the town of Rosario failed to attract offers, and it is considered possible that tenders will again be invited in the near future. Motor omnibus services remain uncontrolled and continue to add to the traffic problem.

Communications.

The United River Plate Telephone Co. has now 310 exchanges, 136,044 subscribers, and 719,700 km. of lines. It estimates that £20,000,000 will have to be spent during the next 10 years to cater for development. Several long-distance lines have been installed recently and the Buenos Aires-Bahia Blanca line (1,600 km.) is to be inaugurated shortly. The automatic system is in operation in Buenos Aires, Cordoba and Rosario.

The international radio service carried on by the Transradio Internacional (a British-German-French-American group) worked without interruption during the year under review. A second long-wave transmitter was to be put into operation last September.

The country is badly served with broadcasting owing to a lack of co-operation between the interests concerned. The transmissions are inferior and spoiled by too much advertising. A recent decree fixed 190 metres as the maximum wave-length for amateurs, and a band of from 200 to 425 metres for broadcasting.

The Italian Submarine Cable Co.'s new cable, connecting Italy and Spain with Brazil, Uruguay and Argentina, was landed in Argentina in May last, and services were opened later.

Trading Methods.

Suitable agents to represent manufacturers are said to be extremely difficult to find, except in the rare cases where handsome remuneration is assured from the outset. Care should be exercised in the appointment of agents, and inquiries through the banks, the D.O.T., or the British Chamber of Commerce, are advised. It should be ascertained whether applicants for agencies have not already too many irons in the fire. With regard to the collection of payments, Mr. Chalkley says that many agents arrange for remittances to be made direct to their principals. Importers in general do not ask for more than 90 days' credit.

There are said to be many varieties of goods in which British trade is low owing to the lack of advertisement or the use of unsuitable advertising. Argentine customers are very receptive to careful and systematic advertising of branded goods backed up by judicious propaganda.

BRAZIL.

A report on the economic and financial conditions in Brazil up to September, 1925, has been prepared for the D.O.T. by Mr. E. Hambloch, British Commercial Secretary at Rio de Janeiro.*

Mr. Hambloch says that the political disturbances of recent months have had little effect upon trade. The bulk of the population takes little interest and no part in politics, and politics and trade are entirely divorced from one another. A favourable trade balance of £27,000,000 in 1924 was an indication of economic prosperity, though largely due to the exportation of coffee. Home producers are very well protected and the result has been an increase in the cost of living which has created serious problems. The continuance of stability is expected to lead to a gradual improvement in the exchange position; at the date of the report exchange was firmer than it had been for many months past.

Electrical Imports.

In the general report it is stated that Great Britain's share of the imports of electrical material and apparatus amounted to 14 per cent., the principal competitors in this trade being Germany and the United States. At the date of the report complete figures of imports during 1924 for the whole of the country were not available, but in an appendix statistics of importation at the port of Santos, supplied by the British Consul at Sao Paulo are reproduced. Although these represent only about 25 per cent. of the total trade they are said to be indicative of the nature of the whole. The imports of insulated copper wire totalled 190 metric tons in 1924 as compared with 362 tons in 1923, and Great Britain's share fell from 11 to 2 tons. Electric cable imports decreased from 407 to 253 tons, while the British share rose from 40 to 118 tons, ousting the United States from the first place. The imports of "apparatus for electricity and electric light" rose from 802 to 1,253 tons, and Great Britain's quota from 57 to 131 tons. Dynamos and generators increased from 222 to 381 tons (Great Britain 1 and 119 tons); electric motors from 909 to 905 tons (Great Britain 28 and 17 tons); and transformers from 662 to 770 tons (Great Britain 11 and 18 tons). The statistics show that Germany was the largest supplier of electrical goods, having contributed 1,483 tons out of a total of 3,802 tons representing the classes mentioned above. The United States supplied 1,168 tons and Great Britain 405 tons. The Acting Consul at Bahia reports that 370 cases of electrical material were taken into that port in 1924; of these 170 came from the United States, 108 from Belgium, 78 from Germany, and 17 from Great Britain.

Electrical Power and Development.

The British Consul at Sao Paulo (Mr. A. Abbott) says that owing to a long drought and the rapid increase in consumption the City and State experienced a severe power shortage. A contributory cause in some respects was the lack of foresight on the part of the Light and Power Company which supplied (at what may be termed an absurdly low figure) other public utilities with power which the company itself had to obtain from other power concerns at a much higher rate. New power stations are being constructed as quickly as possible, including one on the Serra do Mar, which will develop about 200,000 h.p. and will be the largest in South America, and there is no doubt that every effort is being made to remedy past errors. The fact remained, however, that practically all local factories were working (at the date of the report) only three days per week and the situation was daily growing more serious.

* Stationery Office, 2s. net.

The Acting Vice-Consul at Maranham (Mr. J. G. Clissold) says that good progress was made in 1924 by the American contractors to the State Government with the work of improving the town of S. Luiz do Maranhao. The lighting system was completed in July and the trams commenced running later. The American company takes 10 per cent. of the gross receipts from the tramway and lighting undertakings.

Among other developments a new sugar mill in the State of Alagôas is mentioned. This will have a capacity for crushing 1,250 tons of cane in 24 hours and will be electrically operated —an innovation in Brazil.

Railway Electrification.

There is an urgent necessity of electrifying the suburban portion of the Central Railway of Brazil, as under existing conditions it is impossible to increase either the number of trains or the number of cars in each train. The system is said to be from 100 to 150 per cent. overloaded at the busy hours of the day and accidents have been frequent. Plans for the electrification of the West of Minas Railway from Barra Mansa to Angra dos Reis have been drawn up. At August, 1925, the position as regarded electrification was as follows:—Completed: Campos de Jordao Railway (46 km.) and the Paulista Railway (70 km.) from Jundiahy to Rebouças. Under construction: Paulista Railway (24 km.) from Rebouças to Tatú. Projected: Paulista Railway (further extension to Barretos, 368 km.) and the Sorocabana Railway (104 km.). All these lines are in the State of Sao Paulo.

Trading Methods.

Mr. Hambloch puts forward a number of points for consideration by those desirous of trading with Brazil. In the first place, he says, it must be remembered that the language is Portuguese, but for business purposes it is more important that a commercial traveller should have a thorough knowledge of the articles that he wishes to sell rather than that he should be able to speak Portuguese. The visit of a representative of a firm wishing to do business with Brazil facilitates the task of finding suitable agents, but in the event of this being impossible, the D.O.T. is willing to render assistance. In the latter case very full particulars of commission terms, prices, credits, &c., should be furnished and a full range of catalogues (in Portuguese if possible) should be sent.

Many home firms have representatives in Brazil, but the number of local agents with technical training is very small; British goods still maintain their high standard of excellence, but the main difficulty is one of price and credit. It is well to remember that the Federal Government itself is the largest purchaser in Brazil of railway material and of plant for public works installations. Important contracts are also given by the various State and municipal authorities. The importance of adequate, influential, and competent local representation is therefore obvious. Long credits are necessary; there is scope for sound business to be done if the financing thereof (from the purchaser's point of view) be studied first. Many public contracts are given by calls for tenders; but even in these cases it is almost invariably too late for home manufacturers to think of presenting tenders if the first advice they have is the official announcement. The position of British suppliers of all classes of iron and steel goods, railway material, electrical installations of all kinds and public works generally in Brazil requires careful examination. Every effort should be made to find some solution of present difficulties, in order that the outlook for British trade in this class of supplies to Brazil may become generally as satisfactory as in the case of supplies to local British railways. The United States, Germany, Belgium, and France are active competitors.

Institute of Industrial Psychology.—We have received a copy of the annual report for the year 1925 of the National Institute of Industrial Psychology. The report contains a review of the five years' work of the Institute since its commencement. During the year in question the membership increased by over 60 per cent. and the payments received for investigations carried out by the Institute showed an increase of 10 per cent. An effort is being made to raise a fund of £100,000 to place the body on a permanent footing, and it is satisfactory to know that a considerable response is being received.

A Large Electric Winder.—What is claimed to be, from the dimensional point of view, the largest electric winding equipment in the world, is shortly to be installed at the City Deep Gold Mines, near Johannesburg, by the Metropolitan-Vickers Electrical Co., Ltd. The plant is designed to lift a net load of 9¼ tons from a depth of 4,500 ft. Thirty-one loads per hour will be delivered at the surface, and the winding speed will be 3,707 ft. per min., or more than 40 miles per hour. The maximum peak load for the driving motor will be 12,500 h.p., and the motor will operate at 32.7 r.p.m., being direct coupled to a bicylindro-conical drum of 35/17 ft. diameter. The Ward Leonard system of control is being adopted, d.c. energy being supplied by two 2,000-kW generators driven by a 5,200-h.p. induction motor. The double motor is nearly 20 ft. in diameter, with a bore of 16 ft., and weighs about 300 tons. The drum shaft weighs over 50 tons, while the drums themselves weigh about 350 tons and carry 18 tons of rope.

The Electricity (Supply) Bill, 1926.

Summary of Clauses.

The Electricity (Supply) Bill was introduced into the House of Commons on Wednesday, last week, by the Minister of Transport, and was published on Friday.*

The following is a summary of the principal clauses of the Bill:—

Constitution and Powers of Central Electricity Board.

There shall be established a Central Electricity Board, consisting of a chairman and seven other members appointed by the Minister of Transport, who shall hold office for not less than five years, and shall be paid salaries determined by the Minister of Transport.

The Board will be charged with the duty of supplying electricity to authorised undertakers, but shall not, save as expressly provided, generate electricity; it may, with the approval of the Electricity Commissioners, enter into arrangements with any authorised undertakers or other bodies for the exercise of any of its powers which can more expediently be exercised locally. The Board is to appoint consultative technical committees consisting of engineers employed in connection with selected generating stations, to give advice and assistance on such matters as may be referred to them.

Provisions as to Scheme.

The Board shall, as soon as practicable, prepare and submit to the Electricity Commissioners a scheme—

(*a*) Determining what generating stations (whether existing or new) shall be the selected stations at which electricity shall be generated for the purposes of the Board;

(*b*) Providing for interconnection, by means of main transmission lines to be constructed or acquired by the Board, of selected stations with one another and with the systems of authorised undertakers;

(*c*) Providing for such standardisation of frequency as may be essential to the carrying-out of such interconnection;

(*d*) Enabling or requiring temporary arrangements (to be in force during the carrying-out of the scheme) to be made between the Board and owners of generating stations (whether authorised undertakers or not) with respect to supplies of electricity, and to the working of generating stations (whether selected stations or not) by the owners thereof, upon such terms as in default of agreement may be determined by the Electricity Commissioners;

(*e*) Containing such supplemental provisions as may appear necessary.

A private generating station is not without the consent of the owners to be included in the scheme as a selected station, nor will the owners of such a station be required to enter into any temporary arrangements under the scheme.

The Electricity Commissioners are to cause the scheme to be published, and to give authorised undertakers and other persons interested an opportunity of making representations thereon, and after considering such representations, may confirm the scheme subject to such modifications as they think fit. As soon as the scheme is confirmed by the Electricity Commissioners it will be the duty of the Board to give effect to it.

The Board is to make arrangements with the owners of existing selected stations for them to be operated in accordance with the provision of the Act, and for such extensions and alterations as may be required: Provided that if the owners consider that any directions of the Board requiring extensions or alterations are unreasonable, they may appeal to the Electricity Commissioners, with a further right of appeal to the Railway and Canal Commission, against the decision of those Commissioners.

If the owners are unwilling to enter into or fail to carry out any such arrangements to the satisfaction of the Board, the Board is to be entitled to acquire the station at a price to be determined in accordance with the provisions of the First Schedule to the Act.

Where the Board acquires a station under this section, it may carry out such extensions or alterations as it thinks fit, and may either operate it or make arrangements with any authorised undertakers or other company or person to operate it: Provided that the Board shall not operate such a station unless it satisfies the Electricity Commissioners that it is unable to enter into an arrangement for its operation on reasonable terms.

The Board may make arrangements for the provision of such new stations as are required. If it is unable to enter into an arrangement with any authorised undertakers, company, or person for the provision of such new station on reasonable terms, the Commissioners may by a special order authorise the Board to provide the station, which may be operated by the Board if it satisfies the Commissioners that it is unable to enter into an arrangement for its operation on reasonable terms.

The owners of a selected station will be under the obligation to operate the station as the Board may direct, with due regard to economy and efficiency; and to sell to the Board all electricity generated at the station.

The owners of a selected station will be entitled to be supplied by the Board from that station with such electricity as they may require for the purposes of their undertaking, not exceeding the amount generated at the station.

The price to be paid by the Board to the owners of a selected station for electricity generated thereat is to be the cost of production, ascertained in accordance with rules contained in the Second Schedule to the Act.

The price at which electricity will be supplied by the Board from a selected station to the owners of that station will be either the cost of production, adjusted according to load factor, together with a proper proportion of the Board's expenses, or according to the tariff fixed under the Act for the supply of electricity by the Board, whichever is the lower.

If any question between the Board and the owners of a selected station arises under this section, it is to be determined by the Electricity Commissioners.

After a scheme has been confirmed as respects any area, the Board is to construct the main transmission lines required for the interconnection of selected stations with one another and with the systems of authorised undertakers in accordance with the scheme so far as it relates to that area.

Where a scheme provides for the acquisition of any main transmission lines belonging to any authorised undertakers, such lines shall, on payment of the price determined in accordance with the First Schedule, vest in the Board upon an order to that effect being made by the Minister of Transport.

The Board may require any authorised undertakers or the owners of any selected station to alter the frequency employed, if required to effect the standardisation of frequency provided by or under the scheme, or to effect such standardisation of frequency as the Board with the approval of the Electricity Commissioners may think expedient, subject to the payment of any expenses involved (including the cost of altering or replacing plant belonging to consumers). The Board may borrow for this purpose, but the resulting capital charges are to be excluded in assessing rateable value. The amount of the expenses incurred in carrying out any such requirement are in default of agreement to be determined by the Electricity Commissioners.

As soon as a scheme has been completed as respects any area, the Board will be under an obligation to supply to any authorised undertakers in that area demanding such a supply, such an amount of electricity as they require for their undertaking: Provided that the Board shall not supply electricity to authorised undertakers in the area of a power company without the consent of the company, or in the district of a joint electricity authority without the consent of the Electricity Commissioners.

Where it appears to the Board that the outlay incurred in providing the transmission lines required would entail unreasonable expense, the Electricity Commissioners may authorise the Board to impose terms and conditions on the giving of the supply.

Where any authorised undertakers owning a generating station, not being a selected station, demand a supply of electricity, the Board may make it a condition that they shall take the whole of the electricity required for their undertaking from the Board: Provided that the cost per unit to the undertakers will be less than the cost at which electricity is then being produced at the generating station of the undertakers; and the latter may appeal to the Electricity Commissioners, whose decision is to be final.

The Board may, before the carrying-out of the scheme in any area is completed, supply electricity to undertakers in that area.

The price to be charged by the Board for electricity supplied to authorised undertakers is to be in accordance with such tariff as may be fixed by the Board from time to time, so that the receipts shall be sufficient to cover the expenditure, including interest and sinking-fund charges, with such margin as the Electricity Commissioners may allow. The tariff is to show separately (*a*) a fixed charges component; and (*b*) a running charges component, and may be different for different areas.

Where any authorised undertakers take a supply of electricity from the Board, the price charged by them for the supply of electricity in bulk to any other authorised undertakers is to be on the same terms, together with such charges in respect of any transmission line used for the purpose as are mentioned in the Third Schedule; any question as to the amount of the price is to be determined by the Electricity Commissioners.

Where the owners of a selected station who take a supply of electricity from the Board prove to the satisfaction of the Commissioners that the cost of taking that supply in any year during the first seven years exceeds the cost which they would themselves have incurred in generating the like quantity of electricity, the charges will be so adjusted that the amount charged in that year does not exceed the cost which the undertakers would have incurred.

Where the Board notifies to any authorised undertakers owning a generating station, not being a selected station, that

* H.M. Stationery Office, Bill 59. Price 9d. net.

it is in a position to supply the whole quantity of electricity required for their undertaking on specified terms, and is satisfied that the cost of the supply on those terms is below the then prevailing cost to them, and they refuse to take such supply from the Board, then, if the Electricity Commissioners are satisfied as respects the next subsequent year that the cost of production of electricity generated by those undertakers substantially exceeded the cost they would have incurred had they purchased electricity from the Board on the specified terms, the Commissioners are to require the undertakers to make an abatement from the charges for electricity for the ensuing year equal to the amount of such excess.

Where any such undertakers have so refused to take a supply from the Board, it will not be lawful for them subsequently to increase their charges for electricity without the consent of the Commissioners. In calculating for this purpose the cost of production, no account is to be taken of capital charges in respect of the generating station.

The provisions of previous Acts relating to compensation for deprivation of employment are to apply to any officer or servant of any authorised undertakers affected by the closing or the acquisition of a generating station under or in consequence of this Act, as set out in the Fourth Schedule. The powers of authorised undertakers are extended to enable them to carry out arrangements with the Board notwithstanding any existing limitations.

Where the carrying-out of any scheme or arrangement would involve any operation for which the consent of the Minister of Transport or the Electricity Commissioners would be necessary under the Electricity (Supply) Acts, nothing in this Act is to relieve the Board or any authorised undertakers or persons concerned from the necessity of obtaining such consent.

Subsidiary Provisions as to the Board.

The Board is to be deemed to be an undertaker within the meaning of the Electricity (Supply) Acts, 1882 to 1922, but the provisions which relate to the purchase of undertakings by local authorities are not to apply to the undertaking of the Board. The Board is not to supply electricity directly to persons not being authorised undertakers, except the owners of selected stations, not being authorised undertakers, and, with the consent of the Electricity Commissioners, any company, body, or person requiring a supply for power purposes in any area not forming part of the area of supply of any authorised undertakers.

The Board may acquire land or rights over land voluntarily or compulsorily for the purpose of its powers and duties under this Act (including the construction of main transmission lines) like a local authority which is an authorised undertaker.

The Board may, by agreement with any authorised undertakers or other persons, use any main transmission lines upon such terms as may be agreed.

The Board and any company or person producing electricity by water power, waste heat, or otherwise, may enter into arrangements for the purchase of any surplus electricity which may be available, and may be authorised by the Commissioners to exercise such powers as may be necessary for the purpose.

The Board will annually make to the Minister of Transport a report of its proceedings under this Act, and furnish to the Electricity Commissioners such statistics and returns as they may require.

Financial Provisions.

All sums received by the Board will be paid into a separate fund, out of which the salaries of the members and the servants of the Board, and all expenses incurred by the Board will be paid.

The Board may, with the consent of the Electricity Commissioners and subject to regulations to be made by the Minister of Transport with the approval of the Treasury, borrow money, and the regulations may empower the Board to borrow temporarily by the issue of bonds or otherwise, and to make arrangements with bankers, and may apply any enactments relating to borrowing by local authorities.

Such powers of borrowing may be exercised for:—

(*a*) The construction or acquisition of main transmission lines, generating stations, and other works;

(*b*) Any other payment or any work the cost of which ought in the opinion of the Electricity Commissioners, to be spread over a term of years (including the payment of interest on money borrowed for capital expenditure for the period during which the expenditure remains unremunerative);

(*c*) The provision of working capital;

(*d*) Any other purpose authorised.

Any money borrowed under this section, and the interest thereon, may be charged on the undertaking and all the revenues of the Board, and must be repaid within such period not exceeding sixty years as the Electricity Commissioners may determine. The maximum amount which may be borrowed by the Board under this section is thirty-three and a half million pounds.

It will be lawful for any annual provision for the repayment of borrowed money to be suspended whilst the expenditure out of such moneys remains unremunerative, but such suspension must not be for a longer period than five years.

The Board may issue stock (to be called "Central electricity stock"). All such stock, and interest thereon, will be charged on the undertaking, and on all the revenues of the Board.

The Treasury may guarantee the payment of the interest and/or principal of any loan proposed to be raised by the Board, not exceeding thirty-three and a half million pounds. Such sums as may be required by the Treasury for fulfilling any guarantees given under this section will be charged on and issued out of the Consolidated Fund of the United Kingdom or the growing produce thereof. The repayment to the Treasury of any sums so issued, with interest thereon, will be a charge on the undertaking and all the revenues of the Board.

The Board is to prepare an annual statement of accounts, which is to be audited by auditors appointed by the Minister of Transport, and must be published.

Miscellaneous Provisions.

On a power company commencing to receive a supply of electricity from the Board, the Minister of Transport may revise the maximum prices authorised under the special Act of the company to be charged by the company for supplies, other than supplies in bulk to authorised undertakers, and may revise the standard prices fixed by such Act, and on such revision regard is to be had to the benefit to the company of any reduction in the cost of electricity due to this Act.

Where a special Act authorises such a company to make good any deficiency in previous dividends, the Commissioners may, after such inquiry as they think fit, by special order make provision for the repeal or limitation of any such authorisation.

Where any company, being an authorised undertaker and not being a power company, receives a supply of electricity from the Board, the Commissioners may by a special order make provision as to the relation between the charges to be made for electricity, and the dividends to be paid by the company. The provisions of this section are not to apply to any London company.

Where any tree interferes with the working of any electric line owned by authorised undertakers, the latter may give notice to the owner or occupier of the land on which the tree is growing, requiring the tree to be lopped. If objection is raised, the Minister of Transport, after giving the parties an opportunity of being heard, may make an order in that behalf, and determine whether compensation is to be paid.

Amendments of the Electricity Supply Acts.

Section 5 of the Electricity (Supply) Act, 1919, is replaced by a new Section regarding the constitution of electricity districts and the organisation of supply; and provision is made for the execution of works by joint electricity authorities, and for the delegation of powers to committees.

The power under section seven of the Electricity (Supply) Act, 1919, is to include power to constitute a joint electricity authority in any case where the original order did not do so.

Where, after the commencement of this Act, a special order is made authorising a company to supply electricity, and the area of supply includes the districts of two or more local authorities, the purchasing authority may after fifty years, or such shorter period as may be specified, and after every subsequent period of ten years or less, require the company to sell its undertaking upon the payment of the capital expended, less depreciation. The Minister of Transport will determine any questions which may arise in relation to such purchase.

The purchasing authority, where the area of supply is situate wholly or mainly within the district of a joint electricity authority, will be the joint electricity authority; or in any other case, the local authorities, acting through a joint committee or joint board.

The special order in any case to which this section applies may make provision as to the relation between the price charged for electricity and the dividends paid by the company.

Where a company, being an authorised undertaker, has ceased to generate electricity, and is taking a supply of electricity in bulk, and the undertaking is purchased by a local authority the purchase price is to include a sum representing the capital properly expended upon plant and other assets rendered unsuitable for use by reason of the taking of such bulk supply, less depreciation. Any question arising under this provision is to be determined by the Electricity Commissioners, whose decision will be final.

The charge made by authorised undertakers to any ordinary consumer, may, if duly authorised, consist of a periodical fixed or service charge, and a charge for the actual quantity of energy or electricity supplied to the consumer. The fixed charge may include rent in respect of any meter, lines, and appliances provided by the undertakers on the premises of the consumer, whether let on hire or hire-purchase terms or otherwise. A method of charge as aforesaid may be authorised by Special Order or by an approval under the Electric Lighting (Clauses) Act, 1899, or corresponding provision, and an option to ordinary consumers to be charged by an alternative method may be authorised.

The Schedule to the Electric Lighting (Clauses) Act, 1899, is to have effect subject to amendments specified in the Fifth Schedule to this Act. Minor amendments are specified in the Sixth Schedule to the provisions of the Electricity (Supply) Acts, 1882 to 1922.

For the purposes of this Act the expression "authorised undertakers" includes a joint electricity authority.

Schedules.

Seven Schedules are appended to the Bill. The first contains provisions as to the acquisition of generating stations and main transmission lines; matters in dispute are to be determined by an arbitrator appointed by the Minister of Transport.

The second Schedule gives rules for determining the cost of production of electricity at selected stations, and the third relates to authorised charges and allowances in respect of transmission lines used for giving bulk supplies to authorised undertakers.

The fourth Schedule adapts Section 16 of the Electricity (Supply) Act, 1919, as amended by Section 21 of the Electricity (Supply) Act, 1922, in respect of compensation to employés at generating stations closed or acquired by the Board.

The fifth Schedule amends the Schedule to the Electric Lighting (Clauses) Act, 1899, with regard to the disposal of the net surplus remaining in any year, and provides that the amount which may be carried to the credit of the local rate in any year shall not exceed one-and-a-half per cent. of the outstanding debt of the undertaking.

The sixth Schedule contains minor amendments of the Electricity (Supply) Acts, 1882-1922, and the seventh gives rules for determining the fixed charges component, and the running charges component.

The number of kilowatts of maximum demand is to be deemed to be twice the largest number of units of electricity supplied from the generating station during any consecutive thirty minutes in the year of account.

The West Midlands Electricity District.

The First Meeting of the Joint Electricity Authority.

The establishment of the West Midlands Electricity District has been accomplished by the Electricity Commission, which summoned the first meeting of the Joint Electricity Authority for the area at Wolverhampton on March 10th.

The constituent bodies are represented on the J.E.A. in the following order: The municipal corporations of Lichfield and Shrewsbury, one member each; Walsall, two members; West Bromwich, two members; Wolverhampton, four members; the urban district council of Cannock, one member; Midland Electric Corporation for Power Distribution, Ltd., five members; the L.M. & S. and Great Western Railway Companies, one each. Other company undertakers (Cannock Chase Colliery Co., Ltd.), one member; the workers in the industry and colliery owners in the district, one each, while three other corporations, 21 urban and 13 rural district councils, are represented by two members.

Speaking at the first meeting of the J.E.A., Sir Harry Haward, an Electricity Commissioner, was confident that the J.E.A. would be able to co-operate successfully with the Central Electricity Board that was proposed by the Government. The district with the electrical development of which it was charged extended from Birmingham to the Welsh border, with an average width of some twenty miles; its area of 930 sq. miles contained 860,000 people, or 924 to the sq. mile. The electricity sold in 1925 amounted to 119,000,000 kWh, or 138 kWh per head of population. Calculations of Lord Weir's Committee were based on an average output of 500 kWh per head for Great Britain in or about 1940.

Potentialities of electrical development in such a district as that were great. The curve of maximum demand took for granted expansion in the immediate future, the aggregate maximum demand in 1930 being estimated at upwards of 90,000 kilowatts, as compared with 60,750 kW last year, or a 50 per cent. increase in five years.

The Committee's report indicated the nature of the work that lay immediately before it, which comprised: Taking over the control and operation of the generating stations and main transmitting lines belonging to four municipalities (Wolverhampton, Shrewsbury, West Bromwich, and Walsall), and of the Midland Co., with consequential reorganisation and necessary extensions of those stations; the construction of linking-up transmission lines and preparation of detailed plans for a new large generating station at Ironbridge with main transmission lines connecting it with the centres of demand of the district.

The District Orders and Acts of Parliament under which the J.E.A. would function, armed it with all the necessary financial and executive powers, subject to the consent, or approval, of the Commissioners. Generally the Order followed the usual form.

Sir Harry proceeded to refer specially to section No. 12, providing for the transfer of generating stations and main transmission lines, and to the significance of the fact that the terms of transfer had already been agreed. That was, perhaps, the outstanding example of the spirit of co-operation and goodwill which had so clearly manifested itself throughout the course of events in that district.

Sections 16 and 17 were important in that they gave effect to an essential feature of the technical scheme—the exclusion from the district of the area of supply of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. The Joint Authority was thus left with the sole responsibility for the supply of electricity throughout the whole district outside the areas of the authorised distributors. Financial clauses dealt with the borrowing of money up to a maximum amount of £5,000,000, but before putting in hand important works, the J.E.A. would naturally desire to be reasonably assured that such works would not conflict with, or be rendered unnecessary by, the Central Board's scheme when prepared and approved.

Sir Harry did not think it need have any hesitation on that score, and said the Commissioners would be prepared to assist it with advice from time to time as regarded each specific work; and the J.E.A. might take it that they, in giving their consent to any such works, would be guided by their knowledge of the probable working out of the general scheme.

Councillor J. Bell (West Bromwich) was elected the first chairman of the Joint Authority and Mr. G. R. J. Parkinson (chief engineer, Midland Electric Corporation for Power Distribution, Ltd.), vice-chairman, Mr. S. Topwith (Cannock Chase Colliery Co., Ltd.) having withdrawn from nomination. The Town Clerk of Wolverhampton (Mr. F. E. Warbreck Howell) was appointed temporary clerk to the Authority.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Induced Current Cooking.

We witnessed recently a demonstration of cooking on new apparatus about to be introduced by the Falkirk Iron Co., Ltd., at its London showrooms, Craven House, Kingsway. The principle employed is that of the ordinary commercial transformer, the secondary winding actually being, in the case of boiling and frying operations, the cooking receptacle, which is constructed as a one-turn coil, carrying a very heavy current at a very low potential (1.25 V). For roasting, the joint forms part of the secondary circuit, special flexible contacts being provided for the inlet and outlet at the top and bottom of the joint. We reserve our comments on the constructional details of the apparatus until a later date, when we hope to be able to illustrate and describe the system. Some excellent cooking results were obtained; a quart of milk was brought to the boil from cold in 2 min. 10 sec., at a loading of 3,700 watts, at which load two quarts of water were boiled in 4 min.

A "Magnetic" Tee Square.

A new tee square, the Axene, introduced by Messrs. Axene, Ltd., Maxwell House, Arundel Street, London, W.C.2, should prove a valuable addition to the drawing office. This drawing instrument is similar to the ordinary tee square, except that in place of the usual ebony edge at the head it is provided with a special stainless steel magnetic edge. It is intended for use with a drawing board fitted with a steel edge at the appropriate side, so that the tee square is held in position by virtue of the magnetism. It is claimed that the instrument slides smoothly when desired, and yet permits the use of set squares without the necessity of holding the tee square.

A Small Generating Plant.

The accompanying illustration, fig. 1, is of a 120-W, 12-V generating set, a production of Messrs. Stuart Turner, Ltd., 43-47, Market Place, Henley-on-Thames, which was originally designed for the Post Office telephone service for use in automatic exchanges in which over 150 of the sets are already installed. It should prove a suitable set for cottage or bungalow and yacht-lighting installations, and also for charging batteries for wireless and automobiles. The dynamo is of standard make and runs at 1,300 r.p.m.; it is used as a motor, driven from the battery, for starting the engine. This is a ½-b.h.p. machine,

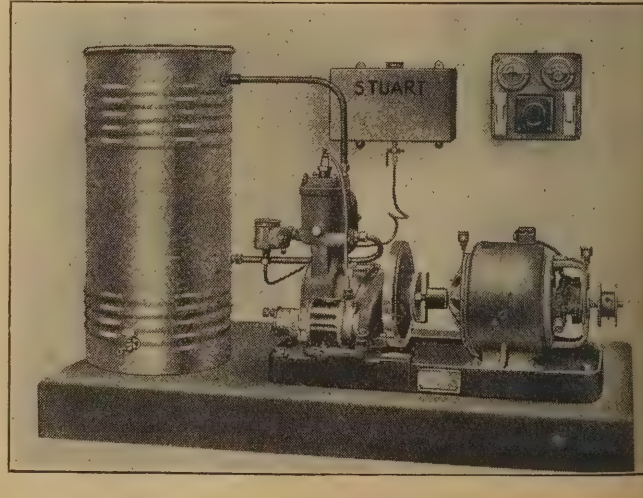


Fig. 1.—Small Generating Set.

designed for running on petrol, benzol or gas, and being completely enclosed, it is claimed to be gas-tight and clean; it is also claimed to be silent and very free from vibration, due to perfect balancing. The fuel consumption, petrol, is said to be a gallon for 10 to 12 hours' running. Starting is effected by means of a push-button on the switchboard, with the battery connected, a touch on the flywheel only being necessary to

help the engine over compression. Starting may also be done by means of a strap wound on the pulley at the end of the dynamo. The battery is of 50-Ah capacity; the cells are of glass with sealed lids and contained in a hardwood crate. The plant is provided complete with petrol and water tanks and the necessary pipes and foundation bolts.

An Improved Electric Cooker.

We have received from the Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, W.1, particulars of a new "Hotpoint-Falco," fig. 2, cooker (No. 5279-A). This is suitable for a household of 4-6 persons, and the hobplate carries two of the new "quick-service" boiling plates. These plates, the former of which is square, have the elements laid in troughs of circular design, and the elements are held in position by small lugs. The plate is of the semi-enclosed pattern, and is supplied with a grid cover which has a circular hole in the centre, exposing the coils when on medium heat, thereby giving a greater efficiency when a small utensil is being used. The plate is there-

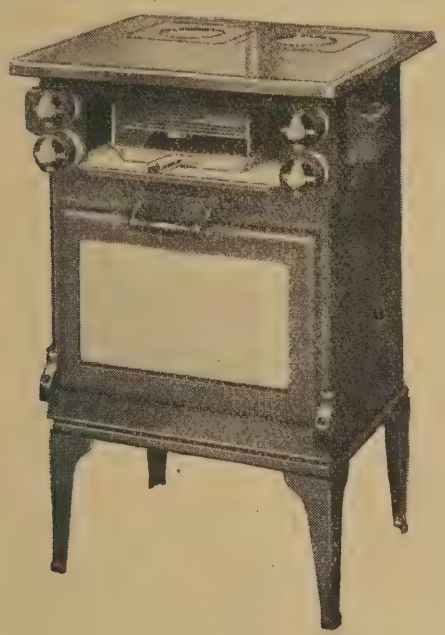


Fig. 2.—"Hotpoint-Falco" Cooker.

fore enamelled on the underside to prevent flaking and rusting at that part, and it is made to be interchangeable with the company's existing boiling rings, and is fitted with a 3-pin plug-in connection. The spirals are of circular pattern and the former is in one piece. Ample provision is made for carrying away spilt liquids, &c., which are carried right through on to the crown plate of the oven, and this is easily cleaned. The two boiling rings and the separate grill are all controlled by separate 3-heat pointer-type reciprocating switches. It is not necessary to lift the hobplate to remove the boiling plates; they can be lifted and withdrawn without disturbing the cooker in any way, and it is therefore easy to replace them. The cooker has been adopted by a number of supply authorities.

An Electrically-Heated Food Trolley.

Among the many devices which afford the use of electricity for novel purposes is an electrically-heated food trolley, fig. 3, designed for hospital use, which is marketed by the Dowsing Radiant Heat Co., Ltd., 91-93, Baker Street, London, W.1. It is a well made oak hot-cupboard with outside hinged doors on

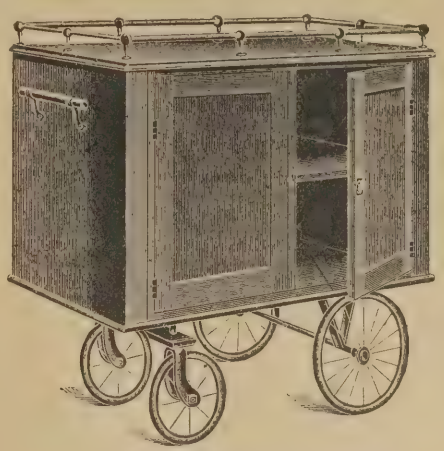


Fig. 3.—Electrically-Heated Food Trolley.

one side, and a brass rail round the top. The interior is lined with asbestos, and suitable heating elements, with 3-heat regulation, are contained in the base. The whole is mounted on rubber-tired cycle-pattern wheels, 12 in. and 7 in. in diameter. The overall dimensions are 3 ft. 9 in. long, 2 ft. 1 in. wide, and 3 ft. 6 in. high. The loading is 1,000 W.

An Improved Flexible Cord.

We have received from Messrs. Ward & Goldstone, Frederick Road, Pendleton, Manchester, two samples of their most recent production, Negrolac flexible cord. It is intended to replace the usual workshop flexible cord, on which the wax compound with which the braiding is treated tends, in warm atmospheres or immediately above the lampholder, to soften. "Negrolac" is treated, under a special process, several times with a flexible oil and acid-resisting varnish, which, it is claimed, will not soften under the conditions named. The result is a smooth and bright appearance. The new product is made in two grades, one for pendant use, 23/36, in which the twin conductors, prepared to the I.E.E. rules, are coated directly with the "Negrolac" finish; in the other type, anti-shock, the insulated conductors are embedded in a soft flexible rubber over which is the "Negrolac"-treated braid.

Electro-Farming.

The Applications of Electricity to Agriculture.

The meeting of the Institution of Electrical Engineers on March 4th, when a paper on the above subject (an abstract of which will be found in our issue of March 12th) was presented, was well attended.

Mr. R. Borlase Matthews, M.I.E.E., the author, taking his paper as read, showed a large number of lantern slides and two kinematograph films to illustrate methods of electric ploughing, the application of electric power and lighting on the farm, and agricultural processes. He also exhibited a selection of plants and bulbs in bloom and seedlings which demonstrated the influence which electric lighting had on their growth.

Discussion in London.

Sir A. Daniel Hall, F.R.S., opened the discussion by remarking that they would need all the author's enthusiasm before they would reap much fruit. It was necessary to distinguish between the use of electricity on farms in this country and in Europe; on the one hand, its application to domestic purposes and small power by means of portable motors was normal on the Continent, and would be here also if they could have similar facilities for distributing electricity; however, that would only mean a small load. On the other hand, what prospect was there of inducing the farmer to change his methods of ploughing and of performing his major operations? They must beware of taking too rosy a view of the economy that would result from the adoption of electrical methods in such cases as those. Every farmer must use horses for cartage and odd jobs; that was a big operation, and the horses had to be kept employed when they would otherwise be idle. Steam ploughs had been available for many years, but they had not displaced horses; in fact, their use was decreasing rather than increasing, which facts indicated the need for a practical type of tractor. Following a reference to costing on a well-organised farm, Sir Daniel said that they were not yet certain about the positive results that were declared to result from the stimulation of plant growth by means of ultra-violet light, mercury-vapour lamps, electric discharge over crops, &c., and that, therefore, they could not begin to calculate the economics of the subject until they were definitely positive. Farmers did not care how they got their power so long as it was cheap and enabled them to carry out their operations economically. They were continually gambling with the weather, and therefore must move slowly and necessarily be conservative because they had no spare cash for experiments. Farmers had enough to do already, and accordingly it was the engineer who must do the pioneering. The farmer would have to be dealt with simply and directly, for he could not afford to adopt new methods until he was sure of them.

Mr. Ll. B. Atkinson, pointing out that the engineer and farmer were largely ignorant of each other's point of view, said it was easy enough to get the farmer to use electricity when it was available. The real problem was how to take the supply into rural areas, and in that connection he agreed with the author's contention that statistics should be dealt with on a basis of route miles and not area supplied. For use in this country a smaller pattern of plough was more

suitable, but the plough was the wrong type of implement (except for horse haulage) and for high-speed work a lighter machine would be needed. The author had done a definite service in working out a concrete example of a transmission and distribution system. A large-scale experiment was needed now, but the farmer could not be expected to undertake it; he would have to be loaned the apparatus and equipment with an option to purchase it later. He agreed that if portable lamps, &c., were to be used, they must be properly specified in order to avoid accidents. He had found that, while the lighter kinds of poultry did continue to feed for longer periods under the influence of artificial light, the heavier breeds apparently took no notice of it, and went to sleep at the usual time soon after sunset; being heavier birds, they probably could eat more in less time. Although he did not question the stimulating effect of artificial light on plants, he pointed out the fact that all plants naturally grew more at night than in the day-time.

Mr. B. M. Jenkin explained that he used to be an engineer, but he commenced farming about 12 years ago. The author's conception of the total consumption of electricity if all farms in this country used it was too high, as his "57 million acres" included forests and other areas unfit for cultivation. He could not think that electric haulage was being used on any farm. The farmer's first object was to avoid useless expenditure. Were fixtures to be provided by the owner or the tenant? The farmer dare not put capital into fixtures when he might have to turn some of his land over to grass in a few years' time. The electric plough could not compete with the tractor, but rotary tillers involved a fundamental difference. More efficient means of driving the machines direct were required to take the place of the older horse-drawn implements which were provided with wheels that used the earth as a transmission belt.

Mr. W. Fennell said the reason why more extensive use of electricity was made on the Continent was that electrical engineers in Europe were allowed to take their mains to the farmers with less hindrance and less stringent regulations than those encountered in England. His experience was that country people wanted electric light and would use it if they could get it; a modified form of "fringe order" was wanted, and an area extension order should be obtainable by specifying the area to be supplied instead of the individual. Increased facilities for running overhead lines were needed, and he appealed to those who had influence to help engineers to obtain that sort of assistance.

Mr. R. B. Matthews, in reply to some of the points raised, pointed out that on his 640-acre farm he had two horses only, and they were not overworked, which fact showed that there were openings for mechanical operations. In America, where the artificial illumination of poultry houses was universal, it was found that the egg production from the heavier breeds of chickens was better than that of the lighter sort. Although ploughing was the traditional method of giving the farmer what he thought he needed, was it really the right operation that was wanted? In the past, farmers had been exploited somewhat by engineers, and they were consequently now diffident about the adoption of new methods.

The president, Mr. R. A. Chattock, then adjourned the meeting.

The discussion was resumed on March 11th, when Col. K. Edgcumbe presided.

Mr. Montague Fordham, who has nearly completed a tour of some of the rural districts of the country, giving a course of about 300 lectures on rural construction, said it was felt in the places which he had visited that the future progress of the country districts depended on the use of electricity. As a reply to Sir A. Daniel Hall's remarks, he recommended the reading of Lady Hall's book, which dealt with rural reconstruction with special reference to electricity. The tendency of the people of the rural districts to leave for the towns would destroy civilisation, and electricity was essential to reverse the process. He found the farmers keenly interested in the use of electricity for agricultural processes, particularly in connection with hay drying.

Mr. F. H. Clough said the difficulties in providing transmission lines were largely political. A serious item was the cost of switchgear for tapping the lines; at 3,000 V a cheap and simple equipment could be provided for loads up to 15 kVA. He recommended the laying of single-phase lines at first, to be followed when the load developed by 3-phase transmission, and suggested that it would be a drawback to include the capital charges of the lines with the consumption cost to the consumer; it would be better to charge the user an annual amount to cover the capital costs.

Mr. H. M. Sayers referred to the question of lighting the hen-runs; he had recently carried out some experiments in this direction and had obtained an average of 3.27 eggs per hen during a period in the winter months. It was important to continue the lighting; after a cessation of only three days the egg production dropped from 130 to 90. He suggested that the heat absorbed by the condensing water in the generating station should be used for warming the soil used for agriculture. To do this a network of pipes carrying the warm water could be laid at a given depth and pitch in the ground. He estimated that a 10 deg. F. rise in the temperature of an acre of land would be equivalent to a 1,000-kW load. Besides warming the land it would defeat the spring frosts. This scheme would enable the market gardener to grow crops the whole year round; to hasten the growth, if slow, intensive lighting could be used.

Mr. E. B. Wedmore criticised the method employed by Mr. Matthews of heating beehives. The proper method was to supply heat at the centre of the cluster. The bee itself, in its natural surroundings, consumed the honey from the centre of the hive and converted it into heat energy. His Association would welcome from Mr. Matthews any proposals for research on the question of the utilisation of electricity on the farm.

Col. R. E. Crompton referred to the proposed National Electricity Scheme; he thought the Prime Minister, when speaking of the saving to be brought about by the proposals, must have meant a saving as regarded agriculture. The industrial world was well served and not much could be saved by cheapening the supply. The young electrical engineer must address himself to the question of electricity supply to the rural areas and so reverse the process of the draining of the population into the towns. Only a large demand and even distribution could make a general rural supply possible. Electricity for lighting should be very cheap to encourage its use for power and other services, and this policy had been adopted in the districts around Milan, in the South of France, and recently in Germany. He would welcome any information as to the results of the production of nitrogen or nitrates in Germany. Some development of the hysteresis control referred to in the paper would probably result in a considerable advance in cultivation by means of electrical energy. He was afraid that the use of electricity on the farm would offer no advantage in diversity of load. He thought Mr. Sayers's scheme very attractive, but he did not see how it would be practicable when the generating station was 50 miles away from the land; if anything, the argument was in favour of the small station.

Major T. Rich paid a tribute to Col. Crompton; such energy and enthusiasm as were shown by the Colonel in the early days of electricity supply were wanted now to deal with the question of supplying the rural districts. In particular they wanted facilities for distribution. In France, where there were many thousands of miles of distribution lines, a committee of business men advised the Government on the question of transmission lines, and great facilities existed. The rural authorities had full powers to deal with the schemes, but they were not foolish enough to retard progress; they got something out of the schemes, as a small fee was paid to them. It was not the practice in France to employ 220 V on the farms; the general pressures used were from 90 to 110 V. In the north of that country 15,000 V was employed for general distribution and it was found that transmission at pressures above 3,000 V did not cost a great deal more. At Bethune 15,000 V was used on iron-wire lines. At the Grenoble exhibition last year a feature was double-stepping transformers for secondary pressures of 660 V and 110 V. He had noticed among the exhibits that the portable motors appeared to be no different to ordinary industrial motors. Developments were also shown in portable transformer stations. During the war the industries in Paris were encouraged by the electrical transmission schemes to move into the rural areas. It was regrettable that in this country they had to pay more for electric lamps than the people in any other country; they ought to be able to get lamps at 1s. or less each. A cheap lamp would do more to encourage the use of electricity than all Government stunts.

Mr. W. J. Minton, in referring to some of the suggested methods for electric ploughing, said it must be remembered that the object of ploughing was two-fold, to turn over the ground and also to bury the weeds. Snatch crops were very desirable to the farmer and in this direction electricity would be a great help. He asked if Mr. Matthews had had any experience in the laying of tramlines over the farm, and also if he advocated the use of single overhead conductors with earth returns. No mention, he said, was made in the paper of the comfort of the farm labourer. If the farm hand was given a few lights in his own dwelling, he would soon be as enthusiastic about the use of electricity as the farmer. He did not agree that the farm labourer was not capable of the ordinary management of machinery; he knew of cases where the labourer took down the tractors and decarbonised them when necessary.

Mr. W. A. Turnbull said that due to the influence of Mr. Matthews, the Aylesbury Council had just placed the necessary order for the electrification of the district. The scheme provided for overhead lines at 11,000 V and the cost was £600 per mile. At that pressure tapping off at any farm could be done with cheap apparatus; it would be difficult to do so at a pressure of 20,000 V. The main lines were to be of 0.075 sq. in. copper and the branch lines of steel wires. As the load developed the copper would be taken down and replaced by aluminium of double the capacity. The cost of the steel line was half that of the copper one. In order to overcome the injurious effects of the ammonia in the cow sheds to the wiring, he was advising the use of ordinary v.i.r. cables run on cleats.

Mr. R. H. White suggested that consideration should be given to the generation of electrical energy for the country districts by wind-driven generators, which were being used to some extent in Germany.

Mr. A. H. Allen emphasised the necessity of cheapening the cost of distribution and of providing facilities for obtaining wayleaves for running overhead lines. The present difficulties experienced in obtaining the necessary wayleaves were a great drawback to progress in electrical distribution in the country areas. Every endeavour should be made to simplify the construction of overhead transmission lines. He felt that the elaborate devices which resulted from the present regulations

were undesirable. Quite recently a case had been reported where the protecting cradle of an overhead wire had been blown about in a gale and had knocked down the live wire itself, resulting in the death of a schoolboy who handled the wire. That was much worse than no protection at all. Many miles of overhead trolley wire were in use in the towns and very little trouble indeed was experienced with them.

Mr. A. E. Jackson criticised the proposal to utilise the condensing water for warming the land on the ground that the heat would be required at night when the station load would be smallest. Referring to the cost of running out transmission lines, he quoted a case where the costs were only £180 per mile. This was effected by the use of a special reinforced concrete pole.

Mr. J. S. Francis said that in Bavaria the rural supply companies did not care to undertake the distribution work and this was taken on by farmers' associations.

Mr. F. Creedy asked for information as to what kind of electrical energy was used on the farm referred to in the paper. He had noticed that the frames of the motors shown on the slides were of the d.c. type. Although polyphase motors were preferable to motors of other types, single-phase transmission held many advantages over 3-phase.

In reply to a number of the points raised, Mr. Matthews said he welcomed the offer of Mr. Wedmore's association, and he would think it over. Referring to the question as to the production of nitrates he said that large quantities produced in Norway were sold to the farmers in this country. Electric ploughs should be considered as of two classes, the commercial type of to-day, worked on the same lines as the steam plough, and the prospective types embodying great improvements. The load and diversity factors of the farm were quite good, there being about 20 different branches in which the energy was used. Except for ploughing he was in favour of using no bigger motor than 5 h.p.; thrashing was a convenient odd-job load. In the Netherlands a steady load of 500 kW was taken by farms for thrashing. The ordinary industrial motor was used for agricultural purposes in France, but that country was farther behind than other countries in the production of agricultural types. As to the decrease in the number of steam ploughs in use in this country, that was due only to large areas of arable land having been turned to grass. The " powers that be " had an open mind on the question of overhead construction and would give careful consideration to any proposal that was put forward; many people were attempting to design lines in an amateur way. Continuity of supply in the rural areas was not of vital importance and the farmers generally were willing to put up with a greater voltage variation than the present regulations permitted. He thought it was a good practice to commence transmission schemes with steel wires and change over to copper lines when the load became profitable. By providing the farmer with the insulators and wires and letting him erect the lines, the capital outlay could be reduced to £25 per mile of line; there were more farmers capable of erecting lines than there were linesmen. It was not generally known that there were in existence two associations with official backing which would assist in schemes for rural construction. The Land Advance Corporation would advance loans for improvement schemes, including the introduction of electricity. The motors shown on the screen were a.c. motors with d.c.-type frames. Three-phase distribution seemed to be at present the most desirable method, but the transmission costs could be reduced considerably by redesigning apparatus for single-phase energy. A comparison between the night growths of two groups of plants in the same house with the same heat, but with different light, showed that the plants provided with intensified light made twice the progress of the others. The question of the price of electric lamps in this country had already been put before the Electric Lamp Manufacturers' Association. The Ministry of Agriculture and the School of Engineering at Oxford had recently completed some tests at Harpenden on windmills, and it was found that by using air-screw designed wings, as used for aeroplanes, the efficiency could be increased by 106 per cent. The use of the single wire with an earth return was receiving consideration in some quarters, and the system advocated by Mr. Seabrook would enable underground cables to be laid as cheaply as overhead lines at present. Electricity would prove a great help in inducing the people to get back to the land, but it must be remembered that electricity alone would not do it.

Legal.

Collins v. Southern Counties Electric Light and Power Supply, Ltd.

Mr. Justice Lawrence, in the Chancery Division on March 12th, had before him this action against the Southern Counties Electric Light & Power Supply, Ltd., of Bournemouth, for judgment in default of defence.

Mr. Hecksher, for the plaintiff, said that the action was for the rescission of a contract to take debentures on the ground of misrepresentation, but on that day a defence had been delivered. In the circumstances, therefore, he could not ask for judgment on this application.

His Lordship said that the defence could not be disregarded, and he made no order.

Loughborough Corporation Summoned.

Arising out of a recent fatality at the Empress Works, Loughborough, when a man named Arthur Hubbard was killed, the Loughborough Corporation was summoned at the local Police Court on March 11th. Two summonses, alleging that regulations had been neglected by leaving the terminal of a high-pressure cable insufficiently protected, were dismissed. A fine of £2 was imposed on a third summons, alleging that the Corporation had allowed an unauthorised person without proper supervision to undertake work where technical knowledge was necessary to avoid danger. On a fourth summons, for having failed to maintain in safe condition certain electrical appliances, a fine of £10 was imposed. Hubbard was engaged to repair the floor outside a cubicle, and being unaware of the danger, he put his head inside the cubicle and came into contact with a cable carrying energy at 6,400 V and was killed.

British Thomson-Houston Co., Ltd., v. The Novelty Co.

Mr. Justice Lawrence, in the Chancery Division on March 12th, granted an injunction on the *ex parte* application of the British Thomson-Houston Co., Ltd., restraining a company called the Novelty Company, of Grays Inn Road, W.C., from infringing the plaintiffs' patent for the gasfilled lamp.

Mr. Trevor Watson, for the plaintiff company, asked that the defendants should also be restrained from parting with the infringing articles.

His Lordship assented.

Leicester Corporation Fined.

The Leicester Corporation was fined £100 at the Leicester Police Court on March 11th, for negligence at the Freeman's Meadow power station as a result of which Andrew Wallace Minto was killed on January 27th. It was agreed that after deduction of the expenses of the prosecution, the balance should go to the relatives of the dead man. Minto was working a portable electric drill, which had no earthing wire attached to it, and he received a fatal electric shock. The Corporation accepted responsibility in law, and the chairman of the bench stated that someone had failed in his duty in not seeing that the regulations respecting the use of such tools were obeyed.

Theft of Motors.

At Old Street on Saturday, Francis Leo Mooney, Upton Park, was charged on remand with stealing and receiving two electric motors, value £6, the property of his employers, the Enterprise Machine Supplies Co., Ltd., Whitechapel. Defendant pleaded guilty, and it was stated that he had borne a good character hitherto and the prosecutors did not desire to press the charge. Mr. Snell bound over defendant for twelve months.

Matton v. Pressland Electric Supplies, Ltd.

This case came before Mr. Justice Russell in the Chancery Division on March 9th, upon a motion by the plaintiff, the sole debenture holder in the company, for judgment against the company in default of appearance. Counsel in support of the application said there had been an issue of £6,000 debentures and the interest was in arrear. Tne minutes were in the usual form. His Lordship granted an order.

B.M.A.S., Ltd.

A petition for the winding up of this company came before Mr. Courthope Wilson, Vice-Chancellor, of the Lancashire Chancery Court, at Liverpool on March 8th. The petition was presented by the Chloride Electrical Storage Co., Ltd., creditor for £759. The defendant company was not represented, and an order for winding up was made.

Galliers v. Milward.

At the Brighton County Court on March 11th, before Judge Cann, Mr. H. J. Galliers, electrical contractor, Worthing, sued Mr. A. Milward and his wife (trading as the Worthing Valet Service) for £56 19s. for work done and materials supplied. It was stated that £10 5s. had been paid into Court.

Mr. R. A. Bull, the plaintiff's Worthing manager, stated that Mr. Milward gave an order for an electrical installation at his shop in Warwick Street, Worthing. As the decoration had been completed and the work was required to be done quickly, witness suggested the use of lead-covered wiring and that was agreed to. The defendant saw the work in progress and made no complaint, and, later, gave instructions for the wiring of the upper part of the premises on the same system. Nor was any complaint received when the account was sent in.

Mr. A. J. Hedgcock (W. T. Henley's Telegraph Works Co., Ltd.), said that the system employed was safe, both electrically and mechanically.

Defendant, giving evidence, said that when he had had other premises wired, Mr. Bull had advised him that steel tubing was the only safe system. He had called attention to the use of lead-covered wiring on the installation in question, and Mr. Bull said that it had been used because it was less unsightly than steel conduit. When he found that lead-covered wiring had been used in the upper part of the premises he asked for it to be removed. Cross-examined, Mr. Milward said that he had had no cause to complain of the installation. He called a witness who, while stating that he considered

that the steel-tubing system was safer, admitted that he had had no experience with lead-covered wiring.

His Honour said that it was perfectly clear that the defendant wished to avoid paying a just debt. The plaintiff would be awarded £46 14s., in addition to the amount paid into Court, with costs on the High Court scale up to the date of remission and subsequently on Scale "C."

Explanation.—Messrs. Fernand Espir, of 68, Coleman Street, E.C.2, ask us to state, in order to avoid misconception among their trade friends, that they have no connection with the defendant in the law case "Bonnella *v.* Espir," reported on page 443 of our last issue.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Kent Coalfield. — On March 8th, Lord Henry Cavendish-Bentinck asked whether, when loans were made to those who were sinking the new coal pits in Kent, conditions were made for preserving as far as possible the amenities of the country side; whether smoke-abatement devices were insisted on at each pithead; and if conditions were laid down as to whether the pits were to be worked by steam or electricity.

Mr. McNeill, Financial Secretary to the Treasury, said that no conditions of the kind indicated were attached to the guarantee which the Treasury had agreed to give to Messrs. Pearson and Dorman, Long, Ltd., but a joint advisory town planning committee was watching the development of the area.

Severn Barrage Scheme.—On March 9th, Mr. Wardlaw-Milne asked the Minister of Transport whether the committee which was to consider the possibility of the Severn barrage scheme would also be instructed to go into the possibilities of smaller power stations by harnessing the stream of the Severn at various points nearer its source in preference to the possible heavy expenditure on a great barrage at the mouth of the river.

Colonel Ashley said that on the recommendation of the Severn Barrage Sub-Committee of the Committee of Civil Research, the Government had decided to carry out certain preliminary investigations. When those had been completed the whole subject, including the points raised in the question, would be further considered.

The Electricity Bill.—On March 10th, the Government's Electricity Bill was introduced by Lt.-Col. Ashley, the Minister of Transport, and read a first time.

Mr. Hardie asked the Prime Minister, in view of the interest manifested in the Electricity (Supply) Bill, whether he would see that ample time was given for discussion even if it should involve some curtailment of the holidays of the House.

Mr. Baldwin said that the Government hoped to secure a second reading of the Bill before Easter in order that the fullest possible time might be available for its discussion during subsequent stages.

Electric Traffic Signs. — On March 11th, Captain Bullock asked the Minister of Transport whether he would consider the advisability of using electric and other signs where there was one-way traffic.

Col. Ashley said that the question of the erection of direction signs, capable of illumination at night, at one-way traffic streets, had been under consideration for some time, and arrangements were now in hand for the erection of such signs in Parliament Square, Long Acre, and elsewhere.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned :—

Tonalite (lettering and design). No. 466,202. Class 1. Electrolyte for accumulators.—A. J. A. de la Porte, 80, Schenkkade, The Hague, Holland. (British representatives: J. S. Withers & Spooner, 51-52, Chancery Lane, W.C.2.).

Guarding the Pole (lettering and design). No. 461,834. Class 8. Electric dry cells.—T. H. Poulsson, 43, Dronningensgade, Stavanger, Norway. (British representatives: Phillips', 70, Chancery Lane, W.C.2.)

Vita. No. 460,612. Class 8. Valves for use in radio-telegraphy and telephony.—Peter Curtis, Ltd.

Radiostar. No. 463,899. Class 8. Instruments, apparatus and parts thereof for use in radio-telephony and telegraphy, but not including detector crystals.—Edison Swan Electric Co., Ltd.

Rafex. No. 465,721. Class 8. Electron discharge tubes for radio and wired telegraphy and telephony, X-ray tubes not for medical or surgical purpose, and rectifying tubes.—Mullard Radio Valve Co., Ltd.

Emeer. No. 465,713. All goods in Class 13.—Metropolitan-Vickers Electrical Co., Ltd.

Varlina (lettering and design). No. 463,155. Class 8. Electrical apparatus for display signs or advertisements by means of illuminated or light reflective surfaces.—Harrington & Co., 47, Litherland Road, Bootle.

Becol, No. 466,434, and Becolite, No. 466,434. Class 8. Instruments and apparatus manufactured wholly or partly from ebonite or vulcanite.—British Ebonite Co., Ltd., 25, Nightingale Lane, Hanwell, W.7.

Davon. No. 455,936. Class 11. Electrical appliances for medical and surgical purposes.—F. Davidson & Co., 29, Great Portland Street, W.1.

Stabe-Larc (lettering and design). No. 463,958. Class 18. Electric arc welding plant.—Allen-Liversidge, Ltd.

Maconite. No. 464,448. Class 40. Preparations composed chiefly of india-rubber for insulating electric cables.—The Macintosh Cable Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

19,824. "Electrical amplifying apparatus." J. W. Kirkland. (Allgemeine Elektricitats-Ges.). August 21st, 1924. (247,612.)

24,360. "High-frequency electric discharge tubes and generators for medical purposes." E. V. Hayes-Gratze. October 14th, 1924. (247,623.)

24,704. "Electrical system employing space discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). October 17th, 1924. (247,626.)

24,793. "Electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. October 18th, 1924. (247,627.)

27,490. "Telephone systems." Automatic Electric Co., and C. E. Lomax. November 17th, 1924. (247,647.)

27,491. "Telephone systems." Automatic Electric Co. and J. Wicks. November 17th, 1924. (247,648.)

27,557. "Control of the effect of fluid currents on the stream-line surfaces of prime movers." Aero-Dynamos, Ltd. (Ventimotor Akt. Ges.). November 18th, 1294. (247,650.)

27,893. "Electrical measuring instruments." Crompton & Co., Ltd., W. F. Jones, and W. G. Smith. November 21st, 1924. (Addition to 233,808.) (247,663.)

27,918. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. November 28th, 1923. (225,542.)

27,931. "Laminated terminals for electric switches and the like." British Thomson-Houston Co., Ltd., H. Trencham, and L. Rigg-Story. November 21st, 1924. (247,665.)

27,936. "Electrical regulating apparatus for alternating current." E. H. Jones. November 21st, 1924. (247,666.)

27,961. "Thermionic valves and the like." Compagnie Générale de Télégraphie Sans Fil. November 21st, 1923. (225,234.)

27,981. "Switch plates." J. B. Tucker. November 22nd, 1924. (247,670.)

28,004. "Electric motor-starting and like switches." H. J. Norballe. November 22nd, 1924. (247,671.)

29,975. "Bracket for the detachable attachment of an electric fan to a wall or like surface." Veritys, Ltd., and H. W. Smallwood. December 13th, 1924. (247,693.)

30,632. "Sparking plugs for use with internal-combustion engines." M. Sacchi. December 19th, 1924. (247,698.)

30,716. "Coupling of magnetos of internal-combustion engines." F. H. Royce. December 22nd, 1924. (Cognate application 30,963/24.) (247,700.)

30,833. "Electric switches, plug-and-socket connections, and like electrical accessories, and the manufacture thereof." J. A. Crabtree. December 23rd, 1924. (247,702.)

31,326. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. December 31st, 1924. (Cognate application 6,604/25.) (247,711.)

1925.

1,534. "Water-turbines for electric generating stations." J. H. Vincent. January 19th, 1925. (247,718.)

1,598. "Brush-holders for dynamo-electric machines." English Electric Co., Ltd., and E. H. H. Hassler. January 19th, 1925. (247,719.)

2,467. "Electrical connector." W. E. Bottom. January 28th, 1925. (247,724.)

2,583. "Supports for wireless and like panels." W. H. Liles and J. K. Pennington. January 29th, 1925. (247,725.)

2,790. "Headlights for motor-cars, motor-cycles, and the like." A. M. Ure. January 31st, 1925. (247,726.)

3,165. "Sound amplifiers." H. Kanders. February 4th, 1924. (228,905.)

3,718. "Production of die-cast iron castings." E. W. Walford (E. Holley). February 10th, 1925. (247,735.)

3,777. "Acoustic amplifiers or radiators." E. A. Graham and A. J. Denniss. February 10th, 1925. (247,736.)

4,316. "Automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), L. P. Lowry, and J. R. Gould. February 17th, 1925. (247,742.)

5,258. "Head-lamps suitable for use on motor-cars." G. Herbert. February 25th, 1925. (247,745.)

5,456. "Method of and means for increasing economy in long-distance cables." British Thomson-Houston, Co., Ltd. February 29th, 1924. (230,085.)

8,170. "Rectifying elements for high-frequency electrical oscillations." H. Wade. (Carborundum Co.). March 26th, 1925. (247,767.)

8,827. "Vacuum tube systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co.). (Western Electric Co., Inc.). April 2nd, 1925. (247,774.)

9,056. "Electrical contact devices." G. G. Bowen. April 4th, 1925. (247,777.)

9,203. "Device for electrically indicating whether a non-electric light has gone out or failed." A. Shaw and F. Fairier. April 7th, 1925. (247,779.)

12,146. "Insulators." M. Treve. November 12th, 1924. (242,942.)

12,158. "Crystal detectors." W. F. Harkness and F. Davies. May 9th, 1925. (247,794.)

13 785. "Electrical fuseholder." H. J. McCarthy. May 26th, 1925. (247,807.)

14,159. "Spark-gaps for induction coils and the like." F. E. Kewley and Bower Electric, Ltd. (in liquidation). May 29th, 1925. (247,809.)

14,684. "Ferraris electric meters." Soc. Genevoise d'Instruments de Physique. June 25th, 1924. (236,187.)

14,871. "Brakes for electric motors." Toledo Automatic Brush Machine Co. October 6th, 1924. (240,791.)

16,443. "Wrapping papers for cables." Felten & Gilleaume Carlswerk Akt. Ges. December 27th, 1924. (245,059.)

17,214. "Distributing transformer." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). July 4th, 1925. (247,824.)

17,660. "Variable air electric condensers." A. K. Croad (Amsco Products, Inc.). July 9th, 1925. ((247,829.)

17,826. "Carbons or electrodes for the formation of ultra-violet rays for therapeutical purposes." Dr. M. Arnone and V. Arnone. July 11th, 1925. (247,831.)

18,768. "Inductance and like electric coils, and mounts therefor." J. Bottomley and A. N. Riley. July 23rd, 1925. (247,834.)

19,717. "Electric ciphering apparatus." H. G. C. Fairweather (Aktiebolaget Cryptograph). August 5th, 1925. (247,838.)

19,927. "Electric drives for looms." Siemens Schuckertwerke Ges. August 8th, 1924. (238,247.)

20,070. "Electrical insulating devices." Metropolitan-Vickers Electrical Co., Ltd. August 14th, 1924. (238,545.)

20,460. "Electrotelephonic sound-box." H. Robeck and Fein-Maschinen-Bau Ges. August 14th, 1925. (247,843.)

21,157. "Alternating pole magnets for small size electrical machines." Fahrrad & Metallwerke L. Bauer & Co. Ges. October 8th, 1924. (241,166.)

24 059. "Electric contact device, particularly for use in electric clocks." Landis & Gyr Soc. Anon. October 28th, 1924. (242,244.)

24 285. "Automobile headlights." C. C. Ramsay. September 29th, 1925. (247,868.)

25,137. "Variable air electric condensers." A. K. Croad (Amsco Products, Inc.). October 8th, 1925. (247,874.)

26,097. "Electric condensers." P. R. Coursey and Dubilier Condenser Co. (1925), Ltd. October 19th, 1925. (247,881.)

26.776. "Method of operating high-speed switches for heavy currents." International General Electric Co., Inc. October 27th, 1924. (241,952.)

1926.

104. "Ignition apparatus for internal-combustion engines." F. H. Royce. November 17th, 1924. (Divided application on 247,304.) (247,897.)

The

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The Electricity Supply Scheme.

ON Monday or Tuesday next week, if the Prime Minister's intentions are carried out, the Electricity (Supply) Bill will be debated and read the second time, after which it will go to a Standing Committee for that detailed examination which Mr. Baldwin anticipates, and for that drastic amendment which it will undoubtedly receive, processes which will probably occupy many weeks.

As the scheme stands, it will find few supporters amongst those who are conversant with the past and present of the electrical industry. That long-suffering industry has from the first laboured under a superfluity of Parliamentary and bureaucratic control in some respects, whilst in others it has lacked the helping hand which could have done so much to smooth its path and hasten the development of electricity supply. The consequence is that, whilst it still needs the latter as much as ever, it is compelled to invoke the former to repair the damage wrought by past legislation. But the salvation of the industry is not to be brought about either by the waving of weird "gridirons" or by the multiplication of authorities. There are already too many doctors for the health of the industry.

First, let us consider the question of the Central Electricity Board, the fundamental feature of the Bill. Already its constitution and status have been vigorously attacked by prominent representatives of the electrical industry. Col. R. K. Morcom, in his speech at the Beama luncheon on Thursday last week, pointed out that the Board would be in all respects—technically, administratively, and financially—under the control of the Electricity Commission; it would have no independent existence, and he could see no justification for its creation. It could not function effectively unless it were given real executive powers and became a strong industrial board of directors. Last week, too, Sir Philip Dawson, M.P., although he welcomed the Bill as a whole, declared that to make the Board subservient to the Commissioners was fundamentally wrong—it must be free and independent. The technical work should be carried out by the Electricity Commissioners, but the great commercial questions connected with the generation and supply of electricity should be in the decision of the Board, which should be directly responsible, through the Minister of Transport, to Parliament, and should be independent of any political party. Mr.

P. J. Hannon, M.P., whose remarks at the dinner of the Birmingham Electric Club were quoted in our last issue (p. 452), was interviewed by the *Financial News*; he again emphatically condemned the proposal to make the Board "an appendage to the Electricity Commissioners," and asked whether the Board was necessary at all. Why not enlarge the powers of the Electricity Commissioners, and make them "the supreme determinant factor in the development of electrical distribution?" Apart from occasional reference to the Minister of Transport, "the whole of the effective power remains in the hands of the Electricity Commissioners." In Mr. Hannon's opinion, whilst no one would object to the endowment of the present Commissioners with the powers embodied in the Bill, "Commissioners come and go, and Governments may change," and he regarded it as essential that such a body should be subject to Parliamentary control.

With the spirit of these criticisms we cordially agree. The new Board, Mr. Baldwin stated at Birmingham, was to consist of men of the highest industrial standing, fully conversant with the conditions obtaining. Such qualifications will undoubtedly be required—but is it to be supposed for a moment that men who possess them will accept office as underlings? Everything depends upon the working of the scheme, and therefore upon the men who direct its working—men who will not easily be found, and who certainly will demand freedom of judgment compatible with the responsibility of their duties and the importance of the affairs entrusted to them. To subordinate their office to the Electricity Commission is not only to impose double duties upon the latter, but also to shut out every man of character and ability adequate to fulfil the functions of the Board with efficiency and strength.

What, then, are the alternatives? Sir John Snell, in his popular address broadcast from the dinner of the E.D.A., asked for constructive criticism of the Bill, and we give it. There should be but one controlling authority—the Central Electricity Board—responsible to the Minister of Transport, who would answer for it in Parliament. The Electricity Commissioners, whose experience derived from their incessant labours during the past six years constitutes an invaluable asset to the State, should either become an advisory body to the Board, dealing with all technical questions, or should be incorporated with the Board. The latter course would appear to be the more rational and effective, and we hope to see it adopted by Parliament.

Sir Philip Dawson and Mr. Hannon have already tabled a motion instructing the Committee which will deal with the Bill to modify it in that direction, and there is a strong body of opinion in the House of Commons hostile to the Bill in its present form.

The Basis of the Electricity Supply Bill.

It is very much to be regretted that one of the most fundamental data with regard to the present position of electricity supply in this country is, we believe, no more than a shrewd guess. No doubt very many important matters have to be dealt with on no better foundation; no man can tell what the future may bring forth, and we have to do the best we can with estimates in the hope that the outcome will not be found materially in error—but at least we ought to be in possession of the facts as they actually exist. Unfortunately we do not know, and have no means of knowing, the present rate of consumption of electricity *per capita* in Great Britain. In the Report of the Weir Committee, dated May 14th, 1925, the energy sold per head of population by authorised undertakings is set down as 110 kWh; in the fifth annual report of the Electricity Commissioners for the year ending December 31st, 1924, p. 10, the figure is given as 117, on the basis of the Census Return of 1921. This figure, however, does not include the energy used for traction and generated at the power stations of railway and tramway authorities, nor does it include "the further large supplies generated privately at stations belonging to industrial and commercial organisations," of which no statistical returns are available. An approximate value could be obtained for the consumption of energy for traction (say 12 per cent. of the aggregate), but the enormous amount that is generated in private establishments can only be guessed at. In the Weir Report we read (p. 5): "It is estimated that if energy from every source, both public and private, were included, the consumption per head in this country would be raised from 110 units to about 200," but the former figure is adopted in the calculations tabulated by the Committee.

In his evidence before the Coal Commission, Sir John Snell put forward the figure of 117 kWh for 1924, and adding the estimated units generated by private plant, gave the probable total consumption as 220 kWh per head, while he suggested that a *sale* of 500 kWh per head would be reached in the course of the next 15 years, assuming that (para. 4,393) further facilities would be given to the Commissioners and to the electrical industry. Questioned with regard to the consumption at collieries, Sir John said the Electricity Commission had information at its disposal, but that it was given in confidence and could not be disclosed without consent (paras. 4,410 *et seqq.*); but Mr. Evan Williams said he could obtain the figures, and the matter was left at that.

It should, we think, be realised that this is a very important question; nearly half the electrical energy that is believed to be consumed in this country to-day is the subject of guesswork, at a time when that quantity is of fundamental importance to the deliberations of Parliament!

In the Annual Report of the Electricity Commissioners above-mentioned, it is shown (p. 10) that the rate of increase of energy *sold* from 1922 to 1923 was 19 per cent.; and from 1923 to 1924 it was 15 per cent. The figures given for energy *generated* for public supply and traction (p. 8) show annual increases from 1922 to 1925 of 17.5, 16.4, and 11.0 per cent. The Weir Committee said (p. 6) that "on the basis of the present increase of 19 per cent. per annum, the demand in Great Britain will have reached 500 units per head of population by about 1940," starting from 110. But if we increase the consumption annually by 19 per cent., from January, 1925, we arrive at 500 kWh per head in 1933, nine years from that date. Yet the Committee places that consummation at about 1940! This estimate of increase, it will be noted, is based solely upon energy *sold*, and takes no account of any possible increase in privately-generated energy, or in the consumption for traction; and it is based on progress that is being made under the existing conditions. If, then, we shall presumably reach the 500-unit mark in eight years from to-day, why did Sir John Snell suggest, in the evidence which he gave on November 11th, 1925, that the consumption of electricity per head would be trebled in 15 years only on the assumption that "further facilities" or "further powers" were given?

These figures are irreconcilable, and it would be very helpful if a coherent statement were issued by the Electricity Commissioners as to what they mean by the rate of increase, and what steps have been or are being taken to ascertain what the actual consumption of electricity (not merely the energy sold) in this country is to-day. The Census of Production, which is in course of compilation, ought to furnish ample data for the purpose—provided that the authorities consider it expedient to disclose the facts.

Another statement of which much has been made is that the amount of spare plant installed in the generating stations of authorised undertakings in this country is 68 per cent. At first sight this appears to mean two-thirds of the plant installed; it is, however, only 40 per cent. of the plant installed. The Weir Committee states (p. 4) that the plant installed is 3,096,535 kW, and the maximum load is 1,844,000 kW (May, 1925), the spare plant therefore being 68 per cent. of the *maximum load*. This is a very different matter. Speakers on this subject who have stated that 68 per cent. of the plant was

spare should have said 40 per cent., which, if admittedly excessive, is by no means so startling a figure.

The last column of the table on p. 25 of the Weir report is similarly misleading, an increase from 110 to 500, for example, being described as a growth of 455 per cent. instead of 355.

Colonel Morcom's Speech.

The annual speech of Col. R. K. Morcom, the chairman of the British Electrical and Allied Manufacturers' Association, which is printed in full on a later page, was one of the most compact and businesslike reviews of the electrical industry to which it has been our privilege to listen. In the main we may leave it to speak for itself, but there are one or two points to which special attention should be directed. The figures of our electrical export trade reflect a very satisfactory state of things. The Colonies and Dominions are enjoying such a measure of prosperity as to permit them to proceed with schemes for the development of their resources, and British electrical and allied industries have been profiting from that state of things. Happily there is in the Colonies and Dominions a spirit of patriotism which inclines them to avoid the temptation to place their contracts outside the Empire family circle. It is unfortunate that the same state of things is too frequently less noticeable at Home. If there had not been a lag upon our great industries these would have been able to proceed with greater developments of our internal resources which would have brought bigger business to our electrical and allied trades from the Home market. The Home trade would then have compared far more favourably with the export business. But apart from the delays in our internal industrial progress, due to a variety of circumstances—among them threatened industrial disputes and anticipated electrical legislation, both occasioning doubt and uncertainty—there has been the placing of orders abroad by Home authorities and buyers. The total of the electrical import trade of the United Kingdom was too high, and Colonel Morcom indicated that if there had been everywhere present amongst buyers in the Home country that same patriotic spirit which possesses our kith and kin beyond the seas, we should have retained sufficient additional orders to secure the filling of our works to their utmost capacity with benefit to our manufacturing concerns and more employment in the nation. It is calculated that the volume of the import electrical business recorded in the statistics quoted would have sufficed to give employment to 15,000 more workpeople in the electrical industry alone, and a further similar number in other trades, if the orders had been kept at home. Another point, stressed now as it was a year ago, is the menace of future German and American competition. The assistance rendered to Germany in the shape of financial aid for industrial and electrical developments is, as we have frequently stated, expected to be followed by a competition keener than ever before experienced. Those who have influence in directing the course of British orders for electrical products can hardly be blind to their duty to assist activity in the Home factories if they appreciate the necessity for securing prosperous national industries with increased employment. Driven by the sheer necessity of their financial responsibilities, the German people are expected to carry on a price-cutting competition the effects of which may be serious if our buyers—whether municipalities, industrial concerns, or private traders—allow themselves to pay regard to cheapness alone, disregarding the well-being of those who are engaged in, or waiting to be employed in, British industry. Purchasers of plant, advisory engineers, directors and committee-men alike, should seriously regard the responsibility that rests upon them to assist British electrical manufacturing to maintain a very strong position among the great national industries. We can understand the difficulty in which some engineers are placed when such questions arise, but wherever they can in reason do so they will serve the national interest better by fighting their difficulties and resisting the voice of the charmer who, by quoting figures alone and omitting references to the needs of our people, makes it appear a foregone conclusion that a foreign tender should be accepted. To quote the words of Col. Morcom, we appeal to our readers to do their utmost to resist "the lure of foreign dumping."

Hiring Electrical Apparatus.

The particulars given elsewhere in this issue by Mr. A. H. Shaw, M.I.E.E., engineer and manager to the Urban District Council of Ilford, with regard to the apparatus hired out to consumers by the Council are worthy of careful study. It will be observed that the hiring system is applied to both large and small apparatus—from costly washers, of which 13 are on hire, to toasters; it is somewhat remarkable that electric irons do not occupy a higher place in the list, as they are generally believed to be the most popular household appliance, but in this case the radiators take the lead, numbering more than one-third of the total.

As we have often pointed out in these columns, there can be no doubt that the hiring-out of electrical apparatus is a most effective method of increasing the use of electricity in the home, and every progressive undertaking should adopt it. In fact, we have no hesitation in declaring that any undertaking which does not adopt it has no right to be called progressive. Development is the great need of the moment, and every obstacle to it ought to be swept away with a firm hand, for the good of the nation, of the consumer, and of every section of the industry without exception.

The Electrical Development Association.

The Electrical Development Association, which held its annual meeting and dinner on Friday last, is to be congratulated not only on the success of the latter, but what is of vastly greater importance, on the great strides that it has made during the past year. Not only has its membership been notably extended—its revenue has increased by no less than 200 per cent.; this excellent result is due, as the new president, Mr. R. P. Sloan, pointed out, to the able guidance of the director, Mr. J. W. Beauchamp, and the work of his staff. We believe with Mr. Sloan that those who have subscribed to the funds of E.D.A. will receive a very good return on their outlay, and we are confident that the greater efficiency of the Association's propaganda resulting from the enlargement of its financial resources will continue to attract additional contributions, snowball fashion.

That there is enormous scope for development was indicated by Lord Burnham, whilst Mr. R. B. Mitchell and Mr. R. P. Sloan, both at the head of very large electrical undertakings, bore witness to the influence of E.D.A.'s work in promoting the use of electricity. Throughout the supply industry there is a firm conviction that the rapid advance in the domestic consumption of electricity which has been recorded during recent years will be not only maintained but accelerated, and the Association will play an important part in keeping the ball rolling in the right direction. As we have previously suggested, the distribution end of the chain of electricity supply is not less important than the generation end; if by Government action the supply of electricity is to be greatly increased whilst distribution is left to take care of itself, the industry must make good the deficiency, and in this work the Electrical Development Association will be a most effective agent.

Incidentally, we wish to enter a protest against the very unfair practice, adopted by the Weir Committee and by speakers at the E.D.A. dinner, of comparing the average consumption per head for the whole of Great Britain—and that only for public supply—with that of the most highly-developed portions of foreign States, such as Chicago and California. Why is no mention made, on such occasions, of *our* best areas, some of which are already at the 500-kWh stage of development?

Notes on the Leipzig Fair: Their Bearing on our 1927 Effort.

The British Industries Fair, 1927.

The announcement that was made last week regarding the British Industries Fair for 1927 has laid all uncertainty to rest, and it will now be possible for the responsible authorities to proceed full steam ahead with arrangements which shall ensure a larger collection of exhibits than at any previous Fair and a record gathering of buyers from abroad.

It is generally held that this year's Fair both in London and in Birmingham was a conspicuous success amply justifying the additional publicity backing that it received from the Government, and the President of the Board of Trade has now announced that a similar grant (£25,000) for publicity and propaganda purposes throughout the world will be made in respect of the Fair which will take place at about the same time next year. As before, the London arrangements will be under the care of the Department of Overseas Trade, and those at Birmingham will be organised by the Birmingham Chamber of Commerce.

This prompt decision is indicative of the Government's belief in the Fair as a means for continuing the stimulus already given to trade, and it enables all concerned to begin their preparations at an earlier date than on any previous occasion. There are already signs that the number of exhibitors and the space occupied will be considerably increased. Space is cheap, and British manufacturers and traders are urged to make their requirements known without delay.

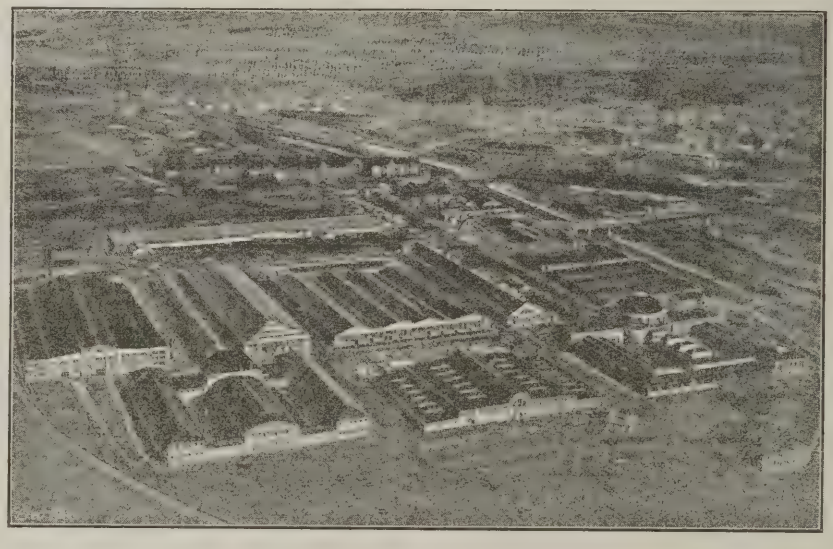


Fig. 1.—Bird's-Eye View of the Leipzig Technical Fair.

The decision to hold the Fair in two places still seems to us to be a wrong one, and we believe that ultimately a change will be made in favour of one big event at one centre, but the decision having been reached we will not now waste time discussing it further, as there are other points upon which we wish to offer constructive criticisms and suggestions designed to increase the efficiency of operations from now onwards until February and March, 1927.

Our readers do not need to be reminded that the Electrical Review used its influence, in co-operation with others, to secure that the British electrical industry should take a prominent part at Castle Bromwich. The story of the success of the Electrical Trade Section last month is familiar to all, and we believe that, while there was room for criticism, as there always is and will be, the general consensus of opinion was favourable toward the continuance and substantial enlargement of that Section next year. The electrical movement only began three months before the Fair opened this time, but that period proved amply long enough for exhibitors to bring together most creditable and businesslike displays. It was not long enough for special electrical efforts to bring overseas visitors to bear all the fruit that we desired. This year we have nearly eleven months in which to make our preparations, and if electrical exhibitors will make their plans early the world invitation to overseas electrical buyers should meet with a more general response because the publicity that the electrical arrangements have received in the Press during the past six weeks will have acquainted those buyers with the fact that the Fair at Birmingham is an Electrical Event of World Importance where they can see everything good that is going in British electrical products of most classes.

It has been observed by some that the Hall devoted to the electrical exhibits at Castle Bromwich was badly placed. Whether that be so or not, it must be remembered that it was the only one available when the movement for an Electrical Section seriously began. Other sections of industry had made up their minds regarding what they wanted, at an early date. The suggestion that such might give place to the electrical trade because it anticipates much larger requirements for 1927 is one for the general committee at Birmingham. No doubt if the demand is substantial enough, and is made in good time, new and special accommodation can be afforded. The point that we must stress most strongly in this connection, as in others, is the imperative need for prompt action by a strong electrical committee which shall be responsible for ascertaining the aggregate space requirements and working in close co-operation with the Department of Overseas Trade in compiling the fullest possible useful lists of buyers who ought to receive personal invitations to attend the Fair.

We believe that, considering the time and space at disposal, the eighty firms who exhibited at Castle Bromwich adapted themselves remarkably well to the shop, or market type, of stand, but in all probability, if things are now organised on a larger scale, this idea can be carried out still more effectively, as we have more time to devote to consideration of what is the best plan to work to.

The Leipzig Fair.

During the progress of the Birmingham Fair it was suggested to us that in view of the practical interest that the Review had taken in the scheme, we might assist the industry still further by proceeding to Leipzig during its great week (commencing on Sunday, February 28th) and studying the organisation and plan for that time-honoured event in the expectation that ideas might be gathered which would assist in perfecting the arrangements for London and Birmingham next year. The suggestion was also advanced to the Technical Press as a whole at one of the functions. We availed ourselves of the suggestion, and the present moment seems to be the appropriate time at which to publish some of the observations which our Special Commissioner has to offer.

It is with the London and Birmingham Fair in mind that one ventures to make a comparison between that combined event and the great German Fair at Leipzig, where the electrical industry was very strongly represented.

Leipzig is a fine, well-laid-out town of some 630,000 inhabitants—that is to say, approximately two-thirds of the size of Birmingham. The journey may be accomplished in comfort from London in 23 hours. While our own Fairs were only commercial in 1915, the year following the outbreak of war, that at Leipzig has taken place for centuries past and has been held in a variety of large

halls situated in different parts of the centre of the town. These halls are still used for many of the Fair purposes, but some 20 years ago it became necessary to find a much larger site on which to house the engineering and other technical exhibits. The so-called Technical Fair is therefore now situated some two miles south of the main railway station; it is fed by a good tramway service, and special 'buses are also provided to meet the various trains. About 100 special trains were run from all parts of Germany during the week.

The Technical Fair comprises 15 separate halls, of which the largest would compare favourably with the

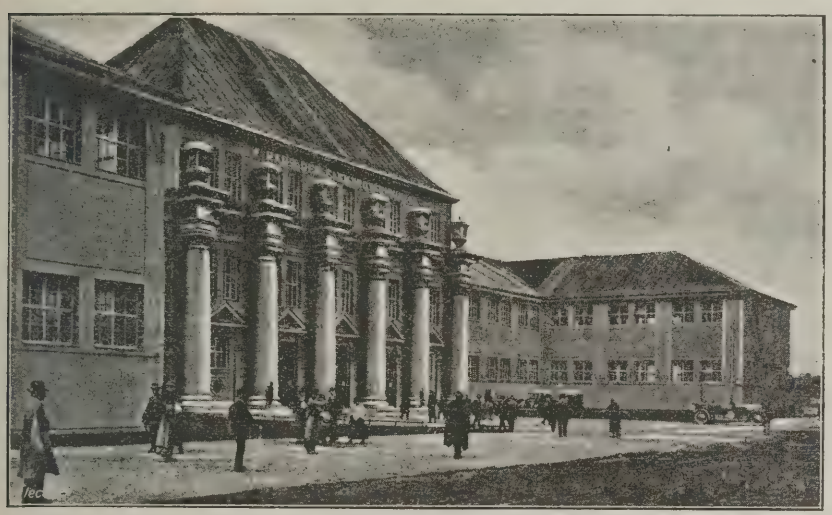


Fig. 2.—Haus der Elektrotechnik, Leipzig.

Palace of Engineering at Wembley; nearly all of these halls are fine permanent buildings.

International Character.

It should be clearly understood that the Leipzig Fair is international in character; that is to say, it is in no sense restricted to German goods, although, of course, the great majority are German. Any country can, if it so desires, take a hall in Leipzig and exhibit any of its productions that it chooses; for example, at this year's Fair, Italy, Czecho-Slovakia, Austria, and the Russian Republic all had separate buildings of their own. The Motor Car Hall contained more American than German cars, and French exhibitors were also to be found.

Organisation.

Centuries of experience, aided by the traditional German capacity for organisation, have built up a really wonderful machine. The Fair has permanent offices all over the world, from Iceland to the southernmost portions of South America, and the intending visitor from any of them will be given the fullest possible information. For example, in London (at 1, Gower Street) there is a Leipzig Fair office which is open all the year round, and the visitor can be advised as to trains, can secure vouchers for badges and catalogues, and can be assisted as to accommodation in Leipzig. A special office at the Leipzig railway station deals with all inquirers and provides accommodation when desired. When it is said that 150,000 people of all nationalities may descend upon the town in one week, it is clear that the usual hotel accommodation becomes totally inadequate, and it is necessary to secure the co-operation of the population, as is done here on a smaller scale when 2,000 members of the British Association attend annual congresses. The majority of private houses are pressed into service, and a complete card index of every available room is kept at the Leipzig station, and within a few minutes the incoming traveller can be fixed up with bed and breakfast at prices varying between 8s. and 10s. per night. Every visitor to the Fair must have a badge, and to obtain one it is necessary to furnish particulars of one's name, home address, and occupation. All badges are obtainable from the central headquarters in Leipzig, but vouchers for them can be purchased in the visitor's own country, and by so doing considerable saving is effected; that is to say, a badge voucher can be obtained in London at 2s. 6d., where 5s. would be payable if it were purchased on arrival in Leipzig. The same thing applies to vouchers for catalogues, the price being higher in Leipzig than if a voucher is obtained first in the visitor's own country. This small concession is obviously designed partly to lessen the amount of work at the Leipzig headquarters, and partly to induce the visitor to attend the Fair office in his own country, and so enable the representatives to become acquainted with him before he leaves.

This badge system is obviously of great value to the organisers, since it gives them a permanent record of all persons who attend the Leipzig Fair, and makes it possible for them to be communicated with at any future date. Every year, of course, this record of possible buyers grows, so that before the Fair opens the central or local organisations can be placed in touch with an immense number of what our American cousins call "prospects." The office or bureau inside the railway station at Leipzig provides the incoming visitor with practically any information he may desire, including accommodation, and he may also obtain the services of a first-class interpreter for any length of time. No one need hesitate for a moment to visit Leipzig on account of language difficulties; it is the business of the Leipzig people to see that this does not stand in the way, and it is done most thoroughly. We quote these particulars in detail because we believe that they have an important bearing upon the British Industries Fair. There is great room for us to profit from this particular piece of organisation work, for it has much to teach both the Department of Overseas Trade and the Birmingham Electrical Committee. The criticism that the visitor to Birmingham—the stranger—needs better assistance on arrival than he had this year was quite justified.



Fig. 3.—The Machinery Hall (No. 9) at Leipzig.

The Haus Der Elektrotechnik.

This is a very fine entirely permanent building with a large, lofty, and well-lighted central hall, which is surrounded by lower buildings also available for exhibitors on two floors. Meals can be had within the building, and on the top floor of the main hall is a large lecture room fully equipped for any desired demonstrations.

The arrangement of stands is very similar to that

adopted at the Birmingham British Industries Fair, each stand being the equivalent of a lidless box with one side removed. There is no competition as regards appearance of the actual stands themselves; all are of the same height, have the same form of lettering, and are of the same colouring; the only thing which differentiates between the sizes of the competing organisations is the amount of space taken. The A.E.G., Siemens and Halske and Siemens-Schuckert organisations had between them a floor space which was nearly as large as that occupied by the whole of the exhibitors at Birmingham. The Bergmann and Brown-Boveri companies also occupied a very large area. Some 340 exhibitors were housed in the main building, but there was a considerable overflow into a temporary hall (No. 5), where there were probably a further 80 exhibitors. These figures will give some idea of the magnitude of the electrical section of the Fair at Leipzig, as contrasted with that at Birmingham and London. Hall No. 5 was in part occupied by very small manufacturers, whose exhibits were simply staged on a counter running along one side of the building. There were not even partitions between these exhibitors, and in some cases they only showed a single novelty on a strip of counter about 3 ft. wide by 3 ft. deep. The exhibitor was provided with a single chair (if he was fortunate), and he covered his exhibit up with a piece of paper at night time. Some system of this kind might, with great advantage, be considered for future fairs in this country, as it should enable the small man to exhibit his goods at very little cost.

The Exhibits.

Speaking of the exhibits generally, even the largest makers did not stage very large pieces of apparatus. There were a number of big mercury-arc rectifiers, some heavy oil switches, and a few transformers of fairly high capacity. Rotary converters, large motors, and turbine plant were conspicuous by their absence. The Siemens group showed direct-current motors having a very wide speed range, *i.e.*, from 750 r.p.m. to 2,250 r.p.m. Particularly noticeable were the very large number of different stands exhibiting lighting fittings of every conceivable character, from the most elaborate electroliers down to single candles. Similarly, the makers of porcelain insulators of every description were very well represented, and the same can be said of the makers of small accessories such as lampholders, switches, ceiling roses, adaptors, &c. Electric irons were very strongly shown and a considerable number of bowl fires, but the ordinary household radiator, with which we are well acquainted here, did not seem much in favour. This may be due to the fact that it is much colder in Germany than in this country, and that the amount of electricity required to heat adequately a fair-sized room would be prohibitive to the average German. The ordinary middle-class house in Leipzig is fitted with double windows throughout, and each room contains an enormous stove which is heated with some form of compressed fuel. There were on one or two of the stands electric radiators which were made up to represent, to some extent, these stoves.

Wireless apparatus was not very prominently shown, except by a few of the bigger firms like the A.E.G., Siemens & Halske, &c. One noticed a fair proportion of "Amplion" loud-speakers.

English was not spoken on the majority of the stands, but all the bigger firms had available at least one man who knew our language.

Back to Birmingham.

Returning now to consideration of the Birmingham Electrical Fair for 1927 we are compelled to stress the importance of the Chamber of Commerce Council calling into co-operation a strong and larger representative committee which shall immediately take the electrical arrangements in hand. In the report of the B.E.A.M.A. Executive mention is made of the fact that the British Industries Fair is an event in which the individual manufacturer is not asked to refrain from exhibiting. Possibly the Council will feel that it can go further and point out to its members the desirability of their taking a share in this brief and inexpensive but very promising Market Event. A definite official approval would convey more definite guidance than the mere word "permitted." Possibly, too, the Chamber of Commerce in setting up an Electrical Committee may see the wisdom of inviting the various electrical industrial organisations to appoint representatives to sit thereon. We are confident that if all take a part in the arrangements a most impressive and effective electrical trade event will be assured, bringing only good to both our Home and our export trade.

Radio Receiving Aerials.

The Importance of Efficient Erection.

By PAUL D. TYERS.

The writer has recently examined a number of aerial systems installed by various electrical traders and, in his opinion, they were utterly deplorable. They nearly all seemed to show an absolute ignorance of what is really required, and one can only surmise that they must be representative of a vast proportion of the aerial systems which are installed throughout the country. Bad aerial systems have a far more deleterious effect upon the wireless trade than might at first be imagined. In fact, it is somewhat surprising that manufacturers of wireless sets are so utterly unconcerned with the manner in which their apparatus is used. The writer knows a case in which a well-known set of good design and manufacture was the subject of a very unfavourable criticism, due entirely to the fact that a local trader had installed it with the most appalling aerial system it is possible to imagine. Obviously, however efficient a receiver may be, it is no use expecting it to give excellent results unless the aerial system is equally efficient. It is believed that a short time ago some of the writers in the popular Press, in order to emphasise the efficiency of the modern receiver, pointed out how well it would function on quite a poor aerial. While this may be true to a certain extent, a statement of this nature is liable to prove very confusing, and tends to give traders a wrong impression. If by "poor aerial" is meant one which is not very high, and one which is possibly rather badly screened, then the writer agrees with this statement, but the best set cannot function efficiently with an aerial which is entirely wrong from several very much more important points of view.

Let us consider very briefly the chief requirements for a really efficient aerial. There should be no need to point out that it is desirable to make the aerial as high as possible, and place it where it is in the position of minimum screening. If circumstances are such that this cannot conveniently be done, it means that more care must be taken with other points in its installation.

Probably the most important point to remember is that the aerial down-lead should be as far from the wall as possible. Even if this means sacrificing some six or seven feet of the horizontal portion, this is of no importance, as increased efficiency will be obtained by keeping the down-lead well away from earthed bodies, that is, the wall of the house. The actual lead-in itself is important; the insulation should be as high as possible, and a good lead-in insulator should preferably be employed. A mistake which is frequently made is that of carrying the lead-in, when it has passed through the window, several yards round the room before it reaches

the aerial terminal on the set. Nothing can be worse than running the lead-in parallel with the wall or mixing it up with curtain rods and blinds. It is even not infrequent to find a lead-in actually fixed to a picture rail with bare staples before it reaches the aerial terminal on the set some nine or ten yards away. In the writer's opinion the best method of bringing the aerial into the room is to run the aerial wire itself straight through a lead-in tube, making the connection to it inside the house. Many prefer to connect the end of the down-lead to the lead-in insulator simply by connecting the wire to a terminal. If this is done care should be taken to protect it from the weather, as the wire is quite likely to become corroded, and a very poor contact is obtained. If the connection is made other than by means of a terminal at the end of a lead-in insulator, the joint should certainly be soldered, and again well protected from the atmosphere.

The actual aerial itself for ordinary broadcast reception need only be a single wire, and should be supported by really good insulators of ebonite, porcelain, or "Pyrex." From tests made on composition insulators, the writer would not recommend their use. Moreover, the insulator chosen should preferably be as long as possible, as this tends to reduce surface leakage. One of the best types of aerial is simply an ordinary copper wire, enamelled probably being preferable. A type of aerial which seems to have become very popular recently consists of covered stranded steel wires arranged round a single copper core. The tensile strength of this, of course, is greater than that of copper wire, but from an electrical point of view it would appear to have little to recommend it over the normal type. The covering on this type of wire, however, is insufficient for insulation purposes, and if used it should be regarded as bare wire.

Insulation for Low-Pressure Switchgear.

The Characteristics of the Materials Employed.

By J. O. KNOWLES, M.A.

The problems of insulation for high-pressure switchgear and cables sometimes overshadow the problems of low-pressure insulation, but whereas high-pressure gear is installed, attended, and maintained by experts, low-pressure gear is often at the mercy of men with little or no electrical knowledge. It is the fate of some low-voltage starters to be dumped in unlined packing cases into an open yard, left lying about in a half completed building and finally handed over to an electrical contractor in a state that would make the control gear manufacturer ashamed of his product. Again, after the gear is installed and connected up and given an initial cleaning up, the enemies of insulation—dirt, damp and chemical action—begin a prolonged attack, carried on from year to year, in November fogs and in summer heat, in air laden with dry dust and with wet dust, in clean workshops and in other places.

Consider then the usual forms of low-pressure insulation and their weaknesses, so as to know what margin of safety there is in commercial practice and in reasonably adverse conditions.

Slate.—This is at once the most common and the least used form of insulation. This paradox is obvious when it is remembered that when slate panels are used, one pole (in d.c., or two poles in a.c.) is commonly insulated from the slate by mica or other bushes, so that the insulation between poles (and also to earth) is not really the slate itself, but the insulating bushes. Why is this so? Slate is a good insulator, and especially if the front of the slate is enamelled and the back shellacked, the leakage across the surface is not found to be great in test cases. Metallic veins are not common, and even if slate is used from a quarry where metallic veins are known to be present, such imperfections are almost invariably discovered in a high-voltage test at the control gear maker's works.

The strength of the case for insulating slate with mica is that electrolytic action so often occurs between studs of opposite polarity on the same slate panel in damp conditions. The slate contains traces of chemical impurities which form with moisture a conducting path between the studs, which then become cathodes and anodes in an electrolytic bath. A whitish deposit appears round the studs of one polarity, which are slowly eaten away, and the studs of opposite polarity are marked with characteristic black patches. Except for the white deposit, which appears round the nuts on the studs through the slate, the action takes place within the holes in the slate, and a stud may be so eaten away as to break in two with the slightest vibration and yet show no external sign of breakage.

Some slate is more liable to this electrolytic action than other varieties. A rough test is to pour strong acid on slate in a powdered form. The greater the ebullition when the acid meets the chemical salts in the slate, the greater the likelihood of electrolytic action. The writer does not know of any slate that is free from this fault in conditions where studs of opposite polarity are fitted close together on the same slate and exposed to dampness. Insulation of one pole from the other with mica is the only safe cure or precaution. The back of the panel should, of course, be coated with shellac varnish *before* the connections are made, and all connections, on at least the pole that is insulated from the slate with mica, should be kept clear of the slate or electrolytic action will be set up where these connections touch the back of the panel.

Usually, in addition to the switchgear in positive and negative lines, there will be coil circuits across the lines, and where there is a drop in potential from the uninsulated pole, even if only of 50 or 60 volts across a coil or resistance, the studs should be bushed, at least if the coil or resistance is continuously in circuit or alive. It is usually possible to keep most of the switchgear parts on one pole or the other so that only a few studs require bushing with mica, and possibly a cheaper alternative to mica bushes would be satisfactory under all but very damp conditions.

Mica.—Steel bars and framework with mica insulation form an excellent if somewhat expensive construction. For switchgear which can be held in position by a few clamps only, this construction is much favoured. It is obvious that parts with heavy momentum, such as contactor armatures and quickly moving parts such as quick-make and break switches, should be clamped on the mica in such a way that the clamps cannot work loose and damage the insulation. Lock-nuts, washers, or patent nuts should be used and made absolutely secure on moving bars, and the size of bar should be such as to present a large surface normal to the direction of greatest shock.

Where a number of small contacts have to be used, steel and mica construction presents a little difficulty. It is not satisfactory to bush stud holes drilled so close to each other that separate washers cannot be used for each stud, for if one micanite plate covers a number of bushes, it is impossible to remove any faulty bush without dismantling the whole plate. For this reason a slate or Bakelite plate is to be preferred to steel and mica construction for starters and regulators of small sizes or of circular faceplate pattern.

Mica bushings should always be fitted so as to break joint, the same construction applying to coil spools of brass and mica construction. In this type of bushing, two micanite tubes are used, one inside the other, and two washers are used at each end, one of each pair of washers fitting over the inner tube and the other over

the outer. In this way the leakage path between tube and washers is much increased, and is diverted from the straight path, thus reducing the likelihood of breakdown.

Mica is perhaps the best of all insulators in its pure form, and not difficult to buy in a good quality. It is more difficult to keep it intact until it is bolted up in the job. Apart from wastage in storing and splitting, it is difficult to keep the mica washers or plates from being crushed, either by careless handling or by being tightened up without proper support underneath the nuts and washers that are being tightened. Micanite tubes, round and square, should be moulded on so that there is no looseness between the steel rod and the tube. Such looseness causes the clamp to distort the tube, opening the layers and crushing the mica.

Bakelite.—There is now a number of firms undertaking the manufacture or part of the manufacture of the synthetic insulation called by the name of "Bakelite" or a similar name, and the output of some firms is already measured in tons per week. It is necessary to say that the quality of such insulation varies according to certain factors, some of which are explained below. Slate and mica are substances formed by Nature, but bakelite is artificial, and depends on processes which may not be carried far enough. The user will be wise if he deals with a firm of standing, and further if he draws up a specification covering a grade of bakelite suitable for the conditions of his work. For ordinary low-pressure work up to 500 volts d.c. or 600 volts a.c., the following points will probably distinguish sufficiently the good from the bad.

Samples should be cut from sheets of the thickness to be used (in the case of sheets, not tubes), and two studs fastened through the sheet, say, one inch apart. Tests may then be made on such pieces as follows:—

(1) Pass through the studs such a current as will slowly raise the temperature of the bakelite to 300 deg. F. This test may be made in air, or the piece may be immersed in oil, according to the use to which the bakelite is to be put. *While still hot*, the insulation resistance between the studs should be measured. On many grades this will be found to be only a fraction of a megohm while hot, though as the bakelite cools, the insulation resistance increases rapidly to its original value of fifty or a hundred megohms. However, bakelite can be obtained which does not drop below 50 megohms even when hot, and this is preferable, since a loose connection or a hot contact would otherwise heat up the bakelite, start a leakage current through its low insulation resistance, and the leakage current will then add to the heat and eventually the bakelite will either char or break down both electrically and mechanically. With bakelite which does not lose its resistance when hot, such troubles cannot occur except in the worse cases of loose and chattering connections. This test will also show the presence of any free phenol in the bakelite. Under heat, any phenol present will bubble out between the layers of bakelite, and the opened layers are then exposed to the ingress of moisture. Good bakelite should not blister under heat.

(2) After soaking a piece of bakelite in water for 24 hours or more, the insulation resistance should not be less than 10 megohms between studs one inch apart (for low-pressure work). Bakelite sheets are made with impregnated paper, and if the paper is not thoroughly impregnated, moisture can creep in. Edges should be polished after cutting to seal them, and the holes should be drilled in a jig, which clamps the layers together. The heat of drilling (dry) will also seal the edges of the holes.

(3) A high-pressure test of 2,000 volts will show whether in polishing the surface of the bakelite any metallic dust has been pressed into the surface. Other tests can be made for specific purposes, but the above will eliminate many grades of bakelite now manufactured. Bakelite tubes can be tested in a similar way, but as the difference of potential is across the layers instead of along them, the tube will resist more successfully. The proportion of paper in the bakelite varies according to the grade, and should be specified and known, the price varying according to the amount of "dilution" with paper. The smaller the proportion of paper, the harder and more brittle will be the sheet or tube, though the effects of moisture will be less. Instead of using sheets of paper, other forms of dilution may be used, and thus permit of moulding, or the pure resin may be moulded without admixture.

Porcelain, &c.—For fuses and small switches, porcelain gives a cheap if fragile insulation. Much depends on the design, and while the porcelain should not be strained by any clamp or bolt, it should not be so loose as to break in the rough jolts of transit to site. With good design, porcelain would be more popular than it is.

There are many other insulating materials on the market, from imitation slate to milk (casein) products, and it is not fair to deal with them in general terms, as much depends on the conditions of damp and heat expected. Some heat-resisting insulators have an asbestos base, and care should be taken with these, as metallic particles occur in asbestos, and for insulation these must be thoroughly eliminated. The casein and other moulded insulators are made in many grades, and where moulded insulators are required, they offer a stronger but more expensive alternative to porcelain, though under certain conditions of heat (depending on the grade) they may distort through softening, and under moderate blows breakage may take place.

Electricity in Bulk.

With Special Reference to the Attitude of Small Local Authorities.

By A STATION ENGINEER.

One notices fairly frequently in the electric lighting notes of various trade journals announcements running somewhat as follows:—"The Slow-coach-in-the-Mud Urban District Council has at last decided to introduce a public supply of electricity. Messrs. Blank & Co., the Council's consulting engineers, have submitted a complete scheme estimated to cost £17,000, &c., &c." After a lapse of many months we again see an announcement somewhat along these lines: —

"The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order authorising the Slow-coach-in-the-Mud Urban District Council to supply electricity in the Urban District of Slow-coach. At the same time the Commissioners do not approve of the erection of a small local generating station, but suggest that the Go-ahead Power Co. be approached regarding bulk supply terms."

Now Slow-coach although in this year of grace, 1926, not possessing a public electricity supply (incidentally it owns a Corporation gas works or, alternatively, the local gas company is strongly represented on the Council) considers itself a very important little community, with a result that indignation runs high at the thought that a supply of electricity be purchased from an outside source. Of course, Messrs. Blank & Co. also get the wind up, as a bulk supply means lower capital expenditure, hence less fees.

Now let us try and examine the causes of local opposition to a bulk supply. In the first place the idea of purchasing current from an outside source does not find

favour in a small country town which no doubt likes to feel independent. The consultants having put forward a complete scheme wish to see it go through and, therefore, harp on the unreliability of overhead transmission lines.

The Council owning the gas works is afraid of affecting its revenue and hopes possibly to run the electricity department, thus satisfying those residents who will have an electricity supply at all costs, but probably doing nothing to really popularise the supply. If power be taken from a power company it fears (in its small-minded way) that the company in its own interests will advertise the advantages of electricity in the district and thus force the Council's hand. It is an undoubted fact that local generation in a small way can at first show a saving in cost per unit sold, but if the potential demand is really to be met and electricity popularised, the small station needs considerable extensions and the original small generating sets become obsolete long before they have been written down very much. Large capital expenditure on plant and buildings has to be faced, the original small staff has to be augmented, and the very favourable costs per unit put forward by our friends Messrs. Blank & Co. are dwarfed. More plant means more repairs and maintenance, and many incidental costs not before taken into account.

Now contrast the foregoing with the conditions that would obtain under a bulk supply scheme. The power company would erect a transmission line that would serve the district for many years; the mechanical strength of the line alone would probably ensure this. Local extensions would be confined to a few more switch cubicles and transformers over and above the necessary distributor and feeder extensions.

What is the remedy? First, let the country town councillor be educated to regard electricity supply in terms of national development rather than local development, let him be told the truth regarding the reliability of overhead lines, and given a list of really important districts that are relying on bulk supplies. Let the economics of electricity supply be simply explained to him together with a brief outline of the Commissioners' general scheme of cutting out small generating stations and developing electricity supply in rural areas. Finally, let him be told that *bona-fide* consulting engineers will not approach him, but that his Council must approach them, and the only safe method is to apply to the President of the Institution of Electrical Engineers for a list of consulting engineers.

The method of education appears to be a job for the Electricity Commissioners. The preparation of a brochure for circulation to all local authorities should be a simple and comparatively inexpensive matter. Many small towns and rural areas await electrification, and many of these are doing nothing to get on with the job. A number are undoubtedly in receipt of ill-advice. In the meantime probably tens of thousands of prospective consumers are awaiting a supply of electricity, whilst their councils dilly-dally with the subject.

The Position and Prospects of the Electrical Industry.

Col. Morcom's Review and the B.E.A.M.A. Council's Report.

The annual meeting of the British Electrical and Allied Manufacturers' Association was held on Thursday, March 18th. We print below a summary of the report of the Executive Council for the year 1925, and an account of the speeches delivered at the annual luncheon held at the Connaught Rooms on the same day.

Three new members were elected during the year and three retired, so that the membership remains at 180.

The multifarious activities of the Association and its members necessitated the holding of 749 meetings and, in addition, members of the B.E.A.M.A. staff attended 300 meetings and conferences, *e.g.*, with the Board of Trade, Chambers of Commerce, and with other Associations.

The speakers at the annual luncheon were Dr. S. Z. de Ferranti, who proposed the toast of "The Electrical Manufacturing Industry," and Colonel R. K. Morcom, the chairman of the Council, who presided. The proceedings were brief and businesslike. From the report given below it will be observed that, after a few reminiscent remarks concerning the origin of the present Beama movement, Dr. Ferranti volunteered some straight words of counsel to members' representatives regarding the harm that they could do to everybody's interests by speaking disparagingly of the work of others. Colonel Morcom gave an excellent review of most of the outstanding matters which have a bearing upon the position and prospects of the industry. This we print in its complete form.

Colonel Morcom has been elected as Chairman of Council for a second year of office.

The Annual Luncheon.

The only toast beside the loyal toast was that of the "Electrical Manufacturing Industry." This was proposed by Dr. S. Z. de Ferranti, who said that the effect of the work of "Beama" had been to transform electrical manufacturing concerns from a state bordering on bankruptcy to moderately successful undertakings which showed a fair return and gave excellent service. It was most important that the industries of the country should be successful and prosperous, for they must have a fairly substantial margin by which to develop new markets, new processes, and generally to promote the advancement of such industries. In this way they could bring in revenue from abroad and give the people of the country very much better service in developing new commodities and things of usefulness which helped to make life go more easily. The essence of "Beama" was true co-operation, and true co-operation amongst members involved true loyalty. He was sorry to say that he knew of quite a good many cases where agents of members of "Beama" were not as loyal as they should be. By their misguided action they were responsible for injuring their country and their country's trade. It was due perhaps to over-anxiety to get business, but he was sure in some cases people went too far in decrying the goods of a competitor with a view to selling their own. It was when that occurred overseas that its effects were of a very mischievous nature, and could not but assist foreign competitors in getting business which would otherwise have come to this country. He appealed to members of "Beama" to do nothing to injure the general business of the manufacturers of this country.

The Chairman's Review.

Col. Morcom, in responding, first referred to the great assistance that had been given to the electrical industry by the increased publicity that the Press had given to electrical matters during the past year. Continuing, he delivered an important speech on the Electrical Industry in 1925. He said that electricity had become such an essential element of social prosperity that in attempting any survey of the performances of the electrical industry during the year it was necessary to consider the general conditions prevailing. The sooth-sayers hailed 1925 with a chorus of optimism. All the prophets—political, financial, and industrial—promised a picture of rosy colouring. Now that it was finished the rose was a very washy pink, and drab predominated. Yet the optimism was not without foundation. Important settlements leading to international stability were either in being or in making. The Ruhr incident was terminated, the Dawes plan agreed, debt-funding well begun, and currency stabilisation effected in many countries. A healthy growing demand for Empire products, largely due to the 1924 Exhibition at Wembley, augured well for Imperial trade. India was enjoying a period of unusual political tranquillity. At home the labour situation seemed on the mend, and the general spirit of confidence suggested that capital would now be freely spent on renovation and extension of plant.

Actually the year did show very great financial activity, as indicated by the increase in advances and clearings of the banks, and by the fact that 130 millions of new capital was subscribed for purposes other than those of the Govern-

ment and public authorities. This compared with 86 millions in the previous year. The satisfactory balance sheets of banks and finance companies reflected this activity in a marked degree. But industrially the year was one of disappointment, for in spite of free spending by the public and considerable prosperity in many trades, stagnation and decline were manifested in our basic industries, unemployment increased, and the volume of exports fell by 2.4 per cent. to 989 millions.

The Home Demand.

The electrical industry had been called one of the bright spots in a dark picture, but it did not escape from the general depression of heavy industry. British factories reported a serious falling off of orders after the first quarter of the year, especially in orders from collieries, iron and steel works, and textile factories. A slight improvement set in towards the end of the year, but the net result was a fall in home orders to 15 per cent. below the 1924 level. A particularly regrettable feature was the fact that nearly £5,500,000 worth of plant and apparatus for electrical purposes was imported. This was about 7½ per cent. of our turnover. The unemployment in the industry was about 6½ per cent. Had the patriotism of those who bought abroad been enough to resist the lure of foreign dumping, the industry would have been fully employed. This would have absorbed at least 15,000 men in the electrical industry and as many more in other industries. The fall in our home turnover was not all due to the general stagnation, but partly to uncertainty caused by the imminence of new electrical legislation, which caused the demands for heavy plant to fall below expectations. Including replacements, the plant sanctioned by the Electricity Commissioners was 480,000 kW. In relation to the increased consumption of electricity, this figure should have been 30 per cent. higher, while to make any appreciable approach to the standard of electrification in competing nations, it should have been doubled. The consumption of electricity increased from 1923 to 1924 by 15 per cent., chiefly through greater industrial electrification. In the face of severe competition and depression, one of the chief hopes of salvation to industry was to make more and more use of electricity. Of the total output of our supply companies, industry took 70 per cent. This high percentage suggested that the time was ripe for extension of the benefits of cheap electricity to greater use in domestic applications, in agriculture and in transportation. They hoped that railway directors would observe that of all our British main lines, the most prosperous was the one with the greatest electrified mileage.

International Comparisons.

The need for a fuller use of electricity by this country was shown by a comparison with other great industrial countries. Our output went up from 5,739 million kWh in 1922-23 to 7,415 million kWh in 1924-25, and so stood at 177 kWh per head of population. This figure in 1924-25 was 975 kWh for Canada, 800 for Switzerland, 560 for the U.S.A., 238 for France, 182 for Germany (542 taking the Ruhr alone), and 180 for Italy. The most ominous feature, however, was that while from 1922-23 we had increased our consumption by 27 per cent., Germany had increased by 52 per cent., and Italy by 75 per cent. In the calendar year 1925 the increase in the output of electricity in this country was only 7 per cent. over that of 1924, judging from the returns of undertakings supplying over 60 per cent. of the total output. This meant stagnation in electrical development, and unless they could make a great effort, they would be left badly behind.

Progress Overseas.

There was one result of 1925, however, of which the electrical industry might be justly proud. The depression of the home market was counteracted by great overseas activity. Our total exports at £17,351,000 were a record for the industry both in tonnage and in value. They showed an increase of 127 per cent. over 1913 figures. Taking the total exports of the five main exporters in 1913, the German share was 48.5 per cent., the British 23.4 per cent., and the U.S.A. 17.7 per cent. In 1925 the U.S.A. share was 31.5 per cent., the British 30.4 per cent., and the German 27.3 per cent. In the face of tremendous difficulties we had improved our world position. No small share of this success might, Col. Morcom thought, be laid to the credit of the B.E.A.M.A. through its research work, propaganda work, and other co-operative activities. To realise the magnitude of our achievement we needed to look at the capacity of our great competitors. The figures in his possession bearing on this point were for 1923, and these showed that the total electrical turnover of the U.S.A. was £284,000,000, of which 5.5 per cent. was exported; of Germany, £90,000,000, of which 15.7 per cent. was exported; of Great Britain, £70,000,000, of which 25 per cent. was exported.

The Gold Standard.

No *résumé* of 1925 could be complete without some reference to the effects of the return to the gold standard. The Prince of Wales, at the Industries Fair, called the export trade the life breath of the nation. The re-establishment of the currency rather winded us. Many traders in export business felt that the step was taken prematurely, and that it would have been better to wait till trade recovery had progressed further before taking it. Its effect, in making us a great buying country, was manifest in our remarkable import figure of 1,375 millions. It also explained the financial activity already mentioned. But the expected adjustments in the world's markets lagged sadly behind expectation, and he thought it was beyond dispute that through this lag the return to the gold standard was the last straw that broke the back of the coal industry, emphasised the crisis in steel and textiles, and, in fact, largely accounted for the disappointments of 1925.

On the other hand, if the advantages promised by the advocates of this important financial operation had been slow to materialise, the difficulties prophesied by its opponents had certainly fallen short of their gloomy prognostications. The financial prophet was notorious for missing the mark. He attributed this to the fact that he was an arithmetician, and therefore thought 2 and 2 made 4, whereas most of his units being vectors this simple summation was the exception rather than the rule. But prophecy apart, he thought they must all believe in the ultimate triumph of financial certitude and honesty. "We who are prepared to face the inevitable initial difficulties of standardising frequency are not the ones to cavil at the efforts of our financial leaders to standardise their own units."

Prospects in 1926.

The new year started with many of the best factors of 1925 still in being. The Dominions were undoubtedly flourishing, and had all embarked on progressive electrical developments. India, owing to the careful policy of Sir Basil Blackett, was in the strongest financial position she had achieved since the war. Good prices for Colonial produce had increased the buying capacity of the Colonies. Outside the Empire prospects were brightening. Japan had made good most of the damage from earthquakes and had established a favourable balance of trade. The Near East, the Northern and Balkan States, as well as Russia, were becoming increasingly potential buyers. In South America, Brazil had settled down, and the other Republics had had very good times. On the debit side, the chaos in China made trade with that great market very hopeless.

Over-speculation might cause a set-back in rubber-producing countries, the persistent fall in copper might be a source of depression in copper-producing areas, and a meat war was disturbing the Argentine. Further, the very unfavourable weather throughout Europe in the fall of 1925 had retarded the growth of wealth in many important agricultural countries. There were also financial grounds for apprehension; the French crisis, the weakness of the Polish zloty and the industrial crisis in Austria might be mentioned, while a hitch seemed to have occurred in the hopeful Belgian programme.

The Dawes Scheme and German Competition.

A more obscure but quite appreciable menace lay in the fact that the Dawes scheme would call on Germany to provide this year £61,000,000 from her internal resources. This was likely to reduce prices to an intensely competitive level. An analysis of German borrowing would show how serious this menace might be to the electrical industry in particular. In the 13 months ended January, 1926, Germany borrowed £79,000,000 from abroad, mostly from the U.S.A. Of this, 8¼ millions was for the account of electrical manufacturing, 20 millions for electrical supply, and 13¾ millions for iron and steel industry. That meant a subsidy of £42,000,000 to an already formidable competitor. The future was thus clouded by the competitive threat of the huge and wealthy American manufacturers and the subsidised strength of the German industrialists. And in these two countries there was a fine home market to help the export position, and their home markets were their own—no foreigner could enter them. The eagerness of the American investor to take advantage of the situation created by the Dawes scheme was already affecting adversely financial conditions in this country. We should need all our industrial resourcefulness to meet this competition, and we should do it if wise counsel prevailed in the settlement of the dilemma that might arise between the demands of labour and the necessities of the employers. As an example of the dangers of unrest, the uncertain future of the coal trade was undoubtedly holding up much work on which our factories could be profitably employed. The very able Report of the Coal Commission was receiving close attention from the Government and industry. It was to be hoped that a settlement would be reached which would give a measure of confidence and a possibility of continuity, and that soon. The result would be beneficial all round and a great stimulus to the electrical industry in particular.

The Electricity Bill.

Touching on the Electricity Bill, arising from the Weir Report, Col. Morcom said that it had long been realised that our position as an electricity consuming nation was unworthy of us. After careful deliberation a scheme had been put before the House of Commons to the end that we might no longer be open to this criticism. As electrical manufacturers, they were vitally interested, and would watch the progress of the Bill with keenness, for on its adequacy would depend, not only their own future prosperity, but the industrial prosperity of the whole country.

As bearing on national industrial efficiency the almost simultaneous publication of the report of the Coal Commission, the Weir Report, and the Electricity Bill was of overwhelming importance. The two subjects of coal and electricity in a country with but little water-power were almost one. On the Coal Report, the Prime Minister advised careful thought

and no premature judgment. In considering this group of three publications, the advice was of triple force.

Some critics had rushed into print with detraction or even condemnation of the Bill, largely ignoring its greater meaning and attacking it from the narrow viewpoint of self-interest. This was a pity, for if this measure was emasculated as was that of 1919, a very definite and perhaps fatal delay might be given to electrical progress. The figures that he had given showed that we had delayed enough. Among electrical manufacturers he found very general approval of the main financial and technical provisions of the Bill.

The arguments in the Report in favour of the pooling of supply, interconnection of stations, creation of joint authorities, and standardisation of frequency were convincing. The report went further and suggested action in the direction of standardising voltages of supply. There was no doubt that the cheapening of plant and apparatus by standardisation would be even greater through standardisation of voltages than through standardisation of frequency, and here closer adherence to the Report would benefit the Bill.

Consideration of the Samuel and Weir Reports together showed that both suggested the formation of a new controlling body. In the one case a National Fuel and Power Committee; in the other a Central Electricity Board. Great care would have to be taken to prevent interference and overlapping of these two bodies—unless, indeed, a Central Board could be so devised as to fulfil both functions.

Both the Reports noted the importance of utilising power from waste heat, and the Bill embodied this idea. The Bill went further, and in referring to waste power must refer to power available from industries in which heat from the exhaust of generating plant was utilisable. To make the cycle complete, the supply of industrial and domestic heat should be within the powers of the Board. The sites of the large steam power stations might well become sites for wholesale production of agricultural products in exhaust-heated glass houses. The keynote of the Bill being the formation of the Central Electricity Board, it was natural that the constitution, functions, and powers of that Board should have called forth most criticism. As the Bill moved towards its final form, these would probably be the grounds for most contention. Under the Bill, the Central Electricity Board, technically, administratively, and financially, was under the control of the Electricity Commission and had, therefore, no independent existence and, as far as could be seen, no real justification. The machinery contemplated for the selection of power stations, for dealing with supply undertakings, for the right of appeal against the Board to the Electricity Commission first and then to the Railway and Canal Commission, was not calculated to quicken up electrical development. Unless the Central Board received real executive powers and assumed the character of a strong industrial Board of directors with all the attributes of such an executive, it was difficult to see how it was to function effectively.

The Weir Report gave a true picture of what was needed to stimulate the electrical development of this country. He had tried to show how much more stimulus was needed.

The Bill, as at present published, contained much of the gist of the Report's recommendations. A clear view of the national importance of an adequate measure, and goodwill during its progress into law, should enable Parliament to produce a satisfactory Act and, if satisfactory, its effect on our welfare would be incalculably great.

The Report of the Council.

The year 1925, begun with a certain measure of optimism, was disappointing, even in comparison with 1924. The financial chaos in France, the restriction of credit in Germany, the tariff war in Central Europe, all retarded the general European recovery; while the final liquidation of the Ruhr adventure meant intensive competition from Germany in the supply of coal. In Britain, three events of importance stood out: the restoration of the gold standard with its consequences in the enhanced value of sterling abroad, the embargo on foreign loans, and the coal crisis. There is little doubt that the first caused a temporary depression in the great exporting industries and a severe restriction in international credit.

There was, however an upward tendency, and it is expected that the year 1926 will represent a time of real improvement.

The Association was consulted regarding the Government's Electricity Bill, and found itself in agreement with it on general grounds. A memorandum bearing on waste heat, power production, the constitution of the Central Board, standardisation of frequency, distribution voltages, and the capacity of the electrical manufacturing industry to meet national requirements, was submitted by the Association, and the Minister of Transport promised to give it his careful consideration. A first essential to meet international competition is an abundant supply of power at economic rates, and, with it, the electrification of industrial processes, so that production can be carried on at a maximum efficiency. Carried out on sound lines the work of reorganisation should raise the status of Britain as a great manufacturing country and improve the economic position of its basic industries, including the electrical industry.

The "Transactions of the First World Power-Conference" have been published in four volumes (6,500 pages), embodying the entire proceedings of the Conference. A meeting of the International Executive Council, of which the Director of the Association is chairman, was held in London last July, 20 countries being represented at it. The chief question discussed was the form of constitution to be adopted by the organisation, and a draft was agreed which has since been submitted for consideration by the National Committees in all participating countries. The International Executive Council further suggested that the Second Conference should be held in 1930, and that, between plenary meetings, sectional meetings might be held. A sectional meeting, organised by the Swiss National Committee, will be held at Bâle from August 31st to September 12th next. An enlarged British National Committee has recently been formed, and in it will vest the responsibility for the participation of Great Britain in the future activities of the Conference.

The Export Committee pointed out to the Australian Customs authorities in what way and to what extent the *ad valorem* basis of duty discriminates (notwithstanding the "preference") against British manufactures, and proposing such alternative methods of assessment as would remove the hardship without diminishing the Australian Customs' revenue. The same proposals have been or will be made to the Canadian Customs authorities, whose tariff is also under revision. The new Greek tariff has also been the subject of discussion with a view to proposals for modification. The South African Customs have recently increased the preference on British electrical and allied manufactures from 3 to 5 per cent. Careful attention has been given, at the request of the India Overseas Committee, to the conditions of contract of the India Store Department, and negotiations are in progress. The South Africa Committee has suggested that its work would be more effective if membership included agents as well as direct representatives of members; the matter is under consideration. The Argentine Committee has been disbanded, and the Association has become a member of the Buenos Aires British Chamber of Commerce.

During the year the Director and the Secretary gave evidence before the Board of Trade Committee on Industry and Trade.

Reference is made to the fifth annual report of the Electrical Research Association, which was reviewed in our issue of February 19th (p. 315), and it is recorded that the chairman of the Research Committee was unanimously elected Chairman of the Council of the E.R.A. for the session 1926-27.

The Council granted six scholarships during the year, four in electrical, one in mechanical, and one in mechanical and electrical engineering. The standard of knowledge and ability of the candidates was again satisfactory. Renewals of their previous scholarships were given to seven scholars. The Education Committee has had under consideration a new and enlarged scheme of scholarship which would lay the awards open to competition by students of any approved university or technical college throughout the Empire. The annual value of the scholarships would be largely increased; and the Committee considers that a B.E.A.M.A. scholarship might be made one of the most coveted distinctions of the engineering world. The relation of technical to other branches of education and to industry is being dealt with by a committee set up by the Association of Teachers in Technical Institutions, and the Association is represented on that committee by the chairman of the Education Committee. The number of overseas students in members' works at the close of the year was 184, an increase of 48 on last year's return, indicating the general trend towards improved industrial conditions. The countries sending the largest numbers were, in order of numbers: India (including Burma), Africa, Australia, South America, New Zealand, Egypt, British Guiana and West Indies, China, Japan, Canada, Tasmania, and the United States. A pamphlet entitled "Training in Electrical Engineering: Information for Overseas Students and Technical Centres in the British Dominions," was sent to 48 universities and technical colleges throughout the Dominions.

The issue in August, 1925, of the fifth edition of the Association's *Standardisation Rules* marks an important stage in British national standardisation. The first edition, issued in May, 1913, formulated for the first time, recognised British practice, and set up standards which have since formed the ground structure of British national specifications. During the past year three additional machinery specifications have been issued, *viz.*, No. 169, Large Generators and Motors (rating permitting overloads); No. 226, Large Generators and Motors (continuous maximum rating); and No. 225, Alternators of the Steam Turbine-driven Type. These four specifications have been adopted by the Association as superseding the original B.E.A.M.A. rules for electrical machinery. The latter rules are therefore omitted from the fifth edition and the B.E.S.A. has withdrawn No. 72/1917, which was not accepted as representative of British practice for industrial motors and generators for the home market.

The rules for the marking and colouring of bus-bars and connections have also been omitted from B.E.A.M.A. rules, together with all other subject matters for which British standard specifications have provided. As the result of a questionnaire, the Association suggested that for three-wire d.c. the voltages should be 230/460, and for three-phase a.c. 230/400. These standards were adopted by the B.E.S.A. and included in the revised standard specification No. 77, and have since been recommended for international adoption by the I.E.C. as alternatives to 220/440 volts d.c. and 220/380 volts a.c. Special panels have been set up by the B.E.S.A., under the Colliery Sectional Committee, for the standardisation of mining motors, transformers, switchgear, cable sockets, and boxes, &c. The appropriate sections of the Association

are represented on all these panels. The Technical Committee of the Switchgear Section has had discussions with H.M. Electrical Inspector of Mines on the subject of earthing conductors in mines. According to the regulations, the exposed metal cases or framework of electrical apparatus which may accidentally become "alive" must be earthed with a conductor having not less than half the conductivity of the "largest conductor used solely to supply the apparatus, a part of which it is desired to earth." The earthing conductor must be carried from the apparatus to an earth plate above ground. This, it is thought, is not absolutely necessary in every case, and conversations are still proceeding with a view to simplifying the conditions.

The extension of electricity by overhead mains into rural areas for agricultural and other purposes has involved the development of a special type of weather-proof switchgear and apparatus. The Standardisation Committee has requested the B.E.S.A. to prepare rules to cover the performance of this class of gear, and the Technical Committee of the Switchgear Section has drafted recommendations to serve as a basis for discussion.

The Association was well represented at the conference of the International Electrotechnical Commission held at the Hague in April last. Definite progress was made towards international agreement on the temperature limits of electrical machinery and the methods of temperature measurement. Final agreement was reached on the temperature of reference for statements of efficiency. Among other subjects considered were nomenclature, symbols, traction motors, overhead transmission lines and voltages, transformer oils, steam turbines, and hydraulic turbines. The discussions will be resumed at the Conference to be held in New York in April next, when, among other items, the questions of tolerances and methods of stating the efficiency of machines will be considered. The discussion on steam turbines and water turbines will be of considerable importance.

The Committee on terminal markings has reviewed the American and Continental proposals with a view to finding some common ground of agreement, and the chairman has recently attended a conference of international delegates in Paris to discuss the whole situation. Internationally there is a wide difference of opinion, and it is hoped that the British system, when complete, will commend itself to other countries as worthy of careful consideration. The technical committees of various sections, *e.g.*, Instrument, Instrument Transformer, Insulations, Meter, and Switchgear, have all been busily engaged during the year in reviewing and revising the standard specifications for apparatus made by them and in preparing draft recommendations for new specifications where none exists. Among the more important subjects under consideration is oil-immersed circuit breakers, which play an increasingly important part in the protection of electrical machinery and distributing and transmission systems. A list is given of specifications of interest to members, published during the year by the B.E.S.A.

The Association's solicitor reports that several municipalities which had hitherto resisted suggestions for the amendment of their own sets of conditions of contract to bring them into line with the I.E.E. text, are now content to accept that text as the basis for discussion. Clause 37 of the text was amended by the I.E.E. Committee during the year so as to define more clearly the nature of the "Regulations and Bye-laws of Local Authorities" with which the contractor is obliged to make himself acquainted before contracting. After discussion with the Engineering Employers' Federation, members were recommended to tender three fair wages clauses, of which the first, governing work in the factory, is the well-known Parliamentary clause, and the other two, governing labour sent from the factory for erection and labour taken on at site, are new.

The I.E.E. Council passed for publication the two new complete texts governing respectively f.o.b. and c.i.f. contracts, but these were found to be susceptible of improvement and were sent back to the I.E.E. Committee for review. Their re-issue is expected during the present session. The Council invited the views of all sections during the year as to the desirability of introducing into the payment clauses of the conditions of sale provisions for deferred payments or hire purchase, but the answers showed any change to be unnecessary.

During the year the Traffic Committee has been mainly occupied with the proceedings of the Railway Rates Tribunal, and it records its disappointment at the slow rate of progress, which, however, appears to be inevitable in view of the magnitude of the task. When the Railway Act, 1921, was passed, it was expected that the Revised Classification of Merchandise and the Schedule of Standard Charges associated with it would be put into operation on January 1st, 1923. Three anniversaries of that date have passed, and "the appointed day" is not yet in sight. The opinion has been steadily gaining ground that, admirable as the Railways Act of 1921 may be in theory, the practical advantages which it was intended to confer are largely illusory. Such progress as has been made has been largely due to discussions out of Court between the representatives of the traders and of the railway companies, who have arrived at agreements which the Tribunal has subsequently ratified. These discussions have served to bring the two parties into a closer realisation of each other's difficulties and to a fuller appreciation of their common interests.

During the latter part of 1924 the Council instituted a new department to take charge of the economic and statistical sides of the Association's activities. During the year the department prepared evidence which was submitted to the Board of Trade Committee on Industry and Trade on the economic position and prospects of the electrical manufacturing industry; prepared a survey of the present state of electrical development in Britain, published under the title, "Electrical Power and National Progress"; issued a number of special publications, among which "The Swiss Electrical Industry" and "The Electrical Industry in France" may be mentioned; and was responsible, directly through its own contribution or indirectly by means of information which it published or otherwise rendered available, for the appearance of over 60 articles in the Press dealing with electrical power. It also collaborated in the preparation of a special electricity supplement to the *Financial Times*.

In setting up a publicity service the Council had primarily in mind the creation of an atmosphere favourable to greater electrical development in Britain and to associate with such development the achievements of members. In view of the fact that new electrical legislation was contemplated by the Government, it was considered advisable to concentrate on the daily Press, thus creating a strong background of public interest in the subject; and, during the last three months of the year display advertisements were inserted at regular intervals in the leading newspapers and the technical Press.

The publicity department also circulated literature dealing with electricity. Special booklets were prepared which might be used in the examination and discussion of the Government's electricity proposals.

The Electrical Development Association reports a further expansion during the year, 64 new members from the supply side of the industry having been added to its roll. In addition, an augmentation of its income, amounting practically to treble that of the preceding year, took place. The Electric Vehicle Committee now forms the Electric Vehicle Committee of the Association.

It is hoped to issue shortly a publication under the title of "Standard System of Cost Accounting in the Electrical Industry."

The Council affirmed, during the year, a previous decision, that all British Industries Fairs, wherever held in Great Britain, are permitted exhibitions.

During the year a Motor Control Gear Section was formed, which absorbed the Controller Section. The Industrial Instrument Section and the Scientific and Telegraph Instrument Section became amalgamated under the title of the "Instrument Section."

The series of booklets, under the general title of "Standard Schedules of Guarantee and Performance" was added to during the year by the publication of one on "Rotary Converters." "Information for Members" was, at its annual re-issue, greatly enlarged so as to afford full information as to the *personnel* of the Committees and Sections of the Association, and to include a diagram from which the working of the whole organisation can be seen at a glance.

The Council acknowledges the assistance which it received during the year from allied or kindred institutions, particularly from the Cable Makers' Association, the Accumulator Makers' Association, the Engineering and National Employers' Federation, the Federation of British Industries, the Institution of Electrical Engineers, and the Incorporated Municipal Electrical Association.

The Rating of Generating Plant.—The Electricity Commissioners inform us that in dealing with applications for their consent to the establishment of new or the extension of existing generating stations, they have noted a growing tendency to provide for the installation of steam-turbo-alternators designed for a continuous maximum rating and a service rating (most economical output) as defined in Specification No. 225-1925, published by the British Engineering Standards Association. The practice hitherto followed in submitting such applications has revealed a lack of uniformity, the capacity of the generating plant proposed to be installed being defined in some cases in terms of the most economical output, and in other cases in terms of the continuous maximum rating.

With the view of obviating inconsistencies and of facilitating direct comparison of the plant capacities of different undertakings, the Commissioners have decided to adopt the continuous maximum rating when giving consent, under Section 11 of the Electricity (Supply) Act, 1919, to the installation of steam-turbo-alternators of the kind in question. With regard to the statistical returns already issued by the Commissioners, the necessary adjustments will also be made in so far as any figures for plant capacity contained therein are included in future returns.

Mines Department Publication.—The Secretary for Mines announces that the 1925 edition of the Annual Volume of Regulations and Orders under the Coal Mines Act, 1911, has now been published, and may be obtained through any bookseller or direct from H.M. Stationery Office, price 1s. net; by post 1s. 3d. In this edition, which contains the Statutory Rules and Orders relating to mines in force on December 31st, 1925, the amending orders have been consolidated with the relative principal orders and a general subject index has been added.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Perak Hydro-Electric Scheme.—On March 15th, Mr. Forrest asked the Secretary of State for the Colonies when it was proposed to commence work on the Perak hydro-electric scheme; and from what source and under what conditions was it proposed to recruit the necessary labour for the purpose.

Mr. Amery said that the Company which was to carry out this scheme had not yet been formed, and he was therefore not at present able to answer the question.

The Broadcasting Committee.—On March 16th, Sir Wm. Mitchell-Thomson, the Postmaster-General, replying to questions, said that in view of the expense involved, it was not proposed to publish the evidence given before the Broadcasting Committee. The report of the Committee had not yet been considered by the Cabinet.

Railway Electrification.—On March 16th, Mr. Barclay-Harvey asked the Minister of Transport, if, having in view the admitted success of the Southern Railway electrification scheme, he would press other railway companies to proceed with electrification schemes in other areas where conditions were reasonably similar, and where in consequence similar successful results might be obtained.

Colonel Moore-Brabazon said that as the railway companies were aware, the Minister would be very glad to see an extension of electric traction on railways where this could be done with advantage to the public and the results would be likely to justify the expenditure involved. It must, however, necessarily rest with the companies to satisfy themselves before embarking on any such scheme that it was likely to be satisfactory from every point of view.

On March 16th, Mr. Scurr asked the Minister of Transport whether he was aware that under Section 21 of the Act of 1912, whereby the Midland Railway Company acquired the London, Tilbury and Southend Railway, the company was under an obligation to prepare forthwith a scheme for working traffic by electrical power by the direct route between Fenchurch Street and Southend; whether a scheme had been prepared; and, if not, whether he would take steps to cause the railway company to fulfil its statutory obligation.

Colonel Ashley said he was aware of the provisions of the section referred to, but he did not think that it would be proper for him to express any opinion as to whether the railway company was, or was not, complying with them. He had no knowledge of any present intention on the part of the company to electrify the line.

The Electricity Bill.—On March 18th, Mr. Baldwin stated that he hoped to take the second reading of the Electricity Bill on March 29th or 30th.

Asked whether, owing to the complexity and technicality of the measure, its second reading could be postponed until after Easter, Mr. Baldwin said he felt that a knowledge of the technicalities would be far more useful in Committee than on the second reading, as he thought the Committee stage was the one to which members should devote their time. His object was to get the Bill into Committee, where it would require a great deal of examination, at the earliest possible date.

Mr. Dennis Herbert, a Unionist member, has given notice that on the second reading of the Electricity Bill, he will move: "That this House, while recognising the need for legislation to facilitate generation and supply of electricity, regards it as unnecessary and inexpedient to proceed with a measure which is calculated to bring about the nationalisation of the industry and which places the industry under the control of, and delegates powers of Parliament to, a body, or bodies, of persons who are assisted by, and dependent upon State guarantees and are not directly responsible to Parliament."

Mr. Hannon and Sir Philip Dawson, also Unionists, have given notice that after the second reading of the Bill, they will move: "That it be an instruction to the Committee that they have power to substitute 'the Ministry of Transport' for 'the Electricity Commissioners,' in Clause 4, sections (1) and (3); Clause 5, sections (1) and (3); Clause 6, sections (2) and (3); Clause 7, section (5); Clause 9, section (1); Clause 11, section (1), sub-section (b), and section (2); Clause 18, section (2), sub-section (b); and Clause 24, sub-section (1)."

No Broadcasting of Speeches.—On March 22nd, Mr. Baldwin informed Mr. Campbell that he had consulted with the leaders of the other parties and had obtained information through the usual channels. He had come to the conclusion that there was a greatly preponderating body of opinion against the broadcasting of the proceedings of Parliament.

Cash-on-Delivery Service.—On March 18th, Sir Alfred Knox asked the Prime Minister whether any conclusion had yet been arrived at as to the institution of an inland cash-on-delivery service.

Mr. Baldwin said that the Government, after careful consideration of the whole subject, had decided that those facilities ought to be afforded to the public. Arrangements had accordingly been made for the institution of an inland cash-on-delivery service as from March 29th.

Municipal Electrical Service.—Under this heading we report elsewhere in this issue part of the proceedings before the House of Lords Committee which dealt with the Colwyn Bay and Colwyn U.D.C. Bill.

On March 22nd and subsequent days a Select Committee of the House of Commons considered similar clauses in the Doncaster Corporation Bill. The proceedings will be reported in our next issue.

Wireless Apparatus Imported.—On March 19th, Mr. A. M. Samuel informed Mr. Day that the following statement showed the imports and exports in the year 1925 of radio instruments, apparatus and valves. The figures were provisional, and subject to possible amendment on final verification of the returns:—

	Radio Instruments and Apparatus.	Wireless Valves.
	£	£
Total imports	654,433	134,048
From United States	110,760	6,567
,, Germany	348,366	7,402
,, France	55,525	32,908
,, Netherlands	14,309	55,678
,, Switzerland	72,043	37
Total exports of United Kingdom manufacture ..	£1,106,311	£183,304

The particulars excluded the imports and exports of batteries and accumulators, and other material, the ultimate use of which could not be ascertained at the time of importation or exportation.

Reviews.

Atomicity and Quanta. By J. H. Jeans, D.Sc., LL.D., F.R.S. Pp. 64. London: Cambridge University Press. Price 2s. 6d. net.

This book consists of some 10,000 words delivered as an address on May 11th, 1925, being the Rouse Ball lecture. The matter it treats of is exactly described by the title, but the object of the writer, clearly to be discerned in a perusal of the book, is to deal with the contradictions which at once appear when an attempt is made to reconcile phenomena of quanta with the mechanical laws which govern the behaviour of natural forces. He points out that phenomena arising from the emission of radiation seem to indicate that energy, once freed of matter, may radiate according to the laws laid down in Maxwell's equation; while phenomena which arise from absorption of radiation, indicate that radiant energy must conform with a corpuscular theory.

The difficulty is to find any theory which accounts for a quantum of monochromatic radiation being specially concentrated upon a single absorbing atom. The book concludes with a sigh, as clearly as print can convey it: "Not much meditation is needed to convince us that we are still very far from understanding the working of the atom or the true meaning of atomicity and quanta."

Electrical Engineers' Data Books. By E. B. Wedmore and D. V. Onslow. Vol. I. Lighting, Traction and Power Distribution. Pp. xxi+714; figs. 203. Vol. II. Manufacture, Design and Laboratory Work. Pp. xvi+471; figs. 151. London: Ernest Benn, Ltd. Price 15s. net each volume.

Though there are many "pocket books" on the market, the average engineer is always interested in the appearance of a new one, for he feels—and rightly so—that no book can fill every requirement and one can never have too much information at one's disposal, provided that it is easily accessible and up to date. In these respects the Data Books now before us attain an unusually high standard. They are entirely new productions in the compilation of which the Editors have drawn upon the latest available research work, test data, standardisation work, professional papers, and manufacturers' publications. That a number of important B.E.S.A. specifications have been issued since the Data Books appeared, is merely an instance of the difficulty which faces every writer on electrical subjects. From the great stress laid by the publishers themselves upon the importance of keeping pace with research workers, we infer that new editions of these Data Books will be issued at frequent intervals. Indeed, so rapid is the advance of knowledge in the electrical field that even an annual publication becomes appreciably out of date during the interval between successive issues. If subjected to frequent revision, however, the Data Books will continue to fulfil their avowed purpose as usefully as they do now.

The general scope of the volumes is well indicated by their titles. Thus Vol. I includes sections on illumination, batteries, power distribution, switchgear, traction, motor control, and electrical machinery; whilst Vol. II deals with insulation, electrical phenomena, properties of metals, &c., bridge measurements, and pyrometers. In *both* volumes there are the same appendices, *viz.*, mathematical, electrical, mechanical, physical and miscellaneous tables, standard data on electricity and magnetism, and abridgments of wiring rules and regulations. This brings us to our first criticism of the Data Books, for it seems a pity to have duplicated 194 pages in each volume. With the two-volume arrangement of the work this could not be avoided, for there is much indispensable matter in the appendices, but the majority of those interested in this class of refer-

ence book will purchase both volumes and, to our mind, it would have been better to have combined Vols. I and II, making a work of 990 pages, instead of the 1,185 pages now existing. The whole of the data would then have been within one pair of covers and there would have been one index instead of the two which must now be consulted. The present arrangement of the indexes, each *in front* of the 194-page appendices, is definitely inconvenient, especially as there is neither tinted paper nor thumb-hole to help one to find them. Also, the pagination of the appendices in Roman numerals will not commend itself to engineers in a hurry; for instance, it is harder to interpret and locate cxlix than 149. This particular inconvenience is due to the duplication of the appendices and the separate page-numbering thereby involved.

So much for the general arrangement of the books; their production is of the highest excellence and, with the exception of the appendices, there appears to be no avoidable repetition, so that the purchaser of the two volumes has close upon 1,000 pages of carefully selected information for the modest sum of thirty shillings.

It being impracticable to read the whole of a work of this nature for the purpose of review, we have adopted the more rational test of referring to the Data Books as frequently as possible for assistance on knotty points during a period of two months. In many instances the desired assistance was forthcoming but, on the other hand, there appear to be some surprising omissions. From a comparatively short acquaintance with a work of this magnitude it would be rash to say that any particular item of information is not given somewhere, but so far we have been unable to find in the Data Books particulars of the electrical properties of phosphor-bronze and telephone wire. Also, we can find nothing concerning rotary boosters and balancers, though there is a useful section on booster transformers. Similarly, we have drawn blank as regards induction regulators and rotary converters, but obtained some useful data regarding power-factor correction and mercury rectifiers. A bare four lines concerning neon lamps helped us not at all, but we found all that we wanted to know concerning storage batteries. The only data on heating and cooking appliances appear to be the I.E.E. rules on the subject; and the chapter on switchgear consists mainly of B.E.S.A. definitions and specifications. Protective systems are described at considerable length, but there is little in the way of actual data concerning their adjustment and operation. We are unable to find anything on the subject of intermittent arcing earth faults. There are some figures relating to lifting magnets, but none for magnetic chucks and clutches.

Admittedly electrochemical and electrometallurgical work does not come within the scope covered by the titles of these volumes, but in our opinion these branches of the industry should have received attention; possibly they are to be dealt with in a later volume. Harmonics and harmonic analysis come distinctly within the province of these books but, so far, we have located nothing on the subject.

In setting out this list of apparent deficiencies we would not have it thought that we are decrying the books. An immense amount of care and labour has been devoted to their preparation and they are correspondingly useful to the purchaser. They are distinctly books which every electrical engineer should examine to see whether they would be of material assistance to him in his work. As already stated, they are extraordinarily inexpensive and, to a great number of engineers, money expended on them would be an excellent investment. Our main criticism—or perhaps it would be fairer to say our general impression—after using the Data Books for some time, is that the contents include more extracts from official and semi-official rules, regulations, and specifications, than one would expect from the title of the work. To many this will be an added merit, especially as it is a feature not elsewhere to be found. Our own preference, however, is to consult the original text of all regulations and specifications, these being procurable at nominal expense directly they are published. At the same time, if we had not these Data Books already on our shelf, we should purchase them.

Re-winding Small Motors. By D. H. Braymer and A. C. Roe. Pp. xiv + 247; figs. 210. London: McGraw-Hill Publishing Co., Ltd. Price, 12s. 6d. net.

It sometimes happens that after a motor has been repaired, its performance is totally different from what it was before. The suspicion then arises that the windings are not identical with the original ones, but it is a difficult matter to find out the discrepancy.

The authors of this book have evidently had practical experience of this trouble. When a motor is received for repair, the first thing to be done is to make a detailed record of the windings before beginning to strip them. The authors devote a considerable space to explaining the best methods of making these records. Forms are suggested for recording all the details of the windings, including the insulation, the winding pitches and the commutator lead, the last of which is so often overlooked.

The book is divided into two parts, one for d.c. and the other for a.c. A great variety of windings is dealt with and full information is given as to how to make the coils, how to place them in the armature or stator, and how to connect them up. Methods of testing are also described and it is pointed out how much cheaper it is if the test shows that the machine is correct than if it has to be re-wound owing to faults.

The scope of the book covers motors for portable drills, fans, sewing machines, automobile starters and lighting dynamos and the like. It is full of information clearly put and certainly should be in the hands of everyone engaged in this class of work.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Australian Plant for Sydney.—The Sydney (N.S.W.) correspondent of the *Daily Telegraph* reports that the Municipal Council has accepted the tender of the Commonwealth Shipping Board to supply turbo-alternators for the Council's new power station at Botany Bay, at a price of £666,000. The board will undertake the work at the Cockatoo Dockyard in collaboration with the Metropolitan-Vickers Electrical Co., Ltd., which has granted a licence to the board to make the machines. The accepted price is £38,000 above the lowest tender, and in addition there is Customs duty of £126,000. The acting manager recommended the lowest tender, but the Council desired to secure that the largest possible proportion of work should be undertaken in Australia. A deputation of electrical manufacturers asked Mr. Bruce to prevent the Commonwealth Shipping Board competing with private enterprise, but the Prime Minister said that Cockatoo Island was primarily required as a naval dockyard, but the overhead expenses would be tremendous if the board were not allowed to undertake other work.

The Cash-on-Delivery System.—It was announced last week that a postal cash-on-delivery system would be instituted by the G.P.O. on March 29th. An explanatory leaflet which has been issued shows that the fee for the service varies from 4d. on parcels valued at not more than 10s., to 2s. for parcels valued at £40, which is the maximum permitted. The system is already in successful vogue in a number of countries, including the United States, Germany, France, several British Dominions, and other important States.

Organisation.—A lecture on this subject was delivered on March 17th by Mr. P. J. Sims, of the General Electric Co., Ltd. (Glasgow), before the Edinburgh Electrical Society. The author dealt with the matter from the standpoints of the supply company, the consulting engineer, the manufacturers, the factors and distributors, and the contractors. There was a large attendance of members of all branches of the electrical industry of Edinburgh and district. An interesting discussion followed.

Proposed Ecuadorean Tariff Increase.—It is stated in the *Board of Trade Journal* that the Government of Ecuador has under consideration of a new Customs tariff which will impose an all-round increase of from 5 to 10 per cent., and if adopted will be put into force within the next three months.

Employment During February.—The March *Ministry of Labour Gazette* reports that employment in the engineering industry during February continued bad on the whole, although it remained fair in the electrical section. The overall proportion of unemployed was 11.3 per cent., while in the electrical section it was only 6.6 per cent. The detailed statistics show that the number of unemployed in the electrical engineering industry at February 22nd was 5,075 out of a total of 76,720 (July, 1925). This represents an increase of 0.1 per cent. as compared with January, and one of 1.1 per cent. in comparison with February, 1925. The percentage of unemployed in the electrical wiring and contracting industry is shown as 8.6, a decrease of 0.9 per cent. as compared with January, but an increase of 0.8 per cent. in comparison with February, 1925. In the electrical cable, wire and electric lamp manufacturing group the proportion of unemployed rose by 0.3 per cent. to 7.8 per cent.

The Industrial Alliance.—As the result of a ballot, the Boilermakers' Society has decided not to join the projected "Industrial Alliance." Only a very small proportion of the members voted, but the ballot showed figures of two to one against the proposal.

Social Event.—The annual concert given by the management of the Union Cable Co., Ltd., Dagenham Dock, Essex, was held at St. Margaret's Hall, Barking, on Saturday, March 13th. Mr. J. Snow Huddleston, the general manager, was prevented at the last moment from attending, but the management was represented by Mr. F. W. Johns, secretary, and Mr. Howitt Smith, works manager. About 700 employés and friends were present. The entertainment was presented by Mr. Charles Hayes and his company.

Unemployment.—The number of unemployed persons decreased further during the week ended March 8th, the total at that date being 1,094,100. This was 13,038 less than on March 1st and 126,633 less than on March 9th, 1925.

Wages in the Engineering Industry.—Although contrary to their declared principles, the trade unions in the engineering industry decided at a meeting on March 16th to approve of local applications for increases in wages.

One of the first sections to take advantage of this decision is the Lancashire and Cheshire district. A conference was held in Manchester on Saturday last to consider the course of action to be followed, and it was decided to ask the employers of the district to meet the men in conference upon the subject. It is anticipated that an increase of 20s. per week will be asked for. The *Daily Dispatch*, in reporting this matter, states that the wages of skilled men in the area are 56s. or 57s. per week and those of labourers range from 37s. to 39s.

The Engineering Joint Trades Committee of the London area arranged a conference on Wednesday last to consider the Unions' application for an increase of 20s. per week in their members' wages.

Threatened Strike at Birmingham.—A week's notice of their intention to cease work was handed in on March 16th by electrical fitters employed in the Birmingham Corporation Gas, Tramway, and Omnibus Departments. They asked that their wages should be brought up to the level of those paid to fitters in the Electric Supply Department, but this was refused by the Salaries, Wages, and Labour Committee, which stated that conditions in the Electric Supply Department were governed by a special agreement which did not apply to men employed elsewhere. The Tramway Committee is said to be in favour of granting an increase, and has asked the Salaries, &c., Committee to reconsider its decision.

Trade Announcements.—The ALTON BATTERY CO., LTD., of Alton, Hants., has appointed Messrs. Campbell, Gardner and Co., of 79, King Street, Belfast, as its agents for the whole of Ireland.

Factory premises have been leased at North Acton for the manufacture of INVENTUM electrical appliances, including their electric cistern. Mr. A. Wright, Sentinel House, Southampton Row, London, W.C.1, is the sales organiser.

MESSRS. HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., have opened a new trade counter and demonstration room for radio apparatus at their premises, Ensign House, 88-89, High Holborn, W.C.1.

The STANDARD INSULATOR CO., LTD., has just removed to Winsley House, Wells Street, Oxford Street, London, W.1.

Catalogues and Lists.—MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—An illustrated leaflet advertising transformers for big power schemes.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—A well-illustrated catalogue dealing with Newton d.c. motors and dynamos, and special transformers for use in charging radio and automobile batteries.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Publication No. 7,747/6, a brochure containing very complete and illustrated particulars of electric winding plant. Also Descriptive Leaflet No. 750/1-1, dealing with the company's coal-cutter protection system.

HIGGS MOTORS, Witton, Birmingham.—A stock list of a.c. motors and d.c. motors and dynamos.

THE SILUMINITE INSULATOR CO., LTD., The Green, Southall, Middlesex.—A leaflet advertising the safety of the company's covers for live rails.

Bankruptcy Proceedings.—A. SANDGROUND, 32a, Allerton Road, Lordship Park, radio factor.—The receiving order in this matter was made on a creditor's petition. The statement of affairs showed liabilities of £214, and there are no assets. Debtor attributes his failure to lack of capital, keen competition, and depression in trade. After being in a different business, he commenced as a radio factor, in March, 1925, when he had a deficiency of about £60. He obtained goods on credit, but the business was not a success, largely by reason of the heavy expenses, and in October, 1925, the petitioning creditors obtained judgment against him for £121. The following are creditors:—

	£		£
Cleartron Radio, Ltd.	70	Hayward & Co.	130

A. E. BURROW and A. G. L. PRAHM, trading as World's Fair Supplies, Bushy Lodge, Totterdown, Bristol, makers of electrical and mechanical games.—The first meeting of creditors was held on March 17th, at the Official Receiver's Offices, Bristol. The statement of affairs showed liabilities of £815, against net assets of £212, leaving a deficiency of £603. The case, being a summary one, was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Bankers	69	Lundberg, A. P., & Sons ...	44
Belbin & Bowden, Ltd.	29	Mawdsleys, Ltd.	20
Burrow, A. H.	321	Strong, H. O., & Sons, Ltd. ...	30
General Electric Co., Ltd. ...	46	Siemens & English Electric Lamp	
Golding, Howell & Co., Ltd. ...	30	Co., Ltd	33

F. WILLIAMS, Gradua Works, Porthcawe Road, Sydenham, trading as Lowther & Co., engineer.—The application for discharge of this debtor was heard recently at the Court House, Greenwich. The Assistant Official Receiver said that the receiving order was made in 1922, and proofs lodged totalled £23,521. The assets were estimated to realise £35 965, being principally made up of certain foreign patent rights. The estate, however, produced comparatively little, and no dividend had been or could be paid to the unsecured creditors. On behalf of the debtor it was stated that debtor's position had been brought about by anticipating the sale of certain patent rights and arranging his finances as if those sales had actually taken place. The judge commented on the fact that debtor had traded for three years after he was aware of his position, and the discharge was granted subject to a suspension of five years.

H. HALL, 26, Egerton Street, late 6, Market Place, and Albert Chambers, Blackburn Street, all Radcliffe, Lancs., radio dealer.—The public examination of this debtor was held recently at the Court House, Bolton. It appeared that in February, 1924, he started business in Radcliffe as a radio dealer, trading as the Central Wireless Co., but this was not a success. In 1921 he was appointed an agent by a firm of moneylenders and clothing club proprietors. His present deficiency amounted to £1,127. The examination was closed

B. G. THOMPKINS, radio engineer, Armstrong's Buildings, Stanley, Co. Durham.—Receiving order made March 13th, on debtor's own petition.

C. BINNS (United Electric Co.), electrical engineer, 55, Low Briggate, Shipley, Yorks.—Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford, released, March 15th.

G. W. RIDLEY, electrical engineer and contractor, 1, Alfred's Court, Chorley.—First and final dividend of 1s. 6½d. in the £, payable at the Official Receiver's offices, 11, Winckley Square, Preston.

W. S. MILES, radio engineer, Roslyn, Worston Road, Burnham-on-Sea.—Receiving order made March 12th, on debtor's own petition.

W. N. SMART, electrician, late of 17, 19, and 19a, Cross Street, Oldham.—First meeting, March 30th, at the Official Receiver's offices, 11, Winckley Square, Preston; public examination, April 14th, at the County Court House, Blackburn.

G. YOULL and A. FRASER (Youll, Fraser & Co.), electric lamp and wireless factors, 6, Hunter Street, Liverpool.—First meeting, March 26th, at the Official Receiver's offices, 11, Dale Street, Liverpool; public examination, April 27th, at the Court House, Liverpool.

H. TIDSWELL (H. Tidswell & Co.), electrical engineer, 11, Bazaar Street, Pendleton.—First meeting, March 26th, at the Official Receiver's offices, Byrom Street, Manchester; public examination, April 15th, at the Court House, Salford.

G. R. SPARROW, electrical engineer, 11, Cloudesdale Road, Balham.—First meeting, March 30th, at 29, Russell Square, W.C.; public examination, April 8th, at the Court House, Wandsworth, S.W.

E. O. HENSTOCK, electrical engineer, 21, Old Road, Brampton, Chesterfield.—Last day for proofs for dividend, March 31st. Trustee, Mr. L. A. West, Official Receiver, 4, Castle Place, Nottingham.

W. R. GRIGSBY (Wenham Lighting Corporation), electrical factor, late of 184, Gray's Inn Road, W.C.—First and final dividend of 4s. 6d. in the £, payable at the offices of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C.1.

Company Liquidations.—FOSTER CONSTRUCTION CO., LTD., constructional, electrical and general engineers, 60, High Street, Plaistow, E.—The statutory first meetings of the creditors and shareholders of this company (in compulsory liquidation) were held last week at Carey Street, W.C. The Official Receiver said that the company was incorporated in December, 1914, with a nominal capital of £5,000, in shares of £1 each, afterwards increased to £40,000, and it was formed for the purpose of acquiring from Walter and Arthur Foster the business of constructional and electrical engineers and general contractors, which they had conducted under the style of W. Foster & Son at Stratford, E. The issued capital amounted to £17,697, of which £14,197 had been allotted for cash, and £3,500, as fully paid in part satisfaction of the purchase consideration. The statement of affairs filed disclosed liabilities of £16,943, of which £4,896 was expected to rank, and assets of £4,100. The latter were, however, subject to deductions of £630 for preferential payments and £2,316 in respect of loans on debentures, and a deficiency of £3,742 was accordingly disclosed with regard to the creditors. In relation to the shareholders a total deficiency of £21,189 was shown. The liquidation was left in the Official Receiver's hands.

DUTTONS (SOUTHPORT), LTD., car and electrical engineers, 6, Wright Street, Southport.—A meeting of creditors was held recently, at the offices of Messrs. Davies & Crane, C.A., Southport. A statement was presented showing the financial position of the company at the date of the liquidation, as far as it had been possible for the liquidator to ascertain it. The statement disclosed liabilities of £1,973, and net assets of £753, leaving a deficiency of £1,220. The shareholders passed resolutions for voluntary liquidation on February 11th last. The matter was discussed, and it was decided to confirm the voluntary liquidation of the company with Mr. J. A. Bond, C.A., of Hoghton Chambers, Southport, as liquidator.

COAL, GAS & ELECTRIC INVESTMENT, LTD.—Winding up voluntarily. Liquidator, Mr. P. B. Gilroy, College House, Little College Street, E.C.4. Meeting of creditors at College House on March 26th. Particulars of claims to the liquidator by April 30th.

PRICE'S BATTERY & RADIO CO., LTD.—A meeting of creditors was called for March 23rd, at Charing Cross Hotel, W.C.

Private Arrangements.—W. H. Agar, 19, Whitecross Place, E.C., electrical and radio dealer.—A meeting of creditors was held recently, when a statement of affairs was presented which showed liabilities of £968, all due to unsecured creditors. The assets totalled £202. The debtor commenced business in 1922 with very little capital, but he traded successfully until October last, when he met with an accident. The present position was attributed to that accident and loss on the manufacture and sale of radio boxes and advertising expenses. It was stated that two of the principal creditors had obtained judgment, and as there was no offer of composition forthcoming it was resolved that the debtor be requested to execute a deed of assignment in favour of Mr. Charles Latham, 78, New Oxford Street, as trustee, with a view to immediate realisation. The following are creditors:—

	£		£
Gregory, A. E.	29	Siemens & English Electric Lamp Co., Ltd.	95
Liverpool Electric Cable Co., Ltd.	60	Standard Electric Co.	230
Harris, G. F. & G.	42	Grafton, Walter, & Sons	33
Hart Accumulator Co., Ltd. ...	36		
Siemens Bros. & Co., Ltd. ...	85		

Dissolutions of Partnership.—Cinema & Electrical Equipment Co., suppliers of kinematograph outfits and electrical engineers, 5, Great Newport Street, W.C.2.—Mr. E. H. Hamilton and Mr. R. P. Eddy have dissolved partnership. Mr. Hamilton will attend to debts.

A. R. Camidge & Co., electricians, 11, Church Street, Stoke Newington, N.16.—Mr. A. R. Camidge, Mr. B. Winters, and Mr. W. A. Dallender, have dissolved partnership. Messrs. Camidge and Winters will attend to debts and continue the business under the same style.

The Threatened Engineering Lock-out.—By the eleventh-hour decision of the employés of Messrs. R. Hoe & Co., Ltd., to return to work, the threatened lock-out in the engineering industry was averted towards the end of last week. Upon the unions giving an undertaking that the men would resume on Monday last, the employers cancelled the notice which was to have taken effect on Friday, March 19th. It is understood that the question of wages will now be dealt with in connection with the application of the London executives of the unions concerned for an all-round increase in the rates paid in the London area.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, March 23rd:—Copper (electrolytic) bars, £66 5s., 5s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £76 5s., 5s. inc.; ditto ditto h.c. wire, no change.

Messrs. James & Shakespeare report, March 23rd:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead, £33, 5s. inc.

Messrs. Edward Till & Co. report, March 23rd:—India-rubber, Para fine, 2s. 5d., 2½d. inc.

Col. Willey on Industrial Needs.—The speech delivered by Col. F. V. Willey at the annual general meeting of the Federation of British Industries last week, upon his relinquishing the presidency of the Federation, contained constructive suggestions upon a variety of matters connected with industry. He said that there appeared to be a tendency for Great Britain to change over from being an exporting nation to one in which the internal trade was more important. The transition period was likely to be a very critical one. There was scope for an "economic general staff" co-ordinating the needs of industry, the capacity of finance and the aims of diplomacy. The highest incentive should be given to effort and that postulated an extension of the principle of payment by results. The F.B.I. had appointed an influential committee to explore the possibilities of increased industrial efficiency. Industrialised countries were progressing to greater collective organisation, and this country would have to keep in step with that world-wide tendency. Col. Willey's suggestions for the elimination of waste (including waste of effort) covered standardisation and the direct distribution of goods from producer to consumer. Action by both employers and employed was necessary, and the speaker said that there was a greater need for young men in industry, who would work freed from misleading tradition. Prosperity would be hastened by keeping in the forefront the ideal of service to the consumer.

For Sale.—Messrs. Girlings, Ltd., of Maldon, Essex, have for disposal one 50-h.p. and one 40-h.p. Crossley suction gas engine, several 105-V dynamos, battery-charging booster, switchboard, &c. Messrs. H. Butcher & Co. will sell by auction on April 15th, at the Strode Engineering Works, Herne, Kent, miscellaneous electrical stores, lighting sets, batteries, cables, &c. Plymouth Corporation Electricity Department invites offers for surplus generating plant. Eccles Corporation Electricity Department has for disposal one 40-kW steam-driven generating set. (See our advertisement pages to-day.)

The Functions of the Commercial Diplomatic Officer.—In a recent address before the British Empire Chamber of Commerce in the United States, Capt. A. J. Pack, Commercial Secretary in New York, answered the often-asked question: "Of what use is a commercial diplomatic officer?" He outlined the duties of commercial counsellors and secretaries attached to embassies, and pointed out that their work in no way overlapped that of the consular officials. While the duties of the latter were local and detailed, the commercial diplomatic officer's were central and general. It was his business to investigate and report in detail upon special subjects or to compile general reports upon the financial, industrial or commercial conditions of the country to which he was accredited. In this work he was assisted by the consular officers with their more detailed knowledge. In conclusion, Capt. Pack said that a British trader in a foreign country could best answer the question for himself by putting his problems before the commercial diplomatic officer at the embassy, when all possible assistance would be rendered.

French Electrical Imports and Exports.—The following table shows the French imports and exports of electrical machinery and apparatus during the past two years, the franc having been taken at 133 to the £:—

	Imports.		Exports.	
	1925.	1924.	1925.	1924.
	£	£	£	£
Insulators, porcelain, parts, &c.	22,320	60,830	66,160	76,300
Incandescent lamps ...	388,300	339,000	260,000	224,630
Dynamo electric machines and parts ...	367,640	367,740	550,300	453,290
Electric and electro-technical apparatus ...	422,600	411,060	1,400,000	1,522,200
Insulated wires and cables	58,800	26,820	170,000	395,460
Arc lamps and parts ...	1,000	235	—	—
Armatures and other parts	142,850	134,850	227,160	184,150
Accumulators and parts	45,300	27,650	75,030	48,980
Dry batteries	950	910	19,900	19,880
Total ...	£1,449,760	1,369,095	2,768,550	2,924,890

Electrical Trades Commercial Travellers' Association.—This Association held the last of its social functions of the season at the Manchester Hotel, Aldersgate Street, on March 20th. The function took the form of a carnival dance and was well attended. During the interval refreshments were served, and Mr. E. A. Joyce, the chairman of the Association, in a witty speech suggested that an outing on the Thames might possibly be organised during the coming summer. Fantastic hats and streamers were distributed in profusion during the evening, and Tom Daly's orchestra was equal to all demands. The thanks of all who were present are due to the entertainment secretaries, Mr. L. Moir and Mr. J. M. Woolnough, for organising a thoroughly enjoyable evening.

Book Notices.—"The Divine Mechanism: The Christian Creed Reconsidered in Terms of a Theory of Mechanistic Universal Mind," by the late J. M. M. Munro, F.R.S.E., M.I.E.E. Pp. 73. Edinburgh: Macniven & Wallace. Price 2s. 6d.

"Specifications *Do* Count." Pp. 21; 10 figs. London: Delco-Remy & Hyatt, Ltd.—This excellently-printed booklet is in no way an instruction book; as is pointed out in the foreword, it is descriptive of a coil-ignition system as supplied to date for more than 7½ million motor vehicles, and its issue has been prompted by the makers' desire to show that this method of ignition "is every bit as reliable as other forms." With reference to the prevalent idea that coil ignition is a drain on the battery, the information on battery performance is given, and the advantages claimed for the Delco-Remy system are fully set out.

"The Port of Southampton: Its Past, Present and Future." By Brig.-Gen. the Hon. Everard Baring (pp. 14, ill.). Reprinted from *Brassey's Naval and Shipping Annual*, 1926, and published by the Southern Railway Co. (Docks and Marine Departments).

"The Secret of High Wages." By Bertram Austin, M.B.E., M.A., and W. Francis Lloyd, M.A., A.M.I.E.E. Pp. iii. London: T. Fisher Unwin, Ltd. Price 3s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV. March, 1926. No. 351. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

New Italian Companies.—Among the new electric lighting and power supply undertakings recently formed in Italy are the Società Impresa di Elettricità U. Sampietro, of Trento, capital 1,500,000 lire; La Società Pinerolese di Elettricita, of Pinerolo, capital 2,000,000 lire; La Società Idroelettrica Sile, of Treviso, capital 100,000 lire; and La Società Idroelettrica Dolomiti, of Rome, capital 1,000,000 lire.

Among the new electric traction undertakings recently organised is the Società Ferrovie Elettriche Abruzzesi, of Rome, capital 100,000 lire.

Electrical Contracting Notes.—We learn that as the result of an Electrical Contractors' Association meeting held in Leeds recently, ten applications for registration were received. In current E.C.A. provincial reports several references are made to the need to relieve indentured apprentices from the fruitless burden of unemployment insurance. We understand that friendly discussion is taking place in Liverpool between the Corporation electrical engineer and the local E.C.A. Branch, concerning the price paid by the Corporation for "cooker wiring." The E.C.A. Liverpool Branch reports that the Birkenhead Corporation is acting as consulting engineers and charging 5 per cent. on the amount of the contract. The Newcastle E.C.A. Branch has prepared a battery-charging price list suitable for overprinting for private use. It is stated that the Dublin E.C.A. Branch is disturbed at the drastic regulations issued by the Dublin Corporation prohibiting the erection and use of any flashing or moving sign. We learn that it is hoped to establish a new E.C.A. Branch at Halifax embodying the membership of the Halifax Electrical Employers' Federation. The E.C.A. Bournemouth Branch notes with satisfaction the proposal to co-operate with finance corporations in dealing with goods on hire or hire-purchase.

Lead.—Messrs. James Forster & Co. reported on March 20th that supplies of lead in this country were plentiful enough, and as, according to Metal Exchange figures, shipments during February from Burma and Australia showed an increase of about 6,000 tons over the shipments in January, there appeared to be little likelihood of a shortage, at all events during April. The Board of Trade returns for February were :—Imports, 22,632 tons; exports, 1,329 tons; leaving for Home consumption 21,303 tons.

Patents in Paraguay.—The Government of Paraguay has passed a Patent Law—the first to be applied in the country. Patents are to be granted for a term of fifteen years, and an annual fee of 5 gold pesos is to be paid in respect of them. The law provides that inventions known in Paraguay prior to the passing of the law shall not be patentable.

Belgian Exhibition of Electrical Plant.—An exhibition organised by the Association of Belgian Manufacturers of Electrical Plant was opened on March 11th at the Colonial Office, Brussels.—*Reuter* (Brussels).

Conditions in China.—The F.B.I. correspondent in China says that the disturbed state of the country naturally precluded any considerable development of electric power during 1925. The principal extensions reported were at Chungking and Pootung, while an important order was placed in connection with the Harbin Tramways. These contracts were all secured by Continental manufacturers, but an order for a small plant for a town near Changsha in Hunan Province was placed with a British firm. A number of orders for small oil engines and suction gas plants for lighting small towns and villages formed a feature of the trade as usual. The formation of a lamp combine is directed towards eliminating the price-cutting which has been a marked feature in this line for some time; the combine succeeded during the year in raising the price for lamps from $10 to $30 per 100. As regards other electrical accessories, considerable competition from locally-manufactured goods has been encountered by importers of fans, and American makers have reduced their prices. A brisk demand for electric conduit has been supplied chiefly by British firms. Great Britain has provided the higher grades of cable, Germany and Japan the cheaper; while bells, switches, current limiters, &c., have come chiefly from Germany. America enjoys a good trade in fittings, heating appliances, dry cells, flashlights, &c.

Canadian Electrical Industries.—A survey of Canadian industries shows that the production of electricity was seventh in importance in 1923, the output being valued at over $91,000,000. The manufacture of electrical apparatus was thirteenth in the list, with a production valued at $51,360,000. Pulp and paper production was the Dominion's leading industry, and this is a large producer and user of electric power. It is noteworthy that gas lighting and heating was the least important of the 40 leading industries, with a production valued at $19,605,000.

Calendar.—We have received from the University Engineering College, Westgate-on-Sea, a neat self-opening pocket diary and notebook for 1926, containing particulars of the U.E.C. courses of correspondence tuition.

The Contractors' Register.—The annual meeting of the National Register of Electrical Installation Contractors was held on Monday last. Pressure upon our space compels us to defer an extended report until our next issue.

New Offices and Showrooms.—MESSRS. PHILIPS LAMPS, LTD., have recently opened new headquarters at 145, Charing Cross Road, W.C.2 (the Oxford Street end). The premises consist of four floors, the first three of which are mainly devoted to storage, each having an area of about 8,000 sq. ft. On the ground floor a showroom has been arranged. Here there is shown a full range of Philips products as well as "Metalix" X-ray equipment. The trade counter is on this floor and at the rear is a large garage. The company now has ten branch offices and distributing depôts in this country.

Danish Industrial Fair.—*Reuter* reports that the Danish Industrial Fair was opened at Copenhagen by the Prime Minister of Denmark on March 13th. The fair is housed in what is said to be one of the largest buildings in Northern Europe, and it is reported that every available inch of space was booked well in advance.

Australian Import Duties.—At a recent inquiry by the Australian Tariff Board into an application by Australian manufacturers for the imposition of an increased duty on imported telephone apparatus, Mr. L. P. R. Bean refuted a statement by an official of the G.P.O. that Australian telephone apparatus was inferior to imported appliances. He also denied that Australian manufacturers were incapable of carrying out certain work as had been stated by a representative of Messrs. Siemens Bros. & Co., Ltd.

Among the recent decisions of the Commissioners is the following :—Insulators, composed of resin and mineral or other fillers (as a substitute for porcelain insulators) : 25 per cent. under the British preference tariff; 30 per cent. under the intermediate tariff; and 50 per cent. under the general tariff.

Cement Works Electrification.—Speaking at the recent annual meeting of the British Portland Cement Manufacturers, Ltd., the chairman (Mr. P. M. Stewart) said that during the current year they hoped to scrap the steam plant at their Martin Earle works and replace it with electrical plant.

New French Company.—A company has lately been formed at Rodez in the Department of Aveyron with a capital of 664,700 fr. and the title La Société d'Electricité Rurale Lescure-Jaoul, to establish a plant to utilise the water power of the Jaoul Falls.

Municipal Trading in Australia.—In our issue of March 12th (p. 419) we quoted a manifesto issued by the Electrical Employers' Association (Sydney) against the proposal of the Sydney City Council to open showrooms for the exhibition and sale of electrical appliances. The Sydney *Daily Telegraph* reports a statement by the Lord Mayor, in reply to this manifesto, in the course of which he said :—"It is my intention that the business of the City Council's Electricity Department shall be increased by placing within the reach of every one of the Council's customers high-class domestic electricity-consuming apparatus, by selling it at the minimum of profit. I propose that this apparatus shall be installed and set to work at the minimum of cost to the customer and that minor repairs shall be carried out free of cost by the crews of demonstration trucks engaged in the sale of electrical appliances. Under the present scheme of purchasing electrical apparatus from private firms, the interest of the seller ceases with the sale. In the case of the sale of apparatus by the Council, interest in the welfare of the apparatus would never cease, because it is to the Council's advantage to keep electricity-consuming apparatus always in usable condition, so as to increase the sales of electrical energy."

Boiler Contracts.—MESSRS. YARROW & CO. (1922), LTD., state that they have recently received a further order for boilers of the latest Yarrow patent water-tube land type, for the County of London Electric Supply Co.'s station at Barking. In addition to this the company has now on order, and going through its boiler shop, Yarrow boilers for Portsmouth Dockyard, Messrs. Michael Nairn, the City of London Electric Light Co. (Bankside), and the London Electric Supply Corporation, Ltd. (Deptford), as well as two high-pressure marine boilers of 550 lb. pressure.

New Chilean Company.—Silva y Taulis, Ltda, is the name of a new concern which has lately been formed in Santiago with a capital of $30,000 to manufacture accumulators.

Lighting and Power Notes.

Ashton-under-Lyne.—NEW PLANT.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £77,126 for the installation of an additional 6,000-kW turbo-alternator with the necessary boilers, cooling towers, and other accessories.

Australia.—LITHGOW.—According to the Sydney *Daily Telegraph*, it is expected that the work of building a power house for the Railway Commissioners near the State coal mine at Lithgow will be commenced shortly. It is planned that the initial plant shall comprise two sets of 2,500 kW each. The Commissioners hope to have the first unit ready in from 12 to 15 months' time. The main purpose of the scheme will be to supply power to the State coal mine, but electricity will be supplied also to local bodies for the Lithgow district and elsewhere on the mountains. The initial stage, it is stated, will cost less than £100,000. Development of the power house will be limited by local conditions, but eventually power may be supplied for an electrified mountain train service.

Basingstoke.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to a loan of £11,350 for the installation of an additional 410-kW Diesel generating set.

Bedford.—LOANS.—The Electricity Committee is to apply for sanction to further loans of £7,000 for meters and £5,000 for electrical apparatus.

EXTENSION OF SUPPLY.—The Committee has recommended the laying of underground cables for the supply of electricity to Sandy and Polton at an estimated cost of £18,000.

Chelmsford.—ELECTRICITY AGREEMENT REJECTED.—At a meeting of the Town Council on March 11th, the question of an agreement with the Electric Supply Corporation, Ltd., to take over the electricity supply in the borough was considered. The Committee reported that the draft agreement submitted by the company provided for a supply of electricity in the borough for 42 years, at the end of which period special terms were outlined for the taking over of the undertaking by the Council. It was decided to inform the company that the Council did not intend to support its application for a new Order extending its powers as undertaker for an additional 42 years.

Continental.—BELGIUM.—At the recent annual meeting of the Société d'Electricité des Ardennes, it was reported that in the northern section the distribution mains have been linked up with a number of quarries, while in the southern section the provincial authorities of Luxembourg are extending the distribution mains a distance of about 30 miles, which will enable a supply to be given to additional villages in the Bastogne district.

Italy.—The Società Elettrici Trevigiana is erecting a 10,000-V transmission line between Treviso (province of Carita) and Paderno. A 150,000-V line is also being established to connect the Silani hydro-electric station at present in course of construction with the towns of Bari and Taranti by the Società Forze Idrauliche della Sila. The line will pass through six provinces.

Jugo-Slavia.—The Municipality of Belgrade has accepted in principle the offer of a Swiss group of a loan of 5,500,000 Swiss francs for the construction of a power station in Belgrade.—*Reuter* (Belgrade).

Germany.—According to *Commerce Reports*, a hydro-electric scheme is proposed by utilising the water of the rivers Our and Irsen on the frontier between Luxemburg and Germany. This scheme calls for the erection of a dam 348 ft. high, which would create a lake about 13 miles long and one mile wide between Stolzembourg and Ouren. The enterprise would be on a larger scale than any now existing in Europe. It is proposed that the capital shall be raised jointly by the district of Bitburg, the Allgemeine Elektricitäts Gesellschaft, and the German Reich.

Austria.—Plans have been prepared for the installation of a new 30,000-h.p. steam turbine and 25,000-kVA generator at the Vienna municipal central electricity station at Semmering. The necessary steam will be provided by four new boilers utilising pulverised fuel, which are also to be installed. When the new plant is installed the old plant will be kept as a reserve for use in periods of excessive demand or temporary stoppage of the main set.

Elgin.—Purchase of Shares.—The Town Council has purchased the 3,543 £1 shares held by Messrs. Edmundsons Electricity Corporation, Ltd., in the Elgin Electric Supply Co., Ltd., with a view to taking over the electricity undertaking.

Gainsborough.—Electricity Supply.—At a meeting of the Urban District Council, on March 15th, the Electricity Committee recommended that application be made for sanction to borrow £32,000 required in connection with the electricity scheme for the district. It was suggested that as the Council was to supply electricity to tradesmen and others along the line of cable, it should extend the scheme to supply others and that sanction should be sought to borrow an additional £20,000 for this purpose. It was also proposed that householders should be supplied on the hire-purchase system. It is understood that the Council will be able to supply at 10d. per kWh, and that electricity can be installed at a cost of £5 per house. The Electricity Committee's recommendation was adopted.

Glasgow.—Progress During February.—The Corporation electricity manager reports that 150 houses were wired during February, bringing the total to date to 1,963, while the number of applications for the hire of appliances during the month was 198, bringing the total to 10,017.

High Wycombe. — Price Reduction. — The Wycombe (Borough) Electric Light & Power Co., Ltd., has reduced the charge for electricity for lighting to quarterly consumers from 9½d. per kWh for the first 100 kWh per quarter and 9d. beyond, to 9d. and 8d. respectively.

Hull.—New Electricity Charge.—The electrical engineer, in a report on the domestic tariff, recommends a uniform primary charge of 15 per cent. on the current assessments, with a minimum of £2 5s. per annum for houses rated at £15 or under, and a secondary charge as at present of ¾d. per kWh, the primary rates in added areas being amended correspondingly, namely, Hessle and Sutton 17½ per cent., and Ferriby 20 per cent., with minima of £2 12s. 6d. and £3 respectively.

Irish Free State.—Dublin.—The Dublin City Commissioners have announced a further reduction in the charges for electricity. As from April 1st the charge for lighting in private dwellings will be reduced from 7d. to 6d. per kWh. There will be an all-round reduction of 20 per cent. in the charges for meter rents, and also a reduction of 25 per cent. for electricity registered by slot meters. These reductions are equivalent to a revenue of £60,000 a year.

Bray (Co. Wicklow).—At the instance of the Ministry of Industry and Commerce, a local inquiry was held recently by Messrs. Fred. J. Allan and Michael O'Ryan, B.E., in the Town Hall, into the application recently lodged by the Urban District Council for sanction to raise a loan of £13,000 to meet additional expenditure on the electricity undertaking.

Lichfield.—Electricity Charges.—In connection with the electricity supply for the town the Town Council has adopted the following charges for electricity:—Lighting, 6d. per kWh, prepayment meters, 7d. Power, heating, and cooking, 2d. per kWh. Industrial power, first 150 kWh per quarter per kW of maximum demand, 2d. per kWh, next 150 kWh, 1¾d., beyond, 1½d. Combined rate for lighting, heating and small power, private houses, a fixed quarterly charge equal to 5 per cent., of the net rateable value for the first £30, plus 2½ per cent. of the rateable value over £30, and a flat rate of 1d. per kWh for all electricity used.

London.—Price Reductions.—The County of London Electric Supply Co. announces that from the March meter readings, a further reduction of 10 per cent. will be made from the percentage increases at present in force on the Company's rates for supply.

Mid-Cheshire.—Electrical Development.—Pending the completion of the works necessary to receive the larger bulk supply from the Mersey Power Co. through the North Wales Power Co.'s recently completed line, the Mid-Cheshire Electricity Supply Co., Ltd., is obtaining electricity from the Salt Union's Winsford plant. The erection of new h.p. mains for the Mid-Cheshire Company, to connect Northwich to Knutsford, Middlewich and Winsford, and the sub-stations for these towns, will be completed within the next few weeks. Distributing mains have been laid in the three towns. A central showroom is being opened at Knutsford. The annual report of the Mid-Cheshire Electricity Supply Co. states that a large number of new buildings are being erected throughout Mid-Cheshire, and almost without exception these are being equipped for electricity. There is a general movement to close down private plants and to change over to the company's supply. The year's net profit is £8,036.

Mid-Lancashire. — Electrical Development. — Municipal electrical engineers of local authorities in the area covered by the Mid-Lancashire Electricity Board met at Blackpool recently. An application was received from Fleetwood for sanction to the erection of a new turbine. It was decided to recommend that the application be granted owing to the isolated and peninsular position of the Fleetwood generating station in relation to Preston. The electrical development of the southern portion of Fleetwood area, however, is to be met by a bulk supply.

Minehead.—Extension of Supply.—The Minehead Electric Supply Company proposes to apply for an Order to supply electricity throughout a large part of West Somerset, extending as far as Williton and Watchet, some eight miles distant from Minehead. The Williton Rural District Council is supporting the scheme, and facilities will probably also be granted by the Watchet Urban District Council.

New Zealand.—Hydro-Electric Development.—According to the Sydney *Daily Telegraph*, an announcement has been gazetted that licences have been granted to Gerald Fitzgerald and others to use for electrical power production purposes water from the falls, or streams, discharging into Deep Cove, or any other part of Smith Sound and Lake Manapouri. The Smith Sound scheme is expected to yield 50,000 h.p., and the lake 250,000 h.p. The principal object of the scheme is to manufacture nitrates. A proposal to establish such works at Milford Sound two years ago aroused public opposition, on the score that it would destroy the scenic beauties. The present scheme replaces the previous scheme.

Nelson.—According to the *Electrical Engineer of Australia and New Zealand*, the growing demand for electrical energy in the city and environs of Nelson necessitates the provision of further generating plant in the near future, and steps are being taken, on the advice of the chief electrical engineer of the Public Works Department, to form a power board to deal with the matter. The board will consist of representatives of the Nelson City Council, the boroughs of Waimea, Richmond and Motueka, and the town of Tahunanui. One proposal is the development of hydro-electric power from Lake Rotorua some 60 miles from the city. The maximum power available from this source is 45,000 kW. If the necessary steps are taken to proceed with the scheme, electricity will be available in 1928.

Perth.—Loan.—The Town Council is applying for sanction to the borrowing of £20,888 for electricity purposes.

Preston.—Loans.—The Town Council has received sanction to the borrowing of £50,257 for the installation of additional generating plant at the Ribble power station, and £7,108 for additional converting plant.

Application is to be made for powers to borrow £13,970 for a 6,600-V overhead cable from the Ribble Station to Longton, Walmer Bridge, New Longton, &c., together with the necessary distributors.

Salford.—Gas *v.* Electricity.—According to the *Manchester Guardian*, with a view to dealing with the smoke evil, the Health Committee is making provision for the consumption of gas or electricity in the dwellings that are now being erected on the Littleton Road Estate. The Committee is to visit a block of completed flats and houses in which gas and electricity have been installed for lighting, heating, and cooking purposes. After tests have been carried out a decision will be made as to whether gas or electricity is to be installed in the 64 flats and 62 houses which comprise the last building scheme.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following:—The West Gloucestershire Power Co., Ltd., for the supply of electricity to certain parishes in the rural districts of Tetbury, Cirencester, Chipping Sodbury, Thornbury, and Warmley; the Clayton Urban District Council, for the supply in the urban district; the North Metropolitan Electric Power Supply Co., in the urban district of Epping, and certain parishes in the rural district of Epping; the Horley and District Electricity Supply Co., Ltd., in certain parishes in the rural districts of Burstow and Godstone; the West Ham Corporation, for the supply of electricity in bulk to the East Ham Corporation, and the Ilford Urban District Council; the Great Yarmouth Corporation, for the supply of electricity in the rural districts of East and West Flegg, and Mutford and Lothingland, and certain parts of the rural districts of Blofield, Loddon and Clavering, Smallburgh, and Wangford.

Sunderland.—MAINS EXTENSIONS.—The Corporation is to extend the mains in the Ettrick Grove district at an estimated cost of £1,842.

Swansea.—MAINS EXTENSIONS.—The Corporation Electricity Committee has decided to carry out mains extensions at a cost of £11,000.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—*Power* reports that the first unit of the Bartlett's Ferry hydro-electric plant of the Columbus Electric & Power Co. has been put in operation, and the second unit will follow it shortly. The first unit is furnishing 20,000 h.p. and three other units are to be installed, bringing the total capacity of the plant up to 80,000 h.p. The total cost of the project, when completed, will be $7,000,000.

The Federal Power Commission has issued the licence covering the development of Conowingo Falls on the Susquehanna River. Under the terms of this licence the construction of this project, expected to cost $52,000,000, can be begun at once. The scheme provides for the development of 300,000 h.p.

Walton-on-Thames.—ELECTRICITY IN BULK.—The Urban District Council has received from the Metropolitan Electric Supply Co., Ltd., an offer of a bulk supply of electricity at not over £4 10s. per kW, plus 0.5d. per kWh.

Wirral.—LOAN SANCTION REFUSED.—The Rural District Council, which had applied to the Electricity Commissioners for sanction to borrow £180,000 for an electricity scheme, has now been informed by the Electricity Commissioners that they cannot give consent. The Council proposed to obtain bulk supplies from the Wallasey Corporation and the Mersey Power Co. and distribute in all parts of the Wirral Peninsula. The Commissioners pointed out that the proposed scheme did not appear to be an economical method of developing the district on account of the loss of the anticipated bulk supply to the Hoylake Urban District Council and the closing down of the Wirral colliery. The estimates of revenue were unlikely to be realised for some years to come. Furthermore it was unlikely that the scheme would rank for financial assistance from the Unemployment Grants Committee. The Commissioners suggest that the Council should reconsider the matter with a view to formulating and submitting modified proposals. At a recent meeting the Council appointed a deputation to interview the Commissioners.

Tramway and Railway Notes.

Accrington.—NEW CARS.—The Tramways Committee has decided to purchase two top-covered double-deck tramcars for use mainly on the Oswaldtwistle section of the system.

Australia.—RAILWAY ELECTRIFICATION.—According to the *Electrical Engineer of Australia and New Zealand*, the Victorian Railways Standing Committee has approved of the extension of electrified service from Eltham to Hurstbridge. The work will involve the conversion of 6¾ miles of main track and nearly a mile of sidings, and the erection of a 1,000-kW automatic sub-station at Diamond Creek. The total cost is estimated at £51,303.

MELBOURNE.—The work of converting the Melbourne cable tramway system to electrical operation is making good progress, and the first electric cars were run on one section recently.

Continental.—FRANCE.—Rapid progress is being made with the electrification of the Culoz-Modane section of the Paris, Lyons and Mediterranean railway. It has been arranged that the necessary energy for the operation of the line shall be taken from the power station of the Société d'Electrochimie et Electrométallurgie d'Ugine.

FRANCE.—It is reported that the Paris municipal authorities have entered into negotiations with the Nord-Sud underground railway concern with reference to the purchase of the line in the near future instead of in 1931, as provided for in the concession.

SWEDEN.—The first train on the newly-electrified Stockholm-Gothenburg railway was recently run between Hallsberg and Katrine, the distance of 40 miles being covered in 34 minutes.

Dundee.—TRACK RENEWALS.—The Tramways Committee has recommended to the Town Council that the tramway track on the Downfield route be renewed at an estimated cost of £10,000.

London.—MORDEN TUBE PROGRESS.—Of the 14½ miles of permanent-way which is being laid between Clapham and Morden about a half has now been completed. Some 87 new cars will be required for operating the services, and the majority of these have already been delivered from the makers. The majority of these cars will be housed at the new depôt which lies beyond the terminus at Morden, and is now practically completed. It comprises five bays and 20 inspection pits and will accommodate 140 cars. The opening of the Morden extension will necessitate the employment of 400 additional men for the operation of the trains, staffing of stations, the maintenance of the rolling stock, &c.

BREAKDOWN.—Owing to an electrical defect on the local down line of the Southern Railway between Charing Cross and London Bridge on March 22nd, the electric train services from Charing Cross were transferred *en bloc* to London Bridge. The defect occurred shortly after 7 p.m., and was remedied later, and before midnight normal services were in operation.

Middlesbrough.—LOAN SANCTIONED.—The Town Council has received the sanction of the Ministry of Transport to a loan of £26,000 for tramway track renewals.

Nottingham.—RAILLESS CARS.—Good progress is being made with the Corporation's scheme for the introduction of railless cars, and it is anticipated that services will be commenced in July.

Preston.—LOAN.—The Tramways Committee is seeking powers to borrow £1,250 for laying down an inter-lacing tramway line in Fishergate.

Telegraph and Telephone Notes.

Continental Telephony.—POLAND.—Direct telephone communication has recently been established between Prague and Warsaw and between Vienna and Warsaw.

BELGIUM.—Direct telephonic communication has also been established between Antwerp, Brussels, and Strasburg. The Belgian Post and Telegraph Authorities have also announced that a direct connection between Brussels and Basle will be established so soon as there is a sufficient demand for the service.

France.—RADIO-TELEGRAPH SERVICE.—A direct wireless-telegraph service has lately been established between France (Paris, Sainte Assise) and Buenos Aires.

Hawaii. — RADIO-TELEPHONY. — Recent experiments with radio-telephone communication indicate that it will do much towards breaking down natural inter-island isolation and will make easier the development of the small island areas. Pine-apple plantation managers on the island of Lanai are now in daily communication with their company's headquarters at Honolulu.

New Cable Ship.—THE "DOMINIA."—The *Dominia*, over 500 ft. long, and having a displacement of 18,000 tons on her summer load draught, the largest cable-laying ship yet constructed, was launched on March 16th, at the Neptune Yard, Walker, of Messrs. Swan, Hunter & Wigham Richardson, Ltd., for the Telegraph Construction & Maintenance Co., Ltd., London. The christening ceremony was performed by Lady Angela Campbell. The *Dominia* will be propelled by twin screws to give a speed of 13½ knots, her four cable tanks will carry over 9,000 tons, or more than 4,000 miles of cable. The cable equipment, made by the owners, is of the most improved type. The vessel's first undertaking will be the laying of a new Pacific cable, says *The Times*.

New Indian Ocean Cable.—SUCCESSFULLY LAID.—A new cable between Cocos, in the Indian Ocean, and Fremantle, Australia, a distance of 1,800 nautical miles, has been successfully laid. The operation was completed on March 15th, says the *Financial Times*, and the cable is the first of the new "loaded" type to be put down by the Eastern Associated group of cable companies, the owning concern being the Eastern Extension, Australasia & China Telegraph Co., Ltd. It was manufactured at Greenwich. The new cable is in duplication of the existing facilities, and will provide another route connecting Europe and Australia.

New Zealand.—NAVIGATORS AND WIRELESS.—New Zealand is a stormy coast, but the loss of life occasioned by wrecks, and the number of wrecks themselves to a certain extent, will in future be reduced, for all coast-wise ships must now be fitted with wireless sets, and all navigators who secure their master's or mate's certificates on these vessels will in future need to comply with the New Zealand enactment, which makes it a part of that examination to qualify as a "wireless signaller." On and after January, 1926, every candidate for a home trade certificate will be required to produce a certificate in the form of an examiner's authority, issued by the Minister of Telegraphs, to the effect that the candidate has passed some satisfactory examination as a wireless signaller. The examination provided by the Minister is not of a technical nature, but consists of a test of the candidate's practical knowledge and manipulation of transmitting and receiving apparatus, similar to that now required to be installed on all ships. The candidate is required to send and receive, for a period of five minutes each, at a speed of not less than ten words per minute, and will be required also to know something of the usual procedure between sea and land stations, and have a practical working knowledge of the regulations governing wireless signalling.

Turkey.—AUTOMATIC TELEPHONY.—The Turkish Government has lately placed a contract with an American company for the installation of an automatic telephone system in the city of Angora.

Venezuela.—TELEPHONE CONTRACTS.—The Government of Venezuela has signed contracts for the installation of two separate systems of automatic telephony. The first, to run for twelve years, will connect Caracas with a number of distant States and territories, and calls for the preliminary installation of 15,000 latest-type telephone instruments. The second contract, for fifteen years, covers a radius of 45 kilo-

metres and will link up the various towns in the State of Lara, with a total population of over 230,000. The Government will receive 10 per cent. of the gross receipts of the first and 5 per cent. of those of the second concessions.—*Reuter's Trade Service* (Caracas).

Radio Notes.

Australia.—High-Power Station.—The farmers' broadcasting station (2FC) at Sydney was to have its power (5 kW) doubled when it was moved from Willoughby to Pennant Hill, in February last.

Egypt.—Station Established.—A radio broadcasting station has recently been established in Cairo by a French company. It has a capacity of 2 kilowatts and works on a wave-length of 325 metres. So far as is known, this is the first station of its kind in Egypt.

S.B. Relays.—New Sub-station.—In connection with the system of relaying programmes to northern B.B.C. stations for which 2LS (Leeds) is the relaying headquarters for the North of England, Scotland and Ireland, a sub-relay station, to which all northern stations have been connected, was put into operation last week-end. New land lines have been laid recently, together with several new lines between Leeds and 2LO (London).

United States.—Libel Problem.—The Illinois State Attorney, Mr. Crowe, who has announced that he is filing a libel action against the wireless announcer at a Chicago cabaret for broadcasting an incorrect statement, has failed to find any statute in the American legal records defining radio libel. There is, however, says the *Daily Telegraph*, a law pending before the United States Congress enabling a libel action to be started for radio mis-statements and defamation of character.

Radio on American Farms.—There are nearly 1,000,000 radio sets on farms in the United States, according to estimates made by the Department of Agriculture, in a report on the increase in the use of radio in agricultural districts during the past five years. In some States, the Department says, there are radio sets on 25 to 40 per cent. of the farms. Estimates made by the Department showed 145,000 sets in use on farms in 1923, 365,000 sets in 1924, and 553,000 sets early in 1925. One station alone, in a period of three months' broadcasting of market and weather reports, received more than 3,000 letters of commendation from farmers, country banks, shippers of livestock, and small merchants in the towns of twelve agricultural States surrounding the station. The Department has made co-operative arrangements with more than 100 stations for broadcasting official market news gathered by the Department representatives in leading shipping and consuming areas. Since the beginning of the year the Department has made arrangements with about 60 stations to broadcast on a regular schedule four additional services dealing with general agricultural information.—*Reuter's Trade Service* (Washington).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—Buenos Aires.—April 12th. Public Works Department. Rock-drilling installation, including steam shovel, aerial transporters, 170-h.p. electric generating plant, &c.*

May 3rd. Electric travelling crane, capacity 1½ metric tons.*

Department of Sanitary Works. May 26th. Two 1,000-kW Diesel-engine generating sets.*

May 27th. Electrically-driven centrifugal sewage pumps.*

Atherton.—March 31st. Electricity Department. 650 yd. .1 sq. in. l.p. cable. (See this issue.)

Australia.—Brisbane.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company. Boundary Street, Brisbane.

Melbourne.—May 11th. P.M.G.'s Department. Telephone jacks.*

March 29th. State Electricity Commission of Victoria. 590 miles of aluminium steel-reinforced cable, various sizes, sufficient aluminium jointing sleeves for each size of cable, 2,000 lb. flat aluminium armour wire. (See this issue.)

June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (March 19th.)

May 11th. Switchgear and accessories, transformers and piping equipment. (See this issue.)

Barnes.—Electricity Department. E.h.p. and l.p. cables. (March 19th.)

Basingstoke.—April 6th. Electricity Department. One 600-b.h.p. heavy-oil engine and direct-coupled dynamo. (March 19th.)

Belfast.—April 3rd. Electricity Department. One 1,000-kW rotary converter, with transformer, l.p., a.c. switchgear, &c. (March 12th.)

Belfast.—April 17th. Electricity Department. Automatic rotary converters with transformers, h.p. and l.p. switchgear and automatic control gear. (See this issue.)

Belgium.—Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. March 31st. 80 tons of bronze wire in two lots. Particulars (Cahier des Charges Special No. 3-186) for one franc.

April 14th. Supply and laying of telephone-telegraph cables between Brussels and Liedekirke, and between Ruysselede and Aeltre-Sainte Marie. Particulars (Cahier des Charges Special No. 3-175) for 3 francs.

Brazil.—Rio Grande do Sul.—April 15th. Port and Bar Management. 10 electrically-operated portal cranes, capacity 2,500 kilos; 2 ditto, 5,000 kilos capacity; and 7 electric winches or capstans.*

Brentford.—March 30th. Board of Guardians. Wiring, &c., at the Institution, Warkworth House, Isleworth. (March 19th.)

Colwyn Bay and Colwyn.—April 8th. Electricity Department. Stores for 12 months, including cables, joint boxes, cut-outs, house-service meters, &c. (March 19th.)

Dover.—April 14th. Electricity Department. 6,250 yd. e.h.p. cable. (See this issue.)

Dundee.—April 20th. Education Authority. Electric lighting at new Central Advanced School at Blackness Road. Schedules from Messrs. Maclaren, Soutar & Salmond, architects, 16, South Tay Street, Dundee.

Edinburgh.—April 12th. Electricity Department. Four water-tube boilers, economisers, and mechanical stokers or alternatively, boilers, economisers, air heaters, and mechanical stokers, or boilers, economisers and powdered fuel plant. (March 12th.)

Egypt.—Cairo.—April 27th. Egyptian Government. 1,100 desk telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Erith.—March 27th. Electricity Department. 1,000 yd. (approx.) h.p. 3-core cable. (March 19th.)

Grimsby.—March 29th. Electricity Department. One 2,000-kW converter, one 1,000-kW ditto, l.p. switchgear, cable work, &c. (March 5th.)

Hallaton, Market Harborough.—Wiring and installation of electric lighting plant at Village Hall. (March 19th.)

Hazel Grove, near Stockport.—April 13th. Hazel Grove and Bramhall U.D.C. 2,300 yd. armoured cable. (March 19th.)

Halifax.—April 12th. Town Council. Wiring for electric lighting of 80 houses, Booth Lane and Nursery Lane. Particulars from Mr. P. Saunders, town clerk, Town Hall.

Horwich.—March 27th. Urban District Council. Wiring for electric lighting 206 houses, Hilton estate. Surveyor to Urban District Council, Public Hall, Horwich.

Huddersfield.—March 30th. Town Council. Electrician's work required in connection with the erection of workmen's dwellings, Woodhouse Hill, Fartown Green. Form of tender, &c., from Borough Architect, 26, Ramsden Street.

India.—April 19th. India Store Department. Goods lift for the Imperial Record Offices at Raisina, Delhi. (A.X. 2,904.)*

April 2nd. Cable. (March 5th.)

April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (March 5th.)

May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

Leyton.—April 9th. Education Committee. Installation of electric lighting and central heating at the Sybourn Street new school. (March 12th.)

London.—Islington.—March 29th. Borough Council. Two 3½-ton electric refuse-collecting vehicles fitted with steel tipping bodies. (March 12th.)

Manchester. — April 6th. Electricity Department. 3-phase, 6,600-V sub-station switchgear. (March 12th.)

3-phase, 33,000-V switchgear, 3-phase, 6,600-V switchgear, neutral earthing resistances, and trip circuit batteries. (See this issue.)

Middlesbrough.—April 16th. Electricity Department. Six or 12 months' supply of cables and 12 months' supply of meters. (See this issue.)

Newcastle-on-Tyne.—March 31st. Tyne Improvement Commissioners. One 2-ton overhead electric travelling crane. Mr. A. Blacklock, Commission Offices, Bewick Street, Newcastle-on-Tyne.

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*

Otley.—March 30th. Wharfedale Isolation Hospital Committee. Electrical installation at the Isolation Hospital, Menston. (March 5th.)

Rosslynlee.—Midlothian and Peebles District Asylum. Stores, including electrical fittings, for six months. Forms from Mr. Chilton L. Addison Smith, clerk and treasurer, 19, Heriot Row, Edinburgh.

Sheffield.—March 31st. Education Committee. Electric wiring and fittings, Firth Park Secondary School. Form of tender, &c., from City Architect, Town Hall.

South Africa.—JOHANNESBURG.—May 6th. S.A. Railways and Harbours. Two electric goods lifts.*

Stoke-on-Trent.—April 13th. Electricity Department. 12 months' supply of mains and cables, a.c. and d.c. meters, sub-station switchgear, and static transformers. (See this issue.)

April 12th. Gas Committee. Electrical and other machinery, gas engine and dynamo. Contract No. 35. Particulars (20s.) from the Chief Gas Engineer, Gas Works, Etruria, Stoke-on-Trent.

Walthamstow.—April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (March 12th.)

West Ham.—April 8th. Board of Guardians. Two 100-V d.c. motors, with slide rails, two starting panels, &c. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia. — MELBOURNE. — P.M.G.'s Department. Accepted :—

Six tons cadmium copper wire, £826; cables (cont. 405), £121,015; telegraph equipment (cont. 415), £398.—British Insulated Cables, Ltd.
Lamps, lamp caps, and sockets (cont. 379), £512; telephone receivers (cont. 452), £293.—British General Electric Co., Ltd.
Lead-covered cable (cont. 406), £24,151; switchboard cable (cont. 422), £5,589; mouthpieces (cont. 432), £316.—Standard Telephones & Cables (Australia), Ltd.
Lead-covered cable (cont. 407), £6,067.—W. T. Henley's Telegraph Works Co., Ltd. do. (cont. 408), £6,044.—W. T. Glover & Co., Ltd.
Telegraph equipment (cont. 411), £2,366.—Walters Electrical Manufacturing Co., Ltd. Do. (cont. 413), £701.—A. W. Hart & Co. Do. (cont. 417), £223.—Precision Engineering Co.
Switchboard cable (cont. 421), £3,824; telegraph equipment (cont. 412), £1,399; telephone receivers (cont. 454), £1,035.—Siemens Bros. & Co., Ltd.
Bells and buzzers (cont. 424), £1,044.—Sterling Telephone & Electric Co., Ltd. Do. do. (cont. 425), £1,511.—New System Telephones Pty., Ltd.
Bells (cont. 426), £658; transmitters, &c. (cont. 430), £441.—British L.M. Ericsson Mfg. Co., Ltd.
Timing clock (cont.428), £1,217.—Ingram Bros.
Dry cells (cont. 464), £25,281.—Widdis Diamond Dry Cells Pty., Ltd.
Automatic telephone exchange equipment, Elsternwick (Vic.) and Northcote (Vic.) (cont. 405), £113,812; do. Canterbury (Vic.) and South Melbourne (cont. 41), £128,901.—Automatic Telephone Mfg. Co., Ltd.
Motor generator sets and apparatus for City South, City East (N.S.W.) and the Canterbury and South Melbourne telephone exchanges (Vic.), £13,192.—Newton Bros. (Derby), Ltd.
Carrier telegraph system with equipment for use between Melbourne and Adelaide (£19,416), between Sydney and Melbourne (£24,064).—Standard Telephones & Cables (Australia), Ltd.

State Electricity Commission of Victoria.

22,000 V, 3-core cable (£22,480), British Insulated Cables, Ltd.; do. (£1,008), Siemens Bros. & Co., Ltd.
Bare h.d. copper cable (£5,288).—British Insulated Cables, Ltd.

SYDNEY.—According to the *Daily Telegraph*, the Sydney City Council has accepted the tender of the Commonwealth Shipping Board for the supply of the turbo-alternators at the new power house at Bunnerong, at £660,000. The machines will be built at Cockatoo Island Dockyard in collaboration with the Metropolitan-Vickers Electrical Co., Ltd.

Bedford.—Electricity Committee. Accepted:—

Converting motive power of clinker grab crane from steam to electricity (£324).—Bedford Engineering Co.
H. and l.p. cables for 12 months (schedule prices).—Siemens Bros. & Co., Ltd.
525-h.p. synchronous motor for supply to sewage pumping station (£1,565).—Crompton & Co., Ltd.

Belgium.—Belgian, German and British (Callender's Cable & Construction Co., Ltd.) firms submitted tenders on March 8th to the Royal Belgian Gun Foundry authorities at Liége for the supply of 20 kilometres of single-conductor electric cable. The lowest offer was that of a Belgian company.

Bexhill.—Electricity Committee. Recommended:—

Feeder pillars (£132).—W. Lucy & Co., Ltd.
3,000 yd. distribution cable (£1,156).—Enfield Cable Works, Ltd.
2,587 yd. .5 3-core feeder cable (£3,259); 16 straight-through joint boxes (£44).—British Insulated Cables, Ltd.

Glasgow.—Electricity Committee. Recommended:—

Transformers for various sub-stations :—
Four 100-kVA transformers (£617).—British Electric Transformer Co., Ltd.
Four 200-kVA ditto (£1,268).—Metropolitan-Vickers Electrical Co., Ltd.
Five 400-kVA ditto (£2,553).—Johnson & Phillips, Ltd.
Three 800 kVA ditto (£2,601).—Ferranti, Ltd.
Six step-up transformers for the new refuse disposal works at Govan (£9,090).—Ferranti Ltd.

Switchboard equipment (£8,368).—A. Reyrolle & Co., Ltd.
Extension of switchboard at Virginia Street sub-station (£351).—Bertram Thomas.

Tramway Committee. Accepted :—

Special work.—Hadfields, Ltd.
D.c.c. wire.—London Electric Wire Co. & Smiths, Ltd.

Corporation. Accepted :—

Electric lighting installation in the second section of Stockwell Street improvement scheme (£1,766).—T. B. & J. A. Mathieson, Ltd.

Cleansing Committee. Recommended :—

35 electric vehicles, £1,050 to £1,099 per vehicle, according to battery.—Richard Garrett & Sons, Ltd.

Kirkcaldy.—Accepted:—

Evaporating and de-aerating plant, including heaters and pumps, for Michael Nairn & Co., Ltd.—Mirrlees-Watson Co., Ltd.

Lamp Contracts.—The British Thomson-Houston Co., Ltd., has received a 13 months' contract from the London and North-Eastern Railway (Scottish area) for the supply of "Mazda" electric lamps. The London & North-Eastern Railway Co. has placed contracts for carbon, drawn wire and gasfilled lamps with the Edison Swan Electric Co., Ltd., and the Siemens & English Electric Lamp Co., Ltd.

London. — BATTERSEA. — Electricity Committee. Recommended :—

Supply of cables for one year.—Callender's Cable & Construction Co., Ltd.
Electricity meters for one year.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.

Manchester.—Tramways Committee. Accepted:—

Siemens "Zed" fuses for 12 months.—Siemens & English Electric Lamp Co., Ltd.

Preston.—Electricity Committee. Accepted:—

Switchgear for Manchester Road sub-station (£1,385).—English Electric Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended :—

Sixteen 100-kVA single-phase transformers, &c. (£1,555); twelve 50-kVA single-phase ditto, &c. (£865); one 300-kVA 3-phase ditto, &c. (£237); four 50-kVA 3-phase ditto, &c. (£343); 29 externally-operated tapping switches (£302).—English Electric Co., Ltd.
100 unbreakable Whipp & Bourne's fuses (£200).—Sadler & Franks, Ltd.
Alterations and additions to the Reyrolle switchgear at Salt River and Maitland sub-stations, with material required for the Dock Road generating station end of the feeders (£1,888).—A. Reyrolle & Co., Ltd.

Wakefield.—Electricity Committee. Accepted:—

Battery for electric lorry (£138).—Chloride Electrical Storage Co., Ltd.

Watford.—Electricity Committee. Recommended:—

Sundry valves (£800).—Hopkinson & Co, Ltd.

Government Contracts.—The following Government contracts were placed during February, 1926 :—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Aluminium ingots.—British Aluminium Co., Ltd.
Cells.—Edison Swan Electric Co., Ltd.
H.p. air compressors.—G. & J. Weir, Ltd.
Electric travelling crane.—T. Smith & Sons (Rodley), Ltd.
Electric heating elements.—Electric Heating Co., Ltd.
Electric lamps.—General Electric Co., Ltd.
Operating panels.—Vickers, Ltd.
Motor-driven pumps.—W. H. Allen, Sons & Co., Ltd.
Electric tractors.—British Electric Vehicles, Ltd.
Tubing, conduits and accessories.—Electrical Conduits, Ltd.; Talbot-Stead Tube Co., Ltd.; General Electric Co., Ltd.; Credenda Conduits Co., Ltd.; Barton & Sons, Ltd.; Eureka Conduits & Fittings Co., Ltd.

WAR OFFICE.

Aluminium ingots.—British Aluminium Co., Ltd.
Petrol-electric vehicle spares.—Rees Roturbo Mfg. Co., Ltd.
Transformers.—Foster Engineering Co., Ltd.
Turbo-alternator and spares.—Brush Electrical Engineering Co., Ltd.

AIR MINISTRY.

Battery (Waddington).—Tudor Accumulator Co., Ltd.
Stand-by plant (Catterick).—Aster Engineering (1913), Ltd.
Internal wiring (North Weald).—S. Dixon & Son, Ltd.
Insulator testers.—Evershed & Vignoles, Ltd.
Magnetos.—North & Sons, Ltd.
Repair of magneto spares.—Delco, Remy & Hyatt, Ltd.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Brit. L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.
Testing, protective and miscellaneous apparatus.—General Electric Co., Ltd.; Johnson & Phillips, Ltd.; Power Equipment Co., Ltd.
Battery stores.—Alton Battery Co., Ltd.; F. S. Bayley Clanahan & Co.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Enfield Cable Works, Ltd.; Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Joint box castings.—Bradley & Turton, Ltd.; Britannia Lathe & Oil Engine Co., Ltd.; McDowall, Steven & Co., Ltd.; Planet Foundry Co., Ltd.; Taylor Bros. (Sandiacre), Ltd.; United Steel Companies (T. Butlin & Co.); J. Williamson & Co., Ltd.
Lamps.—H. Miller & Co., Ltd.
Copper wire.—T. Bolton & Sons, Ltd.; E. & E. Kaye, Ltd.; Nevill Druce and Co., Ltd.
V.i.r. core wire.—British Insulated Cables, Ltd.
Manufacture, supply, drawing-in and jointing cable.—Exeter-Torquay: Pirelli-General Cable Works, Ltd. Manchester-Burnley: British Insulated Cables, Ltd. Holborn-Finchley and Holborn-G.P.O. (South) Junction: Standard Telephones & Cables, Ltd.
Cord circuit repeater equipment.—Inverness: General Electric Co., Ltd.
Power plant Devizes (Wilts.) radio station.—J. H. Holmes & Co.
Steel wireless masts. St. Albans wireless receiving station: Armstrong Construction Co., Ltd.
Telephone exchange equipment.—Armley (Leeds), Battersea (New), Sloane (Relief), Poppsgrove (Park).: Automatic Telephone Mfg. Co., Ltd. Mill Hill: Standard Telephones & Cables, Ltd. Ilford: General Electric Co., Ltd.
Private branch exchange equipment.—Failsworth Industrial Society, Ltd., Yardley & Co., Ltd.; Fisher & Ludlow, Ltd. (Birmingham). Harrison (Birmingham), Ltd., Barnsley Co-operative Society: Relay Automatic Telephone Co., Ltd.

H.M. OFFICE OF WORKS.

Cables (Ulster Parliament Buildings).—Hackbridge Cable Co., Ltd.
Wiring western annexe, &c., British Museum.—H. W. Hives.
Cables, wiring &c., Ministry of Pensions Hospital, Orpington.—Bailey and Incledon.

CROWN AGENTS FOR THE COLONIES.

Adapters, &c.—General Electric Co., Ltd.
Cable.—St. Helens Cable & Rubber Co., Ltd; F. Smith & Co.
Coal-conveyor plant.—Fraser & Chalmers, Ltd.
Electrical materials.—W. T. Henley's Telegraph Works Co., Ltd.
Generating plant.—Campbell Gas Engine Co., Ltd.
Lux cells spares.—Chloride Electrical Storage Co., Ltd.
Telephones.—British L. M. Ericsson Mfg. Co., Ltd.
Train-lighting equipment.—J. Stone & Co., Ltd.
X-ray apparatus.—Watson & Sons, Ltd.

Forthcoming Events.

British Electrical Development Association Conference.—Friday, March 26th. At Caxton Hall, Westminster, S.W. At 9.30 p.m. Paper on "Progress and Prospects of Commercial Electric Cookery," by Mr. J. J. McKenna.

Birmingham Electric Club.—Friday, March 26th. At the Grand Hotel, Birmingham. At 7 p.m. Lecture on "Telephone Repeaters," by Mr. A. B. Hart.

Physical Society of London.—Friday, March 26th. At the Imperial College of Science, South Kensington. At 5 p.m. Ordinary meeting.

Royal Institution.—Friday, March 26th. At 21, Albemarle Street, W. At 9 p.m. Lecture on "The Radiation from Atomic Nuclei," by Sir Ernest Rutherford.

Saturday, March 27th. At 3 p.m. Lecture on "The Rare Gases of the Atmosphere," by Sir Ernest Rutherford.

National Association of Supervising Electricians.—Saturday, March 27th. At the Holborn Restaurant. Annual dinner.

Nottingham Society of Engineers.—Monday, March 29th. At the Victoria Station Hotel. At 7.30 p.m. Lecture on "Emergency Lifting Jobs," by Mr. H. E. Warsop.

Royal Society of Arts.—Monday, March 29th. At John Street, Adelphi, W.C. At 8 p.m. Cantor Lecture on "Thermometry," by Mr. W. F. Higgins. **(Lecture III.)**

Institution of Electrical Engineers (North-Western Centre).—Tuesday, March 30th. At the Engineers' Club, Manchester. At 7 p.m. Lecture on "Electro-Farming; or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(South-Midland Centre).—Wednesday, March 31st. At the University, Birmingham. At 7 p.m. Papers on "Power Factor and Tariff," by Mr. E. V. Clark; and on "Power Factor Improvement," by Mr. E. W. Dorey.

Illuminating Engineering Society.—Tuesday, March 30th. At E.L.M.A. Lighting Service Bureau, 15, Savoy Street, W.C. Discussion on "Stage Lighting," to be opened by Mr. H. L. Groom.

Roentgen Society.—Tuesday, March 30th. At 1, Wimpole Street, W.1. At 8.15 p.m. Ninth Silvanus Thompson Memorial Lecture by Sir John Thomson-Walker.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Hedge-clipping machines (electrically operated).

Red Cross commutator lubricant.

Notes.

National Association of Supervising Electricians.—On March 12th Mr. E. Preece lectured, at the Y.M.C.A. Buildings, Manchester, on "Electric Driving of Textile Factories," illustrating his remarks by lantern slides. Mr. Preece outlined the early history of the textile industry, depicting some of the methods adopted for driving when the steam engine was introduced, and led up to modern mechanical and electrical methods. The chair was occupied by Mr. E. North, M.J.Inst.E., chairman of the Association, supported by Mr. A. Brammer, the general secretary.

The Lowest Domestic Tariff.—Whilst going to press we have received the following letter:—In your issue of the 19th inst. you refer in a leading article to the system of charging for an "overall" domestic supply introduced at Gravesend, and remark that "so far, we have come across only one undertaking with a similar system—Watford."

In Sheffield such a system has been in operation for many years (since 1913) the quarterly charge being 2½ per cent. on the pre-war rateable value, plus one halfpenny per unit. This basis price has been maintained since its inception, and at the present time is subject to 5 or 10 per cent. increase only, according to whether the ultimate price works out at over 2d. per unit or at 2d. or under per unit respectively. The increase will be abolished at no distant date, when Sheffield prices will be at pre-war rates. I have no doubt that there are also other one-time members of the now defunct "Point-five Association" who are continuing with similar schemes, although possibly you are correct if your reference is only to the Greater London area.—S. E. Fedden, *General Manager*, Electric Supply Department, Sheffield, *March 22nd*, 1926.

Appointments Vacant.—Draughtsman assistant (£130) for the Cheadle and Gatley U.D.C. Electricity Department. Plumber-jointer for the Brighton Corporation Electricity Department. Assistant for research work on miners' electric lamps (£377) for the Safety in Mines Research Board. Assistant engineer (£345) for the Wimbledon Corporation Electricity Department. Junior shift engineer for the Reigate Corporation Electricity Department. (See our advertisement pages to-day.)

All-Electric Houses at Salford.—The Salford Corporation Housing Committee has decided to equip the 126 working-class houses which are being erected on the Littleton Road Housing Estate at Lower Kersal so that they will be all-electric. The decision was arrived at after a visit to the estate in company with the Committee's architect, Mr. Charles Swain. An all-electric house had been fitted up by the Electricity Committee for the purposes of the visit, and it was the effective manner in which it was equipped that led the Housing Committee to decide in favour of the principle.

Public Address Equipment in Italy.—The Marconi equipment which has become familiar through its reproduction of speech and music on such occasions as the opening and closing of the Wembley Exhibition, and other public functions, achieved success in Italy last year, and the Italian Marconi Co. has received requests for it to be used at many important sports gatherings in Italy.

Heavy-Load Fuse Tests.—A large gathering of electrical engineers of the Manchester district attended a series of fuse tests conducted recently by Messrs Parmiter, Hope and Sugden, Ltd., at the Polygon sub-station of the Manchester electricity undertaking and subsequently at the Fluvent Electrical Works, Longsight. The demonstrations showed very effectively the superiority of the enclosed and protected fuses over those of the open types. No fewer than 15 "short" tests were carried out on a short-circuit current of 3,540 A at 450 V. All the fuses were of the low-pressure re-wirable type, and were designed for a continuous carrying capacity of 60 A. The machine used in connection with the tests was rated at 125 kW. The fuses tested were of the following types:—Copper, tin, aluminium, and zinc wire in air; copper and tin wires in ordinary types of fuse holders; ordinary cartridge fuses; Aeroflex traction and light-duty fuses, open, in iron case, and in iron case with one pole connected to the case; and the Aeroflex light-duty indicating fuse. After the startling reports and the display of pyrotechnics from some of the earlier experiments, the Aeroflex fuses revealed unquestionable advantages, including their ability to stand up to heavy-duty conditions where the power behind the short-circuit is considerable. At the Fluvent works it was shown by simple experiment how an Aeroflex fuse element would behave when blowing in air. The liquefaction of the low-melting fuse metal was demonstrated with the fuse on a 6-V circuit. After a four-hours' run on full load the temperature of a 1,500-A Aeroflex fuse was 29.3 deg. C. The same fuse was blown on a slight overload in 3 min. 55 sec. Three tests were then carried out on a 60-A Aeroflex fuse blowing at loads of 120, 150, and 200 A, and the respective times taken were 1 min. 46 sec.; 34 sec.; and 12½ sec. After the tests the party had the opportunity of examining some h.p. fuses blown at various generating stations. Aeroflex fuses rated at from 2,000 to 11,000 V, and some three-phase distribution boxes and boards were also seen. The most interesting exhibit of blown fuses was two from Birmingham. These were blown across a 460-V, 6,000-Ah battery, the total resistance in circuit being .006 ohm. These blown fuses revealed the uniformity of the fusible element, the actual rupture taking place on the copper strip at the extreme ends.

After the demonstrations, Messrs. Parmiter, Hope & Sugden, Ltd., entertained the company to lunch at the Midland Hotel, when some complimentary speeches were made. Mr. Vernon Hope spoke of the difficulties that had been experienced in the designing of fuses, perhaps "the most ill-used members of the electrical family."

The "Aeroflex" fuse was described in detail in the Electrical Review, April 10th, 1925, and it will be recalled that the fusible element consists of a patented bi-metal fuse strip in the centre of which is a hollow pocket of pure tin filled with an inert gas.

Progress of the Hiring System at Ilford.—We have received from Mr. A. H. Shaw, M.I.E.E., engineer and manager of the Ilford U.D.C.'s electricity supply undertaking, the following particulars regarding the progress made in the hiring of installations, apparatus, &c., in his area to December 31st, 1925:—

Installations or apparatus.	Number out on hire.
Wiring installations	500
Cookers	350
Kettles	380
Radiators	933
Irons	347
Immersion heaters	35
Toasters	16
Vacuum cleaners	54
Washers	13
Motors	21
Total	2,649

We also learn from Mr. Shaw that his undertaking has been hiring out apparatus for some three years; a separate charge is made for each appliance, energy being charged for at one of the ordinary tariffs, which are as follows:—

Residential: 12½ per cent. p.a. on rateable value, plus ¾d. per kWh.

Lighting, flat rate, 4½d. Lighting, m.d. rate, 7d. and 1½d.

Heating and cooking, flat rate, 1d. (summer), 1½d. (winter quarters.).

The undertaking possesses hiring powers only, under the Act of 1919; people who wish to purchase outright are referred to the local contractors, and it is estimated that an equal number of appliances has been sold by the latter in this way since the scheme was introduced.

French Trials of Accumulator Vehicles.—The Union des Syndicats de l'Electricité, of Paris, is organising a third series of trials of accumulator vehicles, following those which were carried out in 1923 and 1924. Entries for the trials, which have been arranged with the co-operation of the Ministry for War, the Automobile Club of France, &c., will be received up to April 15th at the offices of the Union, and the trials are to take place in Paris between June 5th and 20th.

London Traffic Inquiry.—An inquiry was opened on March 16th at the Middlesex Guildhall by a sub-committee of the London and Home Counties Traffic Advisory Committee into the travelling facilities of East London. Suggestions were made for the electrification of the L.N.E. Railway from Chingford, the electrification of the North London section of the L.M. and S. Railway, and the construction of a new electric railway from the City to Waltham Cross, as means for relieving the traffic congestion.

The Batti-Wallahs' Society.—On March 17th, the Batti-Wallahs held their annual dinner at the Hotel Victoria, London, the President, Mr. A. W. Blake, M.I.E.E., occupying the chair; there was a large attendance of members and guests, many ladies being present.

After the president had proposed the toast of "The King," who, he pointed out, was a sailor, Vice-Admiral Sir R. B. Dixon, K.C.B., proposed "The Batti-Wallahs' Society," referring to the good comradeship which was one of its most notable features. The president, in his reply, said they were all interested in electricity and proud of its progress; it had been hindered by legislation, and he looked with doubt upon the formation of too many organisations to control the industry, which had to bear all the expenses. It was only the applications of electricity that would enable them to enjoy the comforts and benefits that it made available.

Mr. G. W. Partridge, M.I.E.E., vice-president, proposed "The Visitors," praising the work of the Electrical Association for Women, which in one year had enrolled 500 members and was educating women in the domestic uses of electricity. Col. Crompton was the "Grand Old Man" of the industry; in the early pioneering days they knew where they were; now, thanks to Parliamentary interference, they did not know where they were. Miss C. Haslett responded, referring to the electricity supply scheme recently carried out by Miss M. Partridge in a Devonshire town, and urging that they should not talk too much about "cheap electricity," as people were given the impression that the Bill would bring a cheap and abundant supply. Electricity gave women the prospect of relief from drudgery and of opportunities for creative work. Col. Crompton also responded, declaring that he saw sure signs of renewed prosperity in trade, in spite of the Bill, and giving many interesting reminiscences.

Mr. F. Pooley, past president, proposed the health of the president, who, he said, was determined to develop the uses of electricity and imposed no restrictions in his area. Mr. Blake in his reply paid a tribute to the work of the hon. secretary, and proposed the toast of his health, which was heartily honoured; Mr. M. Whitgift briefly acknowledged the compliment.

An excellent musical entertainment was provided, and the function was very much enjoyed

The Manchester Steam Users' Association.—The annual general meeting of the above Assocociation was to be held on March 23rd and the annual report (1925) presented for adoption. At the end of the year in question 1,763 members were on the Association's books and the numbers of works and boilers inspected during the year were 5,047 and 11,662 respectively. The revenue for the year amounted to £43,111, and the working expenses £38,291, leaving a gross surplus to be carried down of £4,820. The Association has completed its seventy-first year of activity.

Fatality.—The death of Richard Henry Goffe (21), an electric meter repairer employed by the Birmingham Corporation Electric Supply Department, at Dale End, was investigated by the Birmingham City Coroner (Mr. Isaac Bradley), last week. The deceased had been employed on mercury meters, but it was not clear as to how he had actually come in contact with the mercury. Dr. Cooper said that he came to the conclusion that Goffe was suffering from mercurial poisoning, and saw that the case was quite hopeless from the point of view of treatment. Professor G. Haswell Wilson (Professor of Pathology at the University) who made a post-mortem examination in conjunction with Dr. Cooper, said that he came to the conclusion that death was due to myelitis, a disease that arose without any obvious cause. Witness added that there was no evidence of chronic mercurial poisoning in the system. Mr. Rigby, a public analyst, who had examined the liver, kidneys and spleen, said he found that the weight of mercury therein was 1.38 grains per lb. of material. The coroner found that the man died from the myelitis condition occurring in a patient who was already suffering from chronic mercurial poisoning.

German Telephones for Japan.—It is reported from Berlin that the Siemens and Halske Company has received orders from the authorities at Kobe and Osaka for the establishment of automatic telephone exchanges. The value of the orders is put at about £200,000.

The London Electrical Engineers.—27TH (LONDON) ANTI-AIRCRAFT BATTALION R.E. (T.A.).—Officer Commanding: Lt.-Colonel C. H. S. Evans, O.B.E. The following orders have been issued for April, 1926:—304th Company (Major P. F. Foulger). 305th Company (Major A. W. M. Mawby, O.B.E., A.M.I.E.E.).—Tuesdays, 7 p.m. to 9.30 p.m. 306th Company (Major F. C. Clarke, A.M.I.E.E.).—Mondays, 7 p.m. to 9.30 p.m. A voluntary camp will be held at Biggin Hill from Good Friday to Easter Monday. It is hoped that at least eight officers and 80 other ranks will attend. Following this camp four officers will be sent on a course to Gosport. General training will be carried out with special regard to musketry and preparation for a recruiting campaign.

Educational.—NORTHAMPTON POLYTECHNIC INSTITUTE.—An entrance examination in connection with the Engineering Day College of the above will be held on Tuesday, April 13th. Further information may be had on application to the Principal. (See our advertisement pages to-day.)

The Electrical Power Engineers' Association.—The annual dinner of the London Western Section of this Association was held on Saturday last, at Stewart's Restaurant, London. The chairman, Mr. T. Welch, presided over a large gathering of members and guests, including many ladies. After the loyal toast, Mr. J. N. Waite, M.I.E.E., proposed "The Association." Referring to the Electricity Supply Bill, he questioned where it could cheapen the supply of electricity, and said that there were already too many authorities—now another was to be added. He regretted the omission of compulsory wayleaves, and considered the compensation clause unsatisfactory. In seven years the Association had made remarkable progress, and having consolidated its position it could now devote attention to questions other than protection; the scheme of training had already been adopted by the No. 5 Joint Board. The members had gained a reasonable remuneration, and should give professional service in return for a professional salary. Mr. A. J. Ostler, president, responded, referring to the excellent educational work done by Mr. Waite's lectures, and remarking that hundreds of power stations were to be shut down, said the members were fortunate in having an Association that would look after their interests.

Mr. W. J. Oswald proposed "The Ladies," to whom, he said, the development of electricity in the home was especially important, and Mr. A. W. Compton responded on their behalf.

The toast of "Our Section and Our Chairman" was proposed by Mr. W. E. Rogers, who remarked that the famous grid and the standardisation of frequency had been washed out for a long time; Mr. Welch, in responding, regretted the loss of the hon. secretary, Mr. T. S. Wallis, who was taking up the post of station superintendent at Bristol.

Music and dancing enlivened the proceedings, which were very successful.

Chief Technical Assistants' Association.—The twelfth annual dinner of this Association will be held at the Holborn Restaurant on Saturday, April 10th, at 6.45 p.m.

The Annual Motor Parade.—The 20th Annual Parade of Commercial Motor Vehicles, organised by the Commercial Motor Users' Association (Inc.), to encourage drivers to take a personal interest in the driving and condition of their vehicles, will be held in London to-morrow, March 27th. The parade is limited to teams of three vehicles in the ordinary classes, but single vehicles may be entered for the electrical class which is open to both members and non-members. The British Electrical Development Association (Inc.) is co-operating with the C.M.U.A. and money prizes ranging from £1 10s. 0d. to 10s. will be awarded to the drivers of the winning vehicles in the electrical class.

Hackney Electricity Undertaking.—The progressive electricity supply policy adopted at Hackney, is, as our readers are aware, exciting increasing interest. The big showroom and service policy has its critics and some of their statements are considered to call for investigation. For instance, Councillor W. Hammer has given notice of the following motion at the Council meeting:—

"That this Council respectfully requests the Electricity Commissioners to appoint experts, both engineering and financial, for the purpose of enquiring into allegations publicly made by Alderman Genese on the 10th February, 1926, to the following effect:—

"(1) 'That the Electricity Show Rooms have cost the ratepayers £43,000.'

"(2) 'That if anything should happen to the Electricity Undertaking, the ratepayers would be faced with a liability of over one million pounds.'

"(3) 'That the Commissioners should be requested to inform the Council as to the result of such inquiry at the earliest possible moment.'"

Institution Notes.

Institution of Electrical Engineers.—NORTH-WESTERN CENTRE.—The annual general meeting was held on Tuesday, March 16th, having been brought forward from the date originally fixed, March 30th, on which a paper is to be read by Mr. R. B. Matthews upon "Electricity in Agriculture." Mr. A. G. Ellis (chairman of the Centre), who presided, stated that members of the Farmers' Union had been invited to attend on that occasion. The membership of the Centre at March last was 1,092, as compared with 1,069 for the previous year. Votes of thanks were passed to the Engineers' Club for the facilities afforded for meetings of the Centre, and to the authorities of the Municipal College of Technology for allowing the lecture by Mr. A. P. Trotter on "Illumination and Light" to be given in the large hall of that building. The officers for the year were elected, including the chairman, Mr. W. J. Medlyn; vice-chairmen, Messrs. H. A. Ratcliffe and A. B. Mallinson; and secretary, Mr. A. L. Lunn.

Institution of Chemical Engineers.—The examinations for the Associate Membership of the Institution will be held in June and July next. Full particulars can be obtained from Mr. C. S. Garland, hon. registrar, The Institution, Abbey House, Westminster, S.W. (See our advert. pages to-day.)

Institution of Mechanical Engineers.—In a paper, "The High-Efficiency Oil Engine," read before the above Institution, Mr. Alan E. L. Chorlton dealt fully with the results of recent investigations on internal combustion. The possibilities of increasing the efficiency of the Diesel engine were considered, and the author said that to do that the design must follow motor-car and aero practice in employing higher speeds, smaller pistons, and fewer rings. Commenting on the mechanical system of fuel injection, Mr. Chorlton said that before good combustion could be possible the feed pump would have to measure out, accurately and consistently, the requisite amount of fuel and inject it into the cylinder under a high pressure with a rapid start and finish to its flow.

Junior Institution of Engineers.—In a lecture, "Paint Spraying," before the above Institution on March 12th, Mr. F. E. Webb said that from the preservation point of view the application of paint by means of a brush did not attain its object nearly so well as paint sprayed on under pressure—the former merely gave a surface coating while the latter method caused the paint to penetrate the pores of both wood and mild steel, as could be ascertained by microscopical examination, besides penetrating crevices and difficult corners not easily reached by a brush. The other advantages claimed were ease and rapidity of execution and a far more perfect surface than that attained by the brush method.

On March 19th, a paper on "Pipework—its Manufacture and Layout," was read by Mr. G. H. Willett, who described the different methods of welding pipes and making weldless tubes, lantern slides being shown of the various processes. The four main types of joints, spigot and socket, screwed and socket, flanged, and welded, were described, and particulars given of the variation necessary for pipes of different materials and for the conveyance of different fluids. The design of pipe layouts was also dealt with. The author said the chief source of danger in a steam main was the problem of drainage, and the design should be such that any condensed steam which might collect, whether in commission or when the steam was shut off and the main had cooled down, could be drawn off automatically by steam traps at as few points as possible.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Mr. Robert Bain has been appointed general superintendent of the Pacific Cable Board's system, to take charge of all staff and technical matters, and assist Mr. Hunter, the general manager.

Mr. R. W. Weekes, consulting engineer, has removed his offices to Clutha House, 10, Princes Street, Westminster, S.W.1, where his telephone number will be "Victoria 4007."

The Islington Borough Council Electricity Committee recommends that the salary of Mr. Albert Gay, chief electrical engineer, be advanced from £900 to £1,150 per annum.

Mr. F. R. Turner, senior charge engineer in the power station of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board (previously reported here as having been appointed charge engineer with the United Alkali Co.) was, on the occasion of his leaving Stalybridge, presented with a set of three antique Korean bronze vases. Mr. R. Blackmore, engineer-in-chief, made the presentation on behalf of the whole of the staff and employés.

Douglas (Isle of Man) Town Council has increased the salary of Mr. P. Bregazzi, mains superintendent, from £273 to £299 per annum, and that of Mr. R. M. Clague, station superintendent, from £305 to £331 per annum.

Mr. Leslie G. Toplis, who has for some time past been associated with the Enfield Cable Works, Ltd., is severing his connection with that company at the end of March, and is taking over the East of Scotland interests on behalf of Messrs. Morris Warden & Co., Ltd., of Glasgow.

Mr. J. S. Tebbitts, assistant engineer of the Post Office Engineering Department of the Hanley Section, has been appointed sectional engineer in succession to the late Mr. A. E. Giffin.

Eighty four applications were received for the position of carshed superintendent at Rawtenstall, which is becoming vacant by the appointment of Mr. A. Baxendale as rolling stock superintendent at Wallasey. Three gentlemen appeared before the Committee on March 18th, and Mr. A. Cooper, of Barrow-in-Furness, was selected for the position.

Mr. H. J. Smith, who recently relinquished the position of resident engineer of the Hertford, Ware and Hoddesdon area of the North Metropolitan Electric Power Supply Co. to take up an appointment as district engineer to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., was presented with a silver-mounted engraved testimonial by the local staff on leaving.

Portsmouth Corporation Tramways Committee recommends the appointment of Mr. Ben Hall (Halifax) as engineer and general manager at a salary of £1,000 a year.

Mr. E. W. Dickinson, M.I.E.E., has joined the technical staff of the Electricity Commission.

Mr. James Nelson, M.I.E.E., M.I.R.E., is terminating his engagement with the British Insulated & Helsby Cables, Ltd., at the end of March, after 22½ years' service. He is taking over the Western area and several other districts on behalf of the British Resistor Co., and is devoting special attention to the wireless side of its products generally in the British Isles. The main line of the company is "Globar," which is specially suitable for electric cooking and heating apparatus. During his time with the British Insulated & Helsby Cables, Ltd., Mr. Nelson has carried out some large contracts; he superintended the laying and testing of the first 100,000-volt cable laid in this country, for Mr. J. S. Highfield, who was then with the Metropolitan Electric Supply Co., and he has had exceptional experience in connection with electrolytic trouble on mains, which he places at the disposal of other engineers.

Obituary.—Mr. Donald McColl.—In our issue of February 5th, 1926, p. 228, we announced the death, at Seaford, Sussex, of Mr. Donald McColl, formerly general manager of the Shanghai Electric Construction Co., Ltd. According to news just to hand, the *North China Herald* of January 30th contained an account of Mr. McColl's work and career. He was born in Glasgow and joined the Corporation tramways there when the cars were horse-drawn, remaining there until the system was electrified. In 1902 he went to the Lisbon tramways for three years, and in 1905 he received an appointment with the London Underground group. Here he was closely associated with the Bakerloo Tube. He went to Shanghai in 1908. There, following the opening of the tramways, he had many difficult problems to face. He envisaged a scheme for tramways in Shanghai as great as that of Glasgow, and in all his correspondence and negotiations with the Shanghai Municipal Council showed his determination, if possible, to secure this. He was an expert in tramway organisation, and foresaw great possibilities for railless trams. As an economist, Mr. McColl also took a very high rank. He was faced, as general manager of the tramways, not only by the differences in the various Chinese currencies, but also by the constant depreciation in copper coinage—the medium in which the greater part of tramway fares is paid. His contributions to the literature of tramway accountancy were very considerable. He published a book on tramway accounting which has been adopted by numerous tramway organisations at home as a standard work. It was not in Shanghai alone that his influence was felt, for subsequent to the war it extended to Singapore, where the Shanghai Electric Construction Co. undertook the reorganisation of the Singapore tramways. This system had not been successful as a commercial venture, but Mr. McColl saw that it could be made so, and under his direction a reorganisation has been proceeding during the past few years.

New Companies Registered.

Lewis Thomas & Sons, Ltd. (212,362).—Private company. Registered March 12th. Capital, £2,000 in £1 shares. Objects:—To acquire the business of electrical and mechanical engineers carried on by L. Thomas, J. L. Thomas, and R. M. Thomas at 54, North Parade, Aberystwyth, as "Lewis, Thomas & Sons." The directors are:—L. Thomas, Boulevard, North Parade, Aberystwyth, electrical and mechanical engineer; J. L. Thomas, 54, North Parade, Aberystwyth, electrical engineer. L. Thomas is to be appointed managing director for life with a commencing salary of £260 per annum. Secretary: W. L. Edwards. Registered office: 54, North Parade, Aberystwyth.

Radiodyne, Ltd. (212,364).—Private company. Registered March 12th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, wireless and mechanical engineers and manufacturers, &c. The first directors are:—G. K. Field, 19, Edith Villas, W. Kensington, W.14; E. L. Rawlins, 143, Graham Road, Wimbledon, S.W.19 (both permanent, subject to each holding 500 shares). Remuneration, £50 each per annum. Solicitors: Richard Brooks & Son, 24, Lawrence Lane, Cheapside, E.C.2. Registered office: 110, Greyhound Road, Hammersmith, W.6.

Roddis Heaters, Ltd. (212,419).—Private company. Registered March 15th. Capital, £1,500 in 950 10 per cent. cumulative preference shares of £1 each and 11,000 ordinary shares of 1s. each. Objects:—To carry on the business of radio, electrical, automobile, hydraulic, mechanical, and mining engineers, manufacturers and workers of, and dealers in electricity or any like power, or any power that can be used as a substitute therefor, for purposes of sound, light, heat, motive power or otherwise; manufacturers and constructors of, and dealers in wireless instruments and parts, &c. The subscribers (each with one preference share) are:—H. Newington, 14, Queen Victoria Street, E.C.4, secretary; G. E. N. Taylor, 54, Goldhurst Terrace, N.W., solicitor's managing clerk. The first directors are to be appointed by the subscribers. Qualification, £50 shares or stock. Remuneration as fixed by the company. Solicitors: Warwick & Gilbert, 14, Queen Victoria Street, E.C.4. Registered office: 14, Queen Victoria Street, E.C.

Yesly Electrical Supplies, Ltd. (212,548).—Private company. Registered March 19th. Capital, £1,000 in £1 shares (500 "A" ordinary and 500 "B" ordinary). Objects:—To acquire from the proprietors, Engineering Supplies, Ltd., all their right, title, and interest in the trade mark "Yesly," and to carry on the business of electrical and motor engineers and contractors, suppliers of electricity, carriers of passengers, manufacturers of, and dealers in railway and tramway appliances and requirements, telegraphic, telephonic, and wireless apparatus, traction engines, road and other rollers, motor wagons, lorries, carriers, cars, cycles, &c. The first directors are:—W. R. T. Willis, 3, Broxholm Road, West Norwood, S.E., electrical engineer (permanent chairman and managing director); W. H. Faber, 115, Kilmartin Avenue, Norbury, printers' works manager. Qualification, 1 share. Solicitors: White, Davison & Co., 61 and 62, Chancery Lane, W.C.2. Registered office: 5a, Iliffe Yard, Crampton Street, Walworth, S.E.

Gamble & Sons, Ltd. (212,322).—Private company. Registered March 11th. Capital, £4,000 in £1 shares. Objects:—To carry on the business of an electric light company and that of electricians, mechanical engineers, suppliers of electricity, &c. The directors are:—A. R. Gamble (permanent managing director), 283, Belgrave Gate, Leicester; T. H. Gamble, 283, Belgrave Gate, Leicester; Minna A. Gamble, 283, Belgrave Gate, Leicester. Qualification, 50 shares. Remuneration as fixed by the company. Solicitor: A. H. Headley, Queen's Chambers, Horsefair Street, Leicester. Registered office: 283, Belgrave Gate, Leicester.

Looe Electricity Co., Ltd. (212,534).—Public company. Registered March 19th. Capital, £6,000 in £1 shares. Objects:—To acquire the business of electrical engineers recently carried on by T. Roberts and J. Taylor, at Looe, Cornwall, as "Roberts & Co.," to adopt an agreement between F. West, of 2, Courtenay Street, Plymouth, as trustee in bankruptcy of the above company of one part, and A. J. Brain, C. W. Cook, E. Middleton, H. Shapcott, B. D. Webster, and A. West, all of Looe, as trustees for this company of the other, and to carry on the said business and that of an electric light company, &c. Minimum cash subscription, £3,000. The directors (to number not less than 5, nor more than 11) are:—J. C. Bray, Wesley Terrace, East Looe, retired butcher; A. H. Brian, Fore Street, East Looe, confectioner; C. W. Cook, Ship Hotel, East Looe, hotel proprietor; A. E. Hurford, Sandplace Road, East Looe, solicitor; R. Marshall, Higher Market Street, East Looe, greengrocer; E. Middleton, Higher Market Street, East Looe, fish merchant; T. H. Northam, North Road, West Looe, granite works manager; R. L. Prynn, "Rockville," East Looe, fish merchant; H. Shapcott, "Cross Sands," Hannafore, West Looe, accountant; B. D. Webster, Port-by-Han Hotel, West Looe, solicitor; A. West, Fore Street, East Looe, motor engineer. Qualification, £10. Remuneration as fixed by the company. Solicitor: R. A. Peter, Looe, Cornwall.

Official Returns of Electrical Companies.

Oco Electrical Apparatus, Ltd.—C. D. Britten, of Princes Chambers, 16, John Dalton Street, Manchester, was appointed receiver on March 6th, 1926, under powers contained in debentures dated November 18th, 1925, and January 6th, 1926.

Elpar, Ltd.—Particulars filed of £300 debentures authorised February 23rd, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Davenport Accessories, Ltd.—Two second mortgage debentures, dated March 1st, 1926, to secure any sums which the person entitled to the charge may be called upon to pay under lease dated December 31st, 1924, respectively, charged on 12 and 14, Pembroke Street, Islington, and the company's undertaking and property, present and future, including uncalled capital. Holders: F. J. W. Palmer, 2, Elderton Road, and N. Rose, 22, Chadwick Road, Westcliff, Southend-on-Sea.

Rapinet, Ltd.—Particulars filed on February 24th, 1926, of £1,000 debentures authorised September 7th, 1925, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Advance Engineering Co., Ltd.—W. G. Hall, of National Provincial Bank Chambers, Silver Street, Hull, incorporated accountant, was appointed receiver on February 22nd, 1926, under powers contained in debenture dated August 19th, 1921.

Peerless Productions, Ltd.—Particulars filed on February 24th, 1926, of £2,000 debentures authorised August 20th, 1925, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Fraser Mares, Ltd.—Debenture dated February 23rd, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. Holmes, 98, Frederick Street, Cardiff.

Cooke and Whitfield Wireless, Ltd.—E. P. Q. Carter, C.A., of 33, Waterloo Street, Birmingham, was appointed receiver on March 4th, 1926, under powers contained in debenture dated May 9th, 1924.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Col. R. E. B. Crompton, C.B., presided at the annual meeting of the company on March 18th. In the course of his speech he pointed out that the company could claim to be the oldest supply company in London, and for 40 years had given a continuous supply at gradually reduced prices and had maintained steady dividends. Their generating stations were now to be handed over to the London Power Co. and they would become distributors only. Referring to the electricity scheme, Col. Crompton said that the promised reductions from the concentration of generating plant and by the adoption of up-to-date machinery, would not by themselves reduce the price to the public. Even if they obtained all that they were promised, the company's present average rate of 3d. would only be reduced to a little over 2½d. per kWh. In all public services distribution and corresponding capital costs more than doubled the generating costs, and any future considerable reductions could only come about by greatly increased use. An increase of 3,000,000 kWh per annum would enable them to reduce their average price by a further ½d. per kWh. Reverting to the report, the chairman said that during the year the modernisation of the Cheval Place and Kensington Court converting stations had been completed and the work on the Albert Vaults and Pelham Street stations was well advanced. He quoted figures showing how the company had reduced its average price per kWh from 4.9d. in 1921 to 3.21d in 1925. The question of further reductions was deferred by the delay in the settlement of an agreed figure for standard prices to be charged under the new Act. In the meantime, however, they had made certain reductions in charges. Col. Crompton also referred to the formation of a superannuation fund for the staff, stating that an initial appropriation of £10,000 would be made for the purpose. Later the shareholders would be asked to agree to devote a certain proportion of the free reserves to this fund. The report and accounts were adopted.

Brompton and Kensington Electricity Supply Co., Ltd.

The annual meeting was held on March 18th. Mr. H. R. Beeton (chairman) presided, and in presenting the report and accounts, said that although the rate of growth of the company's business had not been so great as in some previous years, the year was a satisfactory one. The value of their assets had not yet been determined, but when that was done the capital of the company would be reconstituted on a new basis, and they would be able to see with unwonted precision the future which awaited them. Referring to the Government's Electricity Bill, the chairman said that if the consumers' hopes of economies from concentration in production and interconnection in transmission should not be entirely fulfilled, it would not be the first time in the history of the electricity supply industry that a too-jealous denial of private enterprise had defeated the public good. They could claim to be among the pioneers in the supply of domestic electricity, but they could not afford to risk experimental expenditure until they knew the incidence of profit or loss resulting from it, and they were therefore restricting the operations of the accessories company for the time being.

The report and accounts were adopted.

Marconi International Marine Communication Co., Ltd.

The directors' report shows that the gross revenue for 1925 increased from £976,359 to £995,522, and the net profit from £83,576 to £118,979. This result was obtained in the face of continued depression in the shipping industry. The year was an onerous one for shipowners and rebates to them in respect of ships laid up had to be continued; otherwise the company's revenue would have been greater. The revenue includes the sum of £9,077 in settlement of a claim against the Italian Government. The improvement in the company's position is attributed to a substantial reduction in administration expenses. Discussions are still proceeding in connection with the claim for excess profits duty. The report makes reference to the strike of wireless operators, and states that the whole of the company's debentures have been redeemed, with the exception of £1,680, for which provision is made. To meet expenditure that is anticipated the directors propose to allocate £15,000 to the creation of a reserve for obsolescence of plant. It is also proposed to pay a dividend of 7½ per cent. for the year and to carry forward £16,269. The report records the death of Capt. H. Riall Sankey and the appointment of Major H. Lefroy to the board. Meeting: March 31st.

South London Electric Supply Corporation, Ltd.

The report for the past year shows that the balance on working was £128,900, and the addition of £13,094, brought forward makes available £141,994. After paying debenture interest, &c., and transferring £5,000 to taxation reserve, £25.000 to depreciation, renewals, &c., reserve, and £60,000 to general reserve, there remains £45,485, which it is proposed to distribute as follows:—Dividend of 6 per cent. on the preference shares (3 per cent. already paid); dividend of 15 per cent. on the ordinary shares (5 per cent. already paid); carried forward £4,685. The applications received during the year were equivalent to 1,633 kW, making the total 25,658 kW, and the amount of energy sold rose from 13,670,496 kWh to 14,515,019 kWh. Reference is made to the London Electricity (No. 1) Act, and it is stated that the company's generating station has for some time past been connected with the system of the County of London Co., and inter-connecting mains are now being laid to the Barking station of that company. The appointment of Mr. A. Page to the board is also mentioned. Meeting: March 30th.

Metropolitan Electric Supply Co., Ltd.

Mr. A. W. Tait, C.B.E., presided at the annual meeting last week, and in presenting the report and accounts, he said that the revenue from the sale of energy had increased by 6¼ per cent., and energy sold by 23.76 per cent. There had been a satisfactory increase in the demand for electricity for lighting, heating and cooking, but the substantial increase was principally due to the bulk supplies which were being given to various authorised distributors in the western area. The company's mains were now linked up with the stations of the Central Company and the Charing Cross Company. The business of their allied undertakings also continued to expand. With regard to the Chesham Electric Light & Power Co. which they had taken over recently, the mains had been taken into that company's area and the station at Chesham was closed down last autumn. The generating costs showed a satisfactory decrease, as did the price of coal. The distribution costs had risen owing to increased repairs and mains in connection with the change-over which was being effected in Acton, Paddington and mid-London. When that change-over was completed, there should be a substantial reduction in the charge. Referring to the heavy assessment for rates, the chairman said that appeals had been lodged in a number of instances. Under the terms of their agreement with the London Power Co., that company had an option to purchase the Willesden and Amberley Road stations. With regard to the former, the purchase price had been fixed on the basis

of cost, less depreciation, plus 10 per cent., which the directors considered fair and equitable. Referring to the recent rejection of the company's Parliamentary Bill, Mr. Tait said that, while that was to be regretted, certain amendments which were insisted upon would, in any event, have made the powers of little real value to the company.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The profit for the year ended December 31st, 1925, was £701,671, and to this was added £38,167 brought forward, making £739,838. Debenture interest absorbed £194,100, £150,000 was allocated to reserve for depreciation and contingencies, and £50,000 to reserve for plant renewals and improvements. The preference dividends are being paid, the ordinary shares receive a final dividend of 4½ per cent., making 7 per cent. for the year, and £41,517 is carried forward. The expenditure on plant renewals and improvements amounted to £44,503 during the year; this was charged against the appropriate reserve and the system was efficiently maintained out of revenue. The capital expenditure was £317,938, representing mainly extensions to high- and low-pressure distributing systems. The report mentioned the success of the company's issue of ordinary shares last year, and stated that Mr. H. A. Couves had been appointed general manager of the company. The meeting was held on Tuesday last.

South Metropolitan Electric Light & Power Co., Ltd.

The 1925 revenue account shows a balance of £217,718, which with £17,383 brought forward, makes available £235,095. Debenture interest absorbs £14,584, £2,500 is transferred to the taxation reserve, £45,000 to depreciation fund, and £115,000 to general reserve, and interim dividends required £20,750. This leaves £37,261, and after paying the final preference dividends and one of 10 per cent. on the ordinary shares (making 15 per cent. for the year), a balance of £4,011 is carried forward. The applications received during the year amounted to the equivalent of 1,676 kW, bringing the total to 30,101 kW, and the amount of energy sold rose from 26,066,809 to 29,653,143 kWh. The report states that inter-connecting mains are being laid between the company's generating station and the Barking station of the County of London Electric Supply Co., Ltd. Meeting: March 30th.

Metropolitan-Vickers Electrical Co., Ltd.

The directors' report for the year ended December 31st, 1925, states that the balance of profit and loss account, £178,167, added to the amount of £92,386 brought forward, amounts to £270,553. This has been appropriated as follows:—To general reserve account, £25,000; dividends on the preference and ordinary shares at the rate of 8 per cent., £150,495; carried forward, £95,058. The orders for the year showed a small increase over those for the previous year, a falling-off in home orders being offset by an increase in export orders. Prices still show no improvement on account of continued severe competition. In addition to ordinary current business, the company received during 1925 its full share of important contracts, which will contribute materially to a normal output from the company's works during the current year, and some of which will extend well into the year 1927.

British Aluminium Co., Ltd.

The report for the year ended December 31st, 1925, states that the net profit amounted to £550,434. The addition of £21,243 brought forward gives an available total of £571,677. After meeting debenture interest, &c., and allocating £50,000 to depreciation, £150,000 to reserve, and £10,000 to staff benefit fund, there remains £168,062. The preference and interim ordinary dividends are paid, and the directors recommend a final dividend at the rate of 12 per cent. on the ordinary shares (making 10 per cent. for the year), together with a bonus of 2½ per cent. This leaves £24,959 to be carried forward. The reserve account now amounts to £550,000. During the year the capital expenditure was £64,416; full output was maintained and the demand for the company's products and the prices secured remained satisfactory. The meeting is to be held on March 30th.

French Companies.

The *Société Centrale pour l'Industrie Electrique*, of Paris, reports that the company participated in 1925 in the formation of various electrical undertakings and increases of capital, and co-operated with some distributing and manufacturing companies. Most of the foreign companies in which the Société Centrale is interested yielded results which were more favourable than previously and increased their dividends, while the French distributing companies experienced results which were satisfactory having regard to existing conditions. The net profit amounted to 4,161,000 fr., to which is added a balance of 673,000 fr. from 1924. It has been decided to pay a dividend at the rate of 40 fr. gross per share, or 8 per cent., this comparing with 7½ per cent. in 1924.

The *Société Française des Electrodes* recommends the payment of a dividend for 1925 at the rate of 50 fr. per share, as in 1924.

German Companies.

The *Insulated Wire Company (late Vogel)*, of Berlin, reports net profits for 1925, including the balance forward, amounting to 678,000 marks, as compared with 100,000 marks in the previous year. No dividend was paid for 1924, but a rate of 5 per cent. is proposed for the past year

The *Siemens-Schuckert Works Company* reports a net profit of 8,954,000 marks, as against 430,000 marks. No dividend was paid for 1923-24, but for the past year the rate is 6 per cent. Having regard to the fact that the Rhine-Elbe Union is on the point of participating in the proposed big German steel trust, there has been no pooling of the profits between the former and the Siemens and Schuckert companies for the year 1924-25 under the existing community of interests between the two parties; but should the trust not be actually brought into being, an adjustment of the accounts will subsequently be made.

Czecho-Slovakian Company.—*Skoda Works.*—Last week this company offered in the London market £2,500,000 of 7½ per cent. first mortgage sterling debentures at 95 per cent. The issue is charged upon the company's freehold properties, works and machinery, as well as upon Rumanian and Jugo-Slavian Government securities. The company claims to have the largest steel and engineering works in Europe under one ownership. It turns out steel ingots, castings and forgings, locomotives, gas engines, turbines, and other classes of machinery, and has a paid-up capital equivalent to £4,278,424.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted:—

Auckland Electric Power Board.—£250,000 5 per cent. water power conversion and general extension purposes debentures, 1925, of £100 each, Nos. 1 to 2,500 (bearer).

Oxford Electric Co.—£10,000 6 per cent. debenture stock.

Adelaide Electric Supply Co.—£250,000 five and a-half per cent. redeemable consolidated debenture stock.

Enfield Cable Works.—47,944 ordinary shares of £1 each, fully paid, Nos. 202,057 to 250,000.

Siemens Brothers & Co.—100,000 ten per cent. cumulative preference shares of £1 each, fully paid, Nos. 450,001 to 550,000.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Petters.—Funding certificates (registered) in respect of preference shares.

Société Internationale d'Energie Hydro-Electrique.—325,000 6 per cent. participating preference shares to bearer of 250 fr. each, fully paid, Nos. 1 to 325,000; 325,000 ordinary shares to bearer of 250 fr. each, Nos. 1 to 325,000; 40,000 founders' shares to bearer of no par value, Nos. 1 to 40,000.

Application has been made to the Committee to allow the following to be officially quoted:—

Compania de Electricidad de la Provincia de Buenos Aires.—131,250 ordinary shares of £2 each, fully paid, Nos. 1 to 131,250; and 348,088 8 per cent. non-cumulative pre-preference shares of £1 each, fully paid, Nos. 1 to 348,088.

London Power Co.—Scrip, fully and partly paid, for £3,000,000 5 per cent. redeemable debenture stock.

Folkestone Electricity Supply Co., Ltd.—The report for the past year records a total profit of £38,800. After adding £1,498 brought forward and interest, and deducting debenture interest and preference dividend, there remains £32,793. The depreciation fund receives £13,491 and the reserve fund £7,000. Out of the latter fund £8,000 has been taken in connection with an employés' co-partnership share scheme. It is proposed to pay a final dividend of 6 per cent., free of tax, on the ordinary shares (making 10 per cent., free of tax, for the year), and to carry £1,499 forward. Negotiations have been completed with the Dover Corporation for a linking-up scheme, and a Special Order has been obtained conferring the necessary powers. Meeting: To-day (Friday).

Reports Held Over.—The annual meeting of British Insulated Cables, Ltd., was held on March 22nd, and that of the Metropolitan-Vickers Electrical Co., Ltd., on March 23rd. Reports of these meetings will appear in our next issue.

Midland Electric Corporation for Power Distribution, Ltd.—The net profit for 1925 was £173,307, an increase of £21,836. After allocating £40,000 to depreciation, £50,000 to reserve, and meeting debenture interest and preference dividends, it is proposed to pay a final dividend of 5 per cent. on the ordinary shares (making 10 per cent. for the year), together with a bonus of 5 per cent., and to carry forward £30,963. The distribution is similar to that of the preceding year. The capital expenditure during the year amounted to £108,155. The continued expansion of the company's activities has necessitated the raising of further capital, and the ordinary shareholders are to be offered 70,000 new ordinary shares at par in the proportion of one to four.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors report a net profit of £27,019 for 1925, as compared with £25,908 in the preceding year. The balance brought forward, less £200 given to charities, is £13,053, giving an available balance of £40,072. A dividend at the rate of 8 per cent. is declared (1½ per cent. already paid), leaving £14,472 to be carried forward. The capital expenditure during the year amounted to £11,719, representing the balance of the cost of the completed Horden power station extensions. The aggregate output from the company's stations showed an increase of 13 per cent., but two of the stations did not operate during the latter half of the year. The meeting is to be held to-day (Friday).

British L. M. Ericsson Manufacturing Co., Ltd.—The directors report that the sales during 1925 reached a record figure, exceeding those of 1924 by over 7 per cent. Given stable conditions, the progress is expected to be continued during the current year. The profit, after allowing for depreciation of stock and repairs and maintenance, amounts to £99,171. After providing for debenture interest, depreciation, taxation, &c., there remains £66,174, to which is added £39,785 brought forward, making £105,959. It is proposed to pay the preference dividend, to pay 16 per cent. on the ordinary

shares, to transfer £65,000 to general reserve, and to carry forward £22,258. The 1924 dividend was the same, £15,000 was placed to general reserve, and £15,000 to special reserve. The meeting is to be held on March 30th.

Notting Hill Electric Lighting Co., Ltd.—The directors' report for 1925 states that the capital expenditure during the year was £34,525, bringing the total to £366,548. The available profit for the year is £91,091 (including £23,568 brought forward). After providing for debenture and note interest, and transferring £12,000 to depreciation, renewal and reserve fund, and £3,000 to special reserve, there remains £53,909. The payment of dividends, &c. (including 14s. per share, free of tax, on the deferred shares for the year) leaves £23,213 to be carried forward. The report makes the usual reference to the reorganisation of supply schemes. The meeting is to be held to-day (Friday).

Newcastle and District Electric Lighting Co., Ltd.—The annual meeting was held on March 19th. Colonel F. R. Simpson, who presided, in moving the adoption of the report, said that outstanding debentures and loans had been reduced. The capital expenditure during the year was £33,254, the principal item being £20,449 for extensions to mains, owing to the increasing demand for electrical energy. With regard to the supply of electrical installations on the hire-purchase system, the directors had adopted a scheme with a view to obtaining new customers in streets where mains had been laid, and they were considering the advisability of extending the system to other areas. The report was adopted.

Waygood-Otis, Ltd.—Presiding at the annual meeting on March 15th, Mr. H. C. Walker (chairman) said that he was able to give a satisfactory report. They were making progress with the development of their buildings at Falmouth Road, which, when completed, would give them a modern and up-to-date factory, capable of dealing with an increased business. The company had recently completed for Messrs. Harrods the most advanced lift installation in the country, which possessed a number of new features. The chairman read a list of important lift contracts for Home and oversea concerns, and said that escalators were in hand for the Morden Extension stations of the Underground Railways.

Rhondda Tramways Co., Ltd.—The net revenue for 1925 was £44,667, and the addition of £3,492 brought forward made £48,159. Rent, debenture interest, depreciation, &c., absorbed £17,877; £18,000 is transferred to reserve and renewals account; a dividend of 8 per cent. is paid on the preference shares; and £4,283 is carried forward. There was a decrease in the tramway profit owing to the condition of the coal industry, but the motor-omnibus undertaking continued to expand, and the net result was a substantial increase in the profit as compared with 1924. The meeting was to be held yesterday (Thursday).

Windermere and District Electricity Supply Co., Ltd.—The amount available for 1925, including £766 brought forward, and after paying debenture and bank interest, was £7,479. A dividend of 6 per cent. is paid on the 6 per cent. cumulative preference shares, clearing arrears to November 30th, 1913. During the year a proportion of the reserve fund was capitalised, and 7½ per cent. preference shares were allotted to holders of the preference shares in the proportion of one to five in satisfaction of 20 per cent. of the arrears of dividend. It is proposed to install a further Diesel engine and alternator.

Keswick Electric Light Co., Ltd.—The gross revenue and the working expenses both showed an increase during 1925, and for the first time the company is able to show a balance on the right side and to recommend a dividend at the rate of 6 per cent. upon the preference shares from the date of allotment, March 26th, 1925. These shares (4,000 of £1 each) were allotted to the Windermere & District Electricity Supply Co., Ltd., in payment for plant taken over and in discharge of arrears of debenture interest.

Llanelly and District Electric Lighting and Traction Co., Ltd.—The available profit for 1925 (including £901 brought forward) is £39,180, and after meeting debenture interest, &c., and transferring £3,500 to reserve, there remains £20,604. The directors propose to pay the preference dividend and a final dividend of 2 per cent. on the ordinary shares (making 5 per cent. for the year); a balance of £998 is carried forward. The report states that the depression in trade in South Wales adversely affected the company's revenue, but there are indications of an improvement. Meeting: March 30th.

Stewarts & Lloyds, Ltd.—The net profit for 1925, after providing £75,000 for depreciation, was £291,119, and the addition of the balance brought forward makes available £426,817. After paying the preference and preferred ordinary dividends, the directors propose to pay a dividend of 1s. 6d. per share on the deferred shares and to carry forward a balance of £94,146. The 1924 dividend on the deferred shares was 7½ per cent.

Mid-Cheshire Electricity Supply Co., Ltd.—This company (formerly the Northwich Electricity Supply Co.) reports a profit of £8,036 for 1925. It is proposed to place £1,500 to reserve, to write off £500 from new issue expenses, to allocate £620 as a bonus to the staff, to pay a dividend of 7 per cent. on the ordinary shares (against 8 per cent.), and to carry forward £1,100.

Gateshead and District Tramways Co.—The revenue for 1925 at £138,448 was slightly higher than that for 1924, and after meeting all expenses, including a provision of £10,000 for renewals, there remained a balance of £32 570, to which is added £27,207 brought forward, making £59,777. From this £2,313 is transferred to special reserve and £4,087 to sinking fund, and after paying the preference dividends the directors recommend the payment of a dividend of 10 per cent. for the year on the ordinary shares, leaving £31,410 to be carried forward. Mr. G. R. Hulme has been appointed to the board in the place of the late Mr. H. S. Day. Meeting: March 31st.

Jarrow and District Electric Traction Co., Ltd.—The total revenue for the year 1925 was £11,058, and the balance available, after meeting expenses and adding £3,187 brought forward, was £3,993. A dividend of 4 per cent. is paid on the ordinary shares and £1,596 is carried forward. Mr. G. R. Hulme has been appointed a director in the place of the late Mr. H. S. Day. The meeting was to be held yesterday (Thursday).

Salisbury Electric Light and Power Co., Ltd.—The report which was presented at the annual meeting on March 16th showed a balance of £7,763. A final dividend of 6 per cent., free of tax, was approved, making 10 per cent., tax-free, for the year, leaving £263 to be carried forward. The new generating plant has proved satisfactory, and a second similar set and boiler plant are to be installed.

American Telephone and Telegraph Co.—The recently published report shows earnings of $180,458,913 for 1925, and a net income of $107,405,046. After paying dividends ($9 per share) and transferring $6,000,000 to reserve, a balance of $20,360,620 is carried to surplus.

The Bell system shows total revenues of $741,299,709 and a net income of $136,502,931. Dividends totalling $93,242,657 were paid, and there was a balance of $37,914,694.

Chiswick Electricity Supply Corporation, Ltd.—The revenue for 1925 increased by £8,316 to £73,805, and the balance available (including £15,491 brought forward) is £19,902. The directors were to propose at last Wednesday's meeting that £5,000 should be transferred to general reserve, £3,768 refunded to consumers, a dividend of 16 per cent. paid, and £1,086 carried forward. The 1924 dividend was 15 per cent.

British Electric Transformer Co., Ltd.—The net profit for 1925 was £56,275 and the addition of £9,674 brought forward makes available £65,949. It is proposed to put £10,000 to reserve and to allocate £5,000 to depreciation. The preference dividend of 7 per cent. is to be paid for the two years to June 30th last. (Six months' dividend has already been paid), and £8,949 is to be carried forward. The meeting was held yesterday (Thursday).

Direct Spanish Telegraph Co., Ltd.—The directors recommend the payment of a dividend of 10 per cent. on the preference shares, less tax, and one of 10 per cent. on the ordinary shares, free of tax, for the year 1925. The preference shares have already received a half-year's dividend, and an interim dividend of 4 per cent. was paid on the ordinary shares.

Tyneside Electrical Development Co., Ltd.—The net profit for 1925 was £3,812, and the addition of £732 brought forward makes available £4,544. It is proposed to pay a dividend of 6 per cent. on the deferred shares (as in 1924), to transfer £500 to general reserve, and carry forward £744.

United Alkali Co., Ltd.—Out of a net profit of £391,085 for 1925, plus £100,391 brought forward, the directors propose to pay a final dividend of 6 per cent. on the ordinary shares, making 10 per cent. for the year, and to transfer £100,000 to reserve (making £1,100,000). £103,709 is carried forward.

International Automatic Telephone Co., Ltd.—The profit for the past year was £109,523, comparing with £31,592 for 1924. A dividend of 10 per cent. is to be paid on the ordinary and deferred shares, as against 6 per cent. in the preceding year.

Automatic Telephone Manufacturing Co., Ltd.—After allocating £50,000 to depreciation, and £20,000 to reserve, it is proposed to pay a dividend of 10 per cent. on the ordinary shares (as against 6 per cent.) and to carry forward £37,804.

Pinchin, Johnson & Co., Ltd.—The directors propose to pay a final dividend of 20 per cent. upon the ordinary shares, making 30 per cent. for the year, as in 1924, out of profits of £112,276. The reserve receives £15,000 (against £25,000), and £30,519 is carried forward.

British Engine, Boiler and Electrical Insurance Co., Ltd.—A final dividend of 14s. per share is being paid (making 27s. for the year). £20,000 is put to the pension fund and £10,000 to the contingency fund.

Rangoon Electric Tramway and Supply Co., Ltd.—A final dividend of 1 rupee per share is recommended, making 10 per cent. for the past year.

Northern Mexico Power and Development Co.—A dividend of 1¾ per cent. has been declared on the preferred shares in respect of the quarter ending March 31st.

Chadburn's (Ship) Telegraph Co., Ltd.—The directors recommend the passing of the preference dividend.

Howard & Bullough, Ltd.—A quarterly dividend of 6d. per share has been declared.

Stocks and Shares.

Monday Evening.

The principal feature in the electricity supply list this week is the strength of Underground Electric Railways of London issues. The Income Bonds have risen 3 points, the £10 shares are 10s. up, and the 1s. shares, Bus "A," as they are colloquially called, have put on a florin. These are very unusual movements for shares that in the ordinary way move but slowly in their prices. The advances are due to the announcement that the London General Omnibus Company has acquired controlling interests in four hitherto private 'bus concerns, and this, taken in conjunction with the proposals for the regulation of London traffic, is expected to work a striking alteration in the company's fortunes, whereby the whole group would be, of course, benefited. The buying of these descriptions has led to a little inquiry for the Underground Contingent Certificates, which are mere gambling counters, and the price of which stands in the neighbourhood of 6d. Districts are 1½ higher. London Electric Railway ordinary—a rarely negotiated issue—rose to 45. The London traction varieties have not altered.

The latest reports of the London electricity supply companies simply add to the story of the prosperity prevailing last year. Some of the companies are already taking steps in advance to let their shareholders see how dividend payments are likely to shape in the future, and, as it is around this particular point that speculation chiefly centres, any news or views is, and are respectively, acceptable. It would appear, from hints which have been thrown out, as though the companies intend to maintain, as far as they can upon the re-organised capitals, the dividends that have been paid during the last two or three years upon their stocks and shares, so that holders of the latter may not suffer loss of income. So much depends, however, upon the manner in which capitalisation of reserves is agreed as to invest the subject with uncertainty. Charing Cross ordinary have improved to 45/9 x.d., and the rest of the movements in this list contain no point of special interest.

Manufacturing shares are steady. British Aluminium rose a shilling to 40/6, upon the dividend being advanced from 10 per cent. to 12½ per cent. This was in accordance with general expectation, and the shares have been rising for some time past in anticipation of some such announcement. Cromptons are better at 16/9. English Electrics eased off to 19/-.

In the cable construction shares, Henleys at 3¾, Siemens at 32/-, and Johnson & Phillips at 3 are all better. The jobbers in this section state that there continues to be a very good tone about their market, but that business is quiet, considering, that is to say, the manner in which prices have been rising. Automatic Telephones are 1/16th up, recovering from the slight disappointment experienced at the time of the dividend announcement, when, although the rate was up to expectation, the accounts showed less profit than some people thought they should. Automatics are now 51/3. The International Automatic made a profit last year of £109,500, or 3½ times as much as that of the preceding year. The ordinary and deferred shares are to receive 10 per cent., as against 6 per cent. for 1924. The price has strengthened to 44s.

Marconi Marine has pleasantly surprised the market by publishing a report that shows an increased profit of £35,500, the net being £119,000. Nobody had looked for such good results in what was known to be a bad year for shipping. The dividend is repeated at 7½ per cent., and the shares came into demand at 20/-. No change was made, however, in the official quotation, and Marconis, the parent shares, were left at 22/6 middle, although, in actual fact, the market is better than this implies. The wireless section is harder throughout on this report of the Marine Company, but no fresh strength developed in the shares of the wireless manufacturing concerns.

Anglo-Argentine Tramways first preference weakened to 31/16, at which they are on offer. Brazilian Tractions fell 1½ to 92½, the Brazilian groups being somewhat out of favour. Mexicans are a trifle less depressed, Mexican Light common regaining 2 points at 32½.

Cable stocks keep steady. Westerns are lower, allowing for deduction of the dividend from the price last week. Anglo-American deferred lost another ⅛, although no serious importance is attached to the fact of telephone communication being recently established with New York. Radios remain dull.

Engineering shares responded with a rise to the averting, at the last minute, of the threatened lock-out in the trade. Babcocks promptly went up 1/9 to 53/9. But the iron and steel list is not happy, owing to the prospect that lies glumly ahead of conditions in the coal industry. Rubber, the produce, holds its rally to 2/6½ per lb. The share market is firm, without developing a great deal of activity. What fights against many of the Stock Exchange markets is the wholesale outpouring of new issues. This is a formidable factor in days such as these, the amount of money demanded for the newcomers being so large as to divert capital from existing channels of investment. With the new issues, the approach of the Easter holidays, and the early advent thereafter of the Budget, the Stock Exchange admits that no surprise can be felt at quietude pervading most of its departments.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price Mar. 22. 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	—	60/9	—	4 13 4
Brompton Ordinary	1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	1	14½	15	45/9xd.	—	6 11
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2⅛	—	5 12 11
City of London	1	15	15	45/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	2 9/6	—	5 8 6
County of London	1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/6	+6d.	5 19 2
do. 7% Pref.	1	6	7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	13⅜xd.	—	5 9 1
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	21/6	—	5 11 7
Newcastle-on-Tyne Ordinary	1	7	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅞	—	5 13 10
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	I	15	15	45/-	—	6 13 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/-xd.	—	7 10 0
Yorkshire Elec.	1	8	8	29/-	—	5 10 0

Home Rails.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	65	—	7 13 10
do. District	,,	3½	3½	47	+1½	7 9 0
Underground Electric Ordinary	10	Nil	Nil	3⅛	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	10/6	+2/-	Nil
do. do. Income	Bonds	6	6	100	+3	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	Dividend. 1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23½	—⅛	6 7 8
Automatic Telephone	1	3	6	51/3	+1/16	3 17 10
Chili Telephone	5	6	5	6⅛	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	18xd.	—	*5 9 7
do. do. Pref.	10	6	6	10⅜xd.	—	5 11 7
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi		10	10	22/6	—	8 17 10
Marconi Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	2 1/16	—	*5 16 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17¼xd.	—⅛	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3 1/16	—⅛	8 19 6
do. do. 2nd Pref.	5	6	6	2 1/16	—	11 3 2
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	122½	—	4 18 0
do. do. 6% Pref.	,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	92½	−1½	5 8 1
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	103½	—	*4 11 9
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4½	4½	77xd.	—	5 10 5
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	60½	—	8 5 4
Mexican Light Common	100	Nil	Nil	32½	+2	Nil
do. Pref.	100	Nil	Nil	62½	+1	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	12	53/9	+1/9	*4 9 4
British Aluminium Ord.	1	5	10	40/6	+1/-	6 3 5
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3¼	+1/16	4 18 4
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 1/16	—	4 14 10
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	+6d.	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	3/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/0	—6d.	5 5 3
do. do. Pref.	1	6	6	19/- xd.	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
,, Ord.	1	5	7½	31/3	—	4 16 0
Henley	1	15	16	3¾	+⅛	4 5 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1 1/16	—	*4 4 3
Johnson & Phillips	1	10	10	3	+1/16	3 6 8
Met.-Vickers Ord.	1	8	8	26/3	—	6 1 11
do. Pref.	2	8	8	2 7/8	—	6 11 3
Siemens Ord.	1	—	7½	32/-	+1/6	4 13 9
Telegraph Construction	12	20	10	28½xd.	+¼	*4 4 3

*Dividends paid free of Income Tax.

Exports and Imports of Electrical Goods and Machinery in February, 1926.

ALTHOUGH it is pleasing to see that a substantial increase occurred in the value of electrical goods exported during February as compared with January (a longer month) and with February, 1925, the rise was insufficient to counterbalance the fall which characterised the January figure as compared with January, 1925. Thus in comparison with the first two months of 1925, the January and February total shows a decline of £223,280.

Reverting to the last month's figures, it is seen that the outstanding rise was in unenumerated electrical machinery, which was up by over 30 per cent. as compared with January last and February, 1925. Insulated wires and cables also made satisfactory progress. Batteries and accumulators show up well in the two comparisons, but telegraph and telephone apparatus higher than in the previous month, failed to regain the February, 1925, level. The decreases were comparatively unimportant with the exceptions of those in unenumerated electrical goods and apparatus, and submarine cable. The latter item, as we have frequently pointed out, is always subject to violent ups and downs.

There was a substantial fall (about 30 per cent.) in the import total, the decrease being general. Only two increases occurred, *viz.*, in batteries and accumulators, and carbons, and these were not of great significance. In both the unenumerated classes (goods and machinery) and in non-submarine cables, the fall was particularly marked; in the case of the last item, imports were halved. In comparing the figures with those for February, 1925, remarkable decreases are observed in the items telegraph and telephone apparatus, batteries and accumulators, and meters and instruments. The increases were negligible.

With regard to the re-export figures, it will be seen that a fairly general increase was nullified by decreases in three items. In the comparison with February, 1925, the large decrease was general, there being only three small increases.

So far this year the balance in our favour (including re-exports) is £2,284,086; in the first two months of last year it was £2,169,778.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Feb., 1926.	Inc. or dec. as compared with Jan., 1926.	Inc. or dec. as compared with Feb., 1925.	Electrical imports for Feb., 1926	Inc. or dec. as compared with Jan., 1926.	Inc. or dec. as compared with Feb., 1925.	Electrical re-exports for Feb., 1926.	Inc. or dec. as compared with Jan., 1926.	Inc. or dec. as compared with Feb., 1925.
Electrical goods and apparatus (unenumerated)	£158,974	— £8 837	— £5,397	£79,628	— £45,746	— £9,589	£4,570	— £2 410	— £1,923
Insulated wires and cables ...	340 523	+ 71,963	+ 86 636	45 011	— 2,682	+ 3,453	656	+ 419	— 435
Glow lamps	44 674	+ 2,293	— 4,744	16 560	— 28,046	— 9,613	2,571	+ 310	— 1,754
Arc lamps and parts	1,212	— 975	— 1,060	115	— 215	— 1, 62	21	+ 19	+ 21
Batteries and accumulators ...	100 9 4	+ 15.118	+ 40.033	27,008	+ 2 452	— 23 568	660	— 614	— 1,004
Meters and instruments ...	29.404	+ 7,104	— 4,166	13,796	— 6.599	— 11,750	1,384	+ 656	+ 630
Carbons	1,681	— 818	+ 11,152	5,155	+ 887	+ 317	86	— 20	— 358
Electrical Machinery—									
Electrical machinery (unenumerated)	338 415	+ 114 097	+ 116 309	52 034	— 32,164	— 19,749	4 719	— 1,045	+ 1,360
Railway and tramway motors	47 068	+ 1,663	— 19 997	—	—	—	—	—	—
Other motors and generators ...	205 665	+ 1,7 8	+ 10,208	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	4 900	— 29	— 896	6	— 251	— 214	30	+ 30	— 134
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	61.830	— 6,760	— 19 922	16 296	— 18 368	+ 972	29	+ 12	— 4,525
Submarine telegraph and telephone cable	4.049	— 10,274	— 47,137	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus ...	239,323	+ 28.953	— 20,090	48.467	— 2,386	— 40 532	5,211	+ 673	— 2,374
Totals	£1,578,542	+ £215,216	+ £139 929	£304 076	— £133,118	— £111,335	£19,937	- £1,870	— £10,396
	Exports.			Imports.			Re-exports.		
Decreases for two months of 1926 ...	— £223,280			— £172,064			— £2 ,348		

Chromium Plating.

AT a meeting of the Electroplaters' and Depositors' Technical Society, held at the Northampton Polytechnic Institute on February 10th, Mr. E. A. OLLARD, of the Metropolitan-Vickers Electrical Company, gave a general survey of the present position of chromium plating and of its future industrial possibilities. The two qualities to which chromium owes its importance to the electroplater are its hardness and its resistance to corrosion. In regard to the former, it exceeds nickel and even steel, while in regard to the latter it will withstand atmospheric corrosion better than any metal, with the exception of gold and platinum, and it withstands the action of sea water and of all the common acids, with the exception of hydrochloric. Consequently chromium would long ago have been electrodeposited for protective purposes, for Bunsen produced it by electrolysis so far back as 1854, were it thrown down with the ease with which copper, iron, nickel, zinc, or silver are deposited. This, however, was soon found not to be the case, and a simple solution, such as that of the chloride used by the early workers, is erratic and unreliable as a source of the deposited metal.

Process of Plating.—Numerous solutions have been described and patented within the last few years, but all are based on chromic acid, to which are added chromium salts, such as the sulphate or carbonate. The solution in use at the Bureau of Standards, Washington, which has been published by Dr. Blum, is composed as follows, and most of the solutions advocated are variants of this:

Chromic acid (CrO_3) 33 oz. per gallon.
Chromium sulphate $Cr_2(SO_4)_3$ 0.4 oz. per gallon.
Chromium carbonate $Cr_2O.(CO_3)_2$ 1 oz. per gallon.

Freshly-made solutions work erratically, and it is only when they have been in operation for some time that they become reliable.

For reasons which are suggested by the theory of the process given later, chromium can only be deposited at a high current density, and about 200 amperes per sq. foot is usually employed. This accounts for the low "throwing power" of chromium, for unless the current density exceeds a certain minimum value no metal is thrown down. The difficulty is apparent where objects of irregular shape are to be coated. As a result of the high current density, there is very free gassing at the cathode and the current efficiency there does not exceed 30 per cent. Consequently, chromium anodes—even were they easily procurable—should not be employed, for their anode efficiency is 100 per cent., but the solution must be replenished by the addition of chromic acid. Lead anodes are the best to use and with these a terminal voltage of 8 to 10 is required.

The high current density used will overheat the bath and

therefore for continuous work cooling devices have to be employed. Another practical disadvantage due to the same cause is the liberal gassing which carries off chromic-acid spray as well as gaseous hydrogen. Fumes of this substance are dangerous and must be removed with proper drawing-off appliances.

The chromium as deposited may be either a matt grey in colour or bright, depending on the temperature, current density and composition of the solution. The matt deposit is easily polished. About 0.006 in. is deposited in an hour at a current density of 200 amps./sq. ft.

The Structure of Deposited Chromium.—X-ray analysis has elicited the interesting fact that whereas the crystal structure of ordinary chromium is based on a lattice of centred-cubes, that of the electro-deposited metal takes an hexagonal close-packed form. This difference in structure may account for the increased hardness of the deposited form, although further investigation is called for before any definite conclusions can be drawn.

The Use of Chromium as a Protective Coating.—Chromium can be deposited to adhere satisfactorily upon copper, brass, iron and steel, nickel and cobalt—among the common metals—but not upon aluminium, zinc, or cadmium. Hence there is a great field for it as a protective coating for iron and steel against corrosion. Now, although chromium is electropositive to iron, a thin, porous coating, which leaves the iron exposed in parts, does not protect against corrosion, as would be expected, in the way that zinc does. This is ascribed to the peculiar property of chromium of acquiring the "passive" state, which is negative to iron in the electrochemical series. On this account chromium will only adequately protect iron and steel against corrosion when the deposit is thick, or when an intermediate metal is interposed between the base and the chromium. Mr. Ollard carried out an extensive series of corrosion and tarnishing tests in which cadmium, nickel, and copper formed the intermediate coating. To protect against atmospheric corrosion the best results were obtained with copper; to be precise, steel plated in an alkaline copper bath for half an hour and then given half an hour in a chromium bath was completely protected against atmospheric corrosion. An hour or two's intermediate coating of nickel also gave good results. In regard to the corrosive action of steam spray it was found that chromium was practically untouched and sea-water spray, too, had little corrosive action upon it.

Thus far laboratory experiments; but chromium-plated articles in service have also been tested under a variety of conditions and satisfactory results obtained in the case of car fittings, bathroom and other household fittings; and table ware. Motor lamps in particular have stood up admirably against fog and damp and it is probable that chromium will eventually replace nickel, which is anything but satisfactory as regards resistance to atmospheric action. In the case of tableware, the slightly dark appearance—intermediate between silver and nickel—may prevent its general adoption as a substitute for silver plate, but its freedom from tarnish will render it admirable for restaurant and similar uses.

One of the original purposes for which chromium was deposited was as a substitute for silver in metallic parabolic reflectors, and although its reflecting power is not quite so good as that of silver its resistance to tarnish should make it preeminently suitable for this purpose. Some chromium plated reflectors are in experimental use in small lighthouses. Other promising applications are for the coating of metals for die-casting and for the coating of printing plates and of machine parts subjected to heavy wear. A valve face and seating in a pressure pump used with water containing a fine abrasive material has been successfully plated and has stood for two months, having previously worn badly in a week or two.

Cost of Deposition.—It has been suggested that the high voltage needed and other special features of chromium deposition may render the cost of the process prohibitive. While definite figures cannot yet be published, the experienced gained in Germany and elsewhere would seem to show that once the process has been standardised there is no reason to anticipate unduly high costs of working. The cost of energy in any case is a small percentage of the whole, but while the first cost of a chromium-plating plant will exceed that of a nickel plant, the speed of working will counterbalance that overhead charge, while the labour in both cases is substantially the same. In the opinion of Mr. Ollard, while it is not probable that chromium plating will at present replace nickel plating, a large number of industrial applications will be found for it within the next few years, and it promises to become a stable industry.

Science in the Cable Industry.

A Review of the Problems and Difficulties Encountered.

The wide ramifications of the application of science to the cable industry were indicated in an interesting paper by Capt. P. Dunsheath, O.B.E. (Chief of Research Department, W. T. Henley's Telegraph Works Co., Ltd.), before the Royal Society of Arts on March 3rd. Mr. Ll. B. Atkinson presided.

Cable making had been an art rather than a science, said the author, but as the result of the increased demand for cables embodying highly specialised features, there had been a growing interest in the scientific side, culminating, since the war, in a very definite movement in favour of industrial research.

Industrial research associations fulfilled a very important function in carrying out investigations of common interest to cable makers and users, and in effecting economies when the pooling of information between makers was possible through such organisations as the Cable Makers' Association. Such associations, however, had a definitely limited field, and, to claim the fullest advantages of the application of science, cable-making firms must also carry out research individually in close connection with the actual manufacture. Messrs. Henley's had taken the lead in building and equipping an up-to-date cable research laboratory.*

As a broad principle, the primary object of a works research department was not to carry out fundamental research. At the same time, the academic side, without being sought, was frequently found, and at Messrs. Henley's laboratory a proposals book was kept in which were recorded the many new problems that arose in the day's work. The book was the despair of all men who appreciated the shortness of human life.

The main object of the research department in a factory was to improve the product; as an example he said that a particular type of paper, which was very expensive, had been considered to be the very best and had been used for many years. Trouble was experienced in obtaining the desired test results on a certain batch of cable, and the research department's experiments proved conclusively that the paper, far from being the best, was one of the worst for the particular purpose; as a result it was dropped, the process trouble was eliminated, and production costs were reduced.

Another important function of the works research department was the scrutiny of technical literature, indexing for quick reference, and the running of a technical intelligence service for the benefit of other departments of the Company and its customers. Generally speaking, the cable user, in case of trouble or unusual propositions, welcomed the assistance of a scientifically-equipped cable maker, and the rendering of such service to customers had a distinct publicity value. For example, cellars invested with a curious fungus had to be wired for electric light; by an elementary study in mycology the Company was able to assure the customer that a certain type of cable would be immune from attack.

A wide field of science was covered by the cable maker; probably the physicist had the widest scope. Also, the chemist, who had not begun to run in a groove, as a unit in a research team, was second to none in importance. The value of mechanics, properties of materials, &c., was covered by the broad title engineering; for instance, trouble had arisen in one works owing to the annealed copper wire drawn in another works being too hard. The fault reduced output, but owing to the absence of a measure of the hardness or durability, which was not shown by any known mechanical test, it was difficult to trace the trouble to its source. The research department, therefore, had developed an instrument by means of which they were able to state the softness as a percentage figure which everybody understood and was able to check. In another case, a new test was developed and a special instrument designed to show the extent to which a given weight of different yarns used for lapping and braiding would cover a given area.

One of the most outstanding features which distinguished industrial from university research was the necessity for developing new types of physical tests. The Company had found it necessary to measure the viscosity of compounds many thousand times more viscous than the usual range of liquids previously examined. The viscosity of extremely good insulating materials was so high that in the past it would have been recorded as infinity, but the Company had made a special viscometer of extreme sensitivity that gave a definite value, which, of course, was not infinity.

Metallurgy, particularly the microscopic examination of metal structures (for instance, the study of lead-sheath extrusion) was a valuable aid. The criterion of efficient lead sheathing was largely a question of the perfection of the longitudinal weld, and the preparation of sections for microscopic examination by a technique which the Company had developed, enabled it to throw considerable light on the nature of the extrusion process.

A phenomenon which at times assumed importance was the skin effect: at telephone frequencies it was appreciable, whilst at radio frequencies it became a serious consideration. In order to overcome the difficulty the conductor must be made up of a large number of small wires insulated from one another, and twisted together in such a way that each one travelled alternately near the centre of the cable and near the surface. In this way the inductance of

* Elec. Rev., December 5th, 1924; pp. 859-60.

all the separate wires was made equal, and the current shared itself equally between them.*

The problem of the dielectric was of great complexity, and never were the many unknowns so baffling and, at the same time, so important as now. There was no connected theory that explained all the known experimental phenomena; they were being led more and more to the conclusion that the factor of fundamental importance was dielectric absorption, but they were still ignorant of its inner mechanism. Dielectric strength might be defined as the voltage required to rupture the dielectric, but unfortunately complications resulted from the time-voltage relationship. At very high voltages the time of application affected the breakdown strength enormously, while at lower voltages the effect of time was less marked, though apparently still present. A collection of cardboard models of curves, indicating the nature of this time-voltage relationship, was shown †, and a series of papers was exhibited which showed tree-shaped markings at certain points.

The telephone side was one of the most mathematical and complex of any of the problems that cable makers had to solve, and a considerable amount of science was required in dealing with the mechanical protection of a cable. For instance, single-core cable sheath effects were much more important than those in multi-core cables, and in certain cases (for instance, when a single-core cable was carried through an iron pipe) the effects might be positively dangerous.

Discussion.

Mr. Ll. B. Atkinson, chairman, referring to the availability of new and improved apparatus enabling research to be carried out more quickly than formerly, said that although they could not overtake new problems, they were now nearer to overtaking them than they had ever been before in the history of experimental work. He was glad that at the Henley Laboratory there was a special department for mathematical research, because when one had sound experimental data, mathematical research was a very rapid way of arriving at results which might take a great many years if the whole ground had to be covered in the laboratory itself.

Mr. A. A. Campbell Swinton, F.R.S., speaking of the impurities in copper, said he had reason to believe that the influence of hydrogen in metal was far greater than was imagined. The latest theory was that the difference between diamond and ordinary pure carbon was entirely a question of hydrogen, diamond being carbon with no hydrogen in it. Would the conductivity of copper be improved by the elimination of the hydrogen it contained?

Mr. Hochstader (Holland) pointed out that the ideas of the engineers in different countries differed a great deal on the question of high-pressure cables, whilst measuring apparatus for power cables had been developed on somewhat different lines in the various countries. He suggested, therefore, a more free exchange of views internationally, so that the best qualities of each could be incorporated in one standard apparatus.

Mr. G. L. Addenbrooke also appealed for co-ordination of the vast amount of research work which had been carried out all over the world in connection with cables. A great deal of work had been done over and over again, and a great deal more was likely to be done much more extensively than it need be if some of the fundamental principles were better known. Therefore, he urged that some attention be devoted to those general principles.

Mr. W. H. Patchell (past president of the Institution of Mechanical Engineers) said it was believed that cable faults occurred at the joints, but he had figures which he had obtained in America of faults on a thousand miles of cable (from 20,000 to 45,000 volts) which showed more faults in the cable than at the joints. Such things would continue to happen until they knew what dielectrics really were, and the ill-effects of air on the cable.

Sir George Sutton (W. T. Henley's Telegraph Works Co.), in proposing a vote of thanks to the chairman, touched on the question of co-operation in research. He pointed out that to-day there was money in research, and there was a tendency, therefore, for the researcher to keep his results to himself, but Capt. Dunsheath's paper was prepared at the expense of an industrial trading company which was willing to co-operate with others to the advantage of the electrical industry. In the works which he controlled, no electrician from the United States was refused admission, and although he himself, when visiting the United States years ago, had been refused admission to some of the largest works there, to-day he received invitations to visit them; that showed a growing appreciation of co-operation in research work.

* Elec. Rev., November 20th, 1925; p. 831.
† Elec. Rev., November 20th, 1925; p. 834.

A Direct-Reading Radiogoniometer.

The Directional Indication of Wireless Signals by Cathode Rays.

(Abstracts of papers read before the Wireless Section of the Institution of Electrical Engineers.)

In the three years or so since the Western Electric cathode-ray oscillograph first made its appearance in this country many uses of it have been described. Most of them have been chiefly of laboratory interest, although it has been obvious that the rugged assembly of the oscillograph marked a revolution in the design of such instruments and placed a powerful new weapon in the hands of working engineers.

Perhaps the most interesting and novel use of the device that has yet been described is its application to the direction-finding of wireless signals. An arrangement for this purpose is described in a paper by Messrs. R. A. Watson Watt, B.Sc. (Eng.), A.M.I.E.E., and J. F. Herd, A.M.I.E.E., in which a typical visual direct-reading radiogoniometer installation is outlined which is capable of indicating the azimuth of arrival of wave-trains, the duration of which need not exceed 0.001 second. The arrangements described by the authors are more particularly connected with their work on the investigation of atmospherics which is being carried out on behalf of the Radio Research Board established by the Department of Scientific and Industrial Research, but the device is equally applicable to radio signals, and its use in this manner is also dealt with.

A Novel Radiogoniometer.

The principles involved are very simple: Two fixed loop aerials (one north-south and the other east-west) are used, with their tuning condensers joined either to the plates of a cathode-ray oscillograph or to the inputs of amplifiers working to these plates. On the receipt of a signal arriving at an angle of ϕ with the N.S. aerial, e.m.f.'s are induced in the aerials proportional respectively to cos ϕ and to sin ϕ. In the oscillograph the cos ϕ voltage is applied to the pair of plates producing the vertical (N.-S.) deflection of the beam, while the sin ϕ voltage is applied to the pair giving the E.-W. deflection, this being true whether the oscillograph is joined directly or *via* equal degrees of amplification on each side. Their combined effects follow directly from the general principles of Lissajou figures, of which they are a very simple case. The resultant field opens the fluorescent spot into a line which makes an angle with the vertical (N.-S.) line of deflection the same as that which the signal makes with the N.-S aerial. The normal vertical line of deflection can thus become a N.-S. line on a compass dial from which any other direction of signal can be instantly read.

This is especially useful in the authors' directional work on atmospherics, as it enables—for the first time in technical history—the instantaneous directions of individual atmospherics to be determined. In the paper, results on such work are described, and excellent agreement is shown between the readings of the instrument and the directions of atmospherics proceeding from known thunderstorm sources.

In the reception of signals the indication of direction is equally instantaneous, and the apparatus can deal with two signals at once, even though they are on the same wavelength. In this case (assuming them to be from different azimuths), if the two stations are working at hand speed, two intersecting lines will stand out on a background in the form of a faint parallelogram. With two high-speed stations the lines disappear and the pattern becomes a bright parallelogram, having its sides parallel to the respective directions of the two signals. In the paper the authors offer a novel solution of the beacon-station problem arising out of this property. It is suggested that slowly modulated c.w. be used, the modulation being such as to occupy several seconds to vary the signal strength from maximum to some characteristic minimum. In this case no Morse would be required, and the apparatus could be used directly by a navigator, who would simply have to read the frequency and amount of the modulation of any beacon transmitters that were appearing on the oscillograph. As these would have different and characteristic values for each transmitter, reference to a list of these characteristics would give the bearings instantly.

The Directional Recording of Atmospherics.

The data which have, until recently, been available as to the incidence of atmospherics have consisted almost entirely of relatively brief and isolated observations based on aural estimates. There does not yet exist a sufficient quantity of comparable data, from well-spaced observing stations, over an adequate period, to present anything beyond the barest outline of the world distribution of atmospherics. The purpose of a second paper which was presented by Mr. Watson Watt (also by permission of the Radio Research Board) at the same meeting of the I.E.E. is to describe a simple pen-writing instrument which, despite many limitations and imperfections enumerated in the paper, does enable continuous records taken under comparable conditions at widely distributed stations to be obtained and compared without an excessive

expenditure of effort. The description is followed by the presentation of some data from a first group of such recorders, which is presented as typical of the minimal results to be expected from an international network of co-ordinated recording stations.

The directional recorder comprises teak framing which supports a frame antenna, belt-driven by a turret clock, and carrying a recording drum on which is inscribed the trace of an oscillograph pen that is actuated by the output of a multi-stage amplifier connected to the frame antenna. The nature of the data obtainable is indicated by samples which show the diurnal variation of intensity of atmospheric disturbance, the diurnal variation of apparent direction of arrival, and the location of apparent sources of atmospherics by a group of recorders. It is hoped that means may soon be found for placing at the disposal of those interested the whole of the data obtained, and it is suggested that the time has arrived for the organisation of an international scheme, which need not absorb much labour or capital, for the collection of data on the lines indicated. The author announces that a second step in such a scheme is being taken by the installation of two recorders, of the pattern described, at German meteorological observatories.

It is notable that of the five papers so far presented to the Wireless Section of the I.E.E. during this session—excluding the chairman's inaugural address—four have been by members of the Radio Research Board's staff. The excellent work being done by this Board was the subject of comment by Prof. J. T. MacGregor-Morris in the discussion.

The Supply of Electrical Energy.

The Report of the Weir Committee.

As stated in our last issue, the report of the Committee appointed in January, 1925, to review the National Problem of the Supply of Electrical Energy was published on March 12th; copies may be obtained from H.M. Stationery Office at Adastral House, Kingsway, London, W.C.2, price 2s. net.

The Committee consisted of Lord Weir of Eastwood (chairman), Lord Forres of Glenogil, and Sir S. Hardman Lever, Bart., K.C.B., with Sir John Snell, M.Inst.C.E., M.I.E.E., as technical adviser. Evidence was obtained from the Electricity Commissioners, and Messrs. C. H. Merz, J. M. Kennedy, J. S. Highfield, and R. A. Chattock; various sources of information were drawn upon, including a memorandum of January 2nd, 1925, from the Electricity Commissioners to the Minister of Transport, a report made by Messrs. Merz and McLellan at the request of the Commissioners under the late Minister of Transport, and a memorandum by Sir John Snell, with conclusions based upon it by a technical advisory committee comprising Messrs. J. M. Kennedy, C. H. Merz, and S. L. Pearce, under date April 23rd, 1925. The following is a *résumé* of the contents of the Report:—

After setting out the present position of the electricity supply industry in Great Britain, the Committee states that at the present rate of increase, *viz.*, 19 per cent. per annum, consumption will mount from the existing rate of about 110 kWh sold per head of population to 500 kWh by 1940 or thereabouts. This compares very unfavourably with other countries, some of which are at present consuming from 500 to 900 kWh per head.

Price has a very considerable effect upon consumption, and price can be reduced by (*a*) improvement in generation methods, and (*b*) improvement in distribution methods.

Dealing with generation, the Committee points out that the present parochial system grew out of the circumstances of the past, and is contrary to the technical considerations which experience in this and other countries has shown to be essential to cheap generation. These technical considerations may be summed up as: generation in large stations, favourably situated as regards fuel, water and load, with sets of comparatively large capacity; the minimum legitimate amount of stand-by plant; and the highest obtainable load factor. These considerations involve generation in a few efficient stations interconnected with one another.

By way of comparison with existing conditions, the Committee had a definite scheme for the whole country drawn up, showing, from a purely technical point of view, the best method of securing an annual supply of 500 kWh per head, and taking full cognisance of whatever was of value in the existing or immediately contemplated equipment.

The scheme, an outline of which is printed as an appendix, showed that it would be possible to supply energy at an average price of 1d. per kWh. The average price at present is 2.047d. per kWh sold. The Committee was advised that with existing conditions the average price could not be reduced below 1½d., and would probably not fall below 1¾d. In the former case the adoption of the scheme would result in an annual saving of £44,500,000 on the national electricity bill when the consumption had reached 500 kWh per head, and in the latter case £66,800,000. The scheme is based on the generation of all the energy required for the country in certain selected stations, and the construction of main transmission lines interconnecting the selected stations and joining up with the other stations and transmission systems.

The Committee is of opinion that, while it is essential, if the full economies are to be obtained, that the selected stations should be operated in accordance with a scheme for the whole country, it is not necessary that the stations should change ownership, and that, in fact, there are certain advantages in separate ownership. An element of control is, however, essential.

At the same time, under existing conditions, there is no authority which could create the system of interconnecting lines. The Committee therefore recommends that a new authority, to be termed the "Central Electricity Board," should be constituted, and that this Board should be required to lay down the system of interconnecting lines, and should, subject to appeal to the Electricity Commissioners, exercise the necessary control over the operation of the selected stations by means of contractual arrangements.

After full consideration of the various alternatives, the Committee concludes that there should be a virtual pooling of all electricity so generated. Any other method would lead to artificial prices on a marginal or by-product basis, and would be both unstable and unsatisfactory in character.

To obtain this virtual pooling, the contractual arrangements referred to should be of such a nature as to secure that the owners of the selected stations will act as agents of the Board. All the operating expenses, including capital charges, will be met by the Board, on whose account the energy will be generated. The owners of the stations will repurchase such energy as they require for their own purposes at cost price.

The stations will be operated in such a fashion that it will be possible to meet the requirements of all undertakers. At present many of these undertakers own stations of their own. As the cost under the scheme must inevitably be lower than the cost at which even the best stations can generate under present conditions, it follows that the Board will be able to supply these undertakers at a lower price than they can themselves generate at. The Committee thinks that the closing-down of inefficient stations will take place rapidly after the commencement of the new system, but, as a precautionary measure, it recommends that the Commissioners should have power to require the closing-down of stations after a specified period, provided a supply from the Board at cheaper prices was available.

By this means the generation of electricity will within a comparatively short period of years be segregated and operated in the most economical manner, and will be made available under the control of the Board in the best interests of the country as a whole.

Apart from technical considerations, the suggested segregation of generation can only be justified if it is undertaken, not as a private enterprise for profit, but as a public utility. The Committee therefore recommends (*a*) that the capital required by the Board should be raised by means of Electricity Stock guaranteed by the State as to principal and interest, and (*b*) that the Board should work on a non-profit-earning basis.

Apart from generation and main transmission, both of which will be under the control of the Board, there remains the question of regional transmission. At present the greater part of the industrial regions is covered by Power Companies whose duty it is to lay down regional transmission systems. There are, however, certain towns—generally of the larger class—which have special protective clauses in their Acts; in these the Power Company has no right to supply without written consent.

The Committee recommends that the Board should be empowered to give a direct supply to these towns. Other towns should be supplied through the Power Companies, but the price for bulk supplies should be controlled so that these towns may obtain the benefits of the cheaper energy afforded by the Board.

The parts of the country not covered by Power Companies can be divided into areas where there is a potential demand for power, and purely non-industrial areas. In these areas the Committee thinks that regional transmission and local distribution must be considered together. It finds that there are drawbacks to both Power and Distribution Companies, and therefore recommends that in future there should be a new type of company with power to supply for all purposes, but subject to a purchase clause operative after 50 years. The new type of company will be required to justify the area over which it applies for rights, but subject to justification the area should be unrestricted. The larger companies will be responsible for regional transmission and the Board should be authorised to lay down secondary lines to the smaller companies.

It is essential to see that the benefits of cheap generation should reach the consumer. This involves certain alterations in the present system of controlling prices. So far as Power Companies are concerned, the price to be charged by them for bulk supplies should be confined to cost plus a reasonable return on the capital actually expended for the particular supply. For other supplies they should be subject to a revised maximum-price clause. The Committee also recommends that the power to make up back dividends to the standard 8 per cent. should be repealed.

In the normal course of events the Board should not undertake local distribution. Distribution Companies, subject to purchase by a local authority, should have the right, within seven years of the expiry of their franchise, to require the local authority to declare its intentions.

As regards the financial effects of the proposals, the Committee thinks that the technical scheme will involve during the next 15 years new money to the extent of upwards of £250,000,000. Half of this will be required for distribution purposes and should be raised in the normal fashion. The guaranteed capital needed to place the interconnecting system on a paying basis is estimated at £25,000,000. This should be raised by the issue of Electricity Stock, to be guaranteed as to principal and interest by the Government. The remaining £100,000,000 will be needed for the erection of new, or the extension of selected, generating stations. This capital should be issued by the authorised undertakers concerned on the certificate of the Commissioners to the Treasury, with a Government guarantee as to principal and interest.

The Report deals finally with various points arising directly or indirectly out of the main proposals:—

(1) Standardisation of Frequencies.—This has been estimated to cost under 10½ millions gross and about 8 millions net. The Committee is not prepared to recommend the expenditure of this money except as part of a comprehensive scheme; nor is it prepared to make a recommendation without further detailed investigation. But provided the further investigation is favourable and the main proposals are accepted, it recommends that frequencies shall be standardised at the cost of the State. It suggests that the question of repaying the cost, without interest, at a later date through the operation of the Board shall be considered.

(2) Rating.—The Committee recommends that the system of interconnecting lines shall not be subject to rates.

(3) Railway Electrification.—The Committee points out that its proposals will profoundly modify the position, and suggests that the question shall be thoroughly investigated.

(4) Sales.—The Committee believes that with more scientific and up-to-date methods, very considerable savings can be effected at the distribution end. This is not a suitable subject for legislation, but any existing statutory disabilities should be removed, and every encouragement given to the improvement and development of this side of the business.

(5) Miscellaneous.—Recommendations are made for alterations in the conditions governing the giving of supplies, the utilisation of waste heat, water power, &c., and wayleaves.

Appended to the Report is an abstract of the Memorandum, prepared by Sir John Snell, on the effect of a main transmission system and of the generation of electricity in certain capital and secondary stations when an average consumption of 500 kWh per head is attained throughout Great Britain, with the technical advisory committee's conclusions based thereon. A third Appendix deals with the effect of interconnection on reducing the cost of generation, a fourth with the constitution, powers, and duties of the Central Electricity Board, and a fifth with load factor.

In a prefatory note the Minister of Transport points out that in framing the Electricity (Supply) Bill the Government has not accepted all the proposals of the Committee, and that the scheme detailed in the Report does not represent a definite proposal which would be adopted if the Bill were passed into law.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric General-Utility Tool.

The latest introduction of Messrs. B. E. N. Patents, Ltd., 00, Victoria Street, London, S.W.1, is the U.L.A. general-utility tool, fig. 1, which can, it is claimed, be used as a portable tool, as a bench tool or as a saw-bench. The illustration shows the device fitted up as a saw-bench. The table can be lifted clear of the motor, when the tool may be used for such operations as grinding and polishing. With the cast-iron base removed the tool can be used as a portable drill, &c. The motor is of the universal type, and can be supplied from stock for pressures of 32, 50, 115 and 230 volts.

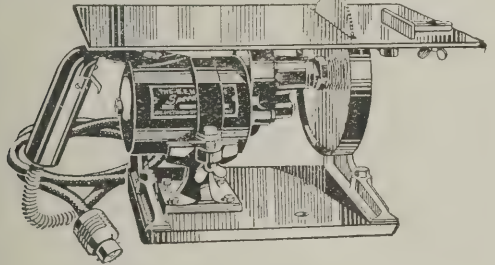


Fig. 1.—Electric Utility Tool.

A New Tumbler Switch.

We have received from Messrs. J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham, samples of their B4,000-model flat-type tumbler switch which was introduced to the trade recently at the British Industries Fair. It is available in two sizes, with normal ratings of 5 and 15 A at 250 V. Test reports show that the 5-A size has dealt successfully with a load of 33 A d.c., and that the 15-A switch has dealt easily with loads of 45/50 A; also that the 5-A switch has operated successfully on 525 V. d.c. The tests were made with the switch covers on at a switch-operating speed of 10 times per min., giving the cases little or no time to escape. The mechanical construction embodies the principle of complete positive action and of not using the spring as a "prime mover," but as an accelerator.

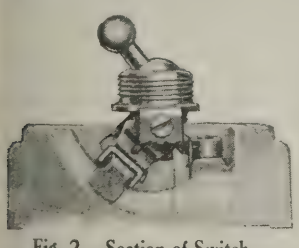


Fig. 2.—Section of Switch.

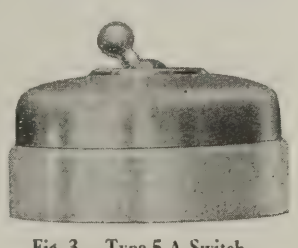


Fig. 3.—Type 5-A Switch.

The firm's usual quick-make and quick-break action is adopted, and an unsually long break is employed, fig. 2. The switch is claimed to be particularly suitable for operating electric fires and cookers and in connection with electric tramway and railway work generally, and in other cases where it is desirable to deal with loads and pressures not hitherto associated with tumbler switches. Fig. 3 illustrates the 5-A type. The switch base is of porcelain, and a neat external appearance is afforded. Both sizes are made in the surface, flush and combined switch-socket types, and the smaller size is made also in the semi-recessed type.

A New Electric Cooker.

The accompanying illustration, fig. 4, is of an electric universal portable oven cooker which has recently been placed on the market by Messrs. L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, Kingsway, London, W.C.2. It is designed for all ordinary cooking, and is built with inner and outer containers on the vacuum flask principle, the element being wound round the inner container. It is claimed that by having the cooker on circuit for about 30 min. it may be disconnected, when the cooking operations will continue. This will render the device a suitable one for supplying a hot meal on a motor journey, &c. The loading is 500 watts. The inner or cooking chamber consists of a heavy aluminium lining surrounded with a thick wall of high-insulating material and encased in a protective steel shell. A tight-fitting insulated cover is held in place by two thumb screws, a safety valve permitting the escape of steam. Two 2-qt. food containers are provided with each cooker.



Fig. 4.—Portable Electric Cooker.

At a recent demonstration at the Ideal Home Exhibition, 2¼ lb. of beef, potatoes for five people, and nine cooking apples were cooked in two hours, the cooker being connected for the first 30 min. only.

A New Tramway Ticket Punch.

A new and ingenious form of ticket punch, which will deal with fares from 1d. to 1s., issue four classes of tickets, and indicate 24 different fare stages, is being experimented with on the Metropolitan Electric Tramway route between Muswell Hill and Bruce Grove. The machine, fig. 5, which has been designed by Mr. A. C. Aspinall, 81, Cannon Street, London, E.C., carries on the top a number of buttons, one for each value of fare and one for each class of ticket. Each button is

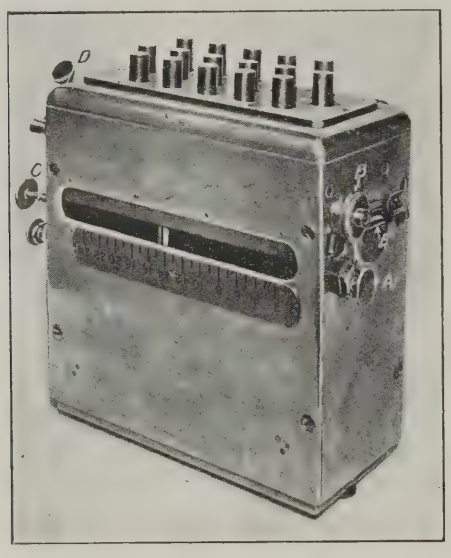


Fig 5.—A new Ticket Punch.

connected with a cyclometer dial which advances one each time the particular button is operated. On the left-hand side is a knob A for unlocking the machine, and also a milled disk B for setting the fare stage. On the other side is a knob C for ejecting the ticket, and also a lever D for punching the fare stage. A "window" on this side enables the serial number of the ticket to be seen. The buttons and the lever D are normally locked and are released by knob A. The operation of the value and class buttons punches holes in the appropriate sections of the ticket and the lever D is then operated to punch the fare stage. On pushing the knob C the ticket is ejected about ¼ in. from the ticket aperture E, so that it can be pulled out and severed at the proper point.

A "Feeding" Tool-Bar.

A useful tool-bar, known in the shops as a "feeding" bar, has been designed by Mr. J. T. Towlson, 9, Saville Road, Silvertown, London, E.16, for use in turning operations, when it can be substituted for the bottom member of the lathe compound rest, the feeding (in or out) of the cut being accomplished with the bar. It is intended primarily for use when it is required to improvise a "fixing" for a job away from the lathe altogether. The turning of the commutator of a large generator is facilitated, it is claimed, with the aid of such a tool, the armature being driven at a suitable speed. The commutator is stripped of the brushes,

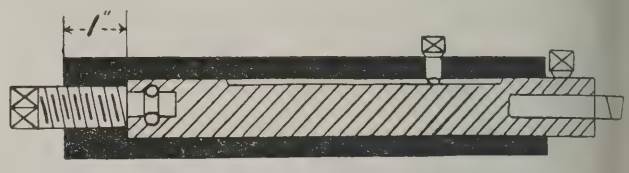


Fig. 6.—A "Feeding" Tool Bar.

and a lathe top slide of suitable length and travel is fixed and set parallel with the axis of the armature, the slide providing the means of traverse of the tool. Fig. 6 shows the bar in part section and part elevation. The device consists essentially of four parts, an outer case which accommodates an internal sliding element, the position of the latter being adjusted by means of a feeding stud screwed into the end of the case. The cutting tool is held at the other end by the sliding portion.

An Oil-Engine Development.

A recent introduction to the petrol-paraffin engine made by the Parsons Motor Co., Ltd., Town Quay Works, Southampton, has resulted in the running of the engine on gas-oil fuel of from 0.85 to 0.86 s.g. The gas-oil engine starts on petrol and changes over after a few minutes to the heavy fuel, and it is claimed to have the same range of flexibility. The new engine is said to be devoid of vibration, to weigh very much less, and to cost much less than the semi-Diesel type. Compressed air is not required for starting, and electric starting equipment can be fitted when required. The makers' standard high-speed sensitive enclosed governor is adopted and speeds below normal are obtained by a hand-lever control. The vaporiser is water cooled, and provision is made for trapping and removing any heavy residue.

Municipal Electrical Service.

The Colwyn Bay Bill and Local Contractors.

The clause giving publicly-owned electricity undertakings power to provide, let for hire, and sell electrical fittings and apparatus, and to wire premises, which a number of local authorities have included in Bills promoted in Parliament, was considered by a Parliamentary Committee for the first time this session in the case of the Colwyn Bay and Colwyn U.D.C. Bill. It came before a Committee of the House of Lords, presided over by the Marquis of Bristol, on March 17th, 18th, and 19th, and, in the result, was unanimously approved, the Committee stating that it was not necessary for the promoters to reply to the arguments advanced against the clause.

The clause was opposed by a number of electrical engineers, electrical contractors and other ratepayers in Colwyn Bay. Previously, before the Court of Referees of the House of Commons, it was held that ratepayers, as such, had no right to be heard.

Mr. W. E. Tyldesley Jones, K.C. (for the U.D.C.), recalled that a clause giving similar powers to those now asked for had been inserted last year in Bills promoted by the Bath, Burnley and Barrow-in-Furness Corporations, after consideration by a Special Committee of the House of Lords, and the matter had also been debated in the House. The position at Colwyn Bay was that the U.D.C. obtained electricity in bulk from the North Wales Power Co., and the price was reduced as the demand increased, so that it was in the interests of all to increase consumption. The use of electricity in the district, however, was not very great, being about 33 kWh per head of population. One factor which militated against the development of the supply of electricity in towns such as this was the initial cost of wiring and fittings. It was because that fact was recognised that a number of local authorities had asked for powers to sell fittings, and up to 1904 about 80 local authorities had been authorised to sell fittings or let them for hire. Then the Electrical Contractors' Association was formed, and it opposed a number of Bills in which these powers were sought; a clause was adopted and inserted in the Model Bill of the House of Lords, in 1912, which provided that local authorities with powers to sell fittings or wire premises should do so only through contractors. The Electricity (Supply) Act of 1919, however, gave power to local authorities to let fittings for hire and to wire premises, and had cut out the necessity for the intervention of the contractor. In 1923 the local authorities at Stoke-on-Trent and Wakefield had asked for selling powers, but were given powers to sell fittings only when the premises in which they were installed changed hands. In 1925 full selling and wiring powers, such as were now asked for, were granted in Bills promoted by the Bath, Burnley and Barrow-in-Furness Corporations. Wiring was an expensive matter, and the poorer classes could not afford it. The electrical contractors had no deferred-payment system, and had never suggested anything of the sort. Local authorities, on the other hand, had power to let fittings and wiring on hire. There was a risk that the tenancy of a house might change hands, and wiring installed for the previous tenant might not be required by the new tenant; when it was pulled out it was of no value, and constituted a loss to the local authority. A system of hire-purchase was better, and the U.D.C. asked for powers which would enable it to apply such a system. It was that which had converted Lord Strachie, who had spoken in the House of Lords in favour of the granting of the powers to local authorities, although he was an anti-municipal trader. The Colwyn Bay and Colwyn U.D.C. also supplied gas, and had power to sell gas fittings, but he had never heard it suggested by gas contractors that their business was injured because local authorities possessed those powers. He also pointed out that every electricity supply company in London had power to sell fittings, and, if it were part and parcel of, and reasonably incidental to the business of electricity supply companies, why should local authorities have their electrical undertakings hampered at the instance of the Electrical Contractors' Association? Some of those who were opposing the granting of these powers in the case of Colwyn Bay knew so little about electricity that they had asked the Electricity Department's

epresentatives how certain work should be done. One person who had been induced to sign the petition against the Bill had wired a house, and had had the work condemned by an insurance company as being dangerous; Colwyn Bay was hampered by the inability to get houses wired in a proper way. Dealing with the list of petitioners, he said that a number of people had been induced to sign the petition as ratepayers, although the Electrical Contractors' Association knew that ratepayers had no right to be heard, because their *locus standi* had been disallowed several times. As to a suggestion that ratepayers' money should not be used for carrying on such private enterprises as wiring and the supply of fittings and apparatus, because such a business might not be remunerative, Counsel said that the clause in the Bill provided that the business should be self-supporting. He dismissed a suggestion that, if these powers were granted, the inspectors of the Council would pass bad work done by the Council's workmen, and would condemn it if carried out by contractors, as being unworthy of comment.

Mr. J. D H. Osborn (chairman of the Lighting Committee of the U.D.C., which controls both the gas and electricity undertakings), gave evidence, and said that, judging from his experience with regard to the gas undertaking, if the powers now asked for were granted to the electricity undertaking there would be a great development in the demand for electricity. There had been an enormous increase in the consumption of gas

Mr. James Smith (electrical and gas engineer to the U.D.C.) gave figures to show that since 1921 the number of new electricity consumers was about equal to the number of new houses erected in the district, implying that the occupants of the older houses had not the facilities for having them wired, or could not afford to do so without a deferred-payment system. His figures also showed that the consumption per head of population in Colwyn Bay was 33 kWh, whilst the figures for other seaside resorts varied from 63 kWh in the case of Lytham St. Annes, to 87 kWh in the case of Bournemouth. Only three of those who had signed the petition, he said, could properly be described as electrical contractors, and only one of those was concerned solely with electrical work; the electrical business was only a minor part of the business of the other two. Their showrooms were inadequate, as were also their stocks of electrical apparatus. The remaining petitioners, other than those who were working electricians, were doing a little electrical work as a side line. In his view, electric cooking and heating would be very much encouraged in Colwyn Bay if consumers were able to obtain the appliances upon the hire-purchase system; recently there had been little development in heating and cooking. On the other hand, his figures showed that there had been substantial development of the gas undertaking, which possessed the powers now asked for with regard to electricity, and, if the powers were granted, he proposed to open an electrical showroom and to organise a campaign for increasing the use of electricity. The present load was almost entirely a lighting load, and if a heating and cooking load could be built up in consequence of the granting of these powers, the consumption could be increased and the price reduced, by reason of the sliding scale of charges for the bulk supply. The electrical installation work carried out by electrical contractors in Colwyn Bay, speaking generally, was of a low grade, and in some cases premises had had to be rewired before the supply could be connected. Cross-examination was directed to show, in the first place, that the U.D.C. Electricity Department made as many mistakes as did the contractors, and Mr. M. N. Drucquer (counsel for the opposition) referred to cases in which consumers had been overcharged, and where faults had occurred. In one case, replied the witness, the trouble was due to a fault on the system of the North Wales Power Co., other cases mentioned by Counsel he had not heard of, and the overcharging was a matter for the accountants' department. It was suggested by Counsel that the Electricity Department had never attempted to let out electric cookers on hire. Witness disagreed, and said they had not been hired because the U.D.C. had no showroom. Counsel put forward the view that the people of Colwyn Bay were not the class of people who wanted cookers on hire or on the hire-purchase system, and in support of this he referred to a case in which a firm had advertised apparatus on the hire-purchase system in the local Press, without result. Witness, however, had not heard of it. In the course of further cross-examination, Counsel said that he did not oppose the granting of powers to the U.D.C. to open a showroom, but suggested that it could have a showroom without having selling powers. Witness replied that, on economical grounds, he would not recommend the Council to open a showroom for display purposes only. It was suggested by counsel that the electricity undertaking was in its present unsatisfactory position because there was no showroom, and because there was no initiative, and he pointed out that in Blackpool the consumption per head of population was 70 kWh, although the Corporation had not the powers now asked for. Witness said he understood that Blackpool had hiring powers, and when it was pointed out to him that under the Electricity (Supply) Act he also had those powers, he said he was not aware of that, or that he had power to open a showroom. Re-examined, witness said that he had done all that could be done to develop the undertaking, and had been met with the reply by prospective consumers that they could not afford to have their houses wired.

Mr. V. Chaplin (foreman of the Electricity Department) gave specific instances of bad wiring by independent contractors with which he had come into contact in his capacity as inspector, and said that men employed by contractors who were opposing the granting of the powers had asked him how certain installations should be carried out.

Mr. E. T. Sidebotham (a builder) gave evidence to the effect that the wiring of houses which he had built had been carried out unsatisfactorily by independent contractors in Colwyn Bay, with the result that he had employed his own men to do the work.

This concluded the evidence on behalf of the U.D.C.

Mr H. Anderton (manager of the Colwyn Bay branch of Messrs. William Anderton & Co., Ltd., electrical contractors) was the first witness on behalf of the contractors. He spoke of the keen competition existing among contractors in Colwyn Bay, and said that they carried out a good deal of canvassing. He had an up-to-date showroom. There was no demand for cookers and fittings on the hire-purchase system in Colwyn Bay, but, if there were, he was prepared to sell on that basis. He confirmed the statement made by counsel that a certain firm had advertised to provide apparatus on hire-purchase terms, without result, and said he had been informed that the advertisements had done the firm more harm than good. If the powers now asked for were granted to the Council, he was afraid that he could not secure orders in competition with it, and would be driven out of business. To the Chairman's suggestion that if good contractors existed in Colwyn Bay the Council would not use the powers, he was unable to reply, but he pointed out that if it did use the powers it would have preference over the contractors, because new residents would first approach the Council for a supply, thus giving the Council the opportunity of approaching them before the contractors could do so. The contractors were quite capable of supplying all the requirements of Colwyn Bay.

Cross-examined by Mr. Rowand Harker, K.C., witness agreed that the deferred payment system was desirable, and, in fact, his firm adopted it; when challenged he gave the names of consumers in Colwyn Bay whose premises he had wired on the deferred-payment system. He did not remember having sold cooking and heating apparatus in Colwyn Bay on that system, but he was prepared to do so. His practice was to obtain cash if possible, and he had never advertised his deferred payment system. Counsel pointed out that by another clause in the Bill the Council was asking for powers to run a showroom, and asked why the promoters had not opposed it. Witness replied that, in his view, showrooms under certain conditions were of assistance to electrical contractors. In the course of further questions, Counsel said he gathered that the point was that the contractors were anxious that local authorities should spend the ratepayers' money in providing showrooms and demonstrating to prospective consumers the value of electricity, but if a consumer asked that a particular piece of apparatus should be installed at his house, then he supposed the condition was that the person in charge of the showroom should refer the consumer to the contractor. Witness said that there were already plenty of showrooms in Colwyn Bay and he could not say why the petitioners had not objected to the clause. Referring to the case in which a firm had advertised electrical apparatus on the hire-purchase system in Colwyn Bay, witness agreed that the firm concerned had become insolvent. Counsel suggested that the advertisement in the local paper referred to was inserted as a sort of last hope just before the firm became insolvent and that they would not have been satisfactory people to have had a hire-purchase agreement with. Witness had no knowledge of an occasion upon which one of his workmen was alleged to have asked Mr. Chaplin for advice as to how to install a 3-phase motor.

Mr. Drucquer said that the Electrical Contractors' Association had always advocated showrooms but held that it was not necessary for local authorities to have selling powers. He quoted the case of Manchester, where the Corporation, although it had full powers, maintained an expensive showroom but sold fittings and carried out wiring only through the contractors. He would like to see the same thing done in Colwyn Bay.

Mr. G. H. Bevan (Messrs. George Bevan & Co., ironmongers, plumbers and electricians, tinsmiths and blacksmiths, of Colwyn Bay) gave evidence, and said that his firm had had a wiring department since the inception of the electrical undertaking and could have done the whole of the wiring necessary in Colwyn Bay in 1924 and 1925. They maintained an expensive showroom which would be sufficient to fulfil the needs of the district for the next 10 or 15 years, assuming that the development continued as at present.

Mr. Harker, having ascertained that electrical work constituted about one-third of the firm's total business, asked whether witness was really afraid of being driven out of business if the Council was granted the powers asked for. Witness said that he was not.

In reply to further questions, he said that he did not think it was necessary for the Council to provide showrooms. Asked whether he thought it reasonable that if the Council let fittings on hire it should not have power to sell them if the users wished to buy, he expressed the view that the Council should not be entitled to sell fittings under any consideration. Replying to the Chairman as to the suggestion that the Council, if it had wiring powers, would be in a better position than the contractors to obtain orders, witness said that when a house had to be wired he had to inform the Council, which could, if it wished, interview the prospective consumer and try to obtain the order for wiring, although he himself had done the canvassing. It was like going to a competing contractor and informing him that he had a prospective customer. He did not think the present engineer would do that, but his successor might.

(To be continued.)

Electro-Medical Radiation Apparatus.

The Artificial-Sunlight Exhibition.

At the Artificial-Sunlight Exhibition which was held at the Middlesex Hospital, Mortimer Street, from March 11th to 16th (Electrical Review, March 19th), a very interesting display of all manner of apparatus for radiating ultra-violet and other beneficial rays was seen, of which the following selected items are representative.

The stand of Messrs. Arnold & Sons was a large one and one of the most interesting exhibits seen on it was the new "Radial" type "Alpine" sun lamp, fig. 1. This lamp incorporates all the advantages of the preceding model, and in addition it is so arranged that it may be used to treat fifteen patients at one time. The arcs are arranged around a central cylindrical heavily-nickelled reflector. The lamp is entirely automatic and no rheostats are employed. The four arcs are arranged in series so that no energy is lost in reducing the pressure by means of resistances. Among the other exhibits on this stand were instruments for the analysis of lamp radiations, recording, by photographing the spectrogram in a quartz spectroscope, the ultra-violet present. Various wave-length spectrometers were also included.

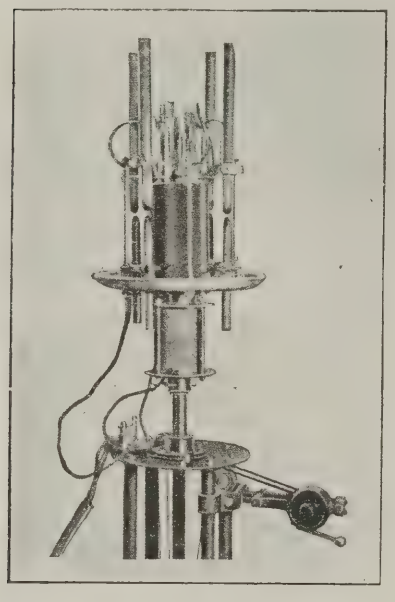


Fig. 1.—"Alpine" Sun Lamp



Fig. 2.—"Ultrozone" Set.

Messrs. Duncan Watson & Co. showed a variety of mercury-vapour lamps and the necessary hoods and accessories, the most recent production being the "Lasem" automatic lamp. A feature of the exhibits was a development of the Potter-Bucky diaphragm. This improved device is fitted with an automatic switch and relay for switching on or off and for taking the photographs.

A departure from the general radiation exhibits was seen at the stand of the Standard Ozone Co., Ltd., in the form of ozone-producing apparatus. Fig. 2 illustrates the "Ultrozone" set No. 25, with which the Broderip ward of the hospital was fitted during the exhibition. The set is made up of four units, each consisting of a silica tube with inner and outer electrodes. A pressure of 10,000 V is applied between the electrodes and the ozone is generated in the tube. Smaller portable, wall and table models were shown, together with a special surgical set for the local application of ozone. Besides the known beneficial effects of ozone as regards health in general, wide claims are made for it as a disinfectant and in this direction its uses in the hospital are almost unlimited.

The Sterling Corporation (Gt. Britain), Ltd., showed a fairly wide and representative range of apparatus. A feature was various designs of high-frequency equipment. It is made in two models, "A" and "Junior," and fig. 4 illustrates the "Junior" type. It is suitable for operation on pressures from 90 to 250 V, and can be supplied complete with a switchboard of polished mahogany, equipped with the necessary switches and connections and a series lamp. A table set consists of the switchboard model referred to mounted on a distinctive table. All sorts of peculiar applicators can be obtained for use with the instrument for the many methods of application and treatment. Another interesting exhibit was the automatic quartz mercury-vapour lamp, fig. 3. The method of striking the arc employed in this apparatus is interesting and the operation is fascinating to watch. The mercury is gradually forced along the arc-chamber, away from the "striking" electrode under gas pressure produced by means of a heating element in the gas chamber. The latter is connected to the arc chamber at the striking end by a tube which communicates the air pressure. A second chamber accommodates the mercury during the maintenance of the arc. It is interesting to note that the arc burns in the gas under pressure; the gas used is either neon, helium, or argon.

The General Radiographical and Surgical Apparatus Company showed several standard types of mercury-vapour lamps. A feature of the exhibit was the "Heliol" arc lamp, a carbon arc lamp, complete with switch and resistance, supported on a floor stand. A new form of portable electric-light bath was also shown. This is intended for bed use and may be expanded to cover any part or practically the whole of the body. Another item of interest was the "electro-atmos" apparatus. This consists of a small portable motor coupled to an air pump. By an ingenious arrangement of valves the compressed air is used for the vaporising of drugs and also for extracting pus.

Messrs. Allen & Hanburys, Ltd., and Newton and Wright, Ltd., had a good show of arc lamps, among which was the "Westminster" automatic arc lamp. This is of the 30-A type and is constructed to maintain a steady arc of 2½ in. for use with either "white flame" or impregnated carbons. Several types of mercury-vapour lamps were exhibited.

The cadmium photo-electric cell, designed for the quantitative measurement of ultra-violet radiation, was seen on the stand of Messrs. Watson and Sons (Electro-Medical), Ltd., who showed a representative display of arc lamps with carbon and tungsten electrodes.

The Western Dental Mfg. Co., Ltd., also had a good display of arc-lamp apparatus for complete or local sun baths.

A varied display of radiant heat and light apparatus was seen on the stand of the Dowsing Radiant Heat Co., Ltd. A feature of this exhibit was a specially designed "bath" cabinet, for home and institution use, employing powerful ultra-violet radiating incandescent lamps.

Messrs. Kelvin, Bottomley & Baird, Ltd., also had a fairly extensive show of sun-bath lamps and apparatus, including several models with ceiling suspension.

Among the other exhibitors were Messrs. T. Clark & Son, A. E. Dean & Co., Ozonair, Ltd., J. R. Quain, the Thermal Syndicate, Ltd., the British Hanovia Quartz Lamp Co., Ltd., the Hewittic Electric Co., Ltd., the Medical Supply Association, Ltd., Rouse & Sons, Ltd., Ajax, Ltd., and the Cox-Cavendish Electrical Co. (1924), Ltd.

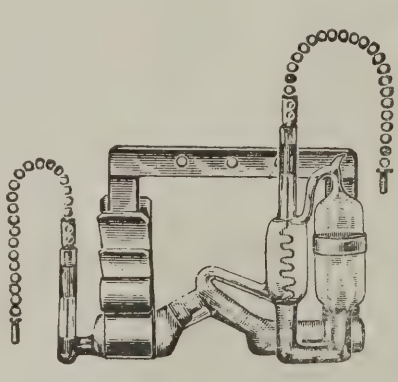


Fig. 3.—Automatic Mercury-Vapour Lamp.



Fig. 4.—High-Frequency Set.

Germany and British Protection.—*Reuter* (Berlin) reports that the Minister of Economics, Herr Curtius, speaking in the Reichstag last week on the Budget of his Ministry, stated that, as compared with 1924, Germany's total trade last year, amounting to 21.2 milliards, showed an increase of 30 per cent., but despite this improvement, Germany's share of the world's trade was only 8.5 per cent., against 13.1 in 1913. Germany's export trade, the Minister declared, was prejudiced by high tariffs, dumping, competition, and State subsidies of foreign countries. As far as England was concerned, Herr Curtius said that on no account need Germany tolerate, in view of her agreements with England, that England should introduce customs rates which were detrimental to German trade, and, if necessary, she would resort to the arbitration procedure provided in the Treaty.

The Electrical Development Association.

Annual Dinner.

The annual dinner of the British Electrical Development Association was held at the Hotel Cecil on Friday, March 19th, Mr. R. F. Sloan, who had been elected President at the annual general meeting in the afternoon, being in the chair. Among those present were the Rt. Hon. the Viscount Burnham, Sir John Snell (Chief Electricity Commissioner), Mr. S. L. Pearce, Sir Harry Haward, Mr. R. A. Chattock (President of the Institution of Electrical Engineers), Col. R. E. Crompton, Dr. S. Z. de Ferranti, Sir Benjamin Longbottom, Mr. D. N. Dunlop, Sir George Sutton, Major Isidore Salmon, Mr. R. B. Mitchell (president of the Incorporated Municipal Electrical Association), Sir Holberry Mensforth, and Mr. J. W. Beauchamp. The company numbered over 200.

Viscount Burnham, proposing "The British Electrical Industry," said that there could be no doubt that their position as a manufacturing country depended to a considerable extent on the electrical industry. Lord Weir's Committee had reported that the present position was the result of a parochial policy, and that not more than 50 of their generating stations were really suitable or efficient. At present in this country, even in the more forward districts, electricity was used for some purpose in only one home out of five, and for nearly all purposes in one home out of 50; surely that was a depressing return. This left out of consideration the application of electricity to the primary industry of the world—Agriculture—which was still in the pre-electric era, although he had read that in Sweden 15 per cent. of the total electric power was used for farm work and that over 40 per cent. of the farms were electrified. In England there were 418,000 farms, and no doubt in time most of them, especially poultry farms, could be electrified. It was of no use, however, pushing sales if the producers were not equal to the call, and in addition to increasing the production of electricity we must see to it that apparatus was improved by reducing the number of types, standardising the parts, and dividing their production among the firms best fitted to make them. There was also the question of salesmanship, which Lord Weir said must be improved by modern methods. The system of production and distribution would have to be thought out anew and drawn to new scales because electricity was fast passing from the stage of public utility to that of public necessity. They were only just beginning to learn the economic effects of short hours and high wages, which must be to make mechanical power, *pro rata*, much cheaper than it was ever before. Public utility supplies had a great effect upon the whole field of home industries and it was by their support that the manufacturing and contracting sides of the electrical industry lived and prospered. What those responsible for those supplies spent went far beyond the provision of employment in the industry, for it resulted in extending the name and fame of British manufacturing towns throughout the world. The brain counted for more than hands in the electrical trades to-day, and it was essential to maintain the highest skilled staffs. It was also essential, in order to increase the uses of electricity, to give the public more electric news and more electric reasons for faith in electricity.

Sir John Snell (Chief Electricity Commissioner), who made the first reply to the toast, said he was addressing a far larger audience, through the medium of broadcast, than those assembled at the dinner, and must deal with some matters with which they were already fully acquainted. He said that last year more than half the total electricity supplied in Great Britain from public stations was generated by 32 out of 494 stations—less than one-fifteenth of the total—and it took all the other 462 stations to generate the remainder, at a considerably greater average cost. In the United States, where the average consumption per head of population was four times that in this country, machinery was practically all electrically driven, whereas here only one-third of the total horsepower in industry as yet enjoyed this advantage. It was no effective argument against this estimate of 500 units per head in America, to say that there was already a great gas industry in this country in which some £170,000,000 had been invested. There were large gas undertakings in the United States, and the fact that a successful gas supply existed in the urban areas of this country was no obstacle to a great development of electricity supply. There was, in fact, room for both; the competition between them was good, giving rise to fertility of invention and enterprise in development on the part of both industries. They had to envisage the period when the public consumption in this country would be not 118 units per head per annum, as now, but 500 units, as was the position to-day in the United States. Personally, he had no doubt that they would greatly exceed that figure, and the point was whether they should do so by continuing along more or less haphazard lines or whether every effort should be made to bring the industry to the highest level of efficiency which it was humanly possible to attain. Speaking on the question of standardisation of frequency, Sir John said that it could be done without serious disturbance of the business of the many consumers now situated in the non-standard areas. It was the desire of the Electricity Commissioners to bring about as quickly as possible a supply of electricity throughout the country at a reasonable price. It was believed that the grid-iron of cables would not only render the supply more secure and make it more available for railway electrification, but that it would also help to decentralise industrial works and relieve the congestion in towns, assist in the development of model villages, and add greatly to the comfort of rural communities. The Electricity (Supply) Bill, 1926, would no doubt be subject to much discussion and criticism; he hoped all engaged in the industry would offer constructive criticisms, so that the Bill might be added to the Statute Book in a form which would ensure the highest and best development.

Mr. R. B. Mitchell (engineer and manager of the Glasgow Corporation Electricity Undertaking) also replied to the toast and said, in relation to the development of electricity throughout the country, that it was, perhaps, a pity that the bulk of the load which would be acquired would have to come from the gas industry, but that must be regarded as inevitable. The householders of past generations had been bred to the use of gas and to tolerate it, but the newer generation would not be content to have gas for lighting or to have their food cooked in an atmosphere of gas fumes. He expressed his strong belief in the work of the E.D.A. and in its effect upon the success of the electrical industry as a whole.

Col. R. K. Morcom, proposing "Our Guests," said the Government and the nation appeared now to have become one vast electrical development association. The new Electricity Bill was the subject of discussion everywhere; his own feeling on the subject was that that legislation was best which led most to individual resourcefulness, and that it was the duty of the Government to lubricate rather than to drive the machinery.

Sir Holberry Mensforth, K.C.B., who responded, said he was going to say something which might seem rank heresy to some of those present. In connection with many of their industries to-day they were living in a fool's paradise and making fundamental mistakes. If this country was to be prosperous they must do more to make themselves a productive nation and less of a distributing nation, towards which there was far too great a tendency. The productive side of industry in this country had received far too little encouragement. The prosperity of America was built on a basis of industry, not selling. They must see to it that they did not lose their staple industries, of which there was more than a danger, and in order to prevent their loss they must be made more attractive to the brains of the country. Greater attention would have to be paid to technical research, but even that was subservient to the great problem of producing more and producing cheaply. They were losing their skilled artisans, and if they became busy again they would be seriously handicapped in that respect. The whole problem of increasing their productiveness as an industrial nation merited the closest attention.

Major Isidore Salmon, proposing "The British Electrical Development Association," spoke of the progress that had been made in the short time the Association had been in existence, and asked what the present position would have been had the Association got to work in the early days of the industry. In addition to the importance of cheap electricity, there was the question of suitable and cheap apparatus. He did not believe that a great development in the use of electricity would mean a less consumption of gas, because there was a field for both.

The President, in the course of his reply to the toast, said that the revenue of the Association during the past year had increased by 200 per cent., which must be regarded as satisfactory and reflected great credit on the director, under whose guidance both the membership and the financial resources of the Association had been largely increased. The Council and the Executive felt that although good work had been done in the past there was still considerable room for further work, and the Association must prepare itself for a much more rapid development in the uses of electricity. A great deal had been said about the consumption per head of population, and it was quite evident that any measure based on the present Government proposals would stand or fall, depending on the consumption per head. There were certain modifications which would have to be made to make the Government proposals the really effective scheme they should be. Speaking of progress made on the domestic supply side of the industry during recent years, the President said that since 1922 the number of consumers on his company's mains had increased by 60 per cent., and he believed that by the end of the current year the number would be increased by 100 per cent. over 1922. That development, perhaps, had been due to the appreciation of the supply authority in that area of the need for development on the domestic side, and it was there that the Electrical Development Association had done such good work. He therefore urged everybody concerned with the industry to keep the ball rolling and not relax their efforts, and he assured those who were not members that subscriptions brought a very good return indeed. There must be concentrated effort to get householders to use electricity for as many purposes as possible, because it was no use having cheap electricity available in large quantities if it were not used in large quantities. Increasing sales was the primary object of the E.D.A., and therefore he urged everybody concerned with the industry to become a member.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Country-House Fires.

I enclose herewith an illustration, taken from the *Evening News* of March 17th, depicting an electric iron which has burnt through, first, the table, and secondly, the floor, and is suspended by the flexible connection in the room below.

Such incidents are by no means rare; the writer has had several cases brought to his notice, where irons have been left "on" in factories and similar places over the week-end, resulting in the iron being found in the room below.

It is not generally understood by the public that an iron will become red-hot in the course of an hour or an hour and a half, if left unattended. About 70 per cent. of users of electric irons have, from time to time, burnt table cloths, tables, floors, &c., through accidentally leaving the iron in circuit.

I am of opinion that the ordinary iron as now offered to the public will soon be superseded entirely by automatic irons, either thermostatically controlled, or controlled by grip-control switches.

Perhaps some of your readers can give particulars of similar accidents, within their knowledge.

A.M.I.E.E.

London, *March 20th*, 1926.

[We have previously illustrated an incident of this kind, the result of carelessness. Fires due to this cause, however, are almost unknown, and the great popularity of the electric iron shows that it bears a high reputation.—Eds. Elec. Rev.]

"Electrical Freedom."

Your editorial comment that Mr. Robinson is causing mirth because of his "working hard," &c., is a little unkind to your correspondents, and not quite justified.

We contractors must appreciate that Mr. Robinson is no fool; his views are no doubt the result of his experience, and are no doubt sincere. There is the question, however, whether Mr. Robinson has gone the right way about things and if his views would have been entirely opposite if he had approached matters rather differently. We shall see.

With your permission, Sirs, I would address my following remarks to Mr. Robinson:—

To quote your own words, Mr. Robinson, you want suggestions for "wholesome co-operation." There is a quotation which reads: "First cast out the beam that is in thine own eye." Mr. Alger tells us that your past policy has largely succeeded in driving electrical contractors out of your territory. Was this your idea of "wholesome co-operation"?

Do I understand that you now wish to make amends, and that you consider "wholesome co-operation" would now be better for the supply in your area? If this is your view, you will find that efficient contractors will return and will more than meet you half-way.

I imagine that you would admit that no gathering of sound and tried business men could ever be persuaded that you and your staff could be better and keener salesmen than a number of keen electrical contractors with their individual enterprise *together with your proper co-operation.*

If you defend your past policy, will you tell us what your serious efforts *have been* towards "wholesome co-operation"? Or will you let us have *your* ideas for future efforts? I would like to ask you a few questions:—

1. Have you ever offered to meet the contractors to discuss selling propositions? I refer to the three things (of mutual interest): wiring, apparatus, and current.
2. Have you ever notified contractors of the exact roads and streets where your mains are being laid, so that they could *more efficiently* act as your unpaid canvassers?
3. Have you ever discussed your various tariffs with contractors so that they may be the better able to advise their customers?
4. Have you ever tabulated and given your data regarding average consumption and cost of current to various classes of houses and works, so that these important things could be utilised?
5. Have you had a genuine feeling of good-will towards the contractors and a desire to meet them on equal terms and not treat them (or allow them to be treated by your staff) with indifference or condescension or by being autocratic? Believe me, these things are regrettably found only too often in supply station engineers and their staffs, and are distinctly harmful to progress generally.
6. Do you make pin-pricking regulations of your own, or work in part only to such I.E.E. regulations as appeal to you, and so more or less cause confusion?

Whether you answer the above things or not, you have in them a firm basis for wholesome co-operation, and they are worthy of serious consideration.

There is your opportunity (and I am led to think you are taking it) of upholding a good class of work through really active support of National Registered Electrical Contractors. There, I submit, is a valuable beginning to co-operation on our side, waiting and asking for you.

Much more could be written on this subject, but if your contribution will lead to some better results (which are unquestionably attainable) you will have no small measure of thanks from the industry generally.

C. J. B. Barlow.

Warrington, *March 16th*, 1926.

I have reserved my comments on Mr. Robinson's article in your issue of February 26th until I saw the answers by other electrical engineers.

I happen to be the head of one of the much-maligned contractors in his neighbourhood, and there are one or two things that he has said which I should like to contradict.

(1) Mr. Robinson is not selling 27 vacuum machines per week—unless one calls hire-purchase selling; the majority are secured by the public at 4s. 8d. per week.

(2) He says that contractors have sold no washing machines. Just before Mr. Robinson held his exhibition at the Hackney Baths (on which occasion he would not allow contractors in his area to exhibit), we held a demonstration for 14 days of a washing machine and sold four, and we should have developed this business, but for the fact that his exhibition took our customers to the Council. In those days we sold cookers and every electrical commodity; now, however, part of that business is stopped through the unfair municipal competition.

(3) At the latter part of last summer we undertook six installations at Mr. Robinson's "cost plus 20 per cent. prices." They were carried out in Henley's lead-covered cable at 21s. 9d. and 22s. per point with plain pendants. The larger price was for smaller installations, up to six lights. Generally there would be two flats in a house, and top floor and one ground floor, and the top flat of three lights had be to fed with, roughly, 50 ft. of 3/.036 or 3/.029 mains, with Tucker main switch and White's main fuses at the service end, and a pair of White's fuses in the flat; the supplying of the mains and switches turned any profit it might have been possible to make into a loss, especially when it was found that we had to pass rooms which did not require electric light *en route* to install the light in other rooms. The six orders did not yield 5 per cent. on the net cost, so either Mr. Robinson's estimating cannot be right, or my staff must have been very slow at their work, and since they are thoroughly good men and have been in my service for many years, I do not think that this is the case.

(4) It is not true to say that factories in the Hackney area are not equipped with other electrical gadgets than electric motors by contractors. Only a month or two ago we installed 24 electric irons in one factory, as well as four motors, plus electric light, and in all probability we shall install exhaust fans when the weather warms up, and this applies to every soft goods factory which we undertake to equip. We have equipped a great many more factories than Mr. Robinson knows about, but the majority are out of his district.

I took the trouble to write to our Town Hall a few weeks ago to get figures relating to the trading of the Borough. The turnover of the Sales Department last year was £14,441, and the net profit £342. I wonder how many business firms could afford to trade at these terms?

Let Mr. Robinson and his whole staff concentrate on reducing the price of the lighting unit, which is now 5d. to 3d., and the heating unit, now 1d. to ¾d., and he will not want to spend £1,000 per annum on advertising and propaganda. Electricity will sell itself in Hackney.

H. Linzell, A.M.I.E.E.

Hackney, N.16, *March 15th*, 1926.

The correspondence under this heading for the past few weeks has been both interesting and amusing, and I venture to add my humble views.

Mr. L. L. Robinson has a perfect right to carry on in his salubrious district as long as he is allowed to do so by his superiors, *viz.*, his Council and those all-important ratepayers who elect them. As for his views expressed so pungently and offensively to us contractors—if it were not for the effect that such statements (coming from an engineer to a London borough council) might have in some quarters, I would prefer to let him boil in his own fat, as he surely will do; alternatively, given enough rope he will hang himself; but unfortunately, Hackney ratepayers will suffer. Mr. Robinson has nothing to lose personally, but would he take the same course if he were spending his own money? Most certainly not!—as it is not difficult for any contractor who sells appliances, especially vacuum cleaners, to know that what he is gaining on the swings he is losing on the roundabouts, and whereas he puts the losses on to the latter account, he shows all profit.

It is worthy of note that Mr. Robinson has not only picked a quarrel with contractors; as your advertisement columns have shown for months past, the Hackney Borough Council "is black," and no E.T.U. man is authorised to work for it without permission. This probably accounts for Mr. Robinson being able to get the work done at so much less than a registered electrical contractor. Will he say that all his employés are being paid full rates, that he allows overhead charges to the full extent and then gives 20 per cent.?

He has evidently hounded all respectable contractors out of his district, or we would have surely seen someone from his area replying to his indictment, which was, after all, directed against contractors in general, but the contractors of Hackney in particular.

Surely this is a matter that could be thrashed out at a round-table conference, and I wonder, if the Contractors' Associations were to invite Mr. Robinson to such a conference, whether he would accept.

We must pull together to reach the end we are all anxious to attain, and therefore I say supply companies should supply electricity at the cheapest possible rates and be in a position to give all that is required in any part of their district without vexatious charges to consumers, and they have got all they can do if they do this.

Registered contractors will obtain all the necessary consumers and carry out the best work, but something must be done to eliminate the plumber-electrician and unqualified men, and the Government should be asked to do this by way of a instruction to all supply authorities that only work carried out by registered electrical contractors may be given a supply of electricity under the order.

Manufacturers should deal through the electrical trade only and stop the practice so prevalent of giving all and sundry "trade discounts," and then *bona-fide* contractors would stock and sell appliances.

All should interlink their respective departments, and even Mr. Robinson would not complain.

Watson, Marsh & Co., Brondesbury, Ltd.
MICHAEL WATSON, *Managing Director.*

London, *March 16th*, 1926.

Low-frequency Transformers.

I should like to call your attention and the attention of your readers to what is apparently becoming a common and misleading practice in Press references to low-frequency transformers. I refer particularly to the question of impedance, which, as every engineer knows, depends, in a reactive circuit such as a transformer winding, to a vast extent on the frequency at which it is measured.

This point is not appreciated by the average radio enthusiast, and therefore any statement of transformer impedance which does not give the frequency at which it is measured, is as misleading as it is useless.

Any transformer may have a comparatively high impedance at, say, 500 cycles, but this does not indicate that it will give good results, since the whole of the male and female speaking voices and the major portion of the fundamental notes are below this frequency, so that for an impedance value to be of any real use it should be stated at a periodicity of not higher than 100 cycles.

If the impedance is reasonably high at this frequency, good reproduction, particularly of the low notes, is assured.

It is sometimes suggested that the impedance of a transformer primary and that of the valve preceding it should be matched; one must say at once that this is quite wrong, and such a state of affairs should be avoided, if at all possible.

The object at which one must aim is to make the transformer impedance as high as possible, so that it is infinitely great with reference to the impedance of the preceding valve; under these circumstances the full amplification of the valve is obtainable, and the true amplification per stage may be calculated by multiplying the valve amplification factor by the ratio of the transformer.

It is only with transformers of comparatively low ratio, say from 3-4/1, that the above high impedance is possible, for which reason high-ratio transformers should be avoided as a rule, unless they are used following valves having very low impedances, under which circumstances the transformer impedance is still comparatively high compared to that of the valve, but in any case, really good results cannot be obtained under any circumstances unless the transformer impedance is very great, which cannot be the case with a high-ratio transformer.

John Baggs.

Manchester, *March 18th*, 1926.

The Government Electricity Scheme.

If Mr. Allcock knew his subject he would not make so many mistakes. He is now comparing 1924 *costs* which, incidentally, were *not* 3.29d. per unit, with 1926 *charges*.

If we were to change over to bulk supply, the material question is: What are we going to save? The only items we are going to save on are: Coal, oil, general stores, wages, and repairs, a total, if one takes 1924 figures, of approximately £1,400, equivalent to a generation cost per unit of 1.87d.; so that if I buy at 3d. to cut out my actual *generating* costs, my current will cost me 1.13d. per unit more. Sound finance for Mr. Allcock, maybe, but not for

C. Culmer Hodges.

Electricity Works, Dawlish, *March 17th*, 1926.

The Sludging of Transformer Oil.

I shall be glad if any of your readers who have had experience in the running and maintenance of h.p. oil-cooled transformers will assist me with regard to the following points re "sludging":—

(*a*) Apart from the question of increased temperature rise, is there any danger of flashing over when "sludging" takes place?

(*b*) Is there any simple test for detecting the early formation of "sludge"?

(*c*) Is there any remedy that one can apply, apart from that of entirely renewing the oil?

The capacity of the transformer in question is about 600 kW, running off a supply at 6,600 volts.

Transformer.

March 20th, 1926.

[No one knows more about this subject than the British Electrical and Allied Industries Research Association, from which our correspondent can no doubt obtain references to satisfy his inquiries.—EDS. ELEC. REV.]

The Cost of Living in Madras.

I was very interested in the letter appearing in your issue of February 5th, signed "A Twenty-five-year Resident of Madras," as I have lived in this city for exactly that period. I should, however, be even more interested if your correspondent would inform me where in Madras one can get accommodation at a boarding establishment, or a private house, for Rs.120/- per month. My experience is that the usual sum charged nowadays is between Rs.250/- and Rs.300/-. Also the rent of a "decent bungalow," given by your correspondent as Rs.125/- to Rs.200/-, would be far more correctly stated as Rs.200/- to Rs.300/-. Possibly there is a slight mistake in your correspondent's *nom-de-plume*, and it should read "A Twenty-five-years ago Resident of Madras." In the far-off days at the beginning of this century, when India was a place worth living in, the figures were approximately as given by your correspondent.

A Sojourner in Madras.

Madras, *March 4th*, 1926.

Legal.

A Receiver Sentenced.

AT the London Sessions on March 17th, John James, an engineer, was found guilty and sentenced to 12 months' imprisonment for receiving transformers and other articles, the property of Radio Instruments, Ltd. A police witness stated that, although the prisoner was drawing the "dole," he owned a motor-car, and, it was believed, a yacht and a motor-cycle.

Neufeldt & Kuhnke v. Wireless Headphone Distributing Co., Ltd.

IN the Chancery Division on March 18th, Mr. Justice Tomlin disposed of an undefended action by the plaintiffs, electrical apparatus manufacturers, of Kiel, Germany, claiming injunctions restraining the passing off by the defendants, of Arundel Street, Strand, W.C.2, of headphones bearing the plaintiffs' trade-marks "N.U.K.," "N. & K.," and "N.K.," as and for the plaintiffs' goods.

Mr. W. LAVINGTON, for the plaintiffs, said that the defendant company was formed by Messrs. Wolffe & James in furtherance of their fraudulent scheme. The plaintiffs were one of the largest firms of wireless and electrical appliance makers and they began the manufacture of headphones in 1921. When they began exporting them to England, Wolffe & James were among those who bought them. They wanted to become the plaintiffs' sole agents in this country for headphones, but others were appointed. When the latter applied for registration of the plaintiffs' marks in this country they found that the defendants had applied to register themselves as the proprietors of the "N.U.K." mark. They fought that application before the Registrar, with the result that they were successful and got the plaintiffs' marks put on the register. It was soon after that that the defendants formed the "N. & K. Wireless Headphones Distributing Co., Ltd.," whereupon a writ was issued, and on motion the defendants gave an undertaking not to use the letters "N. & K." in connection with the name of the company.

Several witnesses were called, including Dr. Richard Bruhn, head of the plaintiff firm.

His Lordship granted two injunctions, (1) to restrain the defendants from using any of the plaintiffs' marks as part of the name of any business dealing in headphones or other wireless apparatus, and (2) to restrain the selling or offering for sale of any wireless apparatus or headphones bearing any of the plaintiffs' marks, not being the plaintiffs' goods. He also gave them the costs of the action and granted an inquiry as to damages.

British Thomson-Houston Co., Ltd., v. W. A. Tunstill, Ltd.

IN the Chancery Division, on March 19th, Mr. Justice Lawrence had before him a motion on behalf of the plaintiffs to restrain the defendants, W. A. Tunstill, Ltd., from infringing their patent for gasfilled lamps.

Mr. TREVOR WATSON, in support of the motion, said his Lordship had last week granted an *ex-parte* injunction against the Novelty Co., and he would probably remember that the invoice for the lamps in that case was made in the name of the Novelty Co., and underneath were the words: "Proprietors:—W. A. Tunstill Co., Ltd." They had discovered that that limited company had gone into liquidation, and there was some doubt as to whether the sale of the lamps was in fact made by the limited company or by Mr. Tunstill him-

self. The only evidence they had then was the invoice. He (counsel) asked that the writ be amended by joining the Novelty Co.

His LORDSHIP asked who owned the business. Counsel said he was instructed that W. A. Tunstill, Ltd., were the owners. That company went into liquidation in 1924, and since then had neither bought nor sold lamps.

His LORDSHIP said that he wanted information as to who was carrying on the business. Counsel promised to do what he could to get the information.

His LORDSHIP gave leave to amend and continue the injunction until March 20th.

Theft of Electricity.

AT the Hendon Petty Sessions, on March 18th, George Edward Adams, an electrician, pleaded guilty to a charge of having unlawfully obtained a supply of electricity from the Hendon Electric Supply Co., Ltd.

For the company it was stated that cables had been laid to premises in Golders Green and sealed. One of the company's inspectors discovered that the seal had been broken and connections had been made. The defendant said that he had connected up the installation because the occupier of the premises was in a hurry and the company was said to be very busy.

The Bench imposed a fine of £5 and three guineas costs.

Fife Coal Co., Ltd., Sued.

IN the Court of Session, Edinburgh, on March 18th, an action was raised on appeal by a miner against the Fife Coal Co., Ltd., Leven, for £600 as damages for the death of his son. It was stated that the boy was playing on unfenced ground belonging to the company where there was a large structure carrying a transmission line to the collieries. The boy's father said it was easy and tempting for children to climb the structure in order to slide down the guy wire ropes. On climbing and reaching the cross-bracing rods the boy received a fatal electric shock. It was argued that the company should have enclosed the cable in a wooden box. In the Outer House Lord Morison allowed a jury trial on the record, but the second division dismissed the action as irrelevant.

Their Lordships were of opinion that as the accident happened about 20 ft. from the ground the boy was a trespasser, and the company had no duty of care towards him.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks must be lodged within one month from March 17th :—

C.V. (lettering and design). No. 466,551. Class 6. Electric carpet sweeping machines and vacuum cleaning machines. No. 466,552. Class 13. Electric lamps and irons. No. 466,553. Class 18. Electric radiators for heating and cooking stoves.—Clyde Valley Electrical Power Co.

Ormond Engineering Co. (lettering and design). No. 454 982. Class 8. Condensers, transformers, resistances and crystal detectors, all being component parts of apparatus for use in radio-telephony.—E. J. L. Delfosse, trading as the Ormond Engineering Co.

Ultra. No. 459,948. Class 8. Radio-telephonic and telegraphic receiving and transmitting apparatus and parts, telephones, loud speakers, transformers, and condensers.—E. E. Rosen & Co., 661-663, Harrow Road, N.W 10.

All-American. No. 459,373. Class 8. Audio- and radio-frequency transformers, power (push-pull) transformers, grid condensers and leaks, complete radio-receiving sets, variable condensers, and valve sockets, all being goods made in the United States.—All-American Radio Corporation, Chicago. (British representatives : E. P. Alexander & Son, 306, High Holborn, W.C.1).

Magnee (lettering and design). No. 465,105. All goods in Class 8.—R. H. Lewis, 22¼, Cazenove Road, Stoke Newington, N.16.

Tefaglad No. 464,149. Class 8. Telephone apparatus.—Shipton & Co., Ltd., 37, Tothill Street, S.W.1.

Belco (lettering and design). No. 458,881. Class 13. Electric lamps (ordinary).—Bell's (Leeds), Ltd., 5, Upperhead Row, Leeds.

Peter the Heater. No. 464,647. Class 13. An electrical appliance for maintaining temperature in internal-combustion engines and for drying and warming generally.—L. G. Hawkins & Co., Ltd.

High-voltage Safety Devices.—A very large number of fatalities and serious accidents have befallen as a result of the wide extensions of hydro-electric power lines in New Zealand, especially in the country districts where exposed sections of the high-pressure lines have been unable to stand up to the weather and have broken. In one case a live wire dropping across a wire fence resulted in several deaths; several other similar fatalities have occurred within recent months, and although safety devices have been on the market for some time, none has given satisfaction so far as the low-pressure lines are concerned; but a device just developed by one of the Power Board engineers appears to have satisfied a very critical test by the chief engineers of the Hydro-Electric Branch of the Public Works Department interested in the matter. The principle involved is an earth-leakage relay attached to an oil-filled circuit breaker at the transformer which trips the circuit breaker, completely "deadening" the line. Thus, it is necessary to find the fault in the line and effect repairs before the section can be restored.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

20,788. "Electrical control systems." Metropolitan-Vickers Electrical Co. Ltd. September 20th, 1923. (222,105.)

22,894. "Electrodes for use with vacuum or gasfilled discharge tubes or lamps." E. V. Gratze-Hayes. September 29th, 1924. (248,023.)

25,561. "Loud-speaking telephone receivers." Dubilier Condenser Co., Ltd. (formerly Dubilier Condenser Co. (1921), Ltd.) (W. Dubilier). October 27th, 1924. (248,026.)

25,826. "Electric hand lamps." T. Stretton and Thor Lamps & Supplies Ltd. October 29th, 1924. (248,030.)

25,963. "Electrical condensers." P. R. Coursey. October 31st, 1924. (248,031.)

27,946. "Thermionic valve holders." A. C. Read. November 21st, 1924. (248 052.)

28,243. "Loud-speaking telephonic receivers." E. A. Graham. November 25th, 1924. (248.060.)

28,244. "Loud-speaking telephonic receivers." E. A. Graham. November 25th, 1924. (248,061.)

28,291. "Ceiling roses or like electrical wiring connections." S. Dagnall, Ltd., and R. S. J. Dagnall. November 26th, 1924. (248,064.)

28,358 "Signalling systems using high-frequency carrier waves." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). November 26th, 1924. (248,069.)

28 461. "Means for producing magnification with a four-electrode valve and circuits therefor." Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. November 27th, 1924 (248,076.)

28,580. "Voltage-regulating systems for alternating-current feeders." E. M. Johnson, C. Ryder L. C. Renton and Metropolitan Vickers Electrical Co., Ltd. November 28th, 1924. (248.083.)

28,598. "X-ray examination apparatus." O. C. Hartridge and P. C. Kent. November 28th, 1924. (248,085.)

28,698. "Means for eliminating interference in the reception and/or measurement of wireless signals." H. A. P. Littledale. November 29th, 1924. (Cognate application 1,676/25.) (248,087.)

28 686. "Means for connecting electric cables to carbon brushes or the like." Soc. Anon. Le Carbone. October 18th, 1924. (241,504.)

28,923. "Electrical heating devices." T. J. Lattimer. December 2nd, 1924 (248,095.)

29,016. "Dry cells and their formation into batteries." H. Vignon. December 3rd 1924. (248,099.)

29,569. "Alternating-current relay." H. Konemann. December 9th, 1924. (Convention date not granted.) (226,525.)

29,637. "Headphones." S. McConnell. December 10th, 1924. (248,116.)

29,674. "Electric converting apparatus." J. E. Calverley and W. E. Highfield. December 10th, 1924. (Cognate application 18,965/25.) (248 117.)

30,014. "Electromagnetic and electrodynamic sound-emitting and converting apparatus." British Thomson-Houston Co., Ltd., and J. Hutt. December 13th, 1924 (248,129.)

30,296. "Electric switches." J. B. Tucker. December 17th, 1924. (248.124.)

30,973. "Covers or enclosing devices for electric switches, accessories, and other electric parts." J. A. Crabtree. December 24th, 1924. (248,133.)

31,003. "Junction boxes for electric cables." Henley's Telegraph Works Co., Ltd., W. T. and W. H. Nichols. December 24th, 1924. (248,134.)

1925.

1,996. "Sound-funnel for radio-telephony or other sound reproduction." G. K. V. Jorgensen. December 2nd, 1924. (244,031.)

2,275. "Process for the transmission of sound by electrical means and for recording and reproducing sound films." A. Poulsen and A. C. G. Petersen. January 26th, 1925. (248.148.)

2,502. "Crystal detectors for wireless purposes." H. R. Taunton. January 28th, 1925. (248,152.)

3,305. "Electric signal systems." C. E. Beach. February 5th, 1925. (248,156.)

4,391. "Regulators for dynamo-electric machines." W. H. Glaser and C. A. Vandervell & Co., Ltd. February 17th, 1925. (248,167.)

5 332. "Sound-recording and reproducing apparatus, particularly applicable for testing audibility." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). February 26th, 1925. (248 174.)

5,468. "Loud speakers for wireless telephony and other purposes." P. Grassmann. February 27th, 1925. (248,176.)

5,600 "Dynamo-electric machines." Diamond Coal-Cutter Co., Ltd., and P. Huggins. February 28th, 1925. (248,177.)

5,785. "Insulated conductors or cables." H. D. Fitzpatrick (Naamlooze Vennootschap Hollandsche Draaden Kabelfabriek). March 3rd, 1925. (248,178.)

7,261. "Electrodes for electric arc lamps." General Electric Co., Ltd., W. Singleton and A. Hare. March 17th, 1925. (248,187.)

8,063. "Electric relays." J. E. Pollak (Piepmeyer & Co. Kommanditges). March 25th 1925. (248,193.)

8,464. "Electric fires" P. M. Edinborough and Metropolitan-Vickers Electrical Co., Ltd. March 30th, 1925. (248,195.)

9,148. "Commutators for rectifying alternating current." L. G. Chaix and E. L. Chaix. April 6th, 1925. (248,197.)

10,111. "Crystal detector." F. E. Bancroft April 18th, 1925. (248,205.)

12,410. "Electric cables." Connollys (Blackley), Ltd., W. Travis and P. Kelly. May 13th, 1925. (248.217.)

12,547 "Trolley head for electric current collectors." W. A. Woodhouse. May 14th, 1925. (248 219.)

13,740. "Sound-reproducing devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). May 26th, 1925. (248,228.)

15,202 "Electrodes for the purification of gases." Siemens-Schuckertwerke Ges. June 12th, 1924. (235,582.)

16,098 "Electric condensers." Dubilier Condenser Co., Ltd. (in voluntary liquidation). September 3rd 1924 (239,492.)

17,159 "Electric power installations." A. J. Stephens (Akt.-Ges. Weser). July 3rd, 1925. (248.241.)

17,546 "Telephone receivers." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Bell Telephone Laboratories, Inc.). July 8th, 1925. (248.246.)

19,176 "Machines for connecting electric cables to carbon brushes or the like." Soc. Anon. Le Carbone. October 18th, 1924. (Divided application on 241,504.) (241,525.)

20,453. "Electrostatic telephones, particularly those of the loud-speaking variety, and microphones." Tri-Ergon Akt.-Ges. July 9th 1925. (248,255.)

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28,585 "X-ray apparatus." C. H. F. Muller (firm of). December 4th, 1924 (244 105.)

32,828. "Manufacture of electric discharge tubes." G. Claude. January 22nd, 1925. (246,453.)

1926.

461. "Electric lamps primarily intended for vehicles." S. Heath and Sons, Ltd., A. Tongue and A. E. Mason. January 7th, 1926. (248,306.)

The

Electrical Review

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Electrical Manufacturing Reports.

THE review of electrical industrial affairs by the chairman of the B.E.A.M.A., published in our last issue, has been immediately followed by several interesting statements by chairmen of electrical manufacturing companies, which are summarised in our "City Notes" this week.

The statement made by Sir Philip Nash at the annual meeting of the Metropolitan-Vickers Electrical Co., Ltd., showed that during 1925 that company produced a record output, the tonnage of orders completed representing an increase of 5.2 per cent. over 1924. Excluding the supply business, there was a decrease of 3 per cent. in home orders, but this was more than compensated for by an increase of 4.68 per cent. in export orders. The year 1926 began with a slightly smaller volume of work in hand, but since then the booking of new business has proceeded satisfactorily. The company suffered from the same experience as some other concerns in respect of the falling off in orders for heavy electrical plant for the Home market, partly because of the unsettling effect of a legislative atmosphere. Sir Philip thinks that such manufacturing concerns must be prepared for progress to be arrested for the time being and for a further falling off in Home sales until the Electricity Supply Bill has made headway in Parliament. He said that it rested with Parliament to convert the Bill into an Act which would not restrict our operations, but would assist the power supply side of the industry to go straight ahead.

The export business tonnage booked by the company during 1925 constituted a record, and this high-water mark will be maintained during 1926, but once again this is only possible by working with the barest margin of profit. Though competition grows in severity, the works must be occupied so as to give employment and to absorb the heavy standing charges. Another point in regard to the company's export trade is its bearing on future developments at home. The largest units in practically every line of Met.-Vickers manufactures go abroad, and technical developments which do much to keep the concern in the forefront of the industry therefore "arise almost entirely from the needs of

the export market." In this way operations for export are placing the company in a position to tackle large contemplated developments at home which may ensue from the electrical legislation now before the nation. This is also the case in respect of railway electrification. The bulk of the traction work carried out by British manufacturers during the last three years has been for abroad; this furnishes both experience and reputation, but let us hope that the Home railways will soon be substantial customers in this department, though it seems to require little short of an earthquake to move them from their rut. Sir Philip Nash and Col. R. K. Morcom have both in recent speeches directed attention to the important fact that wherever railway electrification has been adopted, the results have more than justified the calculations upon which the schemes were based. The M.V. company has established works in Sydney and Melbourne for certain electrical manufacturing purposes in view of the Australian Government's declared policy of giving preference to local production, and it reports that the operations carried on there have resulted in a substantial profit during each year of the existence of the works.

Mr. A. F. Berry, in his speech to shareholders in the British Electric Transformer Co., Ltd., was able to report a very substantial improvement in trade and in profit earned, although the year did not yield a full share of work. He said it was wrong to assume that because electricity supply undertakings were prospering, manufacturers of electrical plant and machinery were also doing so; manufacturers, unlike electricity supply authorities, had no monopoly; indeed, they had to meet stern competition, and to some extent their general charges had to be borne by export work. He expressed a hope that less would be heard this year of British capital being expended upon foreign electrical equipment. Our factories greatly needed the work. The nature of one side of the company's business led him to mention the increasing popularity of domestic electrical appliances. We welcome every speech that is delivered stressing the immense importance of attention being concentrated upon the expansion of the domestic load. Mr. R. P. Sloan, the president of E.D.A., emphasised its value especially at a time of industrial depression such as has been experienced in his own area, and we hope that the current year will witness great progress in many areas whether there is or is not the incentive of industrial depression. As Mr. Berry mentioned, the growing domestic demand has undoubtedly begun to stimulate orders for plant, machinery, cable and switchgear. Domestic electrical development, in which we have made, comparatively speaking, such small progress, is one of the great hopes of the electrical manufacturing industry. It is unquestionably true that the Electrical Development Association has a grand work to do, especially at a time when the public mind is fixed on electricity. With Mr. Sloan as its president we believe Mr. Beauchamp and his staff will not be discouraged, but will be able to press straight forward.

The exceptionally improved results recorded by the British Insulated Cables, Ltd., and mentioned in the annual speech by Mr. James Taylor, were partly due to the completion of work under some large contracts which have been occupying attention for several years, but they were also attributable to the benefit of lower manufacturing costs owing to the large sums spent in recent years upon improving and extending the factories, and to the fact that the year yielded a record output. It is noteworthy that £300,000 was expended on works extensions and equipment during the year. Mention was made by Mr. Taylor of the bonus scheme under which the staff is rewarded according to the results achieved. He attributed the company's success largely to the arrangement under which some of the workers were paid partly by fixed wages and partly by bonus on output or work done, and whereby all the permanent staff were paid partly by fixed salary and partly by a bonus, the amount of the latter depending upon the dividend paid to the shareholders from year to year. The scheme has undergone readjustment consequent upon the bonus share distributions, but what has been done has proved it to be advantageous to the shareholders generally to give every member of the staff a personal incentive to produce the best results.

The Government and the Coal Commission.

The decision of the Government to adopt the Report of the Coal Commission and to institute the legislative measures necessary to give its recommendations effect is of direct interest to the electrical industry in several important respects. Fortunately there is a condition first to be fulfilled by those engaged in the coal mining industry—namely, that they also shall agree to accept the report and to carry on the industry in accordance therewith—and as it will take some time to arrive at that stage, the matter is not so urgent as it might otherwise appear.

The list of recommendations that would require action on the part of the Government, which was circulated after the Prime Minister had announced the decision of the Cabinet last week, contains some rather startling items, such as the compulsory amalgamation of mining properties, the State purchase of the mineral royalties, the granting of powers for local authorities to engage in the retail sale of coal—municipal trading with a vengeance!—and obligatory profit-sharing schemes; but those which more immediately concern the electrical industry are the proposals to assist the investigation of processes for the low-temperature carbonisation of coal, to establish a National Fuel and Power Council, and to extend the provision for research by the industry, with the support of the State.

These three propositions are more or less interdependent, and are so treated in the Summary of Findings and Recommendations at the end of the Report. The Commission contemplates "a closer connection of mining with the allied industries," the latter comprising gas, electricity, smokeless fuel, oil, chemical products, blast furnaces, and coke ovens, and suggests that "the development of electrical supply under the new proposals of the Government should be closely coordinated with the generation of electricity at the mines." This, it will be seen, is an exceedingly comprehensive and far-reaching conception, from which the imagination can conjure up fantastic dreams. Whilst the development of an efficient process of low-temperature carbonisation would unquestionably confer immense benefits upon the country, by the production of smokeless fuel, and of mineral oil in substitution for that which at present we have to import in large and increasing quantities; and whilst these processes inevitably involve the evolution of gas suitable for heating purposes and for the generation of electricity, we most certainly are not prepared to support their association with the coal mining industry in any way whatever. The extraction of coal is one thing—its utilisation is a totally different matter. The idea underlying this proposal, like that put forward by the Miners' Federation, is to bolster up the coal mining industry at the expense of other industries—to subsidise it in kind instead of cash—and we will have none of it. The mining industry must stand upon its own feet.

The establishment of a National Fuel and Power Board, which is an inherent part of the scheme, would not merely add yet another to the already too numerous controlling authorities and Government departments—it would undoubtedly tend to subordinate the electrical to the coal mining industry and impose new burdens upon the long-suffering shoulders of the electricity consumer. All these proposals lead in one common direction—towards the ultimate nationalisation of coal mining and electricity supply, a consummation which we believe would be disastrous to the efficiency and economy of both industries. We trust that our readers will give serious consideration to the dangers which they involve, and will resist their accomplishment by every legitimate means.

Industrial Relations.

For many years past the question of the relations between employers and their employés has been recognised as one of the most potent factors in industry. Thus the Committee on Industry and Trade was well advised to make industrial relations the basis of its second report. This report deals with a vast amount of information regarding wages, hours, and conditions in industry both national and international, and the review of the document which appears elsewhere in this issue does not pretend to be anything more than a guide to its contents. The Committee merely places on record the facts which it has elicited from evidence given before it, and from the study of foreign statistics, and leaves those concerned to draw their own inferences and formulate schemes in the light of the data thus gained.

In studying the latter-day phenomenon of higher wages being received by unskilled labour in "sheltered" industries than by skilled men in the exporting branches, the Committee adopts a non-committal attitude. In view of the complexity of the subject, involving the reconsideration of our position as an exporting nation, the Committee was no doubt wise in refraining from attempts to suggest a remedy. Another important matter studied is the comparative purchasing power of wages in this country and foreign states. This brings out the favourable situation of the North American continent, no less than the poor conditions prevalent in a number of Continental countries.

Upon reaching the main subject of the report, the Committee commends the British system of negotiation and voluntary settlements in industrial disputes, contrasting it with the attempts which have been made in Australia and elsewhere to enforce settlements by legislation. We agree with the implied view of the Committee that attempts to force either employers or workers to adopt any course by legal measures are foredoomed to failure, and we would add that endeavours of either party to impose conditions upon the other by economic measures (*i.e.*, strikes or lock-outs) are just as futile.

If any conclusions are to be drawn from the report, they are these: That the Whitley system, within the limits imposed by external economic conditions, has justified its existence; and that the study of workers' "welfare" is not only humane, but profitable.

At a recent Press gathering, Sir Arthur Balfour, the chairman of the Committee, stated that a third report, dealing with the condition and efficiency of industry, would be issued later in the year, and that this would be followed by a final report containing the Committee's conclusions.

The Census of Industry.

The disquieting news has lately been made public that the first of the preliminary reports of the Census of Production, recently carried out in respect of the year 1924, is not likely to be issued until the autumn, so that no date can be fixed for the appearance of the complete return. To be of service to the industrial section of the country and to justify the expenditure which a census entails, it is necessary for the results to be issued within a reasonable time. The delay is attributed in official circles partly to the fact that although they were sent out early in 1925, not all the forms have as yet been returned by manufacturers. It has, however, been somewhat tardily recognised that part of the blame is due to the fact that the forms sent out to producers were in many cases far too complicated. As an example of this kind, it may be mentioned that the engineering schedule was a formidable document containing 123 questions under 26 main headings; it has now been found that there are many firms concerned with only about half-a-dozen of these items, to which a much simpler form has lately been sent.

While it cannot be too widely known by manufacturers that the filling-up of the inquiry form is a statutory requirement which in the interests of all should be done as promptly as possible, it is equally important for those responsible for the publication of the Census returns to get them out quickly, as each month the information is delayed takes away part of their value.

The Electricity (Supply) Bill.

At the annual general meeting of the Southern Association of Gas Engineers and Managers in London, last week, Sir Arthur Duckham asked how the gas industry would feel if it were dealt with as a whole by a Bill like the Electricity Bill. According to *The Gas World*, "he thought they probably would feel very sorrowful and unhappy—and he was almost certain that that was the feeling of the electricity industry to-day. The Bill was by far the most Socialistic piece of proposed legislation that had ever been known. It was a Bill providing for Government interference in an established industry. . . . So far as the Bill would affect the gas industry, he believed it would be the finest thing that could happen, because for the next few years electricity development would be stultified." Nevertheless, Sir Arthur deprecated that view, remarking that the gas industry would like to see the electrical undertakings prospering and the country benefiting from the use of electricity for mechanical purposes.

Grateful as we are to the speaker for his kind words, we cannot but feel that electricity is indeed in parlous case when it is openly pitied by its rival. The worst of it is that Sir Arthur has accurately summarised the situation. The electrical industry regards the Bill in its present form with profound distrust and aversion; outside the ranks of its promoters, hardly a single voice is raised in support of its provisions. A powerful indictment of the Bill appeared in *The Times* of Monday last, from the pen of Mr. E. Garcke, who has witnessed the enactment and operation of the whole of the Electricity Acts from 1882 onwards, and earnestly protests against the "intolerable interference by the proposed Board with the responsible management of . . . the selected stations," and the discouragement of capital, and emphasises the fact to which we have repeatedly drawn attention, that relatively small economies can be effected in generation, compared with the large savings that can be made by cheapening the distribution of electricity. Mr. Garcke suggests that "all that is needed for the further progress of the industry is to give the Electricity Commissioners additional powers to overcome the artificial difficulties that exist in the way of the present undertakers marketing their product," instead of which the Bill imposes further restrictions and disabilities on existing undertakers, and "overloads the electricity supply business with Government officials and committees."

As we wrote the foregoing, the debate on the second reading of the Bill was in progress; the Labour Party was opposing it because it would not immediately bring about the nationalisation of electricity supply, whilst a number of Conservatives proposed its rejection because, in their opinion, it would inevitably have that result. The outcome of the debate, a report of which is commenced on p. 563, was that the second reading was carried by a majority of 325 to 127, and the Bill was referred to a Standing Committee.

Whilst going to press we have received from the Secretary of the Institution of Electrical Engineers a copy of a letter addressed to the Prime Minister on Monday, March 29th, which reads as follows:—

"The Council of the Institution of Electrical Engineers, after full consideration of the Electricity Supply Bill, now before Parliament, and the Weir Report, are of opinion that certain of the provisions in the Bill require material amendment, as they are based upon an imperfect knowledge of all the facts, and if embodied in an Act might be detrimental to the national interest.

"They therefore consider that it is of the greatest importance that the fundamental questions upon which the Bill is based should be the subject matter of an inquiry at which the various interests in the electrical industry may be heard before the Bill becomes law."

With this communication we fully agree, though the prospect of further delay is unpalatable—already progress in many quarters has been held up for more than a twelvemonth. It is a pity that such an inquiry was not held months ago. The sooner the whole question is settled and peace restored to a harassed industry, the better.

Electricity Supply at St. Helens.

Recent Extensions at the Croppers Hill Generating Station.

A public supply of electricity in St. Helens was first generated in 1896, by an a.c., 145-kW, 1,000-V experimental plant, erected by the Corporation at Warrington Old Road. The purchase of the tramway undertaking in 1897 by the Corporation brought about the erection of a new power station, combined with a refuse destructor, at Croppers Hill on the site of the present power station, to give a d.c. supply for lighting, power and traction, the supply being commenced in 1899 when the Warrington Old Road station was closed down. The original equipment at the Croppers Hill station consisted of two 125-kW and two 215-kW Mather & Platt d.c. generators, directly coupled to Willans & Robinson h.p. steam engines, four Lancashire boilers, and two Babcock & Wilcox water-tube boilers, the latter being used in connection with the refuse destructor. The station capacity was increased gradually to 1,840 kW in 1911, when an important advance was made by the installation of a 1,000-kW Westinghouse turbo-alternator, together with rotary-converter equipment, the introduction of e.h.p. a.c. enabling the Corporation to supply energy to the outlying districts. Additional turbo-alternators and the necessary boiler plant were installed as the load increased, including one 2,000-kW Dick, Kerr turbo-alternator in 1912, one 3,000-kW Westinghouse turbo-alternator in 1916, and one 5,000-kW Oerlikon machine of that description in 1921. In 1924 the output of the station reached 26,912,000 kWh; it became apparent that still further additions to the plant were essential, and the scheme for the recent extensions was formulated.

The new additions, which were inaugurated on March 23rd by the Mayor of St. Helens, Alderman Thomas Hamblett, J.P., include one 6,500-kW turbo-alternator and condensing plant, e.h.p. switchgear, one 1,000-kW motor-converter, one 40-ton electrically-driven crane, four 35,000-lb. water-tube boilers with mechanical stokers, a wagon tippler, coal conveying and elevating plant, the enlargement of the engine-house building, and the erection of a new structural-steel boiler house.

The turbo-alternator plant, fig. 4, was manufactured and erected by the Brush Electrical Engineering Co., Ltd. The turbine is of the Brush-Ljungström type, 3,000 r.p.m., and is supplied with steam at the main stop valve at 250 lb. per sq. in. at a temperature of 700 deg. F., with a vacuum of 27.5 in. of mercury. It is directly coupled to two Brush alternators having a maximum continuous output of 6,500 kW at 6,600 V, 3-phase, 50 periods, 0.8 power factor. All the main bearings, including the governor and thrust-block bearings, are lubricated by a continuous supply of oil under pressure from a rotary pump driven from the turbine shaft; a separate steam-driven pump is provided for use when starting up. The auxiliary pump can be automatically started in the event of the oil pressure falling below a predetermined value. A powerful automatic governor controls the movement of the governor valves through a pressure-relay system, thus obtaining most sensitive and positive governing. The governor can be adjusted at the turbine by hand operation, and also from the switchboard by means of electric control. The condenser is of the two-flow Brush surface type, capable of condensing 70,200 lb. of steam per hour when supplied with circulating water at a temperature of 80 deg. F., and it will maintain a vacuum of 27½ in. with the barometer at 30 in. The air extraction is effected by means of a Brush-Delas ejector plant having an air duty of 30 lb. per hour when consuming 450 lb. of steam per hour. The water is extracted from the condenser by means of a Drysdale No. 3 "Pervac" two-stage vertical-spindle centrifugal pump, capable of dealing with 86,000 lb. of water per hour, and delivering against a total discharge head of 47 ft., plus 28 in. of vacuum, when driven at 1,440 r.p.m. by a 10-b.h.p., 400-V, 3-phase, a.c. motor. Two motor-driven Drysdale "Bon Accord" pumps of the centrifugal type provide the necessary circulating water for the condenser. One of these pumps is driven by a 120-b.h.p., 480-V, d.c. variable-speed motor, and is capable of delivering 366,000 gallons of water per hour against a head of 50 ft. when running at 870 r.p.m.

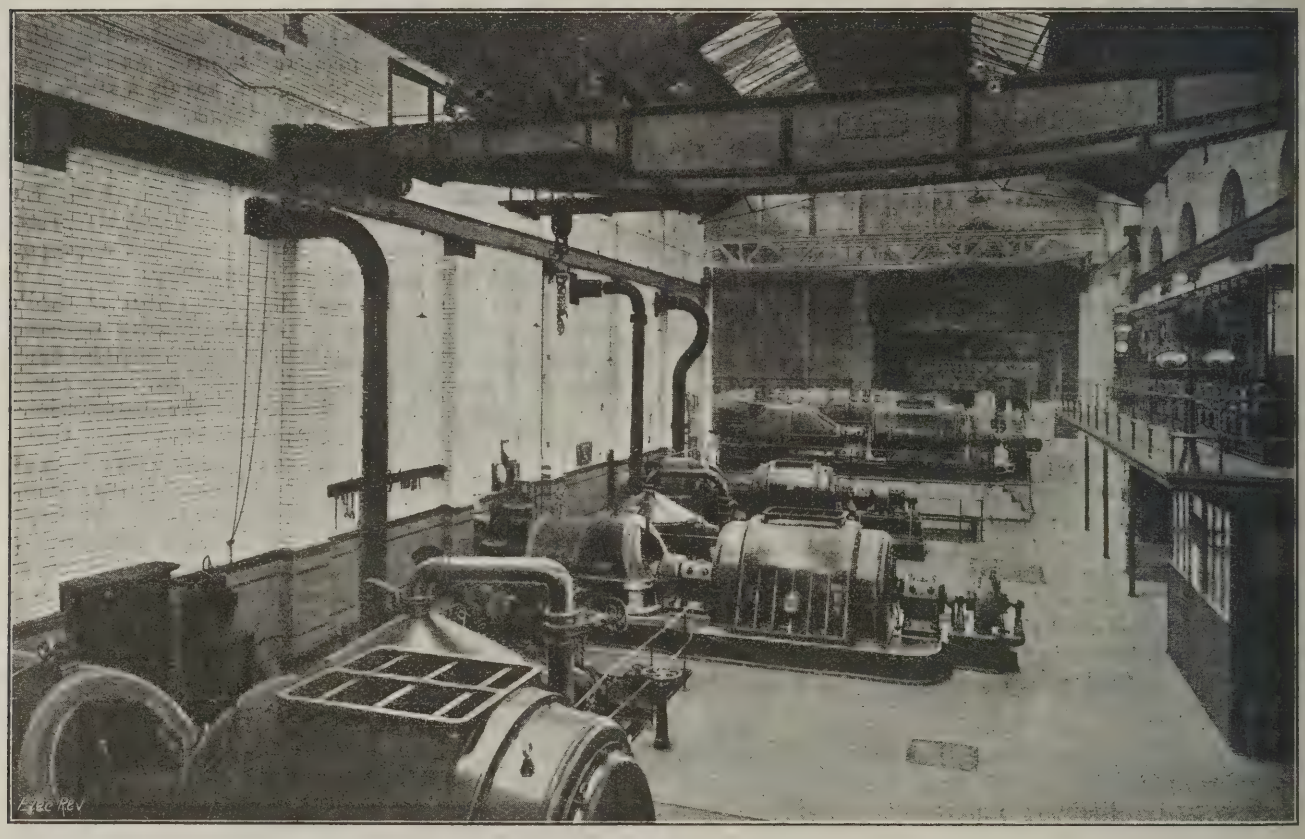


Fig. 1.—Turbine Room at Croppers Hill Station.

The second pump is driven by a 92-b.h.p., 3-phase, 400-V, slip-ring a.c. motor, and is capable of delivering 244,000 gallons of water per hour against a head of 50 ft. when running at 720 r.p.m. The cooling air for the alternators is supplied by a Standard & Oswald Stott fan, driven by a 47-b.h.p. motor, which delivers 24,000 cu. ft. of air per minute. The air is drawn through a Premier wet air filter, and a special alarm device is fitted to give a visible and audible signal in the event of the failure of the air supply. Electrical temperature thermometers are fitted at various points on the turbine, and these are connected up to an indicator mounted on an instrument panel. A Brady & Martin Kenotometer is provided for determining the efficiency of the condenser.

The e.h.p. switchgear was supplied and erected by the British Thomson-Houston Co., Ltd., and forms an extension to the main station switchboard. It includes the makers' standard 6,600-V solenoid-operated remote-control switchgear. The capacity of the oil switch is 1,200 A, the rupturing capacity being 180,000 kVA. The switchgear cubicle is of moulded stone, each compartment being provided with a sheet-steel door. An automatic voltage regulator of the Metropolitan-Vickers type is also provided.

The motor converter, fig. 4, supplied and erected by Messrs. Bruce Peebles & Co., Ltd., is compound wound, and designed for converting 6,600-V, 3-phase, a.c. to d.c. at 480/550 V. Fig. 1 is a general view of the engine room.

The overhead travelling crane is capable of dealing with any load up to 40 tons. For smaller loads up to 7 tons, an arrangement of chain gears is provided for rapid working.

The boiler plant includes four water-tube boilers, fig. 2, with superheaters, economisers, induced-draught plant, steel chimneys, grit arresters, soot-cleaning apparatus, a wagon tippler, coal conveying and elevating plant, coal bunkers, ash-handling plant and auxiliaries, including



Fig. 2.—Boiler Extensions.

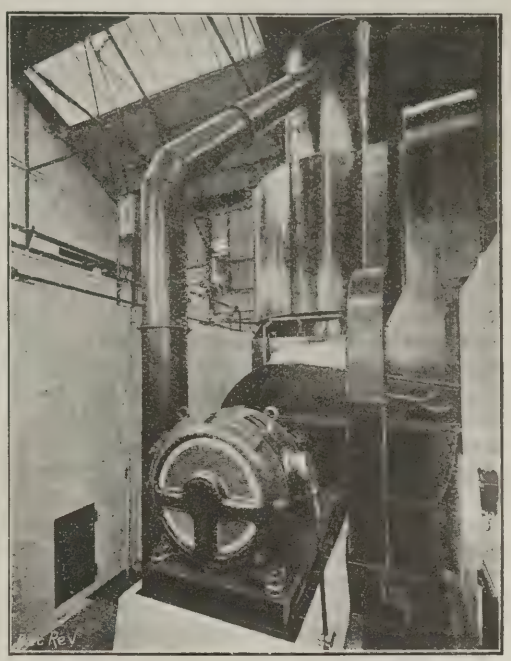


Fig. 3.—Induced Draught Fan.

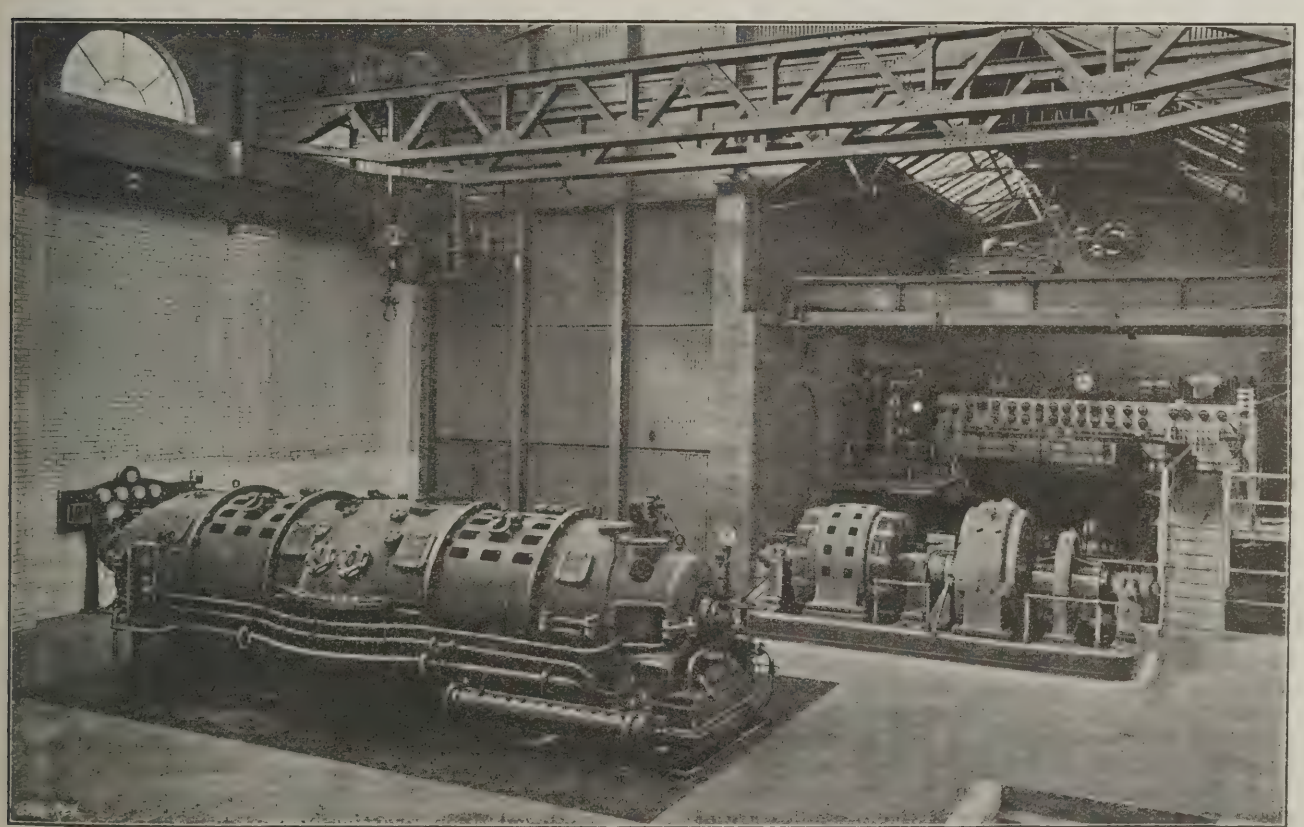


Fig. 4.—6,500 kW. Turbo-Alternator and 1,000 kW. Motor-Converter.

the steam ranges, supplied and erected by Messrs. Babcock & Wilcox, Ltd., and four type-"A" mechanical stokers and ash hoppers, supplied and erected by Messrs. Underfeed Stoker Co., Ltd. Each boiler has a heating surface of 8,019 sq. ft., and is capable of evaporating 35,000 lb. of water per hour, from feed water at a temperature of 110 deg. F., into steam at a working pressure of 265 lb. per sq. in. The external surface of the brickwork is cased with steel plates lined with magnesia slabs wrapped in asbestos. The superheaters have a heating surface of 2,581 sq. ft., and will raise the steam to 750 deg. F. The economisers are of the Green patent ringstay pattern, and each is equipped with 320 tubes arranged in two groups. One chimney and one motor-driven induced-draught fan, fig. 3, are provided for each pair of boilers. The chimneys are 7 ft. 6 in. in diameter, 150 ft. high, and are constructed throughout of steel plates. The fans are of the "Sirocco" centrifugal induced-draught type. A "Sirocco" grit arrester, fig. 3, is fitted to each chimney, and consists of an annular chamber built around the chimney into which the gases from the induced-draught fan are discharged. Adjacent to the inlet to the chimney from the annular chamber there is a patent shunt-type dust arrester connected by mild-steel piping to a cyclone type extractor. A connection is taken from the top of this extractor to the chimney for discharging the flue gases that are carried into the extractor back to the chimney. Each boiler is provided with a "Diamond" mechanical soot-blower installation of the valve-in-head type. To deal with the handling of the fuel, an electrically-driven rotating wagon tippler has been installed, and 12 to 15 wagons per hour can be dealt with. The fuel is tipped into a receiving hopper, 20 ft. by 13 ft., and falls into the elevator pit, whence it is taken by a gravity bucket conveyor and elevator and deposited into the coal bunkers inside the boiler house. The conveyor is capable of dealing with 40 tons of fuel per hour, and has a chain speed of 50 ft. per min. A set of coal-storage bunkers is provided, having a heaped capacity of 500 tons of small coal at 40 cu. ft. per ton. The ash-handling plant is installed in the boiler house basement, where the ashes are taken from the boilers by means of chutes into steel bogies. These are taken along a rail track to an ash hoist by which they are raised and automatically discharged into an ash bunker, prior to being loaded into railway wagons or carts for disposal.

The mechanical stokers comprise eight class "A.7.G." self-contained forced-draught travelling-grate stokers, each having a grate area of 192 sq. ft. Each pair of stokers is capable of dealing with $3\frac{1}{4}$ tons of coal per hour. Two forced-draught fans are fitted to each stoker, and these have cast-iron housings formed as part of the coal hoppers, and one 8-b.h.p., 480-V, direct-current totally-enclosed motor is utilised for driving each stoker and pair of fans.

In order to accommodate the new turbo-alternator plant, the original engine house, the Lancashire boiler house, and works office, have been demolished, the new engine-house extension being erected on the cleared site. The last of the old reciprocating sets have also been removed. The floor of the engine-house extension is 3 ft. higher than that of the other section, except a portion under the 40-ton crane where the original level has been retained to facilitate the loading and unloading of material. The new boiler house has been erected on a site which was occupied by the refuse destructor, so that this structural-steel building adjoins the engine house. The building comprises a basement, 12 ft. high, a firing room, 34 ft. high, and an economiser room, 29 ft. high. Ten compound stanchions support the fronts of the boilers, the coal bunkers and the firing and economiser floors, and extend from the basement to the underside of the main bunker cross girder, and ten roof trusses of 40-ft. span are fixed over the boilers, and are complete with ventilators. The roof is covered with asbestos sheeting secured to the steel purlins with galvanised hook bolts, and six lines of patent glazing extend the full length of the buildings, forming the roof lights.

It is gratifying to see that St. Helens has for a long period progressively held a very favourable position for high efficiency and low costs. For the year ending March, 1923, the working costs were 0.56d. per kWh sold, the average price per kWh being 0.96d. In 1924 the working costs were reduced to 0.49d. per kWh, and the average price per kWh was 0.84d.

In conclusion, we would like to express our thanks to Mr. F. N. Rendell Baker, A.M.I.E.E., the borough electrical engineer and manager, and to the Brush Electrical Engineering Co., Ltd., for their assistance in the preparation of the above particulars.

Second-hand Plant.

Its Waning Influence on Market Prices.

By E. GRAHAM.

Among the many post-war problems which the industrial section of the electrical industry has to face, the problem of second-hand plant has, of late, become pronounced. It is possible to trace qualitatively the history of present second-hand plant, and from that to obtain a clearer idea of current conditions than at the moment appears to be held by many.

It is insufficient to state that the present condition of affairs is simply due to the enormous boom which culminated early in 1921, and then suddenly fell away. While quite a true statement, it goes no further than the words comprising it. It does not, for example, say by just how much has the current situation been so brought about, nor does it say if the present state of affairs is likely to continue or not.

It is therefore interesting to trace the price career of a very representative industrial unit, *viz.*, a direct-current motor of D^2L value about 350 cu. inches. This armature core size represents a motor of the semi-enclosed type, developing about 15 h.p. at 1,000 r.p.m., a unit very comparable with the present actual average output unit. A certain representative maker turning out plant between the limits of 1 kW and 250 kW, reckons 12 h.p. to 25 h.p. per motor as the result of the fraction: total h.p. manufactured ÷ total number of motors sold over the last three years.

In accepting this 15-h.p. machine as representative due cognizance is taken of the fact that its manufacture is entirely dependent upon industrial conditions generally. The demand for the unit arises from those industries requiring means to aid them directly in coping with their own outputs. These concerns first require power and then the means to make use of it. The size of the unit, further, places it outside the range of the domestic load; which is to say, the domestic load only affects the demand for the unit through some other industry. As is well known, industrial electric motors are employed upon practically any duty one can think of: pumps, workshop drives, sugar making, baking, printing, cranes, anything in fact "from a needle to an anchor," so that the 15-h.p. unit chosen really constitutes a remarkably good barometer of industrial conditions generally.

It is to be expected then that any boom occurring in the electric motor trade would occur just prior to a boom in any industry making use of motors. Further, in view of the electric motor's extreme mobility of appli-

cation, it is to be expected that any boom would occur in its manufacture appreciably before a general trade boom. This is actually the case, as will be seen from a consideration of the curve shown herewith.

The graph shows the variation of a certain *maker's* price of the 15-h.p. unit chosen over the period 1913 to current date, and is rather remarkable in its shape. The actual values, while instructive, are of little moment for the present purpose, as the shape of the curve is the main clue to the subject.

According to official statistics of all kinds, but mainly B.O.T., the general trade boom attained a maximum value about January 21st, 1921. Some authorities date it considerably later, others a little earlier, but January 21st seems to be very near the mark. The main maximum of the curve given occurs in September, 1920, bearing out very well the remarks just made.

The law (so called) of supply and demand states, or infers, that the price rate of increase of any given article is proportional to the difficulty of obtaining the article, and similarly that the price rate of decrease is proportional to the ease of obtaining the article. An examination of the curve will show that the two slopes on either side of the main peak attain their maximum values about December, 1919, and March, 1921. The period between these dates is precisely the period of time over which the obtaining of plant of any kind was almost an impossible task. Buyers then could not get early delivery of anything. The reader will well recollect interminable discussions and complaints, in this and other journals, of ill-kept delivery promises and of the many panaceas put forward to cure the trouble. The maker of the industrial units here considered could not then undertake delivery of most orders under eight, nine, ten, and sometimes twelve months. The state of affairs was phenomenal, of course. Manufacturers all over were literally choked up with work. Agents simply had to sit still and stretch out their hands for orders as for tricks at cards.

All this is reflected (or perhaps, foretold) in the curve. From September, 1920, until August, 1921, the curve falls off rapidly, indicating that demand had fallen off, and that all work in hand had been completed. In its turn this caused a slightly better feeling to prevail, plant being more easily obtainable, as is shown by the curve bulging slightly until about April, 1922.

At this point it is meet to notice the dotted curve of second-hand prices for the same unit. This curve was plotted from sales catalogues to begin with, and latterly from second-hand advertisements in various journals. It therefore is not quite so accurate as the other, since the "new" curve is solely based on prices obtaining at the works. Second-hand figures plotted from two different consecutive sources are bound to cover the profits of at least two transactions. The shape of the second-hand curve is, however, sufficiently accurate for the present purpose, which is purely qualitative.

It will be seen that, about February, 1922, the market was evincing a decided tendency to firm up. The memory will recollect, too, that at this time many of our wisest financiers strongly advocated a rigid control, either by the Government or by the great trade associations, of the *rate* of that certain decapitalisation then prophesied. No heed was paid to their counsel, which is seen from the curve to have been wisely inspired. Instead, industry, seriously over-capitalised in plant, made a sudden dash for safety after April, 1922, by attempting to cut all losses as quickly as possible. The period tallies well with the average company's yearly audit. After the books for 1921 had been squared off, the serious position then divulged forced precipitate action upon all over-capitalised concerns, with the net result that plant of every description was practically given away in the mad dash for safety. The state of affairs then is again clearly indicated by the curve. It drops very rapidly from April, 1922, until well on into 1923.

The speed at which plant was got rid of by manufacturers, &c., was only paralleled by the avidity with which it was brought up by dealers of every class and kind. Any man and every man who had any spare cash at all bought plant, whether he knew anything about it or not. Some of them were "bitten," but it must be confessed that the majority have come off fairly well. At any rate the effect on the electrical unit was disastrous, and it was only in October, 1922, that it showed again any sign of steadying up. From that date until March, 1923, the fall was less rapid, the curve reaching a minimum value in March. By that time the gradual slacking-off of sales was beginning to have its effect, for, before the manufactured unit reached its lowest point, the second-hand machine had commenced to rise in value and to rise fairly quickly. That demand which is small, but persistently ever present, had begun to make itself felt once more, and acted conjointly with mutual buying and selling between dealers only. Coupled with the stress of the financial embarrassment of 1922/3, this caused a rapid appreciation in the value of second-hand plant. The more stable part of industry, however, clearly neglected the second-hand unit, so causing the new unit to steady up.

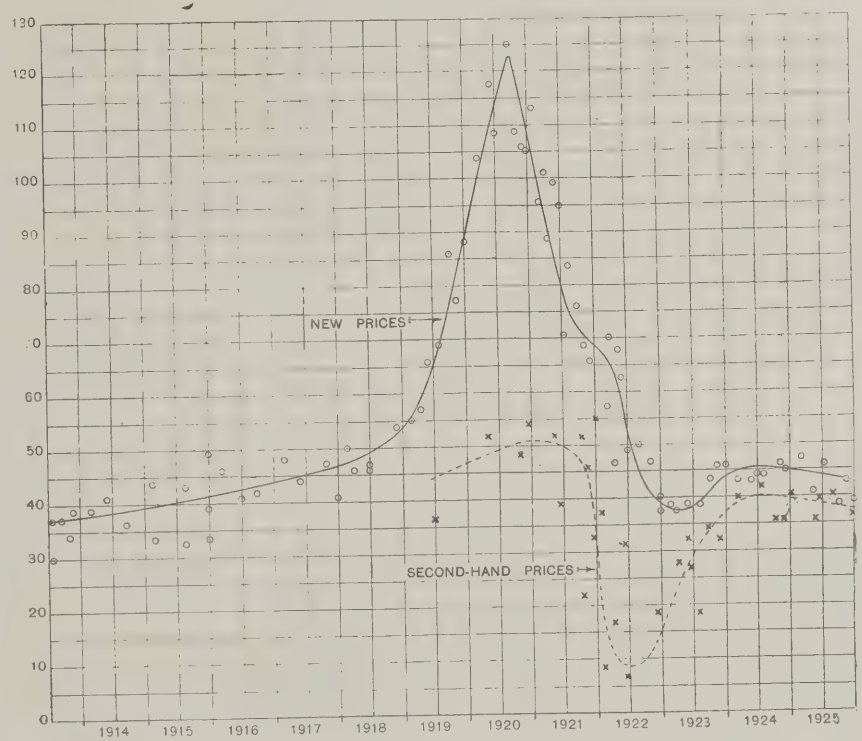


Fig. 1.—Variation in Price of a Certain Make of 15-h.p. Electric Motor.

Second-hand values attained a maximum about July, 1924, just as a flattening-out of the price of the new unit began to take place, indicating that the economic conditions necessary to cope with the small steady demand mentioned were, at that time, generally fulfilled. That is to say, the total amount of plant then capitalised stood at an economic figure.

This state still holds to date, for, at the point noted, the second-hand curve becomes appreciably steady, falling only slightly until to-day. It should be noted, though, that exactly steady figures of second-hand gear are not too easily obtainable now, and from the current falling-off of the new unit curve it is possible that at present the relative value of second-hand plant is a little lower than that shown. At any rate, it is not much higher, but however so, encouragement is to be found in noting that the difference betwen the two curves is only about ten per cent.: not too much when all is said and done.

and even this ten per cent. difference is now being wiped out, as the following experience shows.

A certain industrial electrical concern of late has instituted a thorough system of searching the second-hand columns of all the most important daily papers in the country. Where a second-hand machine is advertised for, a new machine is immediately offered at a very keen figure. True, the total number of advertisements is not great. About a dozen per week is reckoned a good figure, but the firm estimates that out of every twelve quotations submitted in this manner, two orders result, and these mainly from new customers. Other firms are very likely acting similarly, and it is quite likely that the major portion of the remaining ten machines is secured against the second-hand plant in a similar manner.

Thus the curves cannot be widely out, and the obvious moral is that things generally are approaching a condition of stability once more.

That present new prices are so competitive means that dealers now selling second-hand gear are in such a position generally that for them to lower second-hand values would spell loss, for, actually, plant that is now "second-hand" is very likely "third hand." The rise in the second-hand curve until July, 1924, was too rapid to be explained by industrial buying alone. Industry had then too lately got rid of the plant, and naturally did not re-buy. The appreciation, while affected by the small permanent demand, was largely due to buying and selling between dealers themselves. The majority of dealers who bought in the slump days have now got rid of the gear to other, and perhaps less fortunate, brethren, who cannot now afford to sell at anything like the prices ruling when they bought, and this is made the clearer if it be noted that the rate of absorption of second-hand plant is fairly proportional to the slope of the second-hand curve, at present sloping down very slowly. This means that the rate of absorption has passed zero mark and is now negative, which, in its turn, means practically that second-hand plant has had its day.

This is not surprising when, in addition to the foregoing, it is considered how much entirely special gear was in use prior to the slump. The rigorous demands of mass production resulted in a flood of machinery made solely for one or two purposes being supplied to industry generally. Naturally, in slack times, a general purpose machine takes the place of several of these highly-specialised machines, with the result that, when the sales took place, the latter were among the first to be thrown on the market. They are still there, and they are causing much trouble to both dealer and manufacturer alike. The dealer cannot get rid of them, and the result is that the maker is now engaged in rectifying second-hand plant that had been "faked" up to suit normal duties. No guarantee being available, the plant is peculiarly liable to all kinds of "touching up," as an example or two will show.

A batch of vertical motors was bought up by dealers who altered the machines by simply cutting off the stools and turning the motors on their sides. A few weeks later the original makers were inundated with complaints of bad bearings, bad everything. It transpired that no alteration had been made to the hollow bearing carrier or single thrust bearing. Instead of being mounted on the solid shaft and suitably clamped, the bearings were left loose. Naturally the fat was in the fire, and how much potential business has passed the makers as a result of the psychological effect of the trouble is hard to estimate. It must run into hundreds of pounds!

It is a common occurrence to come across a second-hand motor, originally designed for, say, 440 volts, 1,000 r.p.m., sold with only the fields paralleled to run at the same speed and power on 220 volts.

A machine, originally designed for 220 volts, had its interpoles removed and its field coils connected in parallel for 440-volt running. Similarly, some slip-ring machines were re-sold with the rings shorted, and "suitable for switching on the line." Perhaps the reason for this was that the motors had already been run minus the brushes on one ring, and that the starting resistances had been removed, likewise the time lags from the circuit-breaker. Again, odd squirrel-cage motors will be found mounted on channels with odd ram pumps, no provision being made for by-passing the pump at starting. One plant of this kind further had a link removed from the starter, so causing the motor to run on single phase. Certain motors, heavily compounded for driving flywheel-operated machinery, were actually used as battery-charging dynamos by cutting out the compound winding. Strange to say, trouble did not arise until field regulators were inserted!

These abnormalities could be amplified almost indefinitely, and they have had their effect. Buyers have had their "medicine." Hence they are slowly leaning over to new plant, provided that the price be suitable. The present difference of approximately ten per cent. is evidently sufficient to effectively counterbalance constructional and guarantee disadvantages, and, therefore, new plant is once more coming into its own. While new prices are still falling slightly the (to all intents and purposes) parallelism of the two curves shows certainly that the influence of second-hand plant is surely waning. The falling of the second-hand curve commenced 15 months ago, and the rate of fall is appreciably steady, a certain sign that second-hand gear is no longer exercising a potent attraction on buyers in general. Individual instances, of course, must still have their influence on the general situation, and it is probably these instances which have caused the slight fall in new prices, it being borne in mind also that not very long ago "ring" prices were cut rather considerably. (The curve does not represent ring prices). It is felt, however, that this is only a temporary phase, and that it is reasonable to expect, with the more complete sifting out of good and bad second-hand plant in process of time, that the curve of the new unit will again rise.

The process must, of necessity, be slow. Cost accountants know full well that at present industrial electric motor prices are of the order of 20-40 per cent. on net material alone, a state of affairs bordering too closely upon the dangerous to give cause for any satisfaction. Only the most modern methods of production can cope with this, and then only if the market exists.

Fortunately, from the decreasing effect of second-hand plant, it may be taken that the market, if not at present existing, is again in the process of gradual creation, and the near future may, therefore, be regarded with greater confidence than has hitherto prevailed.

Preserving Power Poles.—The power pole problem is causing considerable perturbation among Power Boards in New Zealand, and the increasing scarcity of native timber is making the problem a contest between foreign timber and home-grown makeshifts, with a possibility of the concrete pole slipping into first position as the result. Several Power Boards have experimented with home-grown foreign timber, imported poles, and native timber not hitherto proven satisfactory for pole purposes, and the results have not been very reassuring, inasmuch as many of the experimental poles rapidly deteriorate under weather pressure, resulting in bad breaks and some serious accidents and fatalities.

The Thames Valley Power Board, N.Z., has been experimenting with poles under similar conditions, and has instituted a further test of methods of preserving poles from weather effects. The first series of experiments were with State Forest Service poles erected in sandy soil in an exposed situation, and six different species of timber were included in the test. The experiments were conducted by Mr. N. G. McLeod, the Board's engineer, who tried some 13 different treatments. The first trees were treated with a special preservative mixture in two different strengths, either brushed on hot, or the poles dipped therein. Hot creosote, brushing or dipping; butt charred without other treatment; butt charred and creosote dipped; and butt charred and dipped in hot tar, were the other methods used. A complete check of the trees and their treatment has been recorded by the Board, while observations will be made from time to time to ascertain the results, and a valuable record for posterity should result.

Eve Essential.—At the sixth conference of the season of the North-Eastern Area Sub-Committee of the British Electrical Development Association, held on Wednesday, March 24th, at Newcastle-upon-Tyne, Miss Anna Holm spoke on "Women's Influence in Electrical Development."

Oil Engines in Parallel.

Test Results of Two Heavy-Oil Engines on Electrical Load.

It appears to be not generally realised to what extent success is met with in the running of oil engines in parallel on electrical loads, particularly in connection with 3-phase a.c. supplies. In this connection some culars of two 100-h.p. heavy-oil engines, made by the the Campbell Gas Engine Co., Ltd., which we recently saw under test, driving 3-phase alternators in parallel, together with an outline of the test results, may prove of interest. The engines were built to the order of the Crown Agents for the Government of Ceylon, where the

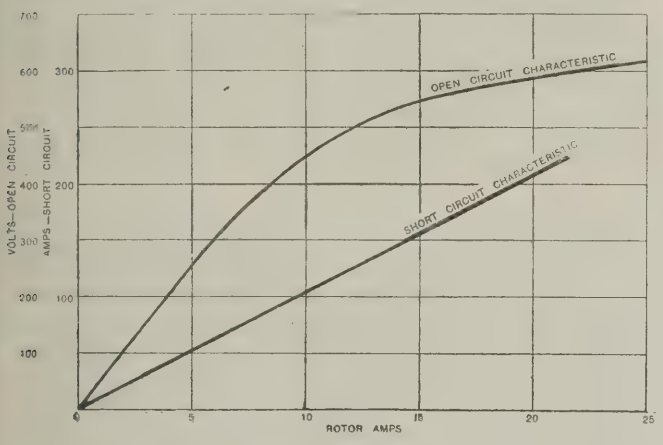


Fig. 1.—Alternator Characteristic Curves.

plant is to be installed with a view to its possible future running in parallel with hydro-electric plant. The engines are identical in every way, and are of the four-cylinder pattern. Each works on the four-stroke cycle, and the fuel is injected through a mechanical atomiser at the end of the compression stroke. Probably the most interesting feature of the engine, to which no doubt the successful results obtained are due to a large extent, is the governing system. Each cylinder is served by its own feed pump, and the stroke of this is varied by the governor through a system of cam and lever apparatus. The governor is of the ordinary spring-loaded centrifugal type, and varies during its operation the vertical position of a small roller mounted at the end of a suitable arm. This roller forms the fulcrum of a lever, one end of which is in contact with a projection of the feed-pump plunger, the other end being acted upon by a cam carried on a horizontal shaft which is worm-driven from the main crank shaft.

The engine is started from cold by means of compressed air without any preliminary heating, the necessary ignition commencing automatically. Starting valves are provided on two cylinders. The governor, which is fitted for hand control, is gear driven, and is designed to maintain constant speed within 5 per cent. for a momentary load variation from full to no load, and 3 per cent. for a permanent variation. The flywheel is of the heavy type, with a coefficient of speed fluctuation not exceeding 1/250. The cylinders are water-jacketed, being provided with removable liners. The inlet and exhaust valves are cam operated. Forced lubrication is provided to all the enclosed bearings, the pressure being produced by positively-operated ram pumps.

During the tests the engines were directly coupled to two 55-kW 50-cycle alternators, made by the Lancashire Dynamo & Motor Co., Ltd., and two 3.75-kW shunt-wound exciters of the same make. The engines were first run on a five-hour full-load test for steady running and fuel-consumption observations. During that period the maximum load variation on "A" engine was between 54 and 55.8 kW, and the average fuel consumption amounted to 0.654 lb. per kWh, or 0.420 lb. per b.h.p.h., the alternator efficiency being 86 per cent. The maximum load variation on "B" engine was between 54 and 55.44 kW; the fuel consumption was 0.708 lb. per kWh, or 0.459 lb. per b.h.p.h., with the same efficiency for the second electrical machine.

A two-hour overload test was next applied to the machines running in parallel, when a steady load of 68.4 kW was maintained on each machine. An extra overload was further put on the parallel engines, when each took 73.8 kW. Another test included the instantaneous throwing of the load of one machine to the other by breaking the circuit of the first alternator; this process was also reversed. The engines were further subjected in parallel to variations from full load to quarter load in about 20 seconds. The last three entirely successful operations were not included in the official tests, as laid down by the consulting engineers, but were undertaken at the request of ourselves to subject the machines to as severe a test as the facilities available would permit.

The official tests were carried out under the supervision of Messrs. Preece, Cardew & Rider, consulting engineers to the Crown Agents.

Reference to the characteristic curves of the alternators, fig. 1, will no doubt add to the interest of the above particulars. Fig. 2 shows one of the sets complete as it appeared on the test platform.

In conclusion, we are indebted to the Campbell Gas Engine Co., Ltd., for the facilities offered to us to see the engines under test and collect the above particulars, and to the Lancashire Dynamo and Motor Co., Ltd., for placing the characteristic curves of the generators at our disposal.

Motor Vehicles Parade.—In connection with the London and Home Counties Division of the Commercial Motor Users Association, the twentieth annual parade took place in Lincoln's Inn Fields on Saturday afternoon, the object being to encourage drivers to take a personal interest in the driving and the condition of their vehicles. About 200 vehicles had been entered, 144 being petrol driven, 24 steam, and 15 electrical. A feature of this year's show was the section for electric vehicles, of which there have never previously been more than half-a-dozen, but in view of the co-operation of the British Electrical Development Association, which, in addition to nominating two special judges, awarded a number of prizes for the best electric vehicles on parade, the number was likely to increase. Willesden District Council took first honours in the electric-vehicle section. Prior to the parade a large company was entertained to luncheon at the Savoy Hotel; Mr. W. McDowall occupied the chair, and Lt.-Col. J. T. C. Moore-Brabazon (Parliamentary Secretary, Ministry of Transport) was the principal guest.

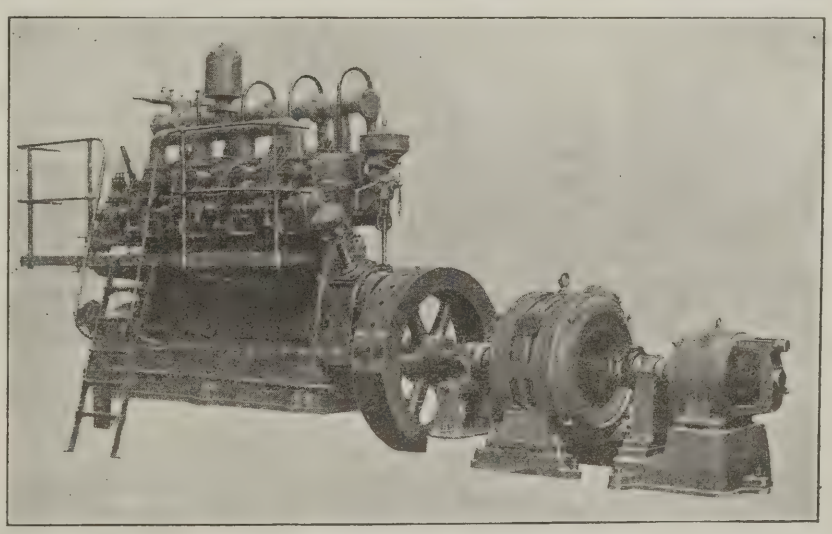


Fig. 2.—Complete Engine and Alternator Plant.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Country-House Fires.

The facts regarding two of the recent but not serious country-house fires reported in the daily Press may be interesting to your readers.

The electrical installations were carried out in screwed steel conduit by my firm, and nothing electrical was to blame.

Both fires were definitely traced to old boiler flues, used for new boilers of about 10 times greater capacity than those in use up to five or six years ago. In one case, the fire broke out right up on the second floor, and in the other on the first floor. Something else might have been blamed if the cause could not have been traced fairly easily.

One fire was put out by means of pails of water and a local fire engine, but resulted in considerable damage, and the other was got under quickly by means of an electrically operated fire protection plant and a well-trained staff of servants.

Installation work in country houses where generating plant is employed is usually of better quality and workmanship than in town houses, the reason being that consumers, architects, and consultants select their contractors with greater care and price is not always placed before reputation.

The consumer will often, unfortunately, allow a chauffeur or semi-skilled engineer to make small extensions and alterations to existing wiring, and the fire risk in that work is sometimes serious. I have seen good jobs spoilt by these extensions, carried out carelessly on motor-car wiring lines.

H. T. Young,
Pp. Troughton & Young.

London, *March 22nd*, 1926.

"Yet more mansion fires caused by the fusing of electric wires."

The monotonous recurrence of the above statement in the daily Press calls for very serious consideration and explanations.

Electricity is now considered without a rival as an illuminant, and a very convenient vehicle for power for all purposes, and should be absolutely safe. But, unfortunately, it has become such a willing servant and *so* docile that any Dick, Tom or Harry considers himself an expert electrician and forthwith runs a pair of wires *via* a switch to a lamp, and forsooth the lamp lights!!

Granting that the first installation is put in by a reputable firm with conscientious men, they hardly turn their backs when another light is wanted somewhere, and the chauffeur or head gardener, or some other handyman undertakes the job, quite oblivious of any rules even of common sense, much less the I.E.E. rules.

Now if every insurance company were to employ a qualified electrical engineer to examine all installations occasionally, he, with his Megger, galvanometer, and battery could very soon detect the various little slips committed by the local tiro, and save the client the unfortunate loss of valuable things and sometimes lives that cannot be replaced, besides much good property.

If the engineer only saved one fire a year it would pay his salary many times over, and save much heart-burning and regrets. At the same time he could cast an inquiring eye on the fireplaces to see if the local jobber had concreted the hearth properly before putting in that beautiful modern well grate in the various entertaining rooms.

Now, even those insurance companies that have an engineering branch affiliated do not cause very careful tests to be made for insulation, continuity, and earthing of a lighting and heating installation. They concentrate on the moving machinery—prime movers, generators, motors, &c., leaving the vulnerable cables, fittings, &c., to chance.

I suggest that for the sake of the electrical trade, and insurance business, independent examination of all installations should be made compulsory.

J. Price.

Manchester, *March 25th*, 1926.

The Government Electricity Scheme.

I must protest against Mr. Hodges's diatribe in your last issue. I was comparing 1924 costs with 1924 charges according to Garcke, 1924-25, the latest figures available to one not connected with Mr. Hodges's company.

But since my last letter, both the draft Electricity Bill and the Weir Report have been issued, and I now feel that we can calm Mr. Hodges's fears. In all probability his bulk supply will cost him much less than 3d.; in any case, he will not be called upon to pay more for his electricity than his present total cost of generation. After reading the Weir Report, one feels inclined to say that Mr. Hodges's figure of 3d. per unit of bulk supply at his works is much too high.

These two facts, I feel, sufficiently answer Mr. Hodges. But I must protest against his drawing a red herring across the trail by comparing his purchase price with his lowest selling price; although in 1924 he was selling *some* electricity at 1½d. per unit, his average revenue (according to Garcke) was 7.39d. per unit: obviously offering a sprat to catch a mackerel, a policy which, according to his letter in your issue of February 26th, is "sheer folly and absolutely uneconomic"!

H. J. Allcock.

Manchester, *March 26th*, 1926.

[This correspondence is now closed.—Eds. Elec. Rev.]

Electrical Engineers' Data Books.

Referring to your review of the above books in your issue of March 26th, I understand from the publishers that the first few copies of the books were bound, for some reason (or lack of reason) unknown to me, with the indexes in front of the appendices. This was quickly rectified, but as copies for review are the first to be sent out, you apparently received one of the few with the index so misplaced.

With reference to the two-volume arrangement of the work and your statement that it would have been better to combine Vols. I and II, I should like to point out that Vols. I and II can also be purchased bound in one volume with one appendix, and in this way it may be obtained at the reduced price of 28s., instead of 15s. each volume.

D. V. Onslow, A.M.I.E.E.

London, *March 27th*, 1926.

The Qualifications of a Salesman.

I read with interest and amusement the advertised vacancy for a sales assistant, appearing in your columns to-day. It appears that applicants are particularly requested to state among other things, birthplace, college attended, &c. The point I wish to raise is this: Have a man's birthplace and the names of his colleges, as such, any bearing on his abilities as a sales assistant? Presumably the odds are in the applicant's favour if he were born, say, in Criccieth rather than in Wigan. The questions of vaccination, measles, &c., were omitted, doubtless reserved for the "personal interview."

Your advertiser runs a grave risk of overlooking the man who can *do* things, in favouring a man whose qualifications will probably extend no further than a high-sounding college name, and the possession of a three-valve wireless set!

Can British employers learn nothing from democratic America, where "efficiency" counts, and a man is given the opportunity to "prove" himself?

Qui Pense.

March 26th, 1926.

The Single-phase Earth Return System.

Owing to an appointment in the country I was prevented from attending the discussion on "Electro-farming" at the Institution of Electrical Engineers; I should have liked to refer to the single-phase earth return system, which is mentioned by Mr. Borlase Matthews in his reply, because I feel certain that until this system is permitted in this country, the cost of electricity for rural districts will be prohibitive.

I have only advocated this because I have seen what has been done in other parts of the world in rural districts by the adoption of this system. There are practically no uses of electricity in rural districts that absolutely necessitate the use of a 3-phase system. There seems to be still an unwarranted prejudice against the use of single-phase motors even for small powers. Surely, when, broadly speaking, single-phase earth returns can be adopted in crowded cities to drive railway trains, the interference with other electrical systems can be overcome. Universal three-phase is a craze, and people will not realise what single-phase can do.

I have not referred to the subject for some time because it seems like beating the air, and an ordinary person has not got the time for that. At the same time it is worth pointing out that in about half the cases I am interested in, we are able to buy electricity at reasonable rates, invariably on the three-phase system, and in the other half local generation has to be resorted to. I can unhesitatingly say that were single-phase earth returns permitted, in no single case would it be necessary to erect a local generating station.

A. Hugh Seabrook.

London, *March 26th*, 1926.

Printing Office Lighting.—An interesting and novel lighting scheme has recently been introduced into the *Daily Express* machine rooms. The printing presses are now illuminated by 100-W White Osram gasfilled lamps suspended around the machines, superseding the older method of installing lamps in difficult and inaccessible positions amid the machinery. The great vibration of the modern printing press demands the use of lamps which will stand up to the severest conditions, at the same time maintaining such an intensity of light as will enable any mechanical defects in the machinery to be instantly observed, and removed whilst the machines are running. An interesting sequel to this installation was afforded when a quantity of molten lead was spilt over one of the lamps; the latter was withdrawn by its flexible cord, with several pounds of lead adhering to it, and it remained lighted.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

"Nick-o-Time Tunometers."

The above-named products of the Tunometer Works (proprietors: M. & A. Elliott) are interesting in that they are claimed to be the only commercial type of "infinitely variable all-wire tuners available for adaptation to electromagnetic coupling, allowing high inductance to be obtained and reactive capacity tuners to be dispensed with on wavelengths below 600 metres. The sample aerial and reaction tuners and fixed inductance coils which we have received are excellently made and an important constructional feature may be noted: The plated 18-gauge bare copper coil is uniformly spaced as indicated in fig. 1, and a rotary contact wheel is employed to enable the wavelength desired to be accurately tuned without the aid of a condenser, giving fine adjustment, greatest inductance, and minimum capacity. The A-type coil itself, in conjunction with the average aerial, should tune to 368 m.; by removing the shorting plug and inserting the standard 35 to 50 coils, it should tune to 600 m., and for reception on 1,600 m. the tunometer may be shunted with a 0.0003 mfd. variable condenser, which, however, should be completely switched out of circuit when working in the B.B.C. wave band. It may be pointed out that although the wire appears to be embedded in the groove in its ebonite former, it is not so, as the wire makes contact with the former throughout the length of each spiral at only two points, which feature results in low distributed self capacity. The small losses, uniform coupling, and regular convolutions of the conductor make the use of only a small amount of reaction necessary, while the reduction of capacity which is possible by the use of these coils makes the use of a low-impedance detector valve desirable, similar to the B.T.-H. "B4."

The aerial "series vernier," fig. 2, is similar in construction, affording a means of fine final control. It is provided with a neat ebonite fixing bracket, which may be easily removed if one-hole attachment is preferred; the terminal of the outer convolution is preferably connected to the aerial side.

Plug-in type nox-variable inductance coils are also made in the same manner; as no two turns come into contact or cross each other throughout the length of the spiral, the condenser effect between turns is reduced greatly. The method of construction implies great mechanical strength, and such coils will not absorb moisture, being easily cleaned with a duster.

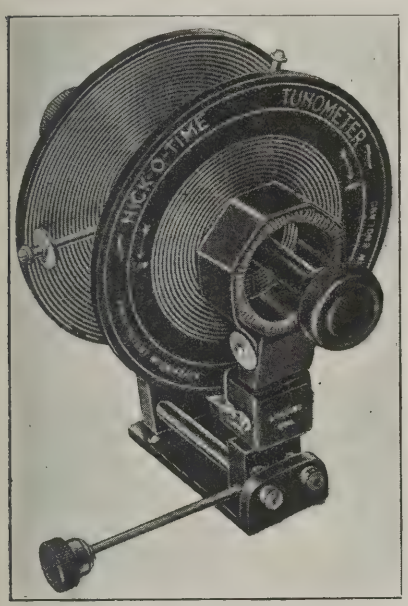


Fig. 1.—"Nick-o-Time" Reaction Tunometer.

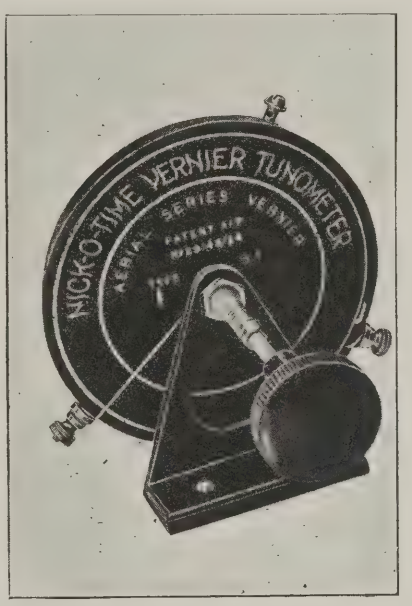


Fig. 2.—Aerial "Series Vernier."

A New Accumulator.

We are informed that the Hart Accumulator Co., Ltd., has recently placed a new low-pressure accumulator cell on the market for radio work. It is said to be specially made for use in conjunction with dull-emitter valves, and is known as the "Enduro." A strong glass box is used having internal ribs, between which the five plates are fitted, and a sealed glass lid is provided. The 2-volt cell has a capacity of 10 Ah (20-hour discharge rate) and weighs about 5 lb. with acid; it is 2¾ in. long, 4 in. wide, and 5⅞ in. high. When a larger cell is required the "Magno" type (25/50 Ah capacity) is available.

Apropos recent references to the radio-telephony of Mr. Derek Shannon, of Sutton Coldfield, who "succeeded in speaking . . . to a man in Mexico City . . .," we are informed that the results were secured with the aid of two 100-volt "RAO"-type Hart high-pressure batteries.

Loud-speakers.

Surprisingly good results are obtainable with home-made loud-speakers. The "Lissenola" attachment, in conjunction with a paper diaphragm, or horn, can be made to give good results, and experiments in this connection should be fruitful. Dr. Lee de Forest's latest invention is said to be the "Audalion," that utilises a paper cylinder which receives vibrations from a reed; it is claimed that the instrument radiates sound uniformly in all directions. Another new speaker is the invention of Dr. N. W. McLachlan, who recently demonstrated it in the course of a lecture before the Radio Society of Great Britain. It is of the cone type fitted with an external annular baffle to balance the upper and lower tones.

A Buoyant Valve-holder.

Designed to impart buoyancy to the valve and protect it from vibration, the holder illustrated in fig. 3, of which we have received samples from Messrs. Garnett, Whiteley and Co., Ltd., have given satisfaction in service. As is shown in fig. 3, the centre piece, which contains the phosphor-bronze valve-leg sockets, is free to move in all directions, stops being provided to protect the nickel-silver springs when inserting and removing the valve. The holder is made of genuine Bakelite, the leg sockets are recessed to prevent shorting, and the terminals stamped G, FF, A on both sides.

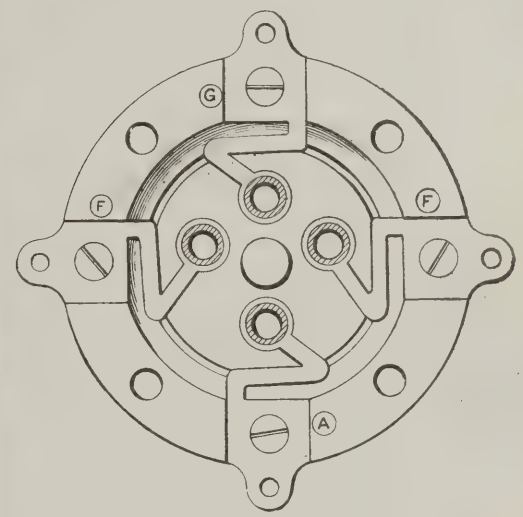


Fig. 3.—"Lotus" Valve-holder.

Variable Condensers.

The General Electric Co., Ltd., has added another unit to the range of "Gecophone" low-loss, slow-motion variable condensers. The original series were of 0.001, 0.0005, 0.0003, 0.00025, and 0.0002 mfd., and the new addition is 0.0001 mfd. They conform to the modern principle of one-hole fixing, and the large control knob with which each is fitted allows the setting to be altered to a very fine degree, the absence of cut gears giving smooth movement.

Novel Scissors and Knife.

A pair of scissors which should be useful to those who delight in assembling radio apparatus at home has been patented by Messrs. Christopher Johnson & Co., of Sheffield. The device should enable components to be mounted without the use of any other appliances, for it combines a universal spanner for round and hexagon nuts; bent shanks, which keep the fingers clear of the panel and enable nuts to be gripped in parts difficult of access; bevelled edge sharpened for cutting rubber insulation and scraping enamel or cotton covering off wire; strong scissors for cutting tape, &c.; wire cutter; a deep-cut file on the back for sawing and a finely-cut file on the side; and a screw driver. The scissors are 4½ in. long.

A somewhat similar tool, but in the form of a hand-made pocket knife, is marketed by Geo. Ibbertson & Co. This Sheffield product has a hand-forged steel blade, which is relieved of work it should not be made to do by the provision of a tool that serves as a screw driver. The flat under side and one of the bevels are file cut, while the other plain bevel is ground to an edge suitable for wire scraping and has a notch for the removal of insulation. At the opposite end to the blade is a pair of wire cutters.

Legal.

Theft of Electricity.

At the Eccles Police Court on March 22nd, Thomas Henry Willcocks, Eccles, was summoned for fraudulently abstracting electricity from the Corporation's mains. For the prosecution it was stated that the defendant's installation was supposed to consist of 80-W lamps, and he was charged on that basis. A Corporation inspector found that the defendant had substituted 100-W lamps and had tampered with a current limiter, putting it out of circuit. Defendant stated that he knew nothing at all about electricity. One night the lights went out, and he undid the seal of the limiter and fastened some wires inside.

A fine of 40s. was imposed.

British Thomson-Houston Co., Ltd., v. W. A. Tunstall, Ltd.

In the Chancery Division on March 23rd, before Mr. Justice Lawrence, Mr. Trevor Watson mentioned the motion against the defendants, trading as the Novelty Co., in which his Lordship had granted an *ex parte* injunction, restraining the defendants from infringing the plaintiffs' lamp patents.

Mr. Watson said that it was a case in which the defendant company, a limited company, was apparently trading under a name other than its own.

Counsel for the defendants said that there was an affidavit from the liquidator of the company, who was pendant to the action, and another by Mr. Wm. Alexander Tunstall. The affidavit of the liquidator explained that immediately the defendant company went into liquidation, the premises and business at 311, Gray's Inn Road, formerly belonging to the defendant company, were taken over by Mr. Tunstall in his own name and he had been trading as the Novelty Co. The defendant company was registered as the proprietary of the business carried on as the Novelty Co., and since it went into liquidation it had been the practice to strike out its name on the stationery. The affidavit of Mr. W. A. Tunstall stated that he formerly carried on business at Hornsey as the Novelty Co., a registered name. The defendant company was incorporated in February, 1922, and registered as the proprietary of the business carried on by the Novelty Co. When it went into liquidation he took over the premises, trading as the Novelty Co. in his own name.

Mr. Trevor Watson suggested that the writ should be amended by adding Mr. Tunstall as defendant.

His Lordship said that Mr. Tunstall was willing to give an undertaking.

Counsel for the defendants observed that they might take the writ as amended, and he would undertake to enter an appearance for Mr. Tunstall.

His Lordship instructed the defendants to give an undertaking not to sell or deal in the lamps until judgment or further order, costs to be costs in the cause.

Theft Charge.

At the Old Street Police Court on March 26th, Walter Fredk. Crispe, 31, traveller, of Mitcham, was charged, on remand, that being bailee of £6 15s. 9d., the moneys of John Eastwick, radio manufacturer, 118, Bunhill Row, E.C., he fraudulently converted it to his own use and benefit. Detective-sergt. Weir said defendant pleaded guilty when previously before the Court and there was a remand that there might be communication with respect to another case. He (the officer) had received a message to the effect that the trader in question did not want to proceed with it. Mr. Snell said that he would remand the defendant in custody for a further week. If he then heard a good report of defendant, he would let him go.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Strike Averted at Birmingham.—On March 23rd, the Salaries, Wages and Labour Committee of the Birmingham Corporation considered the application of electrical fitters in the Gas and Tramway Departments for the raising of their wages to the level of those paid to fitters in the Electric Supply Department. The Committee decided to accede to the demand, and the men accordingly withdrew the strike notice which they had given.

E.D.A. Activities.—A short time ago it was announced that the Electric Vehicle Committee of Great Britain had been reconstituted under the auspices of the British Electrical Development Association. We have now received from the latter body three illustrated pamphlets in which the advantages of the electric vehicle are put forward in an interesting way. Three applications of the vehicle are dealt with, *viz.*, for electricity supply undertakings, for refuse collection, and for delivery purposes. Emphasis is laid upon the lack of noise and odour, the ease of control, the economy and the cheapness of maintenance of the electric vehicle.

Overseas Orders for British Firms.—Among recent contracts secured by members of the British Engineers' Association are the following:—Messrs. W. H. Allen, Sons & Co., Ltd.—Pumping machinery for the main drainage of Cairo, including electrical plant; International Electrolytic Plant Co., Ltd.—Plant for the production of hydrogen and oxygen for France and America; Messrs. Petters, Ltd.—Engines for installations supplied by the British General Electric Co., Ltd., South Africa; the Anderson Grice Co., Ltd.—Four-motor electric locomotive cranes for New Zealand; Messrs. Bruce Peebles & Co., Ltd.—Two 7,500-kW alternators for the Lake Coleridge hydro-electric scheme, New Zealand; and Alloy Welding Processes, Ltd.—Three two-operator arc-welding machines for the Eastern Bengal Railway.

Wages in the Engineering Industry.—A conference was held in London on March 24th in connection with the application of the engineering trade unions in the London area for an increase of 2os. per week in the wages of their members. After a discussion lasting seven hours no agreement was arrived at, and the matter will now be referred to the central conference

Chinese Tariff Increases.—The Chinese authorities at Peking have put forward a list of proposed surtaxes on foreign imports ranging from 2½ to 27½ per cent. *ad valorem*. In Class E, in which goods are subject to a 7½ per cent. surtax, the following items appear:—Electric wires, cables, switches, roses, cleats, batteries, transformers, motors, and materials of all kinds not otherwise specified, except dynamos and motors (*sic*); and telegraph and telephone materials of all kinds. Class D, subject to 12½ per cent. surtax, includes electric lamps and lampware, shades, pendants, brackets; fans and accessories; electric cookers, toasters, radiators, irons and similar electrical appliances

Lead.—Messrs. James Forster & Co., reporting on March 27th, stated that the fresh fall in prices had put a check to any small improvement in demand, and consumers had practically withdrawn from the market. As little influential support was forthcoming, it seemed likely that the price would go to an even lower level until the restoration of confidence. "On the other hand, the position is not without some bright spots. There is a vast amount of buying to be done by consumers, particularly cable makers, few of whom have bought their supplies further than a few weeks ahead. Moreover, there is a better demand in Germany, and the lower prices in London will serve as a check to further selling of lead for forward delivery."

The American Radio Industry.—According to an American trade paper, quoted by the *Wireless Trader*, the radio industry of the United States is in a chaotic condition owing to over-production. One of the leading firms of radio manufacturers produced 300,000 multi-valve receiving sets during 1925 which remain unsold, and other firms find themselves in a similar position. As a result of this the prices of sets have been cut to ridiculous figures; multi-valve sets have been sold at as low as $10. In one liquidation it is estimated that the liabilities must have been well over a million dollars. The valve industry is also in difficulties through excessive production and there again the prices have fallen to very low levels in many instances. Our contemporary thinks that there may be an endeavour to unload a large amount of apparatus upon the British market.

Japanese Tariff Revision.—The import duties on certain plant and machinery will be increased if the new Japanese Tariff Bill is passed into law. Among the articles affected are boilers, gas and oil engines, water turbines and Pelton wheels, and dynamos and other electrical machinery.

Timber Trade Report.—Our Timber Trade Correspondent reports that the country is still well stocked with general construction woods from the North of Europe, and although the market is fairly firm, there is considerable competition for inquiries. In forward business the market has been dull of late. There is, however, sufficiency of timber to come forward, mainly of Finnish, Swedish, and Russian origin, so there need be no anxiety regarding spring and summer supplies. In the hardwood trade, mahogany logs are still a disappointing market so far as the poorer qualities are concerned, although there is a satisfactory call for the better varieties. Mahogany boards and planks are firm, as also are ebony and the choice woods, such as rosewood and satinwood. In American lumber, *i.e.*, ash, oak, walnut, satin-walnut, and other varieties, the high views of shippers for forward business are having the effect of keeping the United Kingdom market firm, notwithstanding large supplies in this country. The pole market is firming up a little, which should help holders of such stocks in this country.

Australian Electrical Industry.—An article in the *Sydney Daily Guardian* for February 12th quotes a number of statements from the presidential address delivered by Mr. G. A. Julius, B.Sc., to the Institution of Engineers at Hobart. After comparing Australian and American wages and giving other statistics, it is stated that to the Protectionist the figures seem to suggest that Australian manufacture needs tariff encouragement, to help it forward to the efficiency of the U.S.A.; but Mr. Julius argued a case against the imposition of tariffs to help smaller industries, and especially against electrical apparatus works. Setting out his case against duties on electrical apparatus, Mr. Julius claimed that the duty paid in 1923-24 was £859,000 to help 3,641 employés earning £174 each, and producing an "added value" of £243 each. The duty was about £236 an employé. Mr. Julius thought the taxation too high for the result. His argument is that these duties (1) have, by high prices, discouraged power equipment; and (2) have impeded the use of electric labour-saving devices. "The present method of extending assistance to electrical manufacturers through the tariff has failed," says Mr. Julius. His remedy is to take the tariff away altogether; not to increase it, in the hope of making electrical apparatus more efficiently in the Commonwealth.

For Sale.—Nottingham Corporation electricity department has for disposal 16 Lancashire boilers, 19 steam dynamos, 4 Weir feed pumps, 3 Berryman feed-water heaters, 2 Green's economisers, steam, exhaust, and feed-water pipes and valves. Hull Corporation Electricity Department has for disposal surplus generating plant. Sutton Coldfield electricity department has for sale one 150-kW steam balancer set, complete with control panels, &c. (See our advertisement pages to-day.)

Trade Announcements.—MESSRS. CARTER LEE & Co. have removed to larger premises at 42, Finsbury Square, London, E.C.2. A priced leaflet of their "Cyldon" variable condenser has been received.

MESSRS. LINDLEY, DUFFIELD & Co., LTD., of Brassington, Wirksworth, have removed their London office to 11, Aldwych, W.C.2. Telephone No.: "Gerrard 6753."

THE LIVERPOOL ELECTRIC CABLE Co., LTD., has opened a city office and stores at 63, Moorfields, Liverpool, where stocks of v.i.r. wires, cables, and flexibles are available, as well as at its works in Bootle. The telephone number of the new office is "Bank 5782."

MESSRS. JOHN RICHARDS & Co., LTD., electrical engineers, of Burton-on-Trent and London, have opened a branch business at 22, Bore Street, Lichfield.

MR. BEN CROSLAND (trading as Crosland & Bateson), electrical contractor and armature winder, Heckmondwike, has opened a new showroom at 85, Bradford Road, Batley.

YESLY ELECTRICAL SUPPLIES, LTD., of 5a, Iliffe Yard, Crampton Street, London, S.E.11, has been registered to continue the personal trade connection of its managing director, who was with Engineering Supplies, Ltd., and Shenton and Co. Catalogues are asked for.

MR. A. S. TONG, Newcastle branch manager of the Foster Engineering Co., Ltd., has taken over the firm's transformer business for the northern area, which, until recently, has been handled by Messrs. Lindsay & Ward.

MESSRS. FERNAND ESPIR have removed to 86 and 88, Queen Victoria Street, London, E.C.4. New telephone Nos.: "Central 2492 and 2493."

The METROPOLITAN RADIO COMPANY has opened a retail wireless store at Dominion Buildings, Drake Circus, Plymouth.

Messrs. ED. BENNIS & Co., LTD., announce that Mr. J. G. McLean is no longer their representative on the North-East Coast and Sheffield and district areas. They ask that until a new appointment is made communications shall be addressed to the head office, Little Hulton, Bolton.

Catalogues and Lists.—MR. PERCY PITMAN, 25, Victoria Street, London, S.W.1.—Leaflet describing a new hydraulic governor.

MESSRS. FREDERICK BRABY & Co., LTD., Glasgow.—A series of pamphlets dealing with various forms of steelwork—for buildings, barrows, staircases, &c.

THE IRON & NICKEL BATTERY Co., LTD., 17-19, Cockspur Street, Pall Mall, S.W.1.—A leaflet describing "Ionic" batteries for yacht lighting.

MESSRS. ROBERT MCGREGOR & Co., Alpine Steelworks, East Molesey.—A blue print illustrating twenty types of cable hangers and racks.

MESSRS. HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., 88-89, High Holborn, W.C.1.—A series of pamphlets advertising the company's radio service.

THE CARPAX Co., LTD., 312, Deansgate, Manchester.—A priced and illustrated folder advertising "Homcharger" battery chargers.

METROPOLITAN-VICKERS ELECTRICAL Co., LTD., Trafford Park, Manchester.—"Service to the Textile Industry"—a brochure (1.874/1) dealing with steam and electric drives for textile works.

MR. E. J. BATY, 157, Dunstable Road, Luton.—A card advertising radio service and a number of devices.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Calendar cards for April, May and June, bearing illustrations of the company's control panels and starters.

MESSRS. GEORGE GREEN & Co., 40, Aybrook Street, Manchester Square, W.1.—An illustrated price list of electrical calorifiers, bath-water heaters, and storage geysers.

DIXONIA, LTD., 4, Portsmouth Street, Kingsway, W.C.2.—A priced and illustrated catalogue of automobile accessories.

MR. L. J. WOLF, 116, Putney Bridge Road, S.W.15.—A folder advertising Robbins & Myers fractional horse-power motors.

MESSRS. GENT & Co., LTD., Faraday Works, Leicester.—A well-illustrated and priced catalogue (Book 2) of telephones and accessories for offices, institutes, and factories.

Bankruptcy Proceedings.—W. S. MILES, "Roslyn," Worston Road, Burnham-on-Sea, Somerset, radio engineer.—The receiving order in this matter was made on March 12th on debtor's own petition. The statement of affairs shows liabilities of £761, against assets of £43, or a deficiency of £718. Debtor states that on June 8th, 1925, he commenced business at Lynton Road, Burnham-on-Sea, as a wireless instrument dealer with a capital of £50, but was only able to make a bare living. Debtor did not at any time take any steps to ascertain his financial position, but admits that he became aware of his position in 1923, when he gave a former partner a promissory note for £600.

First meeting, March 31st at the Official Receiver's office, 26, Baldwin Street, Bristol. Public examination, April 12th, at the County Court Offices, Bridgwater.

C. HUBBARD, electrician, 13, Magdalen Street, Norwich.—Receiving order made March 19th on debtor's own petition.

J. A. A. BARDSLEY, electrical contractor, 91, Old Hall Lane, Withington, Manchester.—First meeting March 30th at the Official Receiver's offices, Byrom Street, Manchester. Public examination April 30th, at the Court House, Manchester.

B. G. THOMPKINS, radio engineer, Armstrong's Buildings, Stanley, Durham. First meeting April 1st, at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne. Public examination April 15th, at the Court House, Newcastle-on-Tyne.

A. MCNEILL (A. McNeill & Co.), electrician, Oakfield Chambers, Motherwell.—The estates of the above debtor were sequestrated by the Sheriff of Lanarkshire on March 23rd. A meeting to elect the trustee and commissioners will be held on April 6th at County Buildings, Hamilton. Agent, Mr. J. K. Murray, solicitor, Motherwell.

J. C. HEALY, electrical engineer, 4, Worsley Terrace, Wigan.—Receiving order made March 26th on debtor's own petition.

M. D. ROSENBLOOM (D. Rose & Co.), electrical engineer, 25, Osborn Street, E.—Application for discharge to be heard April 20th at Carey Street, W.C.

R. HAWORTH, electrical engineer, 154, Duckworth Street, Darwen.—Last day for proofs for dividend April 9th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

Company Liquidations.—PRICE'S BATTERY AND RADIO Co., LTD., 11, Hart Street, New Oxford Street, W.—A meeting of creditors was held on March 23rd at the Charing Cross Hotel, W.C., when Miss E. Watts, who had been appointed to act as the liquidator in the voluntary liquidation, presided. The liquidator reported that the unsecured liabilities amounted to £5,258, and the assets, after deducting preferential claims, to £1,472, leaving a deficiency of £3,786. It was stated that the company was formed in 1924 to take over the business of Alexander Price & Co., which had been established for some twelve years. The company acquired the sole exclusive rights to use certain patents belonging to Mr. Price. The authorised capital of the company was £5,000, of which £3,001 had been issued. The company started trading as manufacturers of batteries, accumulators, &c., but after a time it was decided to expand the business by undertaking the manufacture of radio apparatus. The company did a fairly good trade for some six months, and it was decided to issue further shares, bringing the total issued capital up to £4,500. The present position of the company was attributed to heavy advertising and to expenses incurred in perfecting a patent condenser. For the purposes of the statement of affairs no value had been placed upon the patent in question. The company paid nothing for the patent, but agreed to pay a royalty of one penny on every condenser sold, and acquired the British rights. A balance sheet at June 30th, 1925, showed a balance on the profit and loss account of £1,747. At that time the stock stood in the books at £1,140. The goodwill was valued at £2,770, and trade creditors £1,300. There was also an ovedraft at the bank of £2,133, which had subsequently been paid off by Mr. Agar, who now claimed against the estate. A resolution was passed confirming the voluntary liquidation of the company, with Miss E. Watts as liquidator, and an advisory committee was appointed consisting of Mr. Haines, the representative of Messrs. V. C. Bond, and Mr. W. Baker, representing creditors. The following are creditors:—

	£		£
Haines, H. E.	278	Sun Electrical Co., Ltd. ...	24
Bond, V. C.	135	Lytton's Machine Tool Co. ...	25
Fuller's United Electric Works, Ltd.	125	Metropolitan Electric Supply Co., Ltd.	30
Olver, J. V.	57	Chloride Electrical Storage Co., Ltd.	22
Graham, A.	35	Agar, M. F.	3,385
Burton, B. C.	34	Stones, —.	76
Gardner & Sons, H.	32	Price, —.	427
Birk, F. W., & Co., Ltd. ...	41		
Iliffe & Sons	26		

DOMESTIC & GENERAL ELECTRICAL Co., LTD.—Winding up voluntarily. Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C. Meeting of creditors April 7th, at the Liquidator's offices. Particulars of claims to the Liquidator by April 28th.

BRITISH WIRELESS SUPPLY Co. (1924), LTD.—Winding up voluntarily. Liquidator, Mr. G. S. Smith, 17, Piccadilly, Bradford. Meeting of creditors held March 31st, at Leeds.

Napier Kimber, Ltd.—A meeting of members is called for April 26th, at 24, Basinghall Street, E.C., to hear an account of the winding up from the Liquidator, Mr. S. H. Gillett.

P.S. Wireless Manufacturing Co., Ltd.—A meeting of members is called for April 28th, at 34, Grand Parade, Brighton, to hear an account of the winding up from the Liquidator, Mr. E. Webb.

Private Arrangements.—H. E. Leigh and R. W. Leigh, trading as Leigh Bros., 290a, St. Paul's Road, Highbury, N., manufacturers of radio apparatus.—A meeting of creditors was held on March 22nd, when the chair was taken by the representative of Mr. H. S. Wright, one of the largest creditors. The debtors presented a statement of affairs which disclosed liabilities of £783 and assets of £628, leaving a deficiency of £155. The debtors stated that they started trading in November, 1922, with a small capital. In 1923 the turnover was £5,682, and there was a net profit of £618. In the following year the turnover was £8,340, and the net profit of £637. In May, 1925, Mr. H. S. Wright, who made up a large proportion of the debtors' components, fell ill, and left the country. The debtors then took a workshop in St. Paul's Road and started to manufacture. After May, 1925, a slump occurred in the wireless trade, and the turnover fell considerably, and the debtors were unable to clear off certain liabilities. A resolution was passed agreeing to accept an offer of a composition of 6s. 8d. in the £, payable as to 5s. on April 1st and a further 1s. 8d. in the £ in three months, suitably guaranteed to the satisfaction of a committee of inspection consisting of Mr. E. Fleury, Mr. O'Callagan, and Mr. C. Latham, representing creditors.

Trade with Cuba.—A recent report by Mr. M. H. C. Kelham, Acting British Consul-General at Havana, upon economic conditions in Cuba (Stationery Office, 1s. net), states that although trade between Great Britain and Cuba has shown a steady increase during the past two years, British trade has probably suffered more than that of any other country from local depression. United States and German goods often obtain preference owing to the very low, and in some cases uncompetitive prices offered. There is still in Cuba a willingness to purchase from the United Kingdom, but in spite of this British firms are still encountering many difficulties through delays in delivery, heavier Customs duties, &c.

Reduced Polish Duties on Machinery.—The Minister of Finance has been authorised to make a reduction of 90 per cent. in the import duty on machinery and apparatus not manufactured in Poland and destined for the equipment of new industrial establishments. Since this large reduction is intended to facilitate the equipment of factories on the most modern lines, it will not apply to machinery of old patterns.—*Reuter's Trade Service* (Warsaw).

Proposed Swedish Tariff Reduction.—The Norwegian Government has under consideration a revision of the customs tariff and among the proposals is one that the duty on electric cables and insulators shall be reduced from 35 to 30 öre per kg.

New Electrical Firms.—The following new electrical businesses have recently been started:—

R. Herbert & Co. (radio manufacturers and wholesalers), Horley, Surrey.

The R.B. Sales Co. (radio engineers), London Terminal Aerodrome, Croydon, Surrey.

The Brecknock Wireless Stores (wireless trading), 177, York Road, N.7.

The Cleartron Northern Sales Co. (wireless valves and accessories), 66, Market Street, Manchester.

The Voltron Co. (merchants of wireless), 75, City Road, London, E.C.1.

The Key Manufacturing Co. (radio components and repetition work), 29, Old Compton Street, W.1.

M. Forbes & Dunlop (radio and electrical apparatus), Skaelkmuir Mill, Canon, Falkirk.

E. Lee & Son (cycle and radio engineers), 8, North Street, Gosport, Hants.

The Sulfeta Co. (accumulator acids), 11, Hopwood Gardens, Tunbridge Wells.

H. Page & Sons (electrical engineers and contractors), 70, Wool Exchange, Coleman Street, E.C.

Kimber & Son (electrical engineers), 81, Whitehorse Road, Croydon.

The West (Greenwich) Trading Co. (wireless trading), 78, South Street, Greenwich.

G. Gordon & Co. (electrical and mechanical engineers), 114, Alexandra Parade, Glasgow, E.

The Nelson Electric Co. (electrical engineers and contractors), 26, Bignor Street, Cheetham Hill, Manchester.

The Grange Electric Co. (sale of electrical accessories), Grange Street, Keighley.

The Wireless Repair Depot (repairing wireless accessories), 39, Bethlehem Street, Grimsby.

C. Lindop & Co. (electrical and mechanical engineers), 8, Lower Breck Road, Liverpool.

New Belgian Company.—A new company has lately been formed at Schaerbeek, Brussels, with a capital of 250,000 fr., and the title La Société Belge pour l'Equipement Electrique pour Véhicules.

New Municipal Showroom and Offices.—The showroom and offices of Blackburn Electricity Department in Queen Street, Great Harwood, were opened by Councillor A. Slater, J.P., chairman of the Council, on March 25th.

Chinese Notes.—A recent issue of the *Chinese Economic Bulletin* gave details of the three tramway systems working in Shanghai, those of the Shanghai Electric Construction Co., Ltd., the Cie. Française de Tramways et d'Eclairage Electriques de Changhai, and the Chinese Electric Power Co., Ltd. These three systems cover the main business and residential sections of the city, except the Chinese district of Chapei. Some months ago the Shanghai-Paoshan Tramway Co., Ltd., was organised by a number of Chinese to start a line in the densely-populated Chapei district.

A Shanghai correspondent reports that the Chapei Waterworks & Electricity Co., Ltd., has a bulk supply agreement with the Shanghai Municipal Electricity Department. This expires in 1930, and the company then proposes to install its own plant, consisting of two 4,000-kVA turbo-generators, together with the necessary boiler plant and switchgear. It is probable that long-term credit will be required for payment.

New Cable Company in Czecho-Slovakia.—The Krizik company of Prague, the Bratislava cable works, and the Kablo company, of Kladno, are forming a joint stock company for the manufacture of long-distance cables. The company will have a capital of 1,200,000 crowns.—*Reuter's Trade Service* (Prague).

Local Exhibition.—Bridlington.—The Council's electrical engineer (Mr. A. J. Beckett) informs us that as a result of a week's exhibition at Bridlington, nine of the leading electrical companies have sold 150 cookers and washers, apart from other appliances. Among the concerns which exhibited and demonstrated apparatus were Metro-Vick Supplies, Ltd., the General



Electrical Exhibition at Bridlington.

Electric Co., Ltd., the Edison Swan Electric Co., Ltd., the Jackson Electric Stove Co., Ltd., the Cable Accessories Co., Ltd., Siemens and English Electric Lamp Co., Ltd., Messrs. Moorwoods Ltd., the Credenda Conduits Co., Ltd., and the Hurley Machine Co. The stands of some of these firms are shown in the accompanying illustration.

Threatened Tramway Strike.—At the end of last week the employés of the Rochdale Corporation tramways gave notice of their intention to cease work to-day (Friday) on account of the dismissal of two men for misconduct.

Social Events.—The social clubs of W. T. Henley's Telegraph Works Co., Ltd., and Henley's Tyre & Rubber Co., Ltd., held their annual dinner at the Florence Restaurant, W., on March 20th. Mr. P. Rosling presided in the absence, through illness, of Mr. W. J. Potter. Sir George Sutton sent a telegram regretting his inability to attend. The speeches were brief and witty, and an excellent concert was provided by two members of the staff (Messrs. H. Stanley and J. N. Tinniswood) and a number of professional entertainers.

A dinner was given to their staff by Messrs. E. J. Strange and Sons, Tunbridge Wells, on March 19th, to celebrate the firm's centenary, it having been established in 1824. The firm organised an electrical branch (now Strange & Sons Electrical Engineering Co., Ltd.) twenty-five years ago. We have received a souvenir booklet prepared for the occasion of the centenary.

The third annual staff dinner of the Automatic Telephone Manufacturing Co., Ltd., was held on March 19th, at the Exchange Hotel, Liverpool. Sir Alexander Roger, chairman of the company, presided over an assembly numbering about 150, representative of all sections of the company's Liverpool and London personnel. The toast of the evening, "The Company," was proposed by Mr. W. P. Horsburgh, F.R.I.B.A. In responding, the chairman referred at some length to the progress of the undertaking, its growth and varied interests. He paid tribute to the untiring efforts of the staff. It was announced that the manager of the company, Mr. G. W. Moore, had been appointed to the board of the International Automatic Telephone Co., Ltd. An excellent musical programme was furnished under the direction of Mr. Wilfred Bird, L.R.A.M.

The staff of the Siemens concerns held a dance at Slater's, Oxford Street, W.1, on March 26th. About 200 people attended.

Australian Tariff Decision.—Among the recent decisions of the Australian Customs Board is the following:—Coal-cutting machines: Free under the British preferential tariff; 5 per cent. under the intermediate tariff; and 10 per cent. under the general tariff.

Indian Electrical Imports.—The *Board of Trade Journal* for March 25th contained a review of India's import trade during the first nine months of the current fiscal year (April-December, 1925). This shows that Great Britain maintained her lead as the principal supplier of electrical machinery. The total value of imports under this heading was 146¾ lakhs of rupees, as compared with 139 lakhs in the corresponding period of 1924.

Book Notices.—The *Decimal Educator* for March (price 6d.) reports the progress towards complete reform in weights and measures which is being made by the countries which have most recently adopted the metric system, and gives many instances of the disadvantages to this country which are incurred by its adherence to out-of-date systems. It also gives extracts from an American publication showing the steps which are being taken by that country towards the adoption of the metric system.

"The Colliery Year Book and Coal Trades Directory, 1926." Pp. 100+1,024. London: The Louis Cassier Co., Ltd. Price £1 1s. net.—The fourth edition of this work contains a complete list of all the colliery owners of Great Britain, shows the number of men employed at each colliery, and gives particulars such as the constitution of the companies, their boards of directors, &c. Over a hundred pages of the book are devoted to statistics covering every phase of coal production and distribution, and a table shows the analysed costs of distribution in London and the provinces. The publication also contains a "Who's Who" of the leading men in the industry.

The Spring List published by Sir Isaac Pitman & Sons, Ltd., includes the titles of books on electrical engineering and technology, economics, chemistry, physics, and many other subjects.

"Science Abstracts" (A and B). Vol. XXIX, Part 3. March 25th, 1926. London: E. & F. N. Spon, Ltd. Price 3s. each.

"Commission Internationale de L'Eclairage—sixième session." London: Cambridge University Press. Price 15s. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV. March, 1926. No. 3. New York: The Institute. Price $1.

New Australian Company.—Measurement (Australia), Ltd., was recently registered in Sydney, with a capital of £25,000, to acquire the Australian branch of Measurement, Ltd., and to carry on the business of manufacturers of meters for measuring the flow of water and other liquids and electricity.

Elma Illumination Design Course.—At the conclusion of the eighth illumination design course held in London at the Lighting Service Bureau, from March 23rd to 26th, which was attended by many representatives of electricity supply authorities, the "students" were entertained to dinner at Carr's Restaurant by Elma. In the unavoidable absence of Mr. C. H. Cox, Mr. C. W. Sully, director of Elma, occupied the chair, and expressed the regret of the staff that Mr. W. E. Bush was prevented by illness from taking part in the course. Referring to the questions at issue between some supply authorities and some electrical contractors, he urged that they should work together in harmonious co-operation. Mr. E. W. Jones said they were all agreed that the course had been both instructive and thoroughly enjoyable, and expressed their deep appreciation of the kindly treatment they had received. Mr. A. L. Johnson, proposing the health of the staff, said they had all given of their best, and Mr. Horner (Leatherhead) cordially endorsed his eulogy. Mr. W. J. Jones responded, thanking all for the kind spirit that had prevailed throughout the course. Mr. L. E. Buckell asked for suggestions from salesmen in particular for the improvement of the course for their benefit, and remarked on the extraordinary enthusiasm of the students. Amongst other speakers, Mr. Holmes (chairman of the Sales Committee of Elma) said he was impressed by the close attention given to the lectures, Mr. Hughes (Glasgow), and Mr. Evans (Newcastle) testified to the excellent results they had obtained by popular lectures at many provincial towns, and Mr. Sully, paying a tribute to the organiser of the course, Mr. R. C. Hawkins, said that the Bureau was willing to assist undertakings to open bureaux in the provinces, to be maintained by those locally interested in the industry. An excellent entertainment was provided and was thoroughly enjoyed.

The German Electrical Industry.—The report of the Siemens-Schuckert Works Company states that the revival in the home market which was mentioned in the report for 1923-24, continued until almost the end of 1924-25. The invoiced turnover in 1924-25 was materially higher than in the previous year, which in turn surpassed the turnover of the last pre-war year, considered in volume; measured in prices, it was about one-third higher than the latter. It was necessary to increase by over 30 per cent. the number of workers as compared with 1913 in order to deal with the increased turnover. Thanks to the far-reaching foreign organisation, it was possible for the company to secure a good share of foreign orders. The German iron and steel industry was very reserved in the allocation of orders, but business with public supply undertakings was more active. Special reference is made to the securing of the contract for the harnessing of the Shannon.

The report of the Siemens & Halske Company, dealing with the year ended with last September, states that the amount of the net profits is considered unsatisfactory seeing that the works were abundantly occupied during the whole of the year. Further work was carried out in the direction of reducing the number of types of manufactures and the development of mass production. The advantages resulting from these methods operated for the most part during the whole of the year, but they were insufficient to counterbalance the effect of the increased burdens and the large advances in wages and salaries. The business received was abundant, so that the orders in hand at the commencement of the new financial year showed an increase. Particular activity was manifested in the telephone branch for the extension and improvement of existing installations, but the prices realised in various branches were insufficient, especially for foreign orders owing to increased duties and the preference given to native manufactures. Down to the end of the year business in telephone cables was also satisfactory. The company has participated in the development of broadcasting with the Telefunken Company. There was again a scarcity of orders in the railway signalling branch. After referring to the extension of interests in the department of medical electricity, the report states that business in electric furnaces again improved, that the Vienna works were well employed and that a branch factory has been established in Milan.

Great German Steel Trust.—The shareholders of five leading German steel-producing companies are being asked to approve an amalgamation of their interests in the Vereinigte Stahlwerke A.G. The new trust's capital will amount to 800 million marks (£40,000,000), and the companies participating and the amount of their holdings are as follows:—The Rhein-Elbe Union, 39.5 per cent.; Thyssen, 26 per cent.; the Phœnix, 23.65 per cent.; the Rheinstahl, 8.5 per cent.; and the Van der Zypen, 2.35 per cent. The bulk of the capital of the last concern is held by the Phœnix company.

Electrical Machinery for Argentina.—Our correspondent in Buenos Aires says that extensions and re-equipment of the new port are proceeding and offer a favourable opportunity for British manufacturers. A number of steam and hydraulic cranes are being converted, and the machinery already, or to be supplied includes movable electric cranes, fixed cranes, and electric wall cranes. The port is provided with an electric generating plant. There is also scope in the provinces for the introduction of electrical plant and machinery in sugar factories. Many of the sugar manufacturers would give favourable consideration to any proposal for substituting electricity for steam or hydraulic power in the larger mills. Already, where electrical power has been introduced, the production efficiency has been greatly increased. In one case the introduction of electric plant was effected nearly twelve years ago. A 260-kVA vertical steam-engine driven generator furnishes the power, which is used to operate some fourteen enclosed motors varying in size from 10 to 15 h.p.

The Industrial Alliance.—By 70,695 votes to 31,423 the Amalgamated Engineering Union has decided to join the proposed "Industrial Alliance," which now embraces seven trade unions, with a membership of over 1,600,000, including the Electrical Trades Union. These unions have agreed to render assistance to one another in industrial disputes. The form which the assistance will take ranges from help in negotiations, through financial support, to complete "sympathetic" action.

Unemployment.—The figures relating to unemployment for the week ended March 15th showed that the decrease is still continuing. The total at that date was 1,070,800, as compared with about 1,094,000 a week earlier. The reduction during the preceding twelve months was 148,400.

Lighting and Power Notes.

Bexhill.—Loan Sanctioned.—The Electricity Committee has obtained sanction to a loan of £6,500 for feeders and distributing mains.

Brighton.—Electricity in Bulk.—The Electricity Committee has arranged terms with the promoters of the Hassocks and Hurstpierpoint electricity supply scheme with regard to the terms upon which a bulk supply might be furnished to the company from the Preston Park sub-station. To afford this bulk supply it will be necessary to extend the e.h.p. feeder from Preston Park sub-station to a point in or near Patcham, where a suitable position for housing the switchgear for interconnecting and metering the supply can be arranged for. The cost of the mains is estimated at £4,850.

Canada. — Water-Power Resources.—The Dominion Water-Power Branch of the Department of the Interior at Ottawa has issued a review of the water-power resources of Canada, dated January 1st, 1926, in which it is stated that the known available water power in Canada, from all sources, is 18,255,000 h.p. for conditions of ordinary minimum flow, and 32,076,000 h.p. ordinarily available for six months of the year. A study of the uses to which the water-power installation is put shows that the 4,290,428 h.p. at present installed throughout the Dominion is apportioned to the following uses:

—3,466,422 h.p. in central stations for general distribution for domestic, municipal, and commercial lighting and power purposes; 481,971 h.p. in 116 pulp and paper mills (in addition, pulp and paper mills purchase about 275,000 h.p. from central stations, making a total of nearly 757,000 h.p. used in the manufacture of pulp and paper); 342,035 h.p. installed in industries other than central stations and pulp and paper mills. The total installation for the Dominion averages 465 h.p. per 1,000 of population, a figure which places Canada among the leading countries of the world in *per capita* utilisation of water power. The capital invested in water-power developments is estimated to amount to $815,723,890.

Electrical Development.—The Canada Northern Power Co. has decided to commence work on a transmission line from the Des Quinze plant to Rouyn, Quebec. Not only will the new line assure about 10,000 h.p., but the power site at Des Quinze lends itself to a big increase in power development at any time such construction is required.

Cheadle and Gatley.—Electricity Charges.—The Urban District Council has fixed the charge for electricity for heating, cooking, and domestic appliances to ordinary consumers at 1½d. per kWh during the summer quarters, and 2d. per kWh during the winter quarters.

Chirk.—Electricity in Small Houses.—The Rural District Council has appointed a special sub-committee to interview the Chirk Electricity Supply Co., Ltd., in connection with a proposal to install electric lighting in the Council houses at Rhosywaen.

Continental.—Belgium.—A new 10,000-kW turbo-alternator has recently been added to the power station at the collieries of the Société des Charbonnages de Marcinelle-Nord, bringing the capacity of the plant up to 15,500 kW.

The report of the Société de l'Electricité de l'Escaut of Antwerp for 1925 shows that during the past year the number of consumers increased from 19,081 to 24,087. Delays have occurred in connection with the erection of the 50,000-V transmission line between Merxem and Beerse to supply the northern and eastern sections of the province of Antwerp, but good progress is now being made, and it is expected that the line will be completed within a few weeks. Good progress has also been made with the electrification of the province of Limburg, in which there is now a distribution system supplying electricity to 191 communes. It is stated that there are now only 15 villages in the province without an electricity supply.

France.—La Société Lyonnaise des Eaux et de l'Eclairage has recently secured a concession for the supply of electricity in the Department of the Aube, Marne and Côte d'Or from its steam-operated station at Troyes and from hydro-electric stations at Beaulieu, Juvanze-sur-l'Aube, Autricourt, and Barberey-sur-la Seine.

Switzerland.—The Federal Council has authorised the drawing up of a report of all the hydro-electric stations in the country, the report to be ready by the end of April. At the same time, the Council has requested each canton to furnish a detailed annual statement concerning all the power-houses in its area, their annual yield, their use, &c. The object of these steps is to enable the country to be in a position to furnish every particular that may be asked for at the forthcoming International Exhibition of Hydraulic Forces to be opened at Bâle at the beginning of July, to put the Government in possession of the exact amount of h.p. and kW available for exportation after the country has been duly supplied with "white coal," and to put before the Federal authorities the surveyors' reports of every station with a view to their proper superintendence and taxing.

Coventry.—New Power Station.—The Electricity Committee is applying for consent to proceed with the first section of the new generating station at Longford, at an estimated cost of £559,000.

Ferryhill.—Electricity Supply.—The Cleveland and Durham Electric Power, Ltd., has under consideration a scheme for lighting the district, and proposes to canvass the business community and residents with a view to ascertaining the probable demand for electric lighting.

Gellygaer.—Loan.—The Urban District Council has applied for sanction to a loan of £5,115 for electricity purposes.

High Peak District (Derbyshire).—Electricity Supply.—Various proposals to provide the district with electricity have been advanced. The Power Development Co. has applied for an Order to enable it to sell electricity in the rural districts of Chapel-en-le-Frith and Disley, the urban district of Whalley Bridge, and the parish of Taxal. The electricity is to be purchased from Stockport Corporation and supplied to consumers from a sub-station at New Mills. The New Mills Council has applied for an Order to sell electricity in its own area, the energy to be purchased from Stockport, and distributed from a sub-station to be erected at New Mills. There would thus be two sub-stations taking electricity from one authority, but distributing it in separate areas. A conference of all the Councils concerned has been called to discuss the question of forming a joint board to undertake the supply of electricity to the whole area, the supply being taken from the Stockport Corporation.

Hornsey.—Electricity Extensions.—The Electricity Committee is to carry out the following extensions:—New l.p. feeder from the generating station to Crouch End Broadway, £3,000; extension of l.p. feeder in Stapleton Hall Road, £600; extension of l.p. feeder in Florence Road, £1,500.

Ilford.—Loans.—The Electricity Committee is to apply for sanction to the borrowing of £20,000 for mains and £20,000 for wiring installations.

Japan.—Electrical Development.—The Ina Douki K.K. has amalgamated with the Chuo Denka Koguo K.K., and has increased its capital from 15,000,000 yen to 20,000,000 yen. Application has been made to the Government for permission to erect a power station on the Koshibu River, where the Chuo company held a concession.

Kirkham.—Electricity in Bulk.—The Urban District Council has asked Preston Electricity Committee if it is prepared to give a bulk supply of electricity by tapping the proposed transmission line between Preston and Blackpool. The matter is being considered by a joint committee.

Lanarkshire.—Hospital Supply.—The Upper Ward District Committee of the County Council has arranged with the Clyde Valley Electrical Power Co. to supply electricity to the Roadmeetings Hospital for power and lighting at a flat rate of 2¼d. per kWh, the Committee meeting the first cost of the cable and transformer house, estimated at £2,200.

London.—Battersea.—The Electricity Committee has recommended alterations and additions to the condensing water system at the generating station at a cost of £29,500.

Luton.—Loan Sanctioned.—The Electricity Committee has received sanction to the borrowing of £10,500 for mains and switchgear.

Padiham.—Electricity Supply.—At a meeting of the Urban District Council, on March 25th, a resolution, passed recently, that the Council should operate its own electricity Order was referred back. It was decided to prepare plans for a transformer station.

Palestine. — Electrical Development. — Power stations operated by fuel-oil engines have recently been completed at Haifa and Tiberias.

Plymouth.—Electricity Supply.—The Corporation Electricity Committee is applying for sanction to the borrowing of £75,000 for mains and services estimated to be required during the next three years. Cable extensions at a total estimated cost of £2,094 have been sanctioned. The Committee has accepted a tender at £29,000 for the supply of a new 7,500-kW turbo-alternator.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Edinburgh.—Lighting: From 3¼d. to 3½d. per kWh.

Heston and Isleworth.—Power, heating, and cooking: From 2½d. to 2d. per kWh.

Launceston.—*Launceston and District Electric Supply Co., Ltd.*—Power: From 5d. to 4½d. per kWh. Heating: From 3d. to 2½d. per kWh.

Long Eaton.—Lighting: From 6½d. to 6d. per kWh. Power: From 2½d. to 2d. per kWh, with further reductions in the charges for heating and cooking and meter rentals.

Shipley.—Electricity in Bulk.—At a recent meeting of the Electricity Committee a letter was read from the Yorkshire Electric Power Co. with regard to the supply of electricity in bulk from the company's system. The Committee gave instructions for details of the proposals both for a partial and complete supply to be obtained and a full report prepared for consideration at a special meeting of the Committee to be arranged to consider this matter.

Silsden.—Inauguration of Supply.—The *Keighley News* reports that electricity was introduced at Silsden recently, a public supply for power purposes being provided from the mains of the Yorkshire Electric Power Co. The Company recently extended its mains from Ilkley to Addingham, and from Addingham they have been extended to Eastburn, at which point a connection is made with the Keighley-Skipton line. The Electricity Commissioners are still considering the competing applications for distributing powers deposited by the Keighley Corporation and Electrical Distribution of Yorkshire, Ltd.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The County of London Electric Supply Co. Ltd., for the supply of electricity in the urban district o Epping and certain parishes in the rural district of Epping the Newcastle-upon-Tyne Electric Supply Co., Ltd., in th urban districts of Prudhoe and Rothbury, and parts of th rural districts of Hexham, Alnwick, and Rothbury; the Cleve land and Durham County Electric Power Co., within part of the rural districts of Darlington, Hartlepool, Sedgefield and Stockton.

St. Austell.—Electricity Supply.—In connection with th St. Austell Electric Lighting & Power Co.'s scheme for th erection of a power station at Pontswill, it is proposed to ru h.p. cables from the station to St. Austell and Fowey, wit subsidiary cables to districts *en route* where required.

Sunningwell.—INQUIRY DECISION.—As the outcome of an application to the Ministry of Transport, who recently held an inquiry, the Abingdon Electric Supply Co. has received consent to the erection of h.p. lines over property at the foot of Bayworth Hill for the transmission of electricity.

Thornton-le-Fylde.—ELECTRICITY CHARGES.—The scale of charges for electricity has been fixed at 7d. per kWh for the first 250 kWh, down to 5d. for over 1,000 kWh for lighting purposes; and for power, 3d. per kWh for the first 250 kWh down to 2d. for over 1,000 kWh.

Wigan.—NEW ELECTRICITY CHARGE.—The Town Council, in order to encourage the more general adoption of electricity for domestic purposes, has fixed the following alternative scale of charges for private houses:—An annual charge according to the rateable value of premises, plus ½d. per kWh for electricity consumed. The adoption of the new scale is contingent upon the installation of domestic appliances, other than lamps, in accordance with the following scale of rateable values:—Houses not exceeding £25 per annum, 2 kW minimum to be installed; from £25 to £40, 3 kW; exceeding £40, 4 kW.

Willesden.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £25,000 for mains and services.

York.—ELECTRICITY EXTENSIONS.—The following items are included in the next year's estimates of the Corporation Electricity Committee:—One 6,000-kW generating set, £20,000; cables and services, £10,000; Linton hydro-electric station, £7,000; boiler and engine house, £7,000.

Tramway and Railway Notes.

Continental.—GERMANY.—The Frankfurt correspondent of *The Times* reports that negotiations for a loan of 46,200,000 marks by the State of Baden have recently been concluded. The money is to be used for financing and extending State enterprises, including the electricity supply station. Part of the loan will be used for the purpose of acquiring a share in a large Rhine power works, which is important in connection with the plans for the electrification of the railways in Baden.

FRANCE.—*Electric 'Buses.*—At a recent meeting of the French Union de Voies Ferrées et des Transports Automobiles in Lyons, M. Chalumeau, chief engineer of that city, gave some particulars of the electric 'bus service run by the municipal authorities. Sixteen single-deck vehicles are in use, the chassis being of the De Dion type, the electrical equipment, comprising two 12-15-h.p. series-excited motors for each 'bus, having been supplied by the Tognini-Balbo Co., of Milan, Italy. The battery of Tudor-Hensemberger accumulators weighs from 2.3 to 2.5 tons, and the 'buses in running order (that is, with battery) weigh from 7.15 to 7.35 tons. The motors are directly connected with the rear wheels, the speed of the vehicles being entirely electrically controlled by means of a controller which gives five forward and two reverse speeds. Each 'bus covers a daily distance of about 56 miles, M. Chalumeau pointing out that this does not represent the full capacity of a single charge of the battery, but is a convenient running distance from the drivers' point of view. He added that trials are about to be made with the introduction of reduction gear between the motors and the road wheels; while this will probably slightly reduce the mechanical efficiency, it is expected to be more than counterbalanced by the gain in electrical efficiency.

Halifax.—NEW TRAMWAY CENTRE.—The sanction of the Ministry of Transport has been received to the scheme for the construction of a tramway centre at Bull Green, and the Tramways Committee has decided to proceed with the work.

Japan.—NEW ELECTRIC RAILWAYS.—The Tokyo Gryen Totsudo Koyo K.K. has recently applied for a charter to the Government. It is intended to construct a main electric railway line from Haneda, Tokyo-fu to Setagaya, through Omori and Magome and several branch lines on the outskirts of Tokyo. It is understood that an application for a charter has been made recently to the Railway Minister by the promoters of the Sanshin Railway. The proposed railway will be constructed in the Nagano Prefecture, and have a total length of 44 miles.

London.—"UNDERGROUND" IMPROVEMENTS.—The scheme of duplicating the tracks of the District Railway between Hammersmith and Acton Town, and the running over them of the trains of the Piccadilly Tube, as outlined by Lord Ashfield at the recent general meeting of the Underground companies, presages an important addition to the programme of Underground improvements. In addition to the extension of the Piccadilly Tube trains to Ealing and Hounslow, a general speeding-up of the western services of the District Railway will be afforded, and the additional tracks will enable a large number of Ealing and Hounslow trains to be worked on the non-stop principle between Acton and Hammersmith. The extension of the Piccadilly Tube services will provide Turnham Green, Chiswick, Acton, Ealing, and the Hounslow line stations with direct communication with Knightsbridge, Piccadilly Circus, Holborn, King's Cross, and other important centres. Between Ravenscourt Park and Turnham Green the District trains run over the lines of the Southern Railway, which here comprises four tracks, two of which—over which the old South-Western service to Waterloo, *via* Addison Road, was operated—have been virtually out of use since the war. The work entailed on this section consists in the electrification of the latter tracks and a rearrangement of the four tracks generally. It is expected that the new works will occupy about two years to complete throughout.

METROPOLITAN RAILWAY COMPANY'S BILL.—*The Times* states that the Select Committee of the House of Commons, presided over by Mr. Hopkins, heard further evidence on March 24th in support of the Bill promoted by the Metropolitan Railway Company for two short relief and facilitating railways, approximately between Edgware Road and Kilburn Priory. The estimated cost was stated to be £2,048,255.

Manchester.—PROPOSED UNDERGROUND RAILWAY.—In connection with the proposed tube for the city, the *Manchester Guardian* reports that at a meeting of the Underground Railway Committee, Mr. H. Mattinson, the tramway general manager, proposed that, instead of the scheme embracing the whole of the suburbs of Manchester, underground electric railways should be constructed between the various railway stations in the city. This would mean seven miles of underground railways, and the cost of excavation, &c., on the basis of the figures submitted for the original scheme, would be about £2,250,000. The Committee did not come to any decision, and will meet again to discuss the proposal. It was suggested that the scheme should only be taken up when the railways were electrified. Another suggestion was that there should be "through" services of electric trains between station and station, so that it might be possible to maintain services at the various stations to proceed directly underground. It was also proposed that the Corporation should construct underground railways, and that they should be leased to the railway companies.

Middlesbrough.—TRANSPORT SYSTEM REPORT.—The Corporation has adopted a recommendation, submitted by the tramway manager, Mr. H. G. Jeken, that the present tramway system in the borough be retained. In a report to the Committee, the manager stated that 20 railless cars would be required for the Linthorpe section of the tramway system to replace the present service, and the cost would be £31,000. The cost of alterations to the overhead line would amount to £4,000, and in addition there would be the cost of removing the present rails.

Middlesex.—TRAMWAY LEASE.—According to the *Tramway and Railway World*, the Middlesex County Council at a recent meeting passed a resolution requesting the Highways Committee to explore the possible alternatives to granting a new lease to the Metropolitan Electric Tramways, Ltd.

OMNIBUS COMPETITION.—The London United Tramways has informed the Twickenham Urban District Council that unless something definite is done by the Ministry of Transport to relieve the company of competition on certain routes which are flooded with omnibuses, it will be quite impossible for it to give any definite undertaking in connection with the reconstruction of the tramway in London Road, Twickenham.

Telegraph and Telephone Notes.

Czecho-Slovakia.—AUTOMATIC TELEPHONY.—A new automatic telephone system was put into operation in Prague in December, 1925. As it was impossible to complete connections for the whole city at once, the business sections were the first to be supplied, says *Commerce Reports*. Each of these sections has 4,000 connections and one central office. The remaining 8,000 connections are to be automatised during 1926.

Hungary.—INTERNATIONAL TELEPHONY.—With the view of linking Hungary with the international telephonic system, the Hungarian Post Office has concluded negotiations with the Austrian postal authorities. It has been decided to lay a new cable between Budapest and Vienna, which will be completed towards the middle of 1927. At the same time, cables between Vienna and Passau and Passau and Nuremberg are to be laid, so that the laying of the Budapest-Vienna cable means connection with the French, Belgian, Dutch, and Scandinavian systems. Among other neighbouring States with which negotiations are in progress is Czecho-Slovakia, and negotiations will shortly be initiated with Jugo-Slavia.—*Reuter's Trade Service* (Budapest).

India.—TELEPHONE DEVELOPMENT.—The Calcutta correspondent of the *Daily Telegraph* reports that remarkable strides in long-distance telephony have been accomplished in India during the past year, and the line between Delhi and Calcutta will be opened on April 1st. With the completion of the connection between Calcutta and the new capital the Posts and Telegraphs Department will have carried out practically the entire project which was taken in hand three years ago. There only remains the 1,250-mile line between Calcutta and Bombay, on which work is proceeding. The cost has been enormous, and even optimistic experts now doubt the financial results. The scale of charges has not yet been decided,

but the rate between Calcutta and Delhi is likely to be five rupees (6s. 8d.) for three minutes,, and between Calcutta and Bombay probably fifteen rupees (£1).

Jugo-Slavia. — Telephone Development. — The Jugo-Slav Postal and Telegraph Ministry is considering the carrying out of a plan for laying telephone cables to bring Jugo-Slavia into direct communication with foreign parts. According to the plan, two cables are to be laid from Avala, one to Hungary, *via* Novi Sad Subotica, and the other to Austria and Italy, *via* Zagreb and Laibach.—*Reuter's Trade Service* (Belgrade).

The Telephone Service.—The first automatic telephone apparatus in Preston was inaugurated on March 15th.

The Ipswich automatic telephone exchange was formally inaugurated by Sir John Ganzoni, M.P., on March 20th.

The Times reports that the Postmaster-General, Sir William Mitchell-Thomson, speaking at Redcar on March 23rd, said there were now 114,000 more telephone subscribers than in 1924, representing an advance of 9¼ per cent. The increase was as great in the rural as in the urban areas, 214 new rural telephone exchanges having been opened during the past 12 months. The calls registered exceeded 995,000,000.

Radio Notes.

Czecho-Slovakia.—Progress.—In spite of the rather slow beginning of broadcasting in Czecho-Slovakia, that country's electro-technical industry is very favourably situated, and so offers a solid basis for progress in wireless. At present the the industry is employed especially in the manufacture of spare parts, with which it supplies a very large number of customers. Nevertheless, several works have also begun to manufacture good receiving sets, which they are producing at advantageous prices. A system of relays has yet to be organised between Prague, Brno, and Bratislava, so that each of the three towns may broadcast the theatrical performances and concerts given by the other two.—*Reuter's Trade Service* (Prague).

Ecuador.—New Broadcasting Stations.—The Government of Ecuador has granted the request of a firm in Guayaquil to act for five years as exclusive importers of radio-telephone apparatus. The concessionaires undertake to erect two broadcasting stations, one at Guayaquil and the other at Quito, and to divide equally all profits accruing from the radio business between the Government and itself.—*Reuter's Trade Service* (Quito).

Iraq.—Import of Radio Apparatus.—The ban on the importation of radio equipment into Iraq has been lifted. Purchasers of radio sets must register with the Director of Posts and Telegraphs, however, and obtain a permit before a set may be used. Iraq has no broadcasting station, and reception is very unsatisfactory during eight or nine months of the year, says *Commerce Reports*, which indicates that it is not likely that a profitable market will develop in the near future.

New Radio Circuit.—The daily Press reports that Sir Oliver Lodge has designed a new circuit which will ensure perfect reception without aerial tuning, and will thus avoid the use of reaction. Sir Oliver, in a statement to the Press, said that the reports were entirely premature, but that he expected to be in a position to make an announcement on the subject in about a month's time.

Radio Exhibition at Birmingham.—A Birmingham and Midland Wireless Exhibition is to be held in Bingley Hall, Birmingham, from May 19th to 29th. It is being promoted jointly by the Birmingham Chamber of Commerce and the British Industries Fair (Birmingham Committee). Members of the National Association of Radio Manufacturers and Traders are to participate, and so, it is hoped, will members of other trade organisations.

Russia.—Moscow Station.—The name Popoff has been given to the new broadcasting station at Sokolonika, Moscow, in memory of the deceased Russian scientist, Prof. Popoff.

Wave-length Adjustment. — Geneva Conference. — The International Council of Wireless Experts commenced another conference at Geneva on March 22nd, at which 20 countries were represented. According to *The Times*, it has approved the fundamental principles of a new plan for the allotment of wavelengths in Europe. The detailed plan will be further examined in each country and then submitted to the approval of the Governments. The plan divides wireless stations into two classes, those having a right to exclusive wavelengths and those having a low power which are employing a common wavelength. The waves will have to be measured according to a wave-metre common to all countries and each station will be requested to keep strictly to the wavelength it has been awarded. The plan does not deal with wave-lengths under 200 metres. Three technical committees have been appointed to examine means of clearing up the interests of European wireless organisations in international problems concerning wireless matters.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Argentina.—Buenos Aires.—Department of Sanitary Works. May 26th. Two 1,000-kW Diesel-engine generating sets.*

May 27th. Electrically-driven centrifugal sewage pumps.*

Australia.—Brisbane.—August 27th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator and two water-tube boilers, with economisers, draught plant, &c. Specifications (£5 5s.) from the offices of the company, Boundary Street, Brisbane.

Melbourne.—May 11th. P.M.G.'s Department. Telephone jacks.*

June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (March 19th.)

May 11th. Switchgear and accessories, transformers and piping equipment. March 26th.)

Barnes.—Electricity Department. E.h.p. and l.p. cables. (March 19th.)

Basingstoke.—April 6th. Electricity Department. One 600-b.h.p. heavy-oil engine and direct-coupled dynamo. (March 19th.)

Belfast.—April 17th. Electricity Department. Automatic rotary converters with transformers, h.p. and l.p. switchgear and automatic control gear. (March 26th.)

Bolton-upon-Dearne.—April 22nd. Dearne District Electricity Board. Electric cables and accessories. (See this issue.)

Chesterfield. — April 10th. Electricity Department. 9,000 tons steam slack and 7,000 tons good, clean coke breeze required during 12 months ending May 31st, 1927. Form of tender, &c., from Mr. D. H. Davies, borough electrical engineer, Electricity Works.

Chile.—Santiago.—August 20th. Chilean State Railways. Signals, telegraphs and telephones, electrical material for sub-stations, aerial lines, and lighting.*

Colwyn Bay and Colwyn.—April 8th. Electricity Department. Stores for 12 months, including cables, joint boxes, cut-outs, house-service meters, &c. (March 19th.)

Dover.—April 14th. Electricity Department. 6,250 yd. e.h.p. cable. (March 26th.)

Dundee.—April 20th. Education Authority. Electric lighting at new central Advanced School at Blackness Road. Schedules from Messrs. Maclaren, Soutar & Salmond, architects, 16, South Tay Street, Dundee.

Edinburgh.—April 12th. Electricity Department. Four water-tube boilers, economisers, and mechanical stokers or alternatively, boilers, economisers, air heaters, and mechanical stokers, or boilers, economisers, and powdered fuel plant. (March 12th.)

Egypt.—Cairo.—April 27th. Egyptian Government. 1,100 desk telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Ferry Fryston (Yorks.).—April 20th. West Riding County Council. Electric lighting installation at Ferry Fryston, Airedale, new school. Specifications from Education Department, County Hall, Wakefield.

Hazel Grove, near Stockport.—April 13th. Hazel Grove and Bramhall U.D.C. 2,300 yd. armoured cable. (March 19th.)

Halifax.—April 12th. Town Council. Wiring for electric lighting of 80 houses, Booth Lane and Nursery Lane. Particulars from Mr. P. Saunders, town clerk, Town Hall.

Hull.—Telephones Committee. Supply and installation of automatic telephone exchanges. (See this issue.)

India.—April 19th. India Store Department. Goods lift for the Imperial Record Offices at Raisina, Delhi. (A.X. 2,904.)*

April 23rd. Electrical equipment for 15 motor coaches and 42 trailer coaches. (March 5th.)

April 30th. 22,000-V cables. (See this issue.)

May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

Irvine (Ayrshire).—April 12th. Town Council. Electric lighting installation at 25 blocks, consisting of 100 houses. Plans from Mr. Robert Frew, architect, 3, High Street, Irvine.

Leyton.—April 9th. Education Committee. Installation of electric lighting and central heating at the Sybourn Street new school. (March 12th.)

London.—Hammersmith.—April 14th. Electricity Department. H.p. insulated cables, air-cooled and oil-cooled transformers, and h.p. sub-station switchgear. (See this issue.)

Manchester. — April 6th. Electricity Department. 3-phase, 6,600-V sub-station switchgear. (March 12th.)

3-phase, 33,000-V switchgear, 3-phase, 6,600-V switchgear, neutral earthing resistances, and trip circuit batteries. (March 26th.)

April 13th. Tramways Committee. Copper, silicum, and cadmium bronze trolley wire. Forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly.

Middlesbrough.—April 16th. Electricity Department. Six or 12 months' supply of cables and 12 months' supply of meters. (March 26th.)

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*

WELLINGTON.—May 12th. Post and Telegraph Department. 18 switchboards.*

Perth.—April 12th. Electricity Department. One water-tube boiler, capacity 27,000 lb. per hour. (See this issue.)

Rawtenstall.—April 7th. Haslingden Board of Guardians. Wiring for electric lighting of new nurses' home, Rawtenstall. Form of tender, &c., from Mr. A. N. Rothwell, clerk to Guardians, Union Offices, Rawtenstall.

Salford.—Education Committee. Electric lighting installation at extensions of the Broughton High School for Girls. Specifications from Mr. R. S. Martin, Secretary of Education, Education Offices, Chapel Street.

South Africa.—JOHANNESBURG.—May 6th. S.A. Railways and Harbours. Two electric goods lifts.*

Southend-on-Sea.—April 19th. Electricity Department. 1,450 current limiters. (See this issue.)

Stoke-on-Trent.—April 13th. Electricity Department. 12 months' supply of mains and cables, a.c. and d.c. meters, sub-station switchgear, and static transformers. (March 26th.)

April 12th. Gas Committee. Electrical and other machinery, gas engine and dynamo. Contract No. 35. Particulars (20s.) from the Chief Gas Engineer, Gas Works, Etruria, Stoke-on-Trent.

Walthamstow.—April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (March 12th.)

West Ham.—April 8th. Board of Guardians. Two 100-V d.c. motors, with slide rails, two starting panels, &c. (March 26th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia. — COMMONWEALTH POSTMASTER-GENERAL. — Accepted :—

Counter e.m.f. cell batteries (£811), Automatic Telephones, Ltd.; accumulator and counter e.m.f. batteries (£1,813), Tudor Accumulator Co., Ltd. *Tenders.*

Barking Town.—Electricity Committee. Accepted:—

Switchgear.—New Switchgear Construction Co., Ltd. (£386); Edison Swan Electric Co., Ltd. (£321).

Brighton.—Lighting Committee.

Supply of a storage battery for Southwick power station :—

Tudor Accumulator Co., Ltd. (Accepted.)	**£6,959**
Alternative	7,016
D.P. Battery Co., Ltd.	6,893
Chloride Electrical Storage Co., Ltd.	6,960
Pritchett & Gold & E.P.S. Co., Ltd.	7,041

Standard testing set (£523).—Ferranti, Ltd. (Accepted.)
Motor-alternator set (£385).—J. H. Holmes & Co. (Accepted.)

Tramways Committee. Accepted :—

Points and crossings (£831).—Hadfields, Ltd.
Trolley wire (£80).—F. Smith & Co., Ltd.
Brake blocks (£108).—Hamworthy Engineering Co.

Cardiff.—The *South Wales Daily News* reports that the Electricity Committee last week reconsidered the recommendation which had been referred back relating to the supply of electrical cables for which a Belgian tender at £8,818 was recommended for acceptance, as compared with £10,869, the lowest British quotation. During the discussion it was stated that the lowest British tender had now been reduced by 6 per cent. (£673) so as to keep the contract in this country. Upon the question being put to the vote the Committee reversed its previous decision and accepted the tender of Pirelli-General Cable Works, Ltd., at £10,196.

Coventry.—The City Council has accepted the lowest British tender for cable in connection with its big electricity scheme, rejecting German offers which were 12½ per cent. lower in price.

Dundee.—The Corporation Electricity Committee has recommended acceptance of a German tender for cables. It was stated that on a total of £1,052, the German offer was £206, or 20 per cent., less than the British offers.

Hornsey.—Electricity Committee. Recommended:—

Troughs, covers and bridges for 12 months.—Doulton & Co., Ltd.
Lead service shells and house fuse boxes for 12 months.—Henry Hughes and Sons, Ltd.
H.p. switchgear for 3,000-kW set (£600).—A. Reyrolle & Co., Ltd.

Hull.—According to the *Yorkshire Post*, the Corporation Telephones Committee considered a large number of tenders for cable at its meeting last week, the members being equally divided as to whether the lowest British or the lowest German tender should be accepted. For leading-in wire the German price (Dennis & Co.) was £62, against the British price (W. T. Glover & Co., Ltd.) of £91. For inside wire the Magna Wire Cable Co. (German) quoted £151, and W. T. Glover & Co., Ltd., £187. For lead-covered cable the Power and Lighting Cable Co. (German) quoted £207, and the Union Cable Co. (British) £315. German insulators were quoted at £105, and British at £161. As the voting was equal in all cases, the City Council will have to decide which offers shall be accepted.

Electricity Committee.

Air preheater (£2,500).—Howdens, Ltd. (Recommended.)

Motor connectors.—	A	B
British Thomson-Houston Co., Ltd.	£2,671	£4,668
Bruce Peebles & Co., Ltd. (Accepted.)	**2,533**	**4,278**
Brush Electrical Engineering Co., Ltd.	1,685	3,150
English Electric Co., Ltd.	2,589	3,840
General Electric Co., Ltd.	2,589	4,490
Metropolitan-Vickers Electrical Co., Ltd.	2,590	3,841

Ilford.—The Electricity Committee has reconsidered its recommendation that the tender of the Ateliers de Constructions Electriques de Charleroi at £3,000 for a 1,000-kW La Cour converter, with necessary switchgear, be accepted, and in resubmitting the report, points out that the proposed new converter is a replica of the existing one in the Uphall Road sub-station, and that the provision of the additional machine was contemplated when the original 1,000-kW La Cour motor converter was purchased by the Council.

Electricity Committee.

Feed-water heater (£110).—Worthington-Simpson, Ltd. (Recommended.)
Switchgear (£266).—General Electric Co., Ltd. (Recommended.)
440 yd. .06 sq. in. cable (£173).—Macintosh Cable Co., Ltd. (Accepted.)
440 yd. 0.1 sq. in. cable (£244).—W. T. Henley's Telegraph Works Co., Ltd. (Accepted.)

Tramways Committee. Accepted :—

1 mile of trolley wire (9¾d. per lb.).—Frederick Smith & Co., Ltd.

Lamp Contracts.—The Metropolitan Water Board has placed contracts for 12 months' supply of electric lamps with the General Electric Co., Ltd., and Siemens and English Electric Lamp Co., Ltd.

Leeds.—Electricity Committee. Accepted :—

Cable.—£1,841, Enfield Cable Works, Ltd.; £4,719, Hackbridge Cable Co., Ltd.; and £2,056, Macintosh Cable Co., Ltd.
Cable troughing and covers (£2,905).—Middleton Estate & Colliery Co., Ltd.

Leicester.—Electricity Committee. Erection of two concrete water-cooling towers at power station :—

Mitchell Conveyor & Transporter Co. (Recommended.)	**£22,200**
Premier Cooler & Engineering Co., Ltd.	28,500

Switchgear in connection with electrification of sewage pumping plant (£570).—New Switchgear Construction Co., Ltd. (Accepted.)

London.—LONDON COUNTY COUNCIL.—Highways Committee.

H.p. switchgear for Lewisham sub-station :—

General Electric Co., Ltd. (Accepted.)	**£1,555**
A. Reyrolle & Co., Ltd.	2,138
Bertram Thomas	2,138
British Thomson-Houston Co., Ltd.	2,448
Ferguson, Pailin, Ltd.	2,608
Switchgear & Cowans, Ltd.	2,668
Johnson & Phillips, Ltd.	2,689
Metropolitan-Vickers Electrical Co., Ltd.	2,702
New Switchgear Construction Co., Ltd.	2,766
Whipp & Bourne, Ltd.	2,811
Park Royal Engineering Co., Ltd.	2,820

Education Committee. Recommended :—

Electric service lift at Wandsworth Technical Institute :—

Medway's Safety Lift Co., Ltd.	£238
Holt & Willetts. (Recommended.)	**255**
The Hoisting Appliance Co.	297
Waygood-Otis, Ltd.	378
A. Morgan	425

HACKNEY.—Electricity Committee. Recommended :—

Switchgear for the Millfields Road power house (£12,595).—A. Reyrolle and Co., Ltd.

AIR MINISTRY.—Accepted :—

Inert cells.—Edison Swan Electric Co., Ltd.

Northampton.—Board of Guardians. Accepted:—

Installing electric light at the Institution (£449).—E. Goldston, Ltd.

Retford.—Town Council. Accepted:—

Underground mains (£9,275).—Pirelli-General Cable Works, Ltd.
Transformers and control gear (£2,516).—Foster Engineering Co., Ltd.
Consumers' meters.—Measurement, Ltd.

Stirling.—Town Council. Accepted:—

Electrical work at the new tuberculosis dispensary.—Robert Blyth & Co.

Forthcoming Events.

Edinburgh Electrical Society.—Wednesday, April 7th. At the Royal Scottish Society of Arts, 117, George Street. At 8 p.m. Paper on "The Electrical Equipment of a Battleship," by Mr. G. Peers.

National Association of Supervising Electricians.—Thursday, April 8th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. Paper on "Electrical Heating and Hot-Water Supply for Buildings," by Mr. W. W. Nobbs.

Institution of Electrical Engineers.—Thursday, April 8th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Papers on "The Application of Machinery at the Coal Face," by Mr. S. Mavor; on "The Design of Storage-Battery Locomotives for Use in Mines," by Mr. L. Miller; and on "Electricity in Mines: A Short Survey," by Mr. R. Nelson.

(North-Western Students' Section).—Tuesday, April 6th. At Milton Hall, Deansgate, Manchester. At 7.30 p.m. Annual general meeting.

Diesel Engine Users' Association.—Friday, April 9th. At Caxton Hall, Westminster, S.W. Paper on "Industrial Tests on Internal-Combustion Engines," by Mr. W. A. Tookey.

Electrical Power Engineers' Association (Southern Division).—Friday, April 9th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Boiler Power Plant Developments in Association with Powdered Fuel," by Mr. F. H. Rosencrantz.

Notes.

Civil Service Commission.—Forthcoming examinations for male assistant superintendent of traffic (Class II) in the London Telephone Service and male assistant traffic superintendent in the provinces (18-23); the latest date for the receipt of application forms is June 2nd. Regulations, particulars, &c., can be obtained from the Secretary, Civil Service Commission, Burlington Gardens, W.1. (See our advertisement pages to-day.)

The St. Helens Inauguration.—At the opening ceremony of the extensions to the St. Helens generating station, described elsewhere in this issue, on March 23rd, the Mayor of St. Helens, Alderman T. Hamblett, briefly traced the history and development of the undertaking since its establishment 30 years ago. To-day the plant capacity of the station was 11,800 kW. At a subsequent luncheon at the Town Hall, Councillor F. Wilson, chairman of the Liverpool Electricity Committee, spoke of the enormous electrical progress made during the last few years in South West Lancashire. For years there had been cries of "reduce manufacturing costs," and there was no doubt that to a considerable extent that would be achieved by the generous use of electrical energy.

Alderman Foster referred to the low production costs of the St. Helens undertaking, which few authorities could equal.

Alderman Sir Peter Peacock, chairman of the Warrington Electricity Committee, congratulated the St. Helens Corporation on the progress of its undertaking. Warrington envied St. Helens as being the place that had the lowest production cost of any town in the country.

Mr. F. N. Rendell Baker, Borough Electrical Engineer, replying to complimentary speeches, said that the St. Helens scheme could be greatly developed as and when required. It was regrettable that St. Helens did not possess an electricity showroom, and at an early meeting of the committee he proposed making a recommendation that a first-class showroom should be provided. He hoped that the municipalities in South-West Lancashire would be brought together, so that co-ordination could be considered for a widespread development of the demand.

Mr. W. Johnstone, of the Brush Electrical Engineering Co., Ltd., responded to the toast "The Contractors," and his remarks were supplemented by Mr. W. Bayliss, of Messrs. Babcock & Wilcox, Ltd., who presented Councillor Hewitt, as chairman of the Electricity Committee, with a silver salver on behalf of the contractors.

Local Society.—The Edinburgh Electrical Society on March 20th, paid a visit to Port Edgar, and inspected various works, the Instruction Theatre, the torpedo works, and one of the light cruisers. Following on this visit a lecture will be given on April 7th, on the "Electrical Equipment of a Battleship," by Mr. G. Peers.

Late Legal.—Edison Swan Electric Co. (Branches), Ltd.—Mr. Justice Russell, in the Chancery Division on March 30th, granted the petition of the Edison Swan Electric Co. (Branches), Ltd., for power to extend the objects of the company as allowed by its memorandum of association, and to enable it to carry on its business not only in India, but in any part of the world. Counsel, in support of the petition, said the object of it was to enable the company to carry on an extensive agency business all over the world.

Appointment Vacant.—Junior electrician (£150), for the Cardiff City Mental Hospital. (See this issue.)

National Association of Supervising Electricians.—On Saturday last this Association held its annual dinner and musical evening at the Holborn Restaurant, London; the president, Mr. A. M. Sillar, M.Inst.C.E., occupied the chair, and there was a large attendance of members and guests. After the toast of "The King" had been duly honoured, Mr. A. H. Dykes, M.Inst.C.E., past-president, proposed "The Visitors," remarking on the acuteness of the organising committee in inviting prominent engineers to become acquainted with the Association.

Mr. W. Reavell, president I.Mech.E., responded, recommending electrical engineers to give attention to the mechanical design of their apparatus, as, in his experience, it was generally the mechanical parts that gave trouble. The supervising technician, he said, was the backbone of the electrical industry. Every man engaged in industry should be concerned primarily with service to his fellow men, and secondarily with his own interests; no permanent structure could be raised on a foundation of selfishness. Sir William Noble, M.I.E.E., also responded, recalling the days when he himself belonged to a similar but secret association of supervisers in the Post Office, which at that time was a somewhat risky matter. It was now recognised to be in the interests of both workers and employers that such associations should be formed.

Mr. R. A. Chattock, president I.E.E., proposed "The Association," remarking that many years ago he was instrumental in forming an association of power engineers working on similar lines; the educational activities of such societies were admirable, but still more valuable was the idea of helping one another in time of need. The Association was growing stronger every year, and he wished it every success. The electrical industry was largely dependent on men such as their members, who were doing splendid work. The Government Bill was put forward to stimulate the use of electricity and cheapen it, but the details of the Bill were not satisfactory; it would establish a bureaucracy, which might be amenable to political influence, and the cost of standardising frequency needed thorough investigation before any drastic step was taken. The necessity of standard frequency might disappear, in which case millions of pounds would have been wasted. It seemed likely that even without the Bill, in eight or ten years they would reach the consumption aimed at by the Government.

Mr. A. M. Sillar responded, expressing pleasure at the presence of the presidents of two of the leading engineering Institutions, and recalling the time when he was supervising electrician installing electric light in the Covent Garden Theatre in the 'eighties.

Mr. R. W. Whitley proposed "The Electrical Press" in complimentary terms, and Mr. A. H. Allen, M.I.E.E., responded, remarking that the Press had never had anything but praise to say of the Association. Mr. Lathom proposed the health of the Dinner Committee, and Mr. A. Brammer, general secretary, in reply, said that the maintenance of a high standard of qualifications for membership had paid the Association well; last year the membership increased by 22 per cent. and the funds by 45 per cent.

An excellent musical programme enhanced the enjoyment of the function.

Fatality.—At Dumbarton last week an inquiry was held into a recent accident at the Old Kilpatrick sub-station of the Clyde Valley Electric Power Co., whereby a man lost his life by coming in contact with a live wire. Evidence was given that the deceased and another man were in the building on the day of the accident for the purpose of cleaning 11,000-V cubicles. The man in charge of the sub-station said that although the switch and one set of links were opened, that did not completely shut off the power. The remaining set of links should have been drawn. When the accident happened he heard a report and saw a flame inside the cubicle. In a second the whole place was on fire. At first he did not realise anyone had been injured, and he went outside, but hearing a noise he returned and saw deceased hanging on the cubicle door. His foot had come into contact with a live wire. Replying to the Inspector of Factories, witness explained that when he returned to the chamber after the explosion and helped to free deceased the conductors were still alive in the cubicle. An engineer of the company, referring to the possibility of insulating the wire with which deceased came in contact, said it was not practicable because insulation put on a conductor in that particular position would become highly charged. The jury returned a formal verdict.

London Traffic Inquiry.—The inquiry into the travelling facilities of East London was concluded on March 29th by a sub-committee of the London and Home Counties Traffic Advisory Committee at the Middlesex Guildhall. Further proposals put forward for relieving traffic congestion were a circular tramway route turning down Mansfield Street, on the left of Whitechapel High Street and continuing through the Minories back into Aldgate High Street, and so completing the circular route, and that the sewer known as the Northern Outfall running from Bow Road to Barking should be used as a tramway track, by raising the waste land on each side of the sewer and using it for the tramway only.

New Branch of the E.A.W.—There was a large and representative attendance at the inaugural meeting of the Manchester District Branch of the Electrical Association for Women held on March 25th at the Town Hall, Manchester. Alderman Dagnall, the chairman of the Electricity Committee, presided and noted that one of the objects of the Association was to advance the general use of electricity in the interest of housewives. He had used electricity in his own house for 14 years and at present had neither a gas nor a coal fire.

Miss Haslett, director of the Association, detailed the history of the Association from its inception eighteen months ago. The Glasgow branch now had 200 members; Birmingham had started well and the Manchester branch was their third venture. The Association had sought to put forward the point of view of the woman, who asked for a greater expansion in hire-purchase systems. It should be easier for working women to have electricity installed. Far more education work should be done in the schools in spreading simple electrical knowledge and that matter was having attention in the proper quarters.

Mr. S. J. Watson, electrical engineer, Salford, welcomed the formation of the new branch. Its main objects, he said, were to lighten labour in the home by means of improved apparatus. The need was great in that district on account of the tremendous amount of small property occupied by the working classes. Systems of easy payment were desirable.

Mr. Ellis, chairman of the North-Western Centre of the Institution of Electrical Engineers, encouraged the new branch. He hoped the Association would enter the wider field of considering the women engaged in electrical work. The application of electricity in the home was essentially a woman's business; and they should have women as electrical contractors.

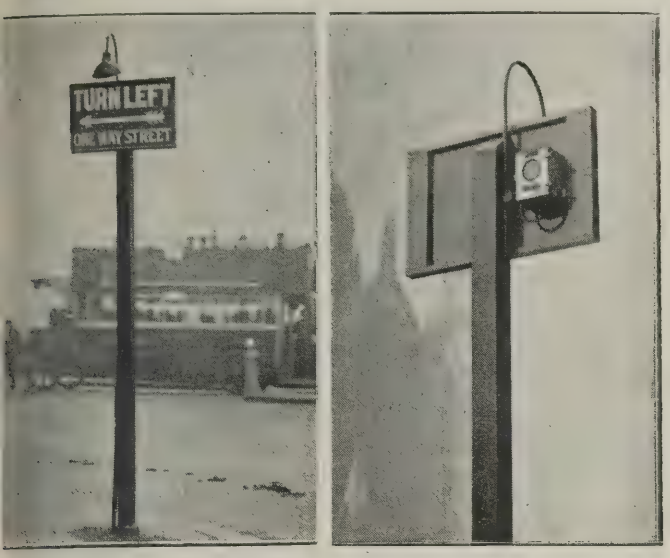
Miss G. L. Entwistle, who had convened the meeting, thanked those who had helped to secure such a representative gathering, and indicated the future programme of the Branch.

Mr. H. C. Lamb, city electrical engineer, Manchester, agreed with the previous speakers as to the new venture. The designs of electrical apparatus for the home would be improved if users could be got to say what they thought about them.

Miss Baines moved the resolution to form the Manchester District Branch, which was seconded by Mrs. Robertson and carried unanimously. The first Council was formed, and Miss G. L. Entwistle was appointed hon. secretary.

The Post Office Tube Railway.—The *Daily Mail* states that it is anticipated that the Post Office London Tube Railway will be available for traffic in the autumn. The total cost up to date has been £1,407,000.

Illuminated Traffic Signs.—The accompanying illustrations show the back and front views of one of the signs which have recently been placed in Parliament Square in connection with the new traffic-guidance regulations. The front of the board is illuminated at the necessary times by means of a suitable bracket lamp which is controlled by a Venner time switch, the latter being fixed on the back of the board.



Illuminated Traffic Signal Posts.

Institution Notes.

Institution of Electrical Engineers.—The arrangements for the remainder of Session 1925-26 include the following items :—

Ordinary Meetings of the Institution.

April 8th.—Mr. S. Mavor. "The Applications of Machinery at the Coal Face."

April 8th.—Mr. L. Miller. "The Design of Storage-Battery Locomotives for use in Coal Mines."

April 8th.—Mr. R. Nelson. "Electricity in Mines: A Short Survey."

April 22nd.—Sir J. J. Thomson, O.M., M.A., F.R.S. The Seventeenth Kelvin Lecture. "The Mechanics of the Electric Field."

April 29th.—Messrs. B. S. Cohen, A. J. Aldridge, and W. West, B.A. "The Frequency Characteristics of Telephone Systems, and Audio-Frequency Apparatus and their Measurement."

May 27th.—Annual general meeting.

June 24th.—Annual conversazione.

Wireless Section Meetings.

April 14th.—Mr. E. H. Shaughnessy, O.B.E. "The Rugby Radio Station of the British Post Office."

May 5th.—Mr. R. L. Smith-Rose, Ph.D., M.Sc., and R. H. Barfield, M.Sc. "On the Lateral Deviation of Wireless Waves and the Development of an Accurate Direction-Finder."

May 19th.—Messrs. M. Thompson, M.A., R. H. Dudderidge, and J. G. A. Sims, M.Sc. (Communication from the staff of the Research Laboratories, General Electric Co., Ltd., Wembley.) "Life-Testing of Small Thermionic Valves."

June 2nd.—Mr. P. W. Willans. "Low-Frequency Intervalve Transformer."

Informal Meeting.

April 12th.—Discussion on "The Linking together of Wireless and Wire Communication Systems." (Opened by Captain P. P. Eckersley.)

Summer Meeting.—The summer meeting of the Institution is to be held this year at the North-Eastern Centre (chairman: Mr. R. W. Gregory) during the week ending June 12th. Members will assemble to meet the local committee at the Central Station Hotel, Newcastle-upon-Tyne, on Monday evening, June 7th, and this year one evening during the week (Thursday, June 10th) has been left free, which will be appreciated by those who have friends in the district. The works to be visited are those of Sir W. G. Armstrong Whitworth & Co., Ltd., Messrs. J. H. Holmes & Co., Ltd., C. A. Parsons & Co., Ltd., and A. Reyrolle & Co., Ltd.; also the North Tees power station (Newcastle-upon-Tyne Electric Supply Co., Ltd.), a pit (Horden Collieries, Ltd.), a shipyard (Swan, Hunter and Wigham Richardson, Ltd.), a steel works rolling mills (Consett Iron Co., Ltd.), and the Lemington glass works (G.E.C.). There will also be an opportunity of seeing Durham Cathedral, and an excursion to Hexham and the Abbey has been arranged, together with the usual civic receptions, dances, &c. It is advisable to book hotel accommodation as early as possible, and members who have friends in the district are urged to endeavour to obtain private hospitality if possible, as the pressure on hotel accommodation in Newcastle during the summer is great.

Informal Meeting.—At the informal meeting on Monday, March 22nd, Mr. A. H. Allen was in the chair, when Mr. G. Rogers opened a discussion on "The Performance of Mercury Arc Rectifiers." Mr. Rogers is an official of the Birmingham electricity works, where he has control of about 10,000 kW of gasfilled rectifiers, and he has an unrivalled experience of this method of converting. He is an enthusiastic advocate of the apparatus, and the British-made rectifier now being produced has his complete approval. His opening was not a formal treatise, but was intended as a supplement to his paper read before the Institution. He therefore dealt at length with the difficulties and objections sometimes associated with rectifiers, and invited discussion of these opinions. He expressed the belief that the life of the valve, which, with reasonable care, was now very lengthy, would be almost indefinitely prolonged by the oil-jacketing as applied to the latest types. The rise of temperature and the ventilation of the cylinder had been the chief difficulties hitherto, and it would seem that oil cooling would eliminate these troubles. An exceptionally prolonged and interesting discussion followed, in the course of which Mr. A. Honeysett said he had dispatched to a remote pumping installation some 300 kW of English rectifiers, which had made a perilous journey quite successfully and had now been in operation for a long period, giving every evidence of entire reliability.

Local Wireless Sections.—The Committee of the North-Western Centre, at the request of the Council, is considering the formation of a Local Wireless Section, and has issued a questionnaire on the subject to its members.

Incorporated Municipal Electrical Association.—Annual Convention.—The preliminary programme of the Convention to be held at Glasgow, from June 14th to 19th, 1926, has just been issued. On Monday, June 14th, there will be a reception by the President and Mrs. R. B. Mitchell, Councillor Dr. Dewar (convener of Electricity Committee) and Mrs. Dewar. On Tuesday the Convention will be opened in St. Andrew's Hall with a civic welcome by the Lord Provost of Glasgow, Sir Matthew W. Montgomery, followed by the presidential address of Mr. R. B. Mitchell, and a paper on "The Practical Working of the Principles of Whitleyism from a Management Point of View," by Alderman W. Walker, M.I.E.E., M.I.Mech.E. After luncheon, as guests of the Corporation of Glasgow, there will be a visit to Dalmarnock power station, and in the evening the Lord Provost and Magistrates will hold a reception, with dancing and a concert, in the City Chambers. On Wednesday a paper will be read on "Supplies to Outlying Districts," by Mr. S. E. Britton, M.I.E.E., M.I.Mech.E., and in the afternoon a visit to Messrs. Babcock & Wilcox's works (Renfrew) will take place. On Thursday papers will be read on "Operating Costs of Electric Battery Vehicles," by Mr. C. W. Marshall, and "Industrial Heating," by Mr. A. P. M. Fleming. The annual dinner will be held in the evening. On Friday, after the annual general meeting there will be a visit to the Falls of Clyde (Clyde Valley Co.'s hydro-electric scheme), or to the Trossachs. On Saturday the events are a visit to the tramway power station at Pinkston, and an inspection of the bulk supply 33,000-volt overhead line between Greenock and Paisley. An exhibition, comprising electric cooking and water-heating apparatus, together with any other apparatus or appliances of interest to electricity supply authorities, will be held in Sauchiehall Street, close to the Corporation Electricity Department's showrooms. There will be included in the exhibition a demonstration of modern lighting methods. All communications prior to June 10th should be sent to the secretary, I.M.E.A., Electric House, 38, High Street, Croydon.

Institute of Transport.—Examinations, 1926.—As a result of the large number of applications to sit for the Graduateship and Associate Membership examinations to be held on April 15th and 16th next, the Institute Council has aranged for candidates to be examined at the following centres :—London: King's College, Strand, W.C.2. Manchester: High School of Commerce, Spring Gardens. Leeds: The University.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

It was reported to the Haslingden Town Council, on March 25th, that the Whitley Council recommended an increase of £50 in the salary of the tramway manager.

Mr. George P. Shallcross, who has been electrical engineer to the Birkenhead Corporation since 1913, will retire in June next, having reached the age limit. He has been in the service of the Corporation for 27 years, and has carried out many extensions to the electricity supply in the borough and the adjoining districts. The Town Council, at its meeting on March 31st, will be recommended by the Electricity Committee to approve the appointment of Mr. Francis Edward Spencer, the assistant electrical engineer, to succeed Mr. Shallcross. Mr. Spencer, who is 44 years of age, entered the service of the Corporation as switchboard attendant in 1899. He was appointed to his present position in 1913.

Sir Benjamin Longbottom, of Electromotors, Ltd., was on March 26th elected president of the Manchester Association of Engineers.

Last Saturday afternoon Mr. R. B. Mitchell inaugurated a new pavilion at the grounds laid out at Dalmarnock for recreation in connection with the Glasgow Corporation Electricity Department's welfare movement. Mr. Mitchell, who is to represent the I.M.E.A. at the conferences of the International Electrotechnical Commission in New York, was to

sail from Southampton on April 2nd. Following the ceremony on Saturday, he was presented with a fitted dressing case, a cabin trunk, and a travelling rug for his voyage.

Prof. W. Peterson, of the Technical High School, Darmstadt, has been elected a director of the Allgemeine Elektrizitats Gesellschaft, of Berlin, in succession to the late Prof. Dr. Klingenberg.

Accrington Electricity Committee recommends that the electrical engineer's bonus be increased from £165 to £214, making his total remuneration £914 per annum.

Mr. E. T. Wright, A.M.C.T., son of Mr. Arthur S. Wright, of Blackpool, has been appointed principal electrical engineer at the Manchester offices of the Traction Equipment Co. Mr. E. T. Wright was for over eight years with the Metropolitan-Vickers Co. at Trafford Park; he left that company to take up his present position. He was recently married to Miss Vera M. Brooke, daughter of Mr. W. A. Brooke, Altrincham.

Mr. A. P. M. Fleming, manager of the Research and Education Department of the Metropolitan-Vickers Electrical Company, was one of the chief visiting speakers to crowded gatherings in the course of the City of Bradford Education Week, which ended on March 27th.

Mr. J. W. Negus, foreman of the overhead equipment section of the Bradford City Tramways Department, retired at the end of March after over 40 years' service in the local tramways. He was presented with a silver rose bowl and case of pipes.

Mr. A. A. Campbell Swinton, F.R.S., has given up his offices at Victoria Street, S.W., and all communications should be sent to him at 40, Chester Square, S.W.1, which is his sole permanent address.

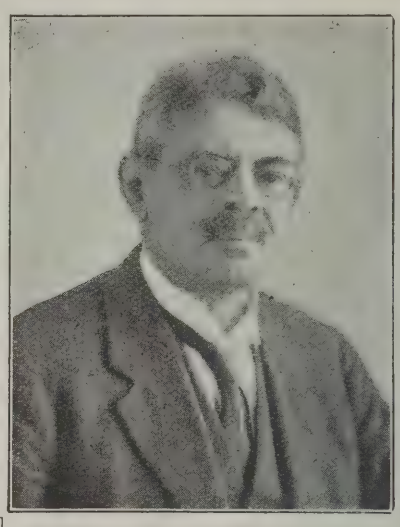
In March Mr. F. H. Livens, M.I.Mech.E., director and chief engineer of Messrs. Ruston & Hornsby, Ltd., completed 50 years' service with the company. At a board meeting on March 23rd the chairman, on behalf of the company and directors, presented him with an oil painting. The picture is by Niemann, and the subject, "Lincoln," as seen in 1858 from the Witham banks of the south-east of the city.

Ald. J. Cope has just completed 25 years as chairman of the Tramways Committee of the Walsall Corporation. On Friday last he was presented with an oak armchair (made from an old tramway sleeper), a wallet, and an illuminated address, from the staff and employés of the undertaking.

The John Fritz Medal Board of Award, representing the American Societies of Civil, Mining, Mechanical, and Electrical Engineers, announces the presentation of the John Fritz gold medal to Edward Dean Adams, "engineer, financier, scientist, whose vision, courage and industry made possible at Niagara Falls the birth of hydro-electric power."

Obituary.—Mr. Francis Hird.—We regret to record that Mr. Francis Hird, B.A.(Cantab.), managing director of Siemens Bros. & Co., Ltd., passed away on March 25th at Lanark House, Old Charlton, S.E.7, in his 59th year. Mr. Hird was also managing director of Siemens & English Electric Lamp Co., Ltd., and Caxton Electric Developments, Ltd. He was further a director of the following companies:—Siemens and General Electric Railway Signal Co., Ltd.; Elliott Bros. (London), Ltd.; the Enfield Cable Works, Ltd.; St. Helen's Cable & Rubber Co., Ltd.; and the Fixed Price Light Co., Ltd. Mr. Francis Hird was born—of British parentage—in Paris in 1868. He came to England in early childhood, and was educated at the Bradford Grammar School, from which he obtained a Natural Sciences Exhibition at Trinity College, Cambridge, and studied under Professor J. J. Thomson at the Cavendish Laboratory. He obtained a First Class in the Natural Sciences Tripos, and took his degree of B.A. in 1887 at the rather unusually early age of 19. In 1889 Mr. Hird joined the staff of Messrs. Siemens Bros. & Co., Ltd., and after a few years became chief dynamo designer to that company. In due course, after having gained some commercial experience, he became head of the company's Electric Light and Power Department. In connection with the various activities in electrical development proceeding at that time, it may be mentioned that Mr. Hird took a considerable personal share in the design and construction of the original equipment of the Waterloo and City Railway. For some time he was works manager of Siemens Bros.' Dynamo Works, Ltd., at Stafford, subsequently returning to Siemens Bros. & Co., Ltd., in order to take charge of their Apparatus Department and to develop their light-current work generally. In this connection he inaugurated their Telephone Department, and thus enabled Siemens Bros. & Co. to be among the first to introduce practical automatic telephone exchanges in this country. Mr. Hird was appointed general manager of Siemens Bros. and Co., Ltd., in 1922, and managing director in April, 1925. He leaves a widow and two daughters.

The funeral took place on Saturday last at Charlton Cemetery. A service was held at St. Paul's Church, Old Charlton, prior to the interment. It was conducted by the Rev. Derman Christopherson, M.A., and the lesson was read by Sir William Bull, M.P., a co-director of Mr. Hird's. Those present in addition to his widow, two daughters, and other relatives, included Mr. G. Mure Ritchie, chairman of Siemens Brothers & Co., Ltd.; Mr. W. O. Smith, M.I.E.E., one of the directors of the company; Dr. H. Wright, general manager of Siemens Brothers and Co., Ltd., and members of the Company's staff; representatives of Siemens & English Electric Lamp Co., Ltd., Siemens and General Electric Railway Signal Co., Ltd., and Elliott Brothers (London), Ltd.; Sir G. H. Hume, M.P., chairman of the London County Council; Mr. L. B. Atkinson (Cable-Makers' Association); Mr. M. J. Railing (General Electric Co., Ltd.); Mr. R. G. Cavell, representing Sir Alexander Roger, chairman of the Automatic Telephone Manufacturing Co., Ltd.; Sir Frank Dyson, Astronomer Royal; and representatives of the Siemens Foremen's Association, the Siemens Staff Club, and the Siemens Sports Club.



Elliott & Fry] [*London.*

The late Mr. Francis Hird, B.A., M.I.E.E.

Prof. A. Witz.—The death recently took place in Lille, France, at the age of 77 years, of Prof. Aimé Witz. The deceased was an authority on internal combustion engines and heat utilisation, and had taken a prominent part in electrical developments in France.

Alderman Smithson.—We regret to record that Alderman R. A. Smithson, who had been a member of the Leeds City Council for 30 years and had taken a leading part in connection with the tramways, passed away last week.

Mr. G. S. Corlett.—We regret to note that Mr. George Stephen Corlett, M.I.E.E., M.I.Mining E., passed away at Wigan on Sunday last, March 28th. Mr. Corlett, who was born in the Isle of Man in 1866, was articled to Mr. Sydney F. Walker, of Cardiff, and after some years engineering experience he was from 1890-92 with Messrs. Mercier, Corlett and Co., electrical contractors at Wigan, and subsequently managing director of the Corlett Electrical Engineering Co., Ltd., from 1892-1914. In the latter year he started as a consulting engineer, and specialised in the carrying out of electrical installation work in English and Welsh Collieries. Mr. Corlett was a past-president of the Association of Mining Electrical Engineers.

Wills.—The late Mr. Arthur L. Cottam, wholesale electrical supplies factor, Bristol, left £8,591.

According to *The Times*, Mr. William Hampson, a leading member of the Council of the Röntgen Society and lately medical officer in charge of the electrical and X-ray departments of the Queen's Hospital for Children, left £5,574.

New Companies Registered.

Esono, Ltd. (212,669).—Private company. Registered March 24th. Capital, £1,500 in 1,000 ordinary shares of £1 and 10,000 deferred shares of 1s. Objects: To acquire (1) from W. Edwards the registered trade mark "Esono," (2) the tenancy of premises at 492, Prescot Road, Old Swan, Liverpool, together with the tenant's fixtures, fittings and tools therein, personal property, and assets of the proprietor of the business known as "Edwards, Son & Co.," electrical, mechanical, radio and automobile engineers, and the goodwill thereof; and (3) the tenancy of the premises and workshop at rear thereof, together with the business, assets and liabilities of William Roberts as a building contractor, and all fixtures, fittings, personal property and assets of the proprietor of that business. The permanent directors are:—Mrs. Annie P. Edwards, 1a, Childers Street, Old Swan, Liverpool; W. Edwards, 1a, Childers Street, Old Swan, Liverpool, electrical engineer (managing director); J. J. Fox, 28, Richard Kelly Drive, Walton, Liverpool, book-keeper; W. Roberts, 344, Queen's Drive, Knotty Ash, Liverpool, jobbing contractor. L. Carlen, 45, Osborne Road, Tuebrook, Liverpool, electrician. Qualification, £10. Remuneration, £150 per annum, divided between them. Solicitors: Bartlett & Son, 30, North John Street, Liverpool.

Cogent Electrical Co., Ltd. (212,526).—Private company. Registered March 19th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical contractors, electrical, mechanical and general engineers, manufacturers of electric or other motors, electric or other lighting sets, toys of all kinds, and parts relating to wireless, &c. The directors are:—A. J. Singlehurst, 30, Falkner Street, Liverpool, electrical engineer; G. H. Miller, 17, Sunningdale Road, Wallasey, Cheshire, wireless operator. Qualification, £100. Solicitors: T. J. Smith & Son, 7, Harrington Street, Liverpool. Registered office: 54, Berry Street, Liverpool.

Callingham Electric Supplies Co., Ltd. (212,628).—Private company. Registered March 23rd. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, electrical engineers, mechanical engineers and manufacturers, &c. The directors are:—G. Davis, 30, Penywern Road, Earl's Court, S.W.5; C. Howson, 144, Bromley Road, Beckenham, Kent. Qualification, £1. Solicitors: R. S. Jackson & Bowles, Ingram Court, 167, Fenchurch Street, E.C.3. Registered office: 121, Westbourne Grove, W.2.

F. F. Chrestian & Co., Ltd. (E.2,519).—Incorporated outside U.K. Particulars were filed on March 19th, pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in Calcutta on January 6th, 1912. The Indian address is Domchanch, Bihar. The British address is Finsbury Court, E.C.3, where E. Berkeley, engineer, and A. Berkeley, chartered electrical engineer, are authorised to accept service of process and notices on behalf of the company. The directors are:—Sir Henry P. W. Macnaghten and Geoffrey L. Winterbotham, both Indian agents, of 9, Wallace Street, Bombay. No memorandum and articles of association have yet been filed.

Nivalight, Ltd. (212,639).—Private company. Registered March 23rd. £1,000 in £1 shares. Objects: To carry on the business of dealers in electric lamps, &c. The first directors are:—H. Kaphan, 159, Eastern Esplanade, Southend-on-Sea, merchant; H. G. Coxon, 190, Bishopsgate, E.C.2. Qualification, 2 shares. Solicitor: P. S. Costerton, 190, Bishopsgate, E.C. Registered office: Pooles Buildings, Mount Pleasant, Clerkenwell, W.C.1.

Truro Electricity Supply Co., Ltd. (212,726).—Private company. Registered March 26th. Capital, £5,000 in £1 shares. Objects:—To carry on in Truro, Cornwall, and elsewhere the business of an electric light and power company, &c. The first directors are:—A. N. Rye, 11, Tothill Street, Westminster, S.W. (general manager, Edmundsons Electricity Corporation, Ltd.); L. A. Hards, Penlu, Tuckingmill, Camborne, Cornwall (manager, Cornwall Electric Power Co.); C. H. Jones, 67, Hayes Road, Bromley, Kent. Qualification, £50 shares. Remuneration as fixed by the company. Solicitors: Godfrey, Warr, Clarkson & Co., 85, Gracechurch Street, E.C. Registered office: Broad Sanctuary Chambers, Tothill Street, Westminster, S.W.

Southern Lighting and Ignition Co., Ltd. (212,725).—Private company. Registered March 26th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical, motor and general engineers, manufacturers of and dealers in radiators, dynamos, magnetos, transformers, motors, and all kinds of electrical goods and plant, manufacturers of and dealers in motor cars, cycles, &c. The subscribers (each with one share) are:—W. T. Beer, 2, Westfields Road, Acton, W.3, solicitor; Ethel E. Windsor, 51, Campden Houses, Kensington, W.8, stenographer. The first directors are to be appointed by the subscribers. Solicitors: W. P. Guillet, 55, Berners Street, W.1.

London and South Wales Electrical Engineers, Ltd. (212,629).—Private company. Registered March 23rd. Capital, £5,000 in £1 shares. Objects: To carry on business as electrical engineers and contractors, general, mechanical, wireless and radio engineers, builders, contractors and dealers in metal, stone, wood, &c. The subscribers (each with one share) are:—H. B. Giles, 66, High Street, Marlow, Bucks., surveyor; H. J. Norris, 138, Ashley Down Road, Bristol, builder's general foreman. The first directors are to be appointed by the subscribers. H. B. Giles signs as manager. Qualification, 250 shares. Remuneration (except managing director or manager) as fixed by the company. Solicitors: Lewis Morgan, Browne and Haslam, 31, High Street, Cardiff. Registered office: Gordon Works, Crockherbtown Lane, Park Place, Cardiff.

Chorlton Metal Co., Ltd. (212,594).—Private company. Registered March 22nd. Capital, £1,000 in £1 shares. Objects:—To acquire the business of radio and wireless merchants, manufacturers, importers, and general dealers carried on by M. Hacker and L. M. Galansky at 60, Long Millgate, Manchester. The permanent directors are:—M. Hacker, 27, Brighton Grove, Fallowfield, Manchester, merchant; L. M. Galansky, 333, Waterloo Road, Hightown, Manchester, merchant. Qualification, £100. Remuneration as fixed by the company. Secretary and solicitor: J. Prior, 7, Brazennose Street, Manchester.

Dalry Electric Supply Co., Ltd. (14,059).—Private company. Registered in Edinburgh on March 20th. Capital, £2,000 in £1 shares. Objects: To carry on the business indicated by the title. The directors are:—Lord Sinclair, Milton Park Lodge, Dalry, Kirkcudbrightshire, 100 shares; T. Edgar, Newfield, Dalry, Kirkcudbrightshire, farmer, 200 shares; A. Young, Garrock, Dalry, Kirkcudbrightshire; W. R. Gourley, Kinbank, Dalry, Kirkcudbrightshire; Mrs. E. I. Chisholm, Lochinvar Hotel, Dalry; T. Rankin, Dalry, baker. Qualification, 25 shares. Secretary: A. Milroy.

Official Returns of Electrical Companies.

J. Springer, Ltd. (in liquidation), electrical consultants and engineers, &c.—R. H. Collett, of 84, Chancery Lane, E.C., ceased to act as receiver or manager on March 12th, 1926.

Satisfaction in full on March 12th, 1926, of debenture dated December 30th, 1922, securing £7,000.

Johnson, Savage & Co., Ltd.—A. P. Barber, of 35, Walbrook, E.C.4, was appointed receiver on March 16th, 1926, under powers contained in first debenture dated October 14th, 1924.

Neutron, Ltd.—W. S. Dawson, C.A., of 31, Great James Street, Bedford Row, W.C., was appointed receiver and manager on March 17th, 1926, under powers contained in debenture dated September 29th, 1924.

Richard Marsden & Son, Ltd.—Mortgage on 115, Church Street, Preston, with machinery, &c., dated March 12th, 1926, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Electricity Distribution of North Wales and District, Ltd.—First mortgage debenture dated March 12th, 1926, to secure £100,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: The Treasury Solicitor. (The company may not without the sanction of the Commissioners of H.M. Treasury and the registered holder create any mortgage or charge on any part of its property or assets ranking, *pari passu*, with or in priority to this charge.)

Normand Electrical Co., Ltd.—Particulars filed of £2,000 debentures authorised December 3rd, 1925, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,200.

C. J. Thursfield & Co., Ltd.—Satisfaction in full on March 16th, 1926, of debentures dated December 27th, 1922, to December 16th, 1925, securing in all £3,250.

Watford Radio Supplies, Ltd.—W. R. Faulkner, of 133, Lower Paddock Road, Oxhey, Watford, ceased to act as receiver on February 20th, 1926.

Morley Electrical Engineering Co., Ltd. (52,358).—Capital, £5,000 in £1 shares. Return dated February 22nd, 1926. All shares taken up. £3,980 paid. £1,020 considered as paid. Mortgages and charges, £3,000.

Lamp Manufacturing Co., Ltd. (76,151).—Capital, £10,000 in £1 shares. Return dated February 11th, 1926. 5,400 shares taken up. £5,400 paid. Mortgages and charges, £2,500 debentures.

British Brown, Boveri, Ltd. (89,167).—Capital, £50,000 in £5 shares. Return dated December 18th 1925. All shares taken up. £21,250 paid (being £2 10s. per share on 8,500 shares). £7,500 considered as paid (being £5 per share on 1,500 shares). Mortgages and charges, nil.

Sturge & Baker, Ltd. (181,382).—Capital, £8,000 in £1 shares (1,500 preference and 6,500 ordinary). Return dated February 9th, 1926. 1,500 preference and 5,896 ordinary shares taken up. £7,396 considered as paid. Mortgages and charges, nil.

Torpoint Electric Supply Co., Ltd.—Satisfaction in full on February 27th, 1926, of debentures dated June 11th, 1923, securing £5,500. Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 27th, 1926, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Bower Electric (1926), Ltd.—Particulars filed of £1,500 debentures authorised January 28th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Energo Products, Ltd.—Debenture dated February 22nd, 1926, to secure £1,244 11s. 8d., charged on the company's undertaking and property, including uncalled capital. Holders: V. B. M. Mallentjer, 57, Scarsdales Villas, W.8; and A. L. Vandervelde, 166, Marylebone Road, W.8.

Hammersley Brothers, Ltd.—Particulars filed of £500 debentures authorised March 8th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £300.

Atkins & Wallis, Ltd.—Particulars filed of £500 debentures authorised February 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £250.

Bell Battery and Accessory Co., Ltd.—F. Wilcock, of 1, Great Winchester Street, E.C.2, ceased to act as receiver or manager on February 27th, 1926.

Siemens Brothers & Co., Ltd.—Satisfaction to the extent of £20,000 on January 1st, 1926, of debenture stock dated January 15th, 1918, securing £1,330,000.

Glantawe Electric Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 19th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

W. S. Jeal & Ebury Engineering Co., Ltd.—A. E. Tilley, of 8, Staple Inn, Holborn, W.C.1, ceased to act as receiver or manager on March 15th, 1926.

Orford Electric Light and Power Co., Ltd.—Issue on March 9th, 1926, of £300 debentures, part of a series already registered.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Metropolitan-Vickers Electrical Co., Ltd.

The annual meeting was held on March 23rd, Major-Gen. Sir Philip A. M. Nash, K.C.M.G., in the chair. In proposing the adoption of the report (*vide* our last issue, p. 510), the Chairman said that for some time past there had been a falling off in orders for heavy electrical plant in the home market, which position, in his opinion, had been partly created by the pending legislation in connection with the supply of electrical energy. During the last ten days or so two publications of very great importance to the electrical manufacturing industry had appeared. One was the report of Lord Weir's Committee, which not only gave an account of the progress of the supply of electrical energy up to date, but also set forth the steps necessary to bring this country up to a standard which would place it more on an equality with other big producing countries. The Committee recognised that Great Britain was favourably placed as a potential producer and distributor of cheap electrical energy, and that to remedy the backward condition in which our country to-day found itself, it was not merely a question of cheap generation of power in large power stations, but it was just as much a problem of proper transmission and distribution of energy. The report showed the great possibilities that lay before a large manufacturing concern like theirs, and he could assure them that the company possessed resources of both plant and personnel which were fully capable of taking their full share of that great electrical development. The draft Bill appeared to give effect to most of the recommendations of the Committee, particularly the setting up of a Central Electricity Board, but it appeared to him that under the terms of the Bill the Central Electricity Board was being surrounded by such restrictions as to make it doubtful whether it could function effectively and quickly. As manufacturers the company desired naturally to support legislation on broad national grounds, which would increase the use of electricity in this country, but at the same time they deprecated any steps being taken that would even temporarily restrict the progress, which large power undertakings—many of which were municipally owned—had been making during the last five years under existing conditions. The company had had its full share of business from such concerns, and he feared that progress might be arrested for the time being, and they must be prepared to see a falling off in their home sales, at any rate until the Bill had got a good long distance in its passage through Parliament. Another document which had just been published and was of very great importance to the electrical industry, was the report of the Royal Commission on the Coal Industry. That Commission had recorded its opinion that the development of electricity supply under the new proposals of the Government must be closely co-ordinated with such generation of electricity at the mines as might be undertaken by the suggested Coal Controlling Authority. There seemed to be a danger of confusion and overlapping between the work of the Electricity Board suggested in the Electricity Bill and the Fuel and Power Committee. It would appear to be necessary that in the creation of those new bodies care should be

taken that in so far as electricity was generated under the operations of the body set up under the Coal Commission's Report, that should be closely co-ordinated in some way with the work of the Electricity Commissioners and the contemplated Central Electricity Board. Reverting to the company's affairs, Sir Philip said that the export business since January 1st had been satisfactory in volume and indicated an ever increasing hold of the company on Dominion, Colonial and foreign markets. The export business obtained during 1925 constituted a tonnage record in the history of the company and there was every indication at the present time that they would be able to maintain that during the current year. There was still only the barest margin of profit in such business; competition grew, if anything, more severe, but the business was essential to the company, not only from the small profit which it contained, but more particularly from the point of view of the employment of workmen and of absorbing the heavy standing charges incidental to a highly technical business such as theirs. Export work was all-important from another point of view. Owing to the relatively backward condition of this country electrically, their largest units in practically every line of manufactures went abroad, and in addition their new technical developments, which alone could keep them in the forefront of the industry, arose almost entirely from the needs of the export market. The carrying on of this work should put them in the best possible position to tackle the large developments at home which were expected from the electricity legislation now before Parliament. Among the countries from which they had continued to obtain business were Norway, Russia, Holland, Rumania, Belgium, Spain, Persia, Burma, Palestine, China, Japan, India, Australia, New Zealand, South Africa, Brazil, Argentina, and Chile. The largest rotary converters that they had ever built went last year to New South Wales, and they were now constructing a turbo-generator unit and condensing plant for Japan larger than any that they had previously produced. The same remark applied to three water-wheel alternators now being constructed for Chile. The operation of the seventy-eight locomotives built for the South African Government had been satisfactory and they received last year a repeat order for seventeen additional locomotives. It was of interest to note that the great buk of the traction work carried out by the company and other English companies during the last three years had come from abroad, and in every instance where the electrification was in active operation, the financial results had more than justified the calculations on which it was based. Another development progressing with ever-increasing volume was that of automatic converter sub-stations with, in many cases, the addition of supervisory control; the order for sixteen rotary converters for the Bombay, Baroda and Central India Railway electrification, with its complement of transformers, switchgear, and control apparatus, was a good example of that kind of work. South Africa also provided some special features in the orders for a number of very large winders for the Rand Mines, among which was that for the City Deep Mine believed to be the largest electric winder ever ordered. Having referred with satisfaction to the progress which was being made by the separate company formed to deal with the supply side of the company's activities, and to the continued good work of the research and education departments, the Chairman concluded by stating that the relation between the management and the workers continued to be of the most satisfactory character and in that connection he mentioned that one of their machinists and the chairman of their works committee was chosen as the representative of the electrical industry in the party of workers now in the United States under the auspices of the *Daily Mail*. Mr. Alex Spencer, the vice-chairman, seconded the motion, which was carried unanimously.

British Electric Transformer Co., Ltd.

The annual meeting was held on March 25th, Mr. A. F. Berry, chairman of the company, presiding. In presenting the report and accounts, which were reviewed in our last issue (p. 511)), the chairman said that the company had started the year under review with a fair amount of work in hand, but the rate of improvement did not continue, so that the second half of the year did not yield so substantial a return as they might reasonably have expected. Immediately there were signs of upheaval in any one of our staple industries, the news was flashed round the world, and orders which would have come here were deflected to those countries from which delivery could definitely be relied upon. Unlike the electricity supply industry, manufacturers had no monopoly, but had stern competition from all sides, and to some extent their general charges must be borne by export work. He hoped that orders would not be sent abroad while manufacturers of this country had so great a need of the work. With regard to the future, the chairman said that, given a year free from interruption and work coming in as at present, they might hope to hold their own with difficulty. To secure the volume of work which they required at prices yielding even a small profit, was as hard to-day as they had ever known it. The holders of the ordinary shares had not yet any return in the way of dividend, but the preference shareholders had at least the satisfaction of seeing the substantial arrears of dividend paid off. Had it not been for those arrears of preference dividend, the ordinary shareholders might reasonably have expected some small return on their holdings. Electrical manufacturing companies, like most other engineering firms, still laboured under difficulties with regard to low wages, which were difficult to remedy. So long as men in " sheltered " occupations received wages in excess of those that could possibly be paid to their skilled men, no one in the engineering industries could feel satisfied. The elimination of that fundamental difficulty seemed but little nearer than a year ago. As a manufacturing country dependent on obtaining orders from abroad, every effort should be made to reduce risks of dislocation of industry. Foreign customers would not place their orders here unless they could feel certain that their goods would be delivered to time. The recent interest in the ordinary shares of electrical manufacturing firms seems to have been occasioned chiefly by the publicity received by the Government's Electricity Bill. While they all hoped that something useful would emerge from the proposals contained in the Bill, it was certain that the utmost goodwill and hearty co-operation of the various interests concerned would be needed if the country in general and the electrical trades in particular were to derive much benefit from the Bill. In the electrical industry the moderate success achieved so far was mainly the result of individual initiative and enterprise, and in spite of legislation, rather than because of it. Even now it was not certain whether the good to the country or to the industry resulting from the publicity that had heralded the Government's proposals, might not even set us back temporarily. Unfortunately, since the Government proposals had been brought forward, there was a feeling amongst many who ought to know better, that electricity was "*going* to be cheap," whereas in point of fact in many places it was not only cheap to-day, but ready to hand. Referring to the Company's domestic appliance business, Mr. Berry said that the development of the heating and cooking load had undoubtedly begun to stimulate the demand for electrical plant, machinery, cables, switchgear, &c. Electrical equipment firms, such as their own, would surely reap much added business from the development of that section of industry. The report and accounts were adopted.

British Insulated Cables, Ltd.

Mr. James Taylor (chairman) presided at the annual meeting on March 22nd, and in moving the adoption of the report and accounts (ELEC. REV., March 19th, p. 472), said that a great deal of the remarkable increase in the profit was attributable to increased dividends received on investments. Apart from their strictly manufacturing business, they undertook large contracts for the laying of cables, erection of power lines, and the electrification of railways, and provision was made out of profits to cover them against unforeseen contingencies. Such contracts frequently took several years to complete, and during the past year the work under some of them was finished and credit balances were left, which they had been able to take into their accounts. Of late years they had spent large sums in improving and extending their factories and they were now reaping the benefit in lower manufacturing costs. Another reason for the larger profit was the greatly increased output. None of the profit had been derived from higher prices to customers. To show that their workpeople had participated in the company's prosperity, Mr. Taylor said that in 1913 wages at the Prescot works represented 10.80 per cent. of the turnover; in 1925 the wages amounted to 18.50 per cent. On the other hand, dividends had fallen from 7.12 per cent. of the turnover in 1913 to 5.14 per cent. in 1925; thus, to maintain the dividend they had had to increase their turnover. Dealing with the activities of the company during the past year, the chairman said that they had disposed of their lamp business, which in some ways interfered with their more legitimate business. The trade of the Indian Cable Co., Ltd., was steadily growing and progressing satisfactorily. During the year about £300,000 had been spent in the extension of buildings, plant, and machinery, and they now had one of the most efficient factories in the country. Investments in other undertakings during the year had increased by about £84,000. The Midland Electric Corporation, in which they held a considerable interest, continued to do well, maintaining the dividend and bonus of 15 per cent., as well as offering a new issue of shares at a bonus price to existing shareholders. The Electric Supply Co. of Victoria had put in new plant which was working well, and had improved the company's position. The Automatic Telephone Manufacturing Co. was also progressing satisfactorily. Their bonus scheme, by which the staff received part of their payment according to output, was proving very successful. The scheme was originated when the share capital was only £500,000, the basis being that after 10 per cent. had been paid in dividends, the staff participated in the profits. Two subsequent issues of bonus shares had necessitated readjustments of the basis, but the staff had not suffered any loss and the directors believed that they were studying the best interests of the shareholders by securing that every member of the staff had a personal incentive to produce the best results. The report and accounts were adopted, and a proposal to increase the directors' remuneration was approved, subject to confirmation at a later meeting.

County of London Electric Supply Co., Ltd.

The annual meeting was held on March 23rd. Sir Harry Renwick, K.B.E., who presided, said that the report (ELEC. REV., March 19th, p. 471), was the most satisfactory one yet presented to the shareholders. The gross receipts showed an increase well over £90,000, and of this increase £70,000 arose from the increased sale of energy and meter rentals, notwithstanding the fact that the rates had been reduced. The net profit showed an increase of over £70,000 and the company was placing to various reserve accounts a total of £560,000. The sum carried forward had been

reduced as the new Act obviated the necessity of carrying forward the usual large amount. The increase in working costs was mainly due to rates and taxes, but the price of coal was lower, and he emphasised that last year's costs received practically no benefit from the new Barking station. The output of energy increased by over 15 million kWh and the total output was now approaching the 100 million kWh mark. The applications for supply amounted to 25,187 kW, including bulk and railway supplies, making the total connected load over 166,000 kW. The most satisfactory feature about the new business was the growth of bulk and railway supplies, which, in future, would form an important factor in the development of the business. Dealing with the Barking power station, the chairman said that additional capital expenditure amounting to £970,000 had been incurred during the year. The station was opened by the King in May last. It naturally took some time to get the station in proper operation; they had had some trouble with the 33,000-V transmission lines connecting the station with the London area, but those difficulties had now been largely overcome, and the company would have all the equipment available necessary to meet the heavy autumn load. Sir Harry then reviewed the position under the London Electricity (No. 1) Act, 1925. He said that the valuation of properties had not yet been fixed, nor the standard price upon which charges to consumers were dependent. In the meantime they were carrying out in practice the object of the Act by interconnecting the generating stations of the companies in the group, and by the giving and taking of bulk supplies. In furtherance of the same policy, interconnecting mains were being laid between the Barking station and the generating stations of the Kent Electric Power Co. and the North Metropolitan Electric Power Supply Co. He was afraid that he was not in a position to throw much light upon the Government's electricity proposals owing to the shortness of time allowed him for the study of the Bill. He did not know whether the Barking power house was to be a "selected" station under the Bill, but they were entitled to conclude that the company and other London supply companies would remain unaffected, seeing that the London situation was settled under the Acts of last year. He was in sympathy with any scheme which had for its object the provision of a cheap supply in bulk—a matter which was long overdue—but it was by no means clear that the Government scheme would provide a cheap supply. Bulk supply was of vast importance to small undertakings, and he could not understand how any such undertaking could refuse to take it, if it was available on reasonable terms and conditions. Bulk supply had converted struggling profitless undertakings into prosperous profit-earning ones. He deprecated the imaginings of journalists which misled the public with regard to the electricity situation, and particularly condemned the common error that the best site for a power station was at the pit's mouth. Such misleading effusions were not likely to assist in the least degree in understanding the very difficult technical problem now before the country. Looking ahead, Sir Harry said that they were justified in anticipating another successful year; the new business secured to date considerably exceeded the corresponding figure for last year, and the works costs so far showed a satisfactory reduction. They had extended their area of supply by some 24 square miles, and were further reducing the rates to consumers. In conclusion, the chairman referred to the appointment of Mr. Archibald Page as general manager, with a seat on the board, and that of Mr. Hobson as joint manager of the company.

Clyde Valley Electrical Power Co.

This company's report was reviewed in our issue of March 19th (p. 472). The annual meeting was held on March 24th. Mr. R. Robertson presided in the absence of Sir Frederick Gardner (chairman) and the deputy-chairman, and in the course of his speech said that the report was highly satisfactory and attested the vigour with which the area was being developed. Extensions in various directions had been proceeding steadily, and during the current year they would be in a position to supply electricity to Helensburgh, Cardross, Vale of Leven, Kirkintilloch, Lanark, Carluke, Kilmacolm, and Bridge of Weir. The company now had over 600 miles of e.h.p. and l.p. mains and 253 sub-stations in operation, and there were eight sub-stations in course of erection. The financial position of the company was sound, and if left to themselves, without undue Government interference, they could look forward to the future with confidence. They had successfully resisted an attempt by the Glasgow Corporation to infringe their rights and they hoped that all contentious matters between the company and the Corporation had now been settled. Mr. Robertson then turned to the Government's Electricity Bill, and said that the company was one of those authorities with a non-standard frequency. He considered that the estimate of eight million pounds as the cost of standardising frequency was far too low. It would, moreover, inevitably increase the cost of electricity to the consumers for many years. While the contemplated expenditure of £33,500,000, if carried out with due regard to economic considerations, would ultimately effect a saving in generating costs, it was inevitable that the immediate burdens would fall most heavily upon the districts served by the owners of "selected" stations. The period of guarantee was totally inadequate, as the charges for interest and sinking fund on the large capital expenditure were not to become effective for the first five years. The scheme appeared to be based upon certain estimates prepared for the Weir Committee, showing the probable results of the scheme over a series of years. So far as the West of Scotland was concerned, those figures were extremely optimistic; if they were not fulfilled, the expected economies would not be fully realised. In conclusion, Mr. Robertson said that the goal which it was hoped to reach, in 1940 or thereabouts, was an average rate to consumers of 1d. per kWh. The company's average rate last year was 0.889d., and in view of the reduction in the price of coal a still lower figure should be reached during the current year.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

Mr. R. P. Sloan (chairman and managing director) presided at the annual meeting on March 23rd. In moving the adoption of the report (*vide* our last issue, p. 510), Mr. Sloan said that the outlook in the more important industries on the North-East Coast was still far from bright, but in spite of the depression the company had not only maintained its position, but had to some extent improved it by the exercise of economies and steady development. Last year's profit showed an increase of over £41,000, which in the circumstances could be considered satisfactory. The horse-power connected amounted to 27,842—only 1,840 h.p. less than was connected in the previous year. This was also satisfactory, in view of the prevailing adverse conditions. In 1924, 3,200 new customers were connected up and in 1925, 5,812. They hoped to reach a total of 12,000 during the current year, and the number of applications received so far indicated that that figure would be reached. Upon the whole he considered the outlook brighter to-day than it was 12 months ago. Referring to the Government's electricity scheme, the chairman said that he regretted that the public had been misled by wild statements made by politicians and others with little experience of the difficult problems involved. There was no short cut to the cheapening of supply; a scheme on the lines contemplated might, in time, result in certain economies being effected, many of which would, in the ordinary course, have been effected in any case, but he was afraid that if they had to rely merely upon any such scheme, the process of cost reduction would be very slow, and much disappointment would result. The only way of bringing about any substantial reduction of costs to consumers lay in the consumers' own hands to a much greater extent than it did in the hands of electricity supply authorities or the Government. It was only by consumers making greater use of the capital invested—by increasing their individual consumption of electricity—that any substantial reduction of cost could be brought about. The general scheme outlined in the Bill closely resembled that which had been developed by the company on the North-East Coast during the past 25 years. Its application to the country as a whole would raise many difficult problems. The high state of electrical development that had been reached on the North-East Coast had only been possible because those responsible had had absolute control over generation. In the Government scheme it was proposed to take away this control and place it in the hands of a board having executive powers. This appeared to be a substantial step towards nationalisation of all electrical energy produced by supply authorities. He was satisfied that if the Government's Bill was not amended and was passed into law in its present form, future development would be very seriously hampered. If a system of high-pressure transmission mains throughout the country was provided, he earnestly hoped that power companies would be allowed to retain control of generation within their own areas. That, in his opinion, would remove one of the strongest objections to the proposals contained in the Bill. The report and accounts were adopted.

Folkestone Electricity Supply Co., Ltd.

Presiding at the annual meeting on March 26th, the chairman (Alderman George Spurgen, J.P.) said that a satisfactory number of new consumers had been added during the year, and the demand had reached a record figure. The main part of the work of bringing the undertaking in line with the most modern practice, both as regarded generation and transmission, had been practically completed. It was hoped that before the next meeting the company's undertaking would be linked up with that of the Dover Corporation in accordance with the instructions of the Electricity Commission. The latter's sanction had been obtained to the installation of a further 3,000-kW set, and an order for that had been placed with the Brush Electrical Engineering Co., Ltd. The directors felt that the broad principle of the Government's Electricity Bill was a sound one, and should eventually lead to considerable economies. The chairman also mentioned the institution of a co-partnership system by which employés could become shareholders in the company. In conclusion he said that the future for the company appeared to be bright.

Midland Electric Corporation for Power Distribution, Ltd.

The annual meeting of this company, whose report was reviewed in our last issue (p. 510), was held on March 22nd. Mr. James Taylor, who presided, said that to meet capital commitments 70,000 new ordinary shares were being offered at par to existing shareholders, giving them a substantial bonus. The progress of the company could be gauged from the fact that the energy sold increased during the year from 48 to 55 million kWh. The demand for electricity continued to grow. Their station at Ocker Hill was fully loaded and not capable of further expansion; further supplies would have to be obtained from the West Midlands Joint Electricity Authority. It was to be hoped that that newly-constituted authority

would proceed at once with the provision of additional generating plant; strong representations had been made to the Electricity Commissioners on that matter. Referring to the Government's Electricity Bill, Mr. Taylor said that the directors were carefully considering its provisions, and while not desiring to do anything to obstruct the improvement of electricity supply in this country, were taking steps to protect the company's interests. A staff benefit fund had been created and a total of £16,954 (including £12,000 provided last year) was being handed over to the trustees of the fund. The report and accounts were adopted, and at a subsequent extraordinary meeting the institution of the staff benefit fund was approved.

West London and Provincial Supply Co., Ltd.

The annual meeting was held on March 24th under the chairmanship of Mr. Harry Kahn, who, in the course of his speech, referred to the death of two directors, Sir T. Brooke-Hitching and Mr. M. Hansell. Turning to the accounts, he said that the Chiswick Electricity Supply Corporation had declared a dividend of 16 per cent., as compared with 15 per cent. in 1924. The West London Company was paying the preference dividend and the directors recommended that 7½ per cent. should be paid on the ordinary shares, that £5,000 should be transferred to reserve, and that £2,379 should be carried forward. Proceeding, the chairman said that the company's holdings consisted almost entirely of its interest in the Chiswick Corporation. Now that the financial position had improved and they had been able to inaugurate a reserve fund, it was considered that their investments should be extended in other directions. The directors were accordingly drawing up a scheme which would improve the status of the company and consequently the shareholders' investment in it. They also aimed at dealing with the method of marketing the company's shares, and taking steps to place the company among the recognised trust companies of the City.

Pinchin, Johnson & Co., Ltd.

In the course of his speech at the annual meeting on March 23rd, the chairman (Mr. E. Robson) said that 1925 was a record year, although there was a slight drop in the net revenue, owing to the non-recurrence of certain items which appeared in the 1924 accounts. They had had to carry in the past year's accounts a fairly heavy depreciation on account of Continental exchanges, and in addition conditions in the Far East had militated against the obtaining of normal results in that particular market. All other sections of the business showed substantial increases in spite of the existing adverse conditions. Considerable progress had been made towards the completion of the new factory adjacent to their Silvertown works. That extension had considerably increased the company's efficiency. The outlook for the present year was a very encouraging one from many points of view, and the sales from January 1st onwards had been satisfactory. The report and accounts were adopted.

City of London Electric Lighting Co., Ltd.

An extraordinary general meeting was held on March 24th. Mr. J. B. Braithwaite, the chairman, explained that until an agreement had been arrived at with the London County Council, under the Act of 1925, a statement of accounts in the customary form would be of little value, and the shareholders would probably prefer to await a balance sheet showing the financial position of the company under the Act. The board was satisfied, however, that the profits for 1925 were sufficient to permit of the payment of the preference dividend and of a dividend at the rate of 15 per cent. upon the ordinary shares. This was approved by those present and at a subsequent meeting resolutions authorising the alteration of the articles of association were passed..

Automatic Telephone Mfg. Co., Ltd.

The directors' report for 1925, which we briefly mentioned in our last issue, shows a profit of £163,325 for the year, to which is added £15,755 brought forward, making £179,080. After meeting debenture interest, preference dividend, &c., and allocating £50,000 for depreciation and £20,000 to general reserve, there remains a balance of £87,408. A dividend of 10 per cent. is recommended and a balance of £37,804 is to be carried forward. Steady production on a large scale has been maintained throughout the year, causing a satisfactory increase in the profit earned and enabling the directors to make substantial allocations to reserve and depreciation. The outstanding £210,000 6½ per cent. debentures were repaid during the year. Meeting: April 7th.

German Companies.

The report of the *Robert Bosch Gesellschaft*, Stuttgart, makers of magnetos and electrical equipment for motor vehicles, shows a net profit for last year of £397,142, out of which a dividend of 8 per cent. is being paid on a capital of £1,500,000. This result has been achieved notwithstanding the fact that part of the works was on short time during the twelve months. It is stated that 80 per cent. of the output of magnetos is exported to other countries.

The *Concordia Electricity Company*, Dusseldorf, states that the expected improvement in business did not take place in 1925. After defraying general expenses the accounts show net profits of 239,000 marks, permitting of the payment of a dividend at the rate of 5 per cent.

The *German Telephone and Cable Industry Company*, Berlin, has declared a dividend at the rate of 6 per cent. for 1925. At the recent annual meeting it was mentioned that the invoiced turnover largely increased last year as well as the stock of orders. Business in the current year had so far been satisfactory, the further development depending upon what funds the authorities would have available for the extension of the telephone network and the conversion of the exchanges to the automatic system.

The *Electricity Supply Company*, Berlin, which owns or is indirectly interested in various undertakings, states that there was no diminution in the demand for energy in 1925, the falling off in some cases having been compensated for by new connections and increased use of plant in other instances. The net profits for 1925 amount to 2,080,000 marks, as against 1,750,000 marks in the previous year, the dividend being at the rate of 9 per cent., as compared with 8 per cent. in 1924.

The *Electricity Company* (*late Schuckert*), Nuremberg, reporting on the situation of the undertakings in which it is interested, states that a declining tendency was manifested in 1924-25 in the turnover of the manufacturing companies and the supply works and the traffic on the tramways, and the company's contracting and financing branches were inactive owing to the scarcity of capital. It was therefore necessary to restrict activity to the maintenance and development of the existing undertakings.

French Companies.

The *Société Française des Electrodes*, of Lyons, proposes to pay a dividend at the rate of 50 fr. per share for 1925 out of net profits of 1,638,000 fr., as compared with 1,686,000 fr. in 1924, when the same dividend was paid.

The *Compagnie du Bourbonnais* (*P. de Lachomette, Villiers et Cie.*), of Lyons, which has a share capital of 28,500,000 fr., reports net profits of 7,109,000 fr. for 1925 as against 6,032,000 fr. in the previous year. It is proposed to pay a dividend of 20 fr. per share.

La Société des Constructions Electriques de France, Paris, is increasing its capital to 100 million fr.

Swiss Company.—The *Oerlikon Accumulator Works Co.*, of Zurich, reports net profits of 700,000 fr. for 1925 as compared with 650,000 fr. in the previous year; the dividend is again 20 per cent.

Danish Company.—The *Copenhagen Telephone Co., Ltd.*, has proposed a dividend of 8 per cent. for 1925, as in previous years.

Chelsea Electricity Supply Co., Ltd.—Mr. W. R. Davies (chairman) presided at the annual meeting on March 24th, and in presenting the report and accounts (Elec. Rev., March 19th, p. 473) referred to the death of Major Woods, a director, and the appointment of Mr. P. D. Tuckett in his place. He said that the company had now come to the end of its period of independence. Although they had been able to pay a dividend of 12 per cent. for the past two years, the dividend during the 37 years of the company's existence had only averaged 5.2 per cent. The amount of the free reserves which could be capitalised and the standard price to consumers had not yet been fixed. They were anxious to have these matters settled as soon as possible to enable them to make a reduction of their charges, which should be substantial. They had decided, in the meantime, to reduce their maximum charge from 7d. to 6½d. per kWh.

Direct Spanish Telegraph Co., Ltd.—The report for 1925 states that the balance available, including the sum brought forward, amounts to £10,678. The 10 per cent. preference dividend absorbs £3,000; a dividend of 10 per cent., free of tax, is paid on the ordinary shares (£6,465); and a balance of £1,213 is carried forward. The traffic receipts showed a decrease of £8,824. During the year the company's Porthcurnow-Bilbao cable was interrupted for two days, and was repaired by the Telegraph Construction & Maintenance Co., Ltd. An issue of £100,000 4½ per cent. debentures was made, and the new cable was laid and opened for traffic on September 8th last. New overhead lines have been erected between the landing place, Arrigunaga, and Bilbao. Meeting: April 15th.

Hastings and District Electric Tramways Co., Ltd.—The annual meeting was held on March 23rd under the chairmanship of Mr. G. T. Moody. The chairman said that a substantial increase in the number of passengers had been accompanied by a decrease in the revenue. Fortunately the expenditure was lower, but the net result only enabled them to pay 2½ per cent. upon the ordinary shares—a totally inadequate return. The undertaking was heavily rated and further relieved the rates by the amount of road maintenance which it was forced to carry out. The Hastings Corporation had proposed to run competing transport services, but the proposal was rejected by the ratepayers. They regretted that their friendly attitude towards the Council had not been reciprocated.

Slough and Datchet Electric Supply Co., Ltd.—The report for the past year shows a profit of £21,261 (including £4,348 brought forward). After providing for depreciation, &c., it was proposed to pay a final dividend of 6 per cent. (making 10 per cent. for the year) together with a bonus of 4 per cent. The 15,000 new shares rank for dividend from January 1st, 1925, on 10s. per share, and from July 1st, 1925, on £1 per share. A balance of £6,150 is carried forward. The extension of the company's mains to Burnham has been attended with satisfactory results, and the company has applied for powers to extend its mains to Hitcham, Dorney, Boveney and Eton Wick.

Costa Rica Electric Light and Traction Co., Ltd.—The net earnings of the company in Costa Rica increased from £26,277 to £27,808 in 1925, but the net profit fell from £9,339 to £8,906. The board has entered upon considerable expenditure upon additional plant and renewals. Five new cars have been purchased and placed in commission, and a new 1,200-kW turbo-generator is being installed. These items will cost £30,000, and accordingly the directors have again placed the balance of net profit for the year to the depreciation and renewals account. The meeting was held on Wednesday last.

London Electric Wire Co. & Smiths, Ltd.—The directors' report for 1925 states that during the year the business of the company was restricted by trade depression, and a large proportion of the business was done at a very small margin of profit. The directors had made an addition of £25,000 to the special reserve account to provide against special contingencies. The preference dividend has been paid and the directors recommend a final dividend of 6¼ per cent. on the ordinary shares, making 7½ per cent. for the year, leaving £35,918 to be carried forward. The meeting was held on Wednesday last.

Stewarts & Lloyds, Ltd.—The annual meeting was held on March 26th. Mr. R. M. Wilson, who presided, said that last year proved to be one of the worst which the iron and steel trade had ever experienced; the competition at home and abroad became greater and showed no signs of decreasing. Indeed, it was likely to become worse. In spite of the adverse circumstances, however, the company had increased its sales. Two of the large works had been remodelled and brought up to date.

Windsor Electrical Installation Co., Ltd.—The profit for the past year (including £3,648 brought forward) was £17,553. After providing for depreciation, debenture interest, preference dividend, &c., there remains a balance of £11,308. It was proposed to pay a final dividend of 6 per cent. on the ordinary shares (making 10 per cent. for the year) and a bonus of 4 per cent., leaving £5,752 to be carried forward.

Greengate and Irwell Rubber Co., Ltd.—The net profit for the past year amounted to £80,186 and the addition of £22,719 brought forward gives an available balance of £102,905. It is proposed to pay a final dividend of 1s. 2d. per share, making 2s. per share (12½ per cent.) for the year, as against 2s. 3d. in 1924, to place £10,000 to reserve, and to carry forward £27,279.

Thames Valley Traction Co., Ltd.—The balance available for the past year's working, after adding £2,538 brought forward and transferring £668 to reserve, was £7,588. A dividend of 6 per cent. is being paid on the ordinary shares (against *nil* for 1924), and £3,088 is carried forward. The directors propose to increase the capital from £75,000 to £100,000.

Browett, Lindley & Co., Ltd.—The directors report that during 1925 it was found impossible to secure sufficient work for the shops, and although economies were effected, the net result was a deficiency of £16,692, which is only partly met by the balance of £3,581 brought forward. So far this year orders have been more plentiful, but prices are very low owing to competition.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months, unless cause is shown to the contrary:—

Amalgamated Radio-Telegraph Co., Ltd.
City Electric Welding Co. (Newcastle), Ltd.
Egyptian Power and Nitrogen Syndicate, Ltd.
Electrical Development and Finance Corporation, Ltd.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Midland Counties Electric Supply Co.—250,000 ordinary shares of £1 each, fully paid, Nos. 1,000,001 to 1,250,000, and 250,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,000,001 to 1,250,000.
Shawinigan Water and Power Co.—$1,179,600 capital stock.

Brown Bros., Ltd.—In the course of his speech at the annual meeting on March 26th, Mr. W. Dickison (chairman) said that a dividend of 7½ per cent. was recommended on the ordinary shares. The company's radio branch had proved a useful addition to its activities.

Scottish Tube Co., Ltd.—Out of a balance of £61,023 for 1925 (including £16,539 brought forward) the directors propose to pay a dividend of 4 per cent. on the ordinary shares and to carry forward £15,967.

Stocks and Shares.

Monday Evening.

The principal event this week in the world of electricity is, of course, the debate on the second reading of the Electricity (Supply) Bill, around which a lively degree of interest has become quickened. The Bill is forming now the focus of political discussion, and, having been put into the political window, it attracts thereby attention from people who in the ordinary way would have regarded the business as much too abstruse and technical for them to attempt to understand. Having been definitely stamped with the label of Socialism by one party and non-Socialism by another, the Bill suddenly assumes a position of first-class importance. The technical mind must be amused, the non-technician surmises, at some of the lay criticisms that are levelled from both sides.

From the purely Stock Exchange point of view, the effect of the hubbub is comparatively slight. The tendency is to let prices droop, but none of the London shares are affected. Proprietors are evidently content to await the course of developments, and to pin their expectation to the future rewarding them with the same dividends as they now receive. For this reason, the price-list is almost unchanged, though some of the provincial shares are a little weaker. Clyde Valleys have gone back to 28s. 6d., Midland Counties to 20s., and Yorkshire Electrics are dull at 25s. 6d. In the London list, Westminsters receded to 43s. 9d. and Edmundsons preference to 22s., but apart from these, no alterations have occurred.

Sharp advances are marked in Metropolitans and in Districts. The latter have jumped 3 points to 50, while Metropolitans are 1½ higher at 66½. London Electric ordinary at 47 is 2 up. The Central London stocks are a little better, but show no quotable changes. In the Underground group there has been a reaction after the material improvements of a week ago. The £10 shares lost 2s. 6d. out of their half-a-sovereign rise and Bus "A" shares eased off to 10s. The 6 per cent. income bonds are left at 100. To explain the rise in Districts it is pointed out that this railway is more intimately connected with the Undergound than is the Metropolitan, and that the benefits expected to accrue to the former through the acquisition by the L.G.O.C. of eight private omnibus concerns are likely to be reflected in the District's profits. Metropolitans pay a very fair yield on the money, considering the prospects that the company possesses of being absorbed into one of the other groups in the future. The rise in London Electric ordinary stock has come about as a result of a little inquiry upon a market in which it is very rarely that stock changes hands at all. Nothing fresh has occurred in the British Electric Traction or the London Tramway stocks.

Marconis have responded to the better tone (which we mentioned last week as being in evidence) by a rise to 23s. 9d., the improvement being due to the unexpectedly good showing made by the Marconi Marine, shares in which latter concern remain at £1. Other wireless shares keep steady. A statement has been issued by Pettigrew & Merriman, the price of whose ordinary shares, 5s. fully-paid, is no better than 2s. 6d. The 7½ per cent. preference, with 15s. paid, stand at 6s. The directors state that in spite of the acute depression in the wireless industry, which the company has had to share with all others, its finances give no cause for anxiety. They will cause interim accounts to be prepared up to the end of June next. The company started business as from the end of October last.

Automatic Telephones maintain their rise at 51s. 3d., and Internationals are steady at 44s. The London Electric Wire Company and Smiths announce a profit for last year of £72,500, a decrease on the previous 12 months of about £18,000. The dividend is maintained on the ordinary at 7½ per cent., and the price of the 7½ per cent. preference shares is 24s. The ordinary are not quoted.

Amongst the newly-issued stocks, London Power 5 per cent. debenture strengthened to 96½ bid, which is not surprising in view of the gilt-edged character of the security. South London Electric 5 per cent. debenture stock is better at 96, and most of the purely investment securities hold their prices. American Telephones went back to 150, and Radio Corporations come weak from New York, the common being no better than 7. The preferred keep about 9¼. Canadian Marconis are listless at 4s. 1½d. All the little interest that was aroused not long ago in the latter shares has evaporated; the price has come back, it will be observed, to about the level at which the recent offer of new capital was made.

Anglo-American deferred stock has recovered to 23¾, but the cable group as a whole is very quiet, and nothing of consequence has happened. Callenders dropped to 75s., to rally to 76s. 3d. British Aluminiums are better at 41s. 3d., and British Insulated hold their rise at 3¼. Siemens at 31s. 3d. have gone back a little. India Rubber shares at 23s. are 9d. down.

Anglo-Argentine Tramways shares are dull, the second preference in particular being weak at 2½. The company is said to be faced with severe 'bus competition, but, besides this, some doubt is expressed as to whether the reported arrangement reached between the Municipality of Buenos Aires and the Anglo-Argentine Tramways Company has been converted into a permanent agreement. It would be useful to hear an authoritative statement upon this point, in order to answer the uneasy questionings of shareholders who are disturbed at the dwindling of the share-prices. Brazilian Tractions are a little lower, and other parts of the traction market present no points of fresh interest.

The engineering section is a shade better, with trifling recoveries in some of the better class iron and steel shares. In the rubber share market activity is checked not only by the close approach of the Easter holidays, but also by the reaction which has taken place in the price of the raw material from 2s. 7d. a lb. to the neighbourhood of 2s. 5d. per lb. New issues from several of the companies connected with the electrical industry are declared by gossip to be in course of preparation. No important offers are likely to be announced until after Easter.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Dividend. 1924	1925.	Price Mar. 29. 1926.	Rise or fall.	Yield. p.c.
	£					
Bournemouth and Poole	1	14	—	60/9	—	4 13 4
Brompton Ordinary	1	10	10	1 1/16	—	*5 18 6
Charing Cross Ordinary	1	14½	15	45/9xd.	—	6 11 2
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2⅛	—	5 12 11
City of London	1	15	15	45/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	28/6	—1/-	5 12 8
County of London	1	15	15	60/-	—	5 0 0
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/6	—	5 19 2
do. 7% Pref.	1	6	7	22/-	—6d.	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	13⅜xd.	—	5 9 1
Lancs. Light and Power	1	7½	7½	26/-	—1/-	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—1/6	6 0 0
Newcastle-on-Tyne Ordinary	1	7	7	23/9	—	5 17 11
do. 5% Pref.	1	5	5	18/9	—	5 6 8
do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅞	—	5 13 10
South London	1	15	15	2 1/16	—	5 17 1
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/9	—1/16	6 17 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/-xd.	—	7 10 0
Yorkshire Elec.	1	8	8	25/6	—3/6	6 5 6

Home Rails.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66½	+1½	7 10 5
do. District	,,	3½	3½	10	+3	7 0 0
Underground Electric Ordinary	10	Nil	Nil	3	—⅛	Nil
do. do. "A"	1/-	Nil	Nil	10/-	—6d.	Nil
do. do. Income	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅜	+¼	6 6 4
Automatic Telephone	1	3	6	51/3	—	3 17 10
Chili Telephone	5	6	5	6⅝	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	18	—	*5 11 1
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 8
Globe Tel. and T. Ord.	10	10	10	17¾	—¼	*5 12 8
do. do. Pref.	10	6	6	10⅜xd.	—	5 11 7
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45½	—	*4 13 5
Marconi	1	10	10	21 3/16	+1/16	8 8 6
Marconi Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	2 1/16	—	*5 16 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17¼xd.	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3 1/16	—	8 19 6
do. do. 2nd Pref.	5	6	6	2½	—3/16	12 0 0
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	122½	—	4 18 0
do. do. 6% Pref.	,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	91½	—1	5 9 3
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	104½	+1	*4 10 1
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4½	4½	75	—2	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	61½	+1	8 2 8
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	62½	—	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	12	53/9	—	*4 9 4
British Aluminium Ord.	1	5	10	41/3	+9d.	4 16 5
British Elec. Transformer Pref.	1	Nil	7	20/9	—	6 14 11
British Insulated Ord.	1	15	15	3½	—	4 18 4
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 1/16	—	4 14 10
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	16/9	—	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	19/0	—	5 5 3
do. do. Pref.	1	6	6	19/-	—6d.	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
,, Ord.	1	5	7½	31/3	—	4 16 0
Henley	1	15	16	3½	—	4 5 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	23/-	—9d.	*4 6 11
Johnson & Phillips	1	10	10	3	—	3 6 8
Met.-Vickers Ord.	1	8	8	26/3	—	6 1 11
do. Pref.	2	8	8	2 1/16	—	6 11 3
Siemens Ord.	1	—	7½	1 1/16	—9d.	4 16 0
Telegraph Construction	12	20	10	28½xd.	—	*4 4 3

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price March 30th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			...
Grade I	per ton net.	£257	£9 dec.
Grade II	,, ,,	£180	£6 dec.
Grade III	,, ,,	£98	£4 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅝d.	...
c ,, Tubes (solid drawn)	,,	1/- to 1/0¼	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£65 5s.	15s. dec.
d ,, ,, Sheets	,,	£114 10s.	...
d ,, ,, Wire Rods	,,	£75 5s.	15/- dec.
d ,, ,, H.C. Wire	per lb.	9 1/16d.	⅛d. dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	6/6	...
h India-rubber, Para fine	,,	2/3	½d. inc.
l Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£31 15s.	20/- inc.
g Mercury	per bot.	£14 10s. to £14 15s.	...
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£280 5s. to £281	£15 10s. to £15 15s. dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

The British Association.—The British Association for the Advancement of Science has issued the preliminary programme for this year's meeting at Oxford. This contains information regarding accommodation, lists of officers, and a map and historical details of the city and university. The Prince of Wales will deliver his presidential address on August 4th, and the meeting will continue until August 11th. Some excellent excursions are being arranged to places of interest in the neighbourhood of the city. The meetings of Section G.—Engineering are to be held at the Electrical Laboratory. Sir John Snell, president of the section, will deliver an address on "Electricity Supply: Its Recent and Probable Future Development," on August 6th. The proceedings of the section will include a discussion on "Refrigeration."

A Stand-by Plant Test.—We have received some particulars of an interesting speed-service test which was recently carried out at the Winnipeg hydro-electric generating station in connection with its steam stand-by plant. Without warning to the stand-by crew the main switches were tripped and the water plant shut down, the pulverisers and conveyors for the steam installation automatically ceasing to function. At the sound of the shut-down siren the stand-by men ran up from the storage steam a 1,000-h.p. house turbine, and in 2¼ min. there was sufficient electrical energy developed to start feeding the boilers. The two 7,500-h.p. main stand-by turbines were then warmed up and in 26 min. from the time when the water plant was shut down the steam turbines were on load giving an adequate supply. It is interesting to note that the three steam machines were supplied by Messrs. James Howden & Co., Ltd., Glasgow.

The Electrical Exports of Germany.

With the publication of the monthly returns, for December and the twelve months of 1925, of the foreign trade of Germany, some interesting information regarding the progress of the electrical trade of the country can be ascertained. As, however, a number of alterations in the classification were made on October 1st, when the new Customs tariff came into operation, an exact comparison with the results of the previous year is not always possible. In the following table are shown the number of dynamos, motors, converters and transformers of certain specified weights exported during the first nine months of 1925 to the principal destinations, together with the total weight in double centner (= one-tenth of a metric ton) and the value in gold marks. Side by side are given similar figures for the whole of 1924.

	1924. (12 mos.)	1925. Jan.-Sept.
Dynamos, motors, converters and transformers up to 25 kg.	204,412	231,452
Weight (Double centner)	7,689	6,383
Value (Reichsmark)	5,211,000	4,815,000
To Great Britain	14,031	13,939
,, Italy	12,721	10,241
,, Holland	35,630	49,316
,, Austria	13,468	10,456
,, Switzerland	21,930	23,900
Ditto, 25 to 100 kg.	41,444	29,904
Weight (Double centner)	22,548	16,191
Value (Reichsmark)	5,343,000	4,148,000
To Holland	5,037	3,469
,, Argentina	3,182	3,653
,, Brazil	2,602	2,331
Ditto, 100 to 500 kg.	21,394	15,916
Weight (Double centner)	43,356	32,294
Value (Reichsmark)	9,235,000	6,857,000
To Italy	1,034	854
,, Holland	1,307	1,010
,, China	1,074	465
,, Brazil	3,041	2,667
Ditto, over 500 kg.	6,904	4,945
Weight (Double centner)	140,429	115,964
Value (Reichsmark)	20,598,000	18,366,000
To Italy	407	307
,, Holland	406	367
,, Spain	518	345
,, Japan	447	172
,, Brazil	599	415

Since October 1st, 1925, the records of this trade have been further sub-divided according to weight, the total exports from that date until the end of the year being as follows:—

	Number.	Weight. Do. c'tner.	Value. Gold mk.
Up to 10 kg.	76,569	1,484	1,564,000
10 kg. to 25 kg.	6.802	1,153	713,000
25 kg. to 150 kg.	12,217	8,462	2,145,000
150 kg. to 500 kg.	2,688	7,335	1,705,000
500 kg. to 3,000 kg.	1,593	16,941	3,246,000
Over 3,000 kg.	204	17,296	2,597,000

Holland, Austria, and Czecho-Slovakia figure prominently amongst the destinations of machines up to 150 kg. in weight; Italy, Argentina and Brazil are good customers for those from 25 to 3,000 kg., whilst of those over 3,000 kg. 24 went to Argentina, 20 to Italy, 18 to Norway, and 16 to Japan, during the period mentioned.

In regard to the following items a useful comparison can be made:—

	1924. (12 mos.)	1925. (12 mos.)	Inc. or dec.
Armatures and commutators (Double centner)	26,515	24,137	− 2,378
Value (Reichsmark)	5,425,000	5,554,000	+ 129,000
Accumulators, plates, &c. (Double centner)	34,144	40,177	+ 6,033
Value (Reichsmark)	4,645,000	6,354,000	+1,709,000
To Denmark (Double centner)	4,803	6,063	+ 1,260
,, Finland (Double centner)	†	1,068	—
,, Great Britain (Double centner)	895	1,149	+ 254
,, Holland (Double centner)	4,225	5,360	+ 1,135
,, Sweden (Double centner)	7,788	14,887	+ 7,099
Galvanic batteries and parts and heating elements (Double centner)	40,690	53,928	+ 13,238
Value (Reichsmark)	7,230,000	10,452,000	+3,222,000
To Great Britain (Double centner)	16,255	25,355	+ 9,100
,, Holland (Double centner)	4,129	6,625	+ 2,496
,, Sweden (Double centner)	5,311	6,894	+ 1,583
Electric cable (Double centner)	230,567	344,163	+ 113,596
Value (Reichsmark)	21,526,000	35,971,000	+14,445,000
To Denmark (Double centner)	†	15,123	—
,, Great Britain (Double centner)	†	8,174	—
,, Italy (Double centner)	†	26,083	—
,, Holland (Double centner)	41,447	109,686	+ 68,239
,, Norway (Double centner)	35,176	28,864	− 6,312
,, Poland (Double centner)	21,262	24,870	+ 3,608
,, Argentina (Double centner)	20,737	34,966	+ 14,229
Electric safety and signalling apparatus (Double centner)	10,172	8,967	− 1,205
Value (Reichsmark)	5,632,000	6,076,000	+ 444,000
To Denmark (Double centner)	573	568	− 5
,, Great Britain (Double centner)	2,796	1,536	− 1,260
,, Italy (Double centner)	302	652	+ 350
,, Holland (Double centner)	641	904	+ 263
,, Austria (Double centner)	166	637	+ 471
,, United States (Double centner)	1,295	650	− 645
Insulating material of asbestos, mica, and micanite (Double centner)	1,035	613	− 422
Value (Reichsmark)	940,000	850,000	− 90,000
To Great Britain (Double centner)	†	93	—
Insulating tubes of paper or cardboard (Double centner)	17,764	24,840	+ 7,076
Value (Reichsmark)	1,672,000	2,508,000	+ 836,000
To Russia (Double centner)	†	3,477	—
,, Sweden (Double centner)	†	4,644	—
Telephone material (Double centner)	8,613	10,052	+ 1,439
Value (Reichsmark)	12,421,000	17,980,000	+5,559,000
To Holland (Double centner)	807	725	− 82
,, Switzerland (Double centner)	619	789	+ 170
,, Japan (Double centner)	†	1,817	—
Measuring and recording instruments (Double centner)	42,809	39,171	− 3,638
Value (Reichsmark)	30,566,000	31,564,000	+ 998,000
To Great Britain (Double centner)	†	1,704	—
,, Italy (Double centner)	6,639	5,284	− 355
,, Holland (Double centner)	3,809	3,795	− 14
,, Russia (Double centner)	5,077	2,468	− 2,609
,, Sweden (Double centner)	2,752	1,998	− 754
,, Spain (Double centner)	1,458	1,786	+ 328
,, Czecho-Slovakia (Double centner)	1,468	1,686	+ 218
,, Japan (Double centner)	5,665	5,371	− 294
,, Argentina (Double centner)	2,225	2,271	+ 46
Metal filament lamps (Hundreds)	512,328	558,205	+ 45,877
Weight (Double centner)	11,934	12,676	+ 742
Value (Reichsmark)	22,078,000	25,470,000	+3,392,000
To Denmark (Hundreds)	28,500	30,002	+ 1,502
,, Finland (Hundreds)	18,310	16,879	− 1,431
,, France (Hundreds)	18,580	12,438	− 6,142
,, Gt. Britain (Hundreds)	40,030	68,464	+ 28,434
,, Italy (Hundreds)	39,600	51,298	+ 11,698
,, Norway (Hundreds)	10,130	15,950	+ 5,820
,, Austria (Hundreds)	29,700	25,037	− 4,663
,, Russia (Hundreds)	9,400	31,099	+ 21,699
,, Sweden (Hundreds)	33,982	35,596	+ 1,614
,, Switzerland (Hundreds)	11,598	15,157	+ 3,559
,, Czecho-Slovakia (Hundreds)	19,164	33,933	+ 14,769
,, China (Hundreds)	20,377	13,214	− 7,163
,, Argentina (Hundreds)	12,110	11,878	− 232
,, Brazil (Hundreds)	12,443	23,362	+ 10,919
,, United States (Hundreds)	52,705	25,536	− 27,169

†Unspecified

	1924. (12 mos.)	1925. (12 mos.)	Inc. or dec.
Wireless material (Double centner)	16,941	31,230	+ 14,289
Value (Reichsmark) ...	19,207,000	29,566,000	+10,359,000
To Denmark (Double centner)	321	915	+ 594
,, Great Britain (Double centner)	9,858	17,640	+ 7,782
,, Holland (Double centner)	775	1,478	+ 703
,, Sweden (Double centner)	1,186	1,781	+ 595
,, Japan (Double centner)	—	1,902	+ 1,902

The remaining items are not wholly comparable, for the reasons stated.

	1924. (12 mos.)	1925. (Jan.-Sept.)
Heating and cooking apparatus (Double centner)	12,204	9,278
Value (Reichsmark)	5,399,000	4,635,000
To Great Britain (Double centner) ...	601	683
,, Holland (Double centner)	1,741	1,344
,, Argentina (Double centner) ...	1,045	575

[From October 1st until the end of the year, electric irons, formerly included in the above heading, have been shown separately. Exports during the period were 708 Double centner, value 184,000 Reichsmark.]

Electrical apparatus for lighting, power transmission, electrolysis, resistances, &c. (Double centner)	213,369	156,178
Value (Reichsmark)	65,146,000	53,749,000

[Ignition apparatus (excluding magnetos) and electrical equipment for motor-cars, formerly included in the above heading, have been shown separately since October 1st. From that date until end of December exports were 3,241 double centner, value 3,739,000 Reichsmark.]

Electrical, medical or dental apparatus (excluding from Oct.-Dec., 1925, Röntgen tubes weighing 2,559 double centner, value 2,659,000 Reichsmark) (Double centner)	12,465	8,547
Value (Reichsmark)	11,582,000	9,349,000
To Great Britain (Double centner) ...	739	359
,, Austria (Double centner)	971	518
,, Czecho-Slovakia (Double centner)...	920	729
,, Russia (Double centner)	1,051	1,221
,, Spain (Double centner)	952	718
,, Argentina (Double centner)	994	393

The National Register of Electrical Installation Contractors.

Report and Annual Meeting.

The report for the past year of the Executive Committee of the National Register of Electrical Installation Contractors commenced with an expression of regret at the death of Mr. L. G. Tate, whose efforts in its initiation and active assistance in furthering its aims and objects, had placed the institution under a deep obligation. The executive was advised that the Articles of Association would have to be amended, to enable registered contractors who were not members of any electrical trade organisation to appoint representatives on the Registration Board. The income and expenditure account did not show receipts in the same proportion as the previous year, as the fee for renewal was £1 only, whereas that for registration was £5, and new applications accepted totalled 163 as compared with 674, including duplicates for 1924. Assuming that the expenditure was on no greater scale than the year 1925, and that advertising and publicity expenditure were treated as special items, the annual expenditure was estimated to amount to approximately £1,000, leaving a deficit of approximately £100 to be made up by further registrations, which it was anticipated would be forthcoming during 1926.

Applications for registration up to December 31st, 1925, totalled 930, of which 804 were accepted and 50 were still under investigation and consideration; of the remainder 76 were declined for various reasons. Bringing these figures up to the date of the last meeting of the Executive, 1,018 applications had been received, 853 accepted and 84 declined, so that for the comparable year there was a net addition of 183 contractors to the Register. During the year there were 11 registrations which were not renewed owing to various causes. The Executive recommended the amendment of the rules to provide that branch establishments of a registered contractor might be registered for the payment of £1 and £1 annual renewal fee. The municipalities of Cheltenham and West Hartlepool, and the Newcastle-upon-Tyne Electric Supply Co., had joined the corporate bodies which were confining their orders to tenderers who were on the National Register. Inquiries which had been made encouraged the Executive to believe that Corporations were making considerable use of the National Register. Consultants and architects had also applied for information. During the year a Publicity Committee was appointed on which Mr. Beauchamp and the late Mr. Tate were co-opted to take up the question and to carry out a programme, and a complete list in book form of registered contractors was issued to station engineers, consultants, architects and builders to the number of some 15,000. The Royal Institute of British Architects, in pursuance of a settled policy, was withdrawing its representatives from all institutions including the Registration Board. An agreement was reached with the Commissioners of Inland Revenue that the renewal fees paid by Registered Contractors should be allowed as a trading expenditure in their accounts.

Eighty local Advisory Committees had now been constituted and were functioning smoothly. The following nominations to the Board were made by the respective nominating bodies: The Institution of Electrical Engineers, the Incorporated Municipal Electrical Association, the British Electrical and Allied Manufacturers' Association, the Association of Consulting Engineers, and the Illuminating Engineering Society, renominated their respective retiring representatives. The Electrical Contractors' Association of Scotland nominated Mr. R. A. Ure in the place of Mr. A. Lindsay. The Electrical Contractors' Association, the Electrical Wholesalers' Federation, the Irish Centre of the Institution of Electrical Engineers, and the Electricity Supply Association of Ireland, had not sent in their nominations up to the date of the report. Many inquiries had been made as to whether the National Register had adopted a set of wiring rules. Such was not the case, but it was probable that the subject would have to be considered by the Board in the future. A lengthy inquiry was made by the Executive into complaints against the work of a registered contractor carrying on business in a northern suburb of London, which were found to be justified and admitted by the contractor. The Committee had no other course open but to withdraw his certificate and strike his name off the Register. Notices of appeal from the Executive's refusal to register two applicants were received and an appeal was lodged against the Executive's refusal to approve a new qualifying manager of a registered contractor. The Executive invited discussion and such a decision on the subject as would lead to the most economical and speedy procedure being adopted.

The report concluded with special reference to the indefatigable services of the chairman, Mr. P. V. Hunter.

The annual meeting of the Registration Board was held at the Institution of Electrical Engineers on March 22nd, under the chairmanship of Mr. P. V. Hunter. After the adoption of the balance sheet and accounts, Mr. Shaw raised the question of the various Local Advisory Committees holding meetings in their areas for the purpose of obtaining further applications for registration, and a general discussion ensued. It was pointed out that the National Register considered that it could not canvass for applicants, but was prepared to grant registration to duly qualified applicants, and that the matter of increasing the number of registered contractors lay with the contractors themselves. The matter was left to the Executive Committee for further consideration and to make any recommendations which it might think fit to the contractors' associations concerned.

The nomination of Mr. Ure as the representative of the Electrical Contractors' Association of Scotland in the place of Mr. Alex. Lindsay was confirmed, and the retiring representatives of other bodies having been renominated were re-appointed. The retiring members of the Executive Committee, Messrs. Dykes, Cash, and Britton, were also re-appointed.

A lengthy discussion on the subject of the adoption of a set of wiring rules by the National Register was then entered into, in which Col. Crompton, Mr. Dykes, Mr. Shaw, Mr. Cash, and Mr. Gaster took part, and the difficulties in the way of so doing were fully pointed out. The general opinion was that the time was not yet opportune to take action in that direction, and the matter was left in the hands of the Executive to report to the Registration Board when action should appear desirable.

The Chairman explained the desirability of amending the rules affecting the registration of branch establishments and moved amendments, which were adopted. The chairman and the vice-chairman were unanimously re-appointed for the ensuing year. The question of hearing appeals from decisions of the Executive was discussed, and it was decided that a month's notice to members of the Registration Board other than those on the Executive Committee would be sufficient to secure the necessary number on the day fixed. A vote of thanks to the chairman concluded the proceedings of the meeting.

International Fair at Salonica.—*Reuter's Trade Service* learns that one of the principal aims of the International Fair to be held at Salonica from May 15th to May 31st is to give the trade and agricultural centres of Greece, particularly those of Macedonia, an opportunity of entering into closer and more frequent business relations with European manufacturers. The articles to be exhibited at the Fair include electrical apparatus, dynamos, motors, transformers, lighting and heating equipment, &c. Further particulars and application forms can be obtained from any Greek Consulate in Great Britain or the Fair's hon. representative in England, Mr. G. Loutsis, Commercial Secretary, 51, Upper Brook Street, W.1.

Municipal Electrical Service.

The Colwyn Bay and Doncaster Bills and Local Contractors.

(*Concluded from page 519*).

The Colwyn Bay Case—(*continued*).

Mr. F. C. Raphael (consulting engineer) gave evidence on behalf of the contractors. Originally, he said, a number of undertakers had obtained full selling powers, but in 1904 the Electrical Contractors' Association was formed and had opposed a number of Bills, with the result that time after time special conditions were inserted to the effect that the powers granted could only be exercised through a contractor. The Electricity (Supply) Act, 1919, did not give those powers to local authorities, whilst in a later contest the Wakefield Corporation had been refused these powers by the House of Lords. Side by side with the Parliamentary fight there had been an action in the Law Courts, when the Leicester and Sheffield Corporations lost their cases. He also quoted from the Annual Report of the Electricity Commissioners published in 1923, where it was stated that in granting Special Orders it was the general policy of the Commmissioners not to confer any powers with regard to electrical fittings beyond those conferred on joint electricity and local authority undertakers by Section 23 of the Act of 1919, and that any departure from that policy could only be considered in cases where strong and exceptional reasons were given. Witness could not recollect any cases which had been fought since 1904 in which full powers had been given, except that of the London County Council General Powers Act, until last year, when selling powers were given to the Bath, Burnley and Barrow Corporations. In those cases the main reason put forward was that it was desired to wire poorer class houses on a free-wiring or hire-purchase system, and he was strongly in favour of that. It was not necessary, however, in order to carry out that scheme, that the local authority should do the wiring. He saw no object in local authorities starting wiring departments, which was a new business entirely. They had already contracting firms who could carry out the work and naturally they had to invest their capital for those installations if they were going to sell them on the hire-purchase system. The amount of capital that they invested would be no more if they employed a contractor to do the work than if they did it themselves; in fact, it might conceivably be very much less because they had to build up their wiring business first. By having contractors in the district they had the advantage of the canvassing done by the contractors and further, there was always better canvassing where there was competition than in the case of a monopoly. Reference was then made to cases where wiring was carried out on hire-purchase terms through contractors, though the local authorities concerned did not possess or had not put into force wiring powers. In the case of South Shields the contractors' canvassers were provided with a form of hiring agreement, they were paid on commission by the contractors, and the contractors who secured the orders were given the order for the wiring, which was carried out on an agreed schedule and financed by the Corporation. Within six months of the inception of that scheme there were 7,477 applications for supply. Within seven months the number of private houses connected to the supply had increased by 86 per cent. Mr. Raphael said that all the wiring was carried out in comparatively small property. There was nothing to prevent the Colwyn Bay Council from carrying out a similar scheme if it chose to do so without further powers. The St. Marylebone Borough Council, though it had full powers, did not use them, but had an assisted wiring scheme. Applications for wiring were submitted to contractors for tender, the most suitable being accepted. In the 18 months from the time the scheme was started until November last, 177 radiators and 128 cookers had been connected in one block of artisan dwellings only, containing 540 flats, and the total energy consumed was estimated to be 238,894 kWh. At Walthamstow, where full wiring powers were possessed, the local authority had had an assisted scheme since 1922. It did not have a fixed rate for rentals, but obtained quotations for the work from contractors and worked out the rentals from those. The consumers chose their lamps and shades at the local authority's showroom and bought them from the contractors. Other hire-purchase schemes referred to, in which the work was done by the contractors, were those of Tamworth and Gillingham, Kent.

The Chairman asked whether it did not come to this, that so long as the contractors were reasonable the corporations would employ them to do the work, whether they had powers or not. Mr Raphael replied that that would be the reasonable course, but there were cases where there were very pushful municipal engineers who would exercise their powers and drive the contractors out of business. The Chairman asked if there were no contractors who were unreasonable.

In further evidence, the witness said there was no guarantee that a wiring department run by a local authority would be self-supporting. He had examined the accounts of a number of undertakings who had these powers and it was impossible to ascertain whether the wiring departments were carried on at a loss or at a profit. He also stated that as a rule local authorities had no experience of wiring, whereas on the whole the contractor knew his business very well and did it very well. If the Colwyn Bay Council started wiring it would be in the position, as the supply authority, to condemn the wiring carried out by contractors; also the consumer who received tenders for wiring from the Council as well as from contractors would, in nine cases out of ten, accept the Council's tender on the pure question of standing. As to the allegations of bad wiring at Colwyn Bay, he gathered from the evidence that with the exception of one or two cases, they were matters of very small detail. Cross-examining, Mr. Rowand Harker said that witness suggested that the scheme was one by which the Council should be liable to the contractor for the full amount of the bill and that the ratepayers should finance the local contractors who were unable to finance themselves. Witness agreed that the Council should pay for the wiring; it would finance not the contractors but the hire-purchase scheme. Mr. Harker said that if the hire-purchaser did not meet his obligations the ratepayers would bear the loss incurred. Witness replied that there should be no loss because the Corporation could collect the fittings. He agreed that the wiring would be of little value unless taken over by the next tenant, but there had been very few failures in that respect. Mr. Harker asked if it were suggested that if the Council obtained these powers it would deliberately run the wiring department at a loss in order to drive the independent contractors out of business. Witness replied the Council would not do it for that purpose but any municipal department which started a business and could not run it at a profit would continue to run it at a loss. Mr. Harker pointed out that the clause in the present Bill made it clear that work carried out under the powers asked for should be self-supporting, whilst another clause imposed upon the Council the obligation to keep separate accounts for each undertaking and laid down exactly how moneys were to be applied.

Referring to the report of the Electricity Commissioners, Counsel asked whether it was not the case that the Commissioners took the view that when simply asked to "extend" existing powers they had no jurisdiction to grant such powers as the Council was now asking for. Witness replied that the Commissioners' view was that they had no jurisdiction to grant any powers at all beyond those referred to in Section 23 of the 1919 Act.

Mr. T. E. Alger (President of the E.C.A.) was the final witness, and was giving evidence as to why competition by local authorities was ruinous to contractors, when Mr. Turner (representing the Colwyn Bay Council) interposed with the remark that the Association was not petitioning in this case but that the petitioners were individual contractors in Colwyn Bay. In his cross-examination, Mr. Turner, having ascertained that there were eight members of the Association in Colwyn Bay, suggested that they had joined in large numbers recently in view of the present proceedings. Witness, however, disagreed and said he did not think any had joined within the last six months, although he was not sure about that. Those eight members would represent 90 per cent. of the competent electrical contractors in Colwyn Bay and they were admitted to membership by examination.

This concluded the evidence, it being stated by Mr. Drucquer that he had other witnesses, but as their evidence did not refer specially to Colwyn Bay he would not call them, in view of the Chairman's request that the evidence should deal as far as possible with the conditions there.

Mr. Drucquer, addressing the Committee on behalf of the contractors, said he fully realised the difficulty which he had to face in that last year a Committee of the House of Lords, after carefully considering the matter, had decided to grant the powers now asked for to the Bath, Burnley and Barrow Corporations. He asked the Committee, however, to deal with the matter now upon the special grounds relating to Colwyn Bay. There was no doubt at all that in the case of the three Bills referred to the matter was, to a very great extent, decided upon principle. He did not dispute that, prior to 1904 when the E.C.A. was formed, some 71 local authorities had obtained the powers now asked for, because nobody had opposed or had thought about them, but from 1904 to 1919 the Association had opposed successfully in all cases except that of the L.C.C. General Powers Act, and had succeeded in getting the powers refused or a special clause inserted which provided that the work should be done through contractors. There could be no doubt, therefore, that the policy of Parliament, and especially of the House of Lords, was that it was inimical to the interests of the country that this retail trade should be carried on by local authorities against the contractors. That policy was also reflected in general Acts of Parliament. In the Electric Lighting (Clauses) Act, 1909, an attempt was made to insert those powers, but it was unsuccessful; the Electricity (Supply) Act of 1919 did not give the powers, but made it necessary for a local authority to show a special case before they could be granted. The powers were also refused in other private Bills. Dealing with the events leading up to the granting of these powers in the Bath, Burnley, and Barrow Bills last year, he said that the Institution of Municipal Engineers had written to the Lord Chairman pointing out for the first time, so far as counsel was aware, that there was a very strong case for giving those powers, because, unless they were granted, it would be impossible to

supply electricity to a very large number of the poorer classes, who could not afford to pay the initial cost of wiring. In consequence of that, a Committee was appointed specially to inquire into it. The evidence before that Committee was such that he could scarcely see how it could have reached any other decision than to grant the powers, because it had had simply a strong body of evidence to the effect that the powers were necessary in order to wire working-class houses. Had that Special Committee known that free-wiring or hire-purchase wiring could be done and was being done very successfully by a number of local authorities throughout the country, whether or not they had those powers, that change of mind of which Lord Strachie had spoken would not have occurred.

Continuing his address on March 19th, Mr. Drucquer referred to the case made by the Council that it was absurd for it to go to the expense of providing a showroom and not be allowed to sell fittings in it. His answer to that was that the cost would be very small, as the fittings shown would be supplied by manufacturers or contractors who would be pleased to supply them. It would be dangerous for a local authority supply undertaking to carry on selling, and in Manchester it was appreciated that it was not safe to run a separate trading undertaking owing to the danger of being unable to cover properly the risk of loss, but a showroom was maintained. As to the suggestion that it was unreasonable to expect the local authority to pay for wiring and fittings supplied on the hire-purchase system and for the contractors to take the profit, he pointed out that the local authority would have to pay whether it carried out the wiring itself or through the electrical contractors, and it would then receive payment by instalments. On the other hand, by doing the work through contractors, it had a body of men who, by reason of competition among themselves, were certain to do their best to obtain new consumers.

Another ground on which it was urged that the powers should be granted was that it was fairer when consumers who had hired cookers and other big appliances wished to buy them, that the Council should have power to sell. In this case, however, the Council had never made any attempt to let these appliances; it had not let a single cooker. Even so, the main point about letting cookers was that it increased the consumption of electricity. It had also been suggested that when cookers were no longer required, the Council could do nothing but scrap them. There was no evidence, however, that that was so; such cookers could be burnished up and hired out again. The allegation as to bad workmanship in Colwyn Bay was a very slender reason indeed for putting forward the present case. There were cases of bad workmanship all over the country, and there was no special reason for saying that the contractors of Colwyn Bay as a body were not fit to carry out the work. If there was ever a case which showed an absence of all enterprise, it was this particular case. In the witnesses' own admission the undertaking was in a very serious state. Its supply was equivalent to 33 kWh per head of population, and it was due to the lack of initiative. Blackpool had been referred to as a successful undertaking, but Blackpool had not the powers now asked for, and was comparable in every respect with Colwyn Bay, except that in the one case there was real initiative, whilst in the other there was none. A retail trade of the description referred to needed initiative, and if the Council had not that initiative that was one of the principal reasons why the powers should not be granted in this case. The Council had done nothing to increase the number of consumers, except in the case of new houses, and the supply in those cases was probably given as the result of applications by the householders themselves. Finally, having regard to the fact that the Lord Chairman hoped that a Joint Committee would be appointed at an early date to settle once and for all by statutory enactment what should be the powers granted to local authorities, he asked that the powers should not be granted until that Special Committee had been appointed.

The Chairman said that the Committee was unanimously of opinion that it was not necessary for counsel for the promoters to address the Committee, the decision being in favour of the granting of the powers.

The Doncaster Corporation Bill.

A Select Committee of the House of Commons considered Clauses 43 and 44 of the Doncaster Corporation Bill on March 22nd and subsequent days. These clauses asked for full wiring and hiring and selling powers in respect of electrical fittings, and powers to maintain showrooms. The proceedings were largely a repetition of those before the House of Lords Committee which considered the Colwyn Bay Bill. The same Counsel appeared as in the Colwyn Bay Bill, *viz.*, Mr. Tyldesley Jones, K.C., Mr. Harker, K.C., and Mr. Wrottesley, K.C., for the Doncaster Corporation, and Mr. Craig Henderson, K.C., and Mr. Drucquers for the electrical contractors, who again opposed.

Mr. Tyldesley Jones, in the course of his address on behalf of the Corporation, said that the principle that local authorities should supply electricity had been established and it was only logical that these authorities should be able to wire premises and hire and sell apparatus in the same way that electricity supply companies and gas companies could. As a matter of fact, the Doncaster Corporation owned the gas undertaking in the town and had all these powers in respect of gas. The development of electricity supply would be greatly speeded up if the Corporation had the powers; there were difficulties in the way of contractors wiring houses on the hire-purchase system or letting out apparatus on hire. The clause provided that the wiring business should not be carried on at a loss. Referring to the report of Lord Weir's Committee, Counsel called attention to the statement that the restriction on municipalities with regard to the supply of electrical fittings, &c., did not exist in America and ought to be removed in this country. It was true that no clause to this effect appeared in the Government Bill, but the Committee had made a very clear statement of its view on the matter. The Electricity Commissioners had drawn attention to the powers granted under Section 23 of the Electricity Supply Act, 1919, which permitted local authorities to hire out fittings but not to sell them, and had stated that no doubt the Committee would require the Corporation to justify the wider powers now being asked for. Counsel urged that full powers should be granted to municipalities unless very good reasons could be brought to the contrary.

Mr. S. R. Windle, borough electrical engineer, Doncaster, said that there were 12,000 premises in the borough, of which only 4,000 were connected to the electricity supply mains. The reason was that the tenants of smaller houses could not afford the expenditure involved in wiring their houses and the landlords would not do it. He was constantly finding people who had electricity for lighting and wanted apparatus such as cookers, vacuum cleaners, &c., but the cost of these was too high unless they were hired or let out on a hire-purchase system. At present the cost of wiring for lighting purposes in Doncaster was from 20s. to 25s. per point and considerably more than that for power purposes. He would be willing to co-operate with contractors to develop the supply in the borough but he could not say what the policy of his Committee would be in that respect. He would not agree that the contractors would be badly hit if the Corporation came in as a competitor, because under the scheme of development contemplated, new consumers would be obtained who would never come on to the mains under the present system. Broadly, the desire of the Corporation was to be able to deal with the customer right through into his premises and to give real service in connection with electricity supply.

On March 23rd, Mr. Windle, in answer to questions by Mr. Craig Henderson, for the electrical contractors, denied that the Corporation had been slack in developing the electricity supply undertaking. The Corporation had not put the powers to hire, under the Electricity Supply Act of 1919, into force because those powers were not considered sufficiently comprehensive. Moreover, it was not considered practicable to hire out electric cookers without giving the customer an option to buy. He regarded easy payment terms of purchase as a very important factor. He agreed that the Corporation had never tried to hire out cookers nor had it prepared a tariff of charges for hiring.

Mr. H. M. Marshall, a member of the Electricity and Housing Committees, said that 52,000 people in Doncaster out of a total of 55,000, were living in houses having a rental of less than 10s. per week and it was in order to deal with those that the wiring and fittings clauses were asked for. In the ordinary way, assuming the contractors offered a reasonable schedule of prices, the work would be done through contractors and not direct, but without the power on the part of the Corporation to do the work direct it would be in the hands of the contractors. There had been an instance of that in connection with a housing scheme when four contractors quoted exactly the same price, *viz.*, £612 for wiring 42 houses. The Corporation and the Government Housing Inspector thought the price too high and the work was not carried out.

Mr. Henderson expressed strong doubts whether the tenants of such small property as had been referred to, would really improve the landlords' property, by wiring it at their own expense.

Mr. Matthews said that the position of the contractors in the event of the powers being granted, had been seriously discussed by the Electricity Committee and everything possible would be done to co-operate with them and prevent any injury to them, if the contractors would assist.

Mr. F. W. Purse (borough electrical engineer, West Ham) said that West Ham had had full wiring powers since 1898 and did most of the work directly, although there was a certain amount done by contractors. He agreed that the number of contractors in the borough was now very small and that there was not one registered contractor there. He did not think the Doncaster contractors would be injured by the present proposals, so far as sales of fittings were concerned. The Corporation would be handicapped if it could not sell fittings in the showrooms.

Asked about the South Shields wiring scheme, which was being carried on through contractors, Mr. Purse replied that although the scheme had been a success, it was not one which he would recommend his Committee to adopt. It was nothing more than a disguised hire-purchase system, carried out through contractors, and if anyone cared to take action it seemed to him that an injunction could be obtained against the Corporation. Asked as to his own wiring and fittings department, Mr. Purse replied that a balance had been shown on the right side ever since it was started, allowance being made for interest on capital and depreciation. This closed the case for the promoters with regard to the wiring clauses.

The first witness for the contractors in opposition to the clauses was Mr. Walter Finlay, secretary of the Electrical Contractors' Association of Scotland, who emphasised the point that the Edinburgh Corporation had no powers to sell fittings and did all its wiring and fitting through contractors, whilst the Glasgow Corporation, which had powers to sell as

well as to hire, also did all its work through contractors in a most satisfactory manner. As to the demand for the hire-purchase of electric cookers, he said the sensible man would hire in order to safeguard himself against obsolescence. He objected to the Doncaster Corporation having selling powers because the customers might get the impression that their work would be better and more expeditiously done by the Corporation than by contractors, whereas it was not so.

Mr. Finlay said he had no doubt that the clause was all right in theory from the paying point of view, but in practice it did not always work out, and Corporations did not always conform to the strict letter of the clause. If no one took action then a loss might very well be incurred; it had happened in Scotland.

On the question of wiring small houses, Mr. Finlay said that once the Rent Restriction Act was done away with, he believed landlords would be inclined to have their houses wired, even when they were quite small, but he admitted that the Scottish wiring contractors had not advertised offering to undertake wiring on the hire-purchase system, although he believed that it had been done by private arrangement. Replying to questions concerning the necessity to inform the supply authority of a possible customer, Mr. Finlay said it was necessary to find out where the cut-out would be and it would be impossible to avoid giving away the name of the customer to the Department, and that was undesirable when the Department was also a competitor.

Mr. Thomas Alger (President of the Electrical Contractors' Association) said that that Association had a membership of 1,250, representing 90 per cent. of the firms in the trade. It was impossible for contractors to exist in a district where the Corporation had the powers asked for and did the work itself. At West Ham, for instance, there were no electrical contractors of any importance. A short time ago, the Hackney Council followed the policy of West Ham and there were no electrical contractors in the borough but since that policy had been changed, there were good class contractors there, and they were now doing the work for the Borough Council. Something like 20 or 30 contractors could get a living in West Ham if it were not for the policy of the Corporation. Questioned as to the position of contractors concerning hire-purchase arrangements, Mr. Alger said this matter was under the serious consideration of the contractors in conjunction with the manufacturers and he hoped that something would be done before long. If, however, full wiring powers were to be given to local authorities, the effect would ultimately be the same as had happened in the gas industry. Owing to the work being done by the gas supply authorities there was hardly an ordinary gas fitter left in business in the country. The contractors and the manufacturers in an endeavour to work out a hire-purchase scheme for wiring and fittings, had seriously discussed the matter during the past twelve months.

Mr. E. Brett, a Doncaster electrical contractor, and one of the contractors who put in the price of £612 referred to earlier in the proceedings, said he had had no communication whatever with the other three firms who quoted precisely the same price, and it came as a surprise to him to know that they were identical. It rather emphasised the keenness of the competition among the contractors of Doncaster. The Corporation went outside the borough for a later contract and gave it to a man who so undercut that he went bankrupt before he could complete the contract. Witness had not advertised his willingness to undertake wiring on the hire-purchase system, but he had done work and allowed payment to stand over for a while.

Mr. G. E. Shipe, another Doncaster electrical contractor, was also called and the Committee adjourned until March 24th, when counsel delivered their final speeches.

Mr. Craig Henderson, K.C., for the contractors, referred to a number of local authorities, with and without selling powers, which were carrying on business successfully by co-operation with contractors. He contended that Section 23 of the Electricity Supply Act of 1919 did not give wiring powers to local authorities which had not been authorised under a special Act or Order. He appealed to the Committee to leave the general law on the subject as it was at present, pending a general discussion of the whole subject, which would settle the difficulty once for all. Perhaps the best way to do that would be for the municipal authorities to seek to insert a similar clause to Clause 43 of the Doncaster Bill, in the Government's Electricity Supply Bill when it was discussed in the House of Commons, and so get a final decision which would become the general legislation for the country. In conclusion, he said that it the Corporation was merely asking for powers to deal with wiring under hire-purchase arrangements, the work of installation to be done by contractors, the contractors would not have opposed.

Mr. Rowand Harker, on behalf of the Corporation, said that it was the intention, if the Committee allowed Clauses 23 and 44 to work through contractors if the contractors made it possible by offering reasonable schedules of prices.

The Chairman inquired whether the Doncaster Corporation Gas Department had powers to sell gas fittings, and was informed that those powers existed but were not exercised.

The Chairman, in announcing the Committee's decision, said that Clauses 43 and 44 would be granted subject to the insertion of a provision that the wiring of premises must be carried out only through contractors.

A Survey of Industrial Relations.

Wages and Conditions.

This is the title of the second report* by the Committee on Industry and Trade, under the chairmanship of Sir Arthur Balfour, K.B.E.† In an introductory summary and review the Committee has digested a vast amount of authoritative information relating to wages, hours, and conditions in industry. The Committee emphasises the fact that the volume is purely descriptive and it does not make definite recommendations for action.

Having explained that the proportion of the population which follows definite occupations has remained fairly constant during the last forty years, the Committee draws attention to the decrease between 1881 and 1921 in the numbers and percentage employed in agriculture, *viz.*, from 1,500,000 (12 per cent.) to 1,300,000 (7 per cent.) and the great increases in coal mining, from 500,000 (4 per cent.) to 1,300,000 (7 per cent.); and in the metal and engineering group of trades, from 900,000 (7 per cent.) to nearly 2,500,000 (13 per cent.).

The Committee then proceeds to discuss the subject of wages. Having mentioned that the Board of Trade Index Number of wages showed a rise of about 13 or 14 per cent. in the twenty years preceding the war, it examines the level of rates of money wages in 1924 and 1925 as compared with 1914 and states that on the whole this rise may be taken to average between 70 and 75 per cent. over industry as a whole. The conclusion is reached that the prevailing rates of increase of weekly rates of money wages in the most exposed trades range from 45 to 75 per cent., with an average of about 60, while for the trades sometimes described as "sheltered" the increases range from 80 to 120 per cent., with an average of about 100. The average "real" rates of wages have remained roughly unchanged. The Committee further finds that in industries in which time rates of wages prevail, skilled workers fully employed in industries directly exposed to foreign competition are on the average less well off than before the war, while, on the other hand, unskilled workers generally, and workers in the so-called "sheltered" industries, have, generally speaking, improved their position. The Committee points out that in any trades in which piece-work has become materially more prevalent since 1914, the true average rise in weekly earnings will be somewhat greater than the recorded rise in time rates. On the question of wages in other countries, the Committee emphasises the difficulties surrounding the subject but quotes such official figures as are available for comparing the purchasing power of wages in London and various other capital cities. With certain qualifications, it may be said that the figures for June, 1924, indicate that in New York and Ottawa the purchasing power of an hour's wages in terms of food was roughly double that in London, while at the other end of the scale were Rome and Vienna with purchasing power less than half that of London. The figures for Paris and Berlin were each about two-thirds, and that for Brussels about three-fifths, of the London figure.

The Committee says that there are indications that payment by results has probably been gaining somewhat on payment by time, and describes certain special methods of industrial remuneration such as profit-sharing and family allowances, in certain foreign countries.

The Committee estimates that in 1914 the average weekly hours of industry were between 53 and 54 and that they have been reduced now to an average of about 48. In pre-war years, while wage movements were subject to periodic fluctuations, there was a continuous tendency towards the shortening of the working day. There has been little general change since 1914 in the ratio between overtime and ordinary rates of pay, or in the overtime conditions generally prevailing. The movement towards reduced hours of labour in Great Britain is only part of the movement in the same direction throughout a great part of the world, and mention is made of the legislation enacted in a large number of countries for the establishment of maximum hours of labour, usually, in principle, eight a day, or 48 a week. It is pointed out that this legislation differs very materially and is very elastic.

Passing from questions of remuneration and hours of labour, the Committee proceeds to discuss a group of miscellaneous matters concerning working conditions. The question of industrial fatigue is dealt with and the Committee points out that in given industries an optimum limit of hours in relation to production per hour and per shift can probably be determined. The Committee expresses the view that the researches on this and cognate points by the Industrial Fatigue Research Board may be expected to have important bearings on indus

* The first report was published in July last (Elec. Rev., July 24th, p. 151), and took the form of a survey of overseas markets.

† Stationery Office, 5s. net.

trial efficiency, and refers to the improvements in the amenities of workshop life and in industrial relations, and the increased continuity of personnel and productive efficiency which have already taken place and may be expected to result in increasing measure from the development of welfare work through the voluntary action of employers and the encouragement of Joint Industrial Councils and the Industrial Welfare Society. Mention is made of the increasing attention which welfare activity is receiving in the other principal industrial countries. On the subject of time lost in industry through various causes, the Committee points out that time lost through sickness in the three years 1921-4 was very much less than that lost through unemployment, while the time lost through the latter cause was also many times greater than that lost by persons engaged in trade disputes. Attention is also drawn to the loss of time in certain important industries, *e.g.*, the engineering, shipbuilding and building trades due to disputes between different bodies of skilled workmen as to their right to perform a particular branch of work. During the four years 1921 to 1924, an average of 74 million man weeks of potential work were lost owing to unemployment alone, the figure in the worst year, 1921, being as high as 93 million. It is found that unemployment has been higher in the group of exporting trades than in industry in general. The main groups of industries which have lately been most severely depressed are those connected with or dependent upon shipping or iron and steel. The readjustment of personnel and plant to peace requirements is still incomplete in some of these industries. On the other hand, most trades connected with house construction showed rates of unemployment well below the average, and the same is true of the printing and paper trades, public utility services (gas, water and electricity supply, railway, tram and omnibus services, &c.), and the distributive trades. The total number of persons in employment in Great Britain is fully as great as immediately before the war, the increased margin of unemployed being at least balanced by the increase of the employed population. An investigation made by the Ministry of Labour showed, *inter alia*, that 63 per cent. of the males and 77 per cent. of the females in the sample 10,000 individuals examined would in normal times usually be in steady employment. As to unemployment in other countries, two tendencies appear to be indicated, *viz.*, that in the period immediately before the war the percentage of industrial workers totally unemployed in Germany was probably lower and the range of its variation narrower than in Great Britain, and that while a collapse of employment occurred in the United States in 1920-21, at the same time as that in Great Britain, the recovery was much more rapid in that country than here.

The Committee includes its review with a discussion of the machinery in existence for industrial negotiation. It draws attention to the growth of collective bargaining, the result of which is a widespread system of regulating working conditions by means of national agreements reached by the parties themselves. The two main tendencies to which the committee calls attention are the essentially voluntary nature of British practice, and the differences which exist in the machinery evolved in the various trades to correspond to the great variety of conditions and needs of the individual industries themselves. The Committee considers that probably far fewer disputes to-day arise out of mere misunderstanding than was the case prior to the war. The Committee gives a summary of the legislation in existence in the Dominions and in foreign countries for the prevention and settlement of industrial disputes. It is explained that while many countries have relied on purely voluntary methods, a number of experiments in the utilisation of compulsion in one form or another have been made. The Committee selects the experiences of Australia, New Zealand and Canada as the most instructive, and explains the systems of compulsory awards, prohibition of strikes and compulsory investigation of disputes in existence in each of these Dominions. The experiences of Australia and New Zealand suggest that where compulsion is present conciliation in the true sense will be neglected.

High-Power Fusible Cut-Outs.

Some Factors which Influence their Rupturing Capacity, and Research Developments.

By L. C. GRANT, A.M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

Hitherto fuses have been used to control only small amounts of power; in this section of the subject no real problem is involved, but when the power source is large the simple fuse in its various arrangements becomes unequal to the duty. Power station auxiliaries are usually supplied from a transformer bank of the order of 2,000 kVA, which could feed perhaps 50,000 kVA into a fault. This immediately emphasises an important difference between the duty required of a fuse and a circuit breaker, for a properly designed fuse operates so rapidly that the peak current and the effect of asymmetry must be taken into account in estimating the kVA to be ruptured. Distribution network transformers are usually fed from a high-pressure system of considerable capacity which would thus be capable of maintaining the full potential on the primary of the transformer under almost any condition. The use of pressures, nor was there a reliable fuse suitable for the protection of potential transformers and similar duty. A heavy current medium-voltage fuse is one important requirement for switchboard and similar work, and a good high-pressure fuse is equally desirable. Even at the present time there are few fuses which could clear a short-circuit properly, yet this is an essential duty if safe and consistent design is to be a characteristic of any scheme. Many of the claims made for fusible cut-outs could not be substantiated, and the general impression obtained from the tests was that most manufacturers were not correctly visualising the problem.

The author has endeavoured to confine his attention to the rupturing capacity and the problems having a direct bearing upon it. Between the time a new fuse element is fitted and the time it may operate, the setting is gradually altering

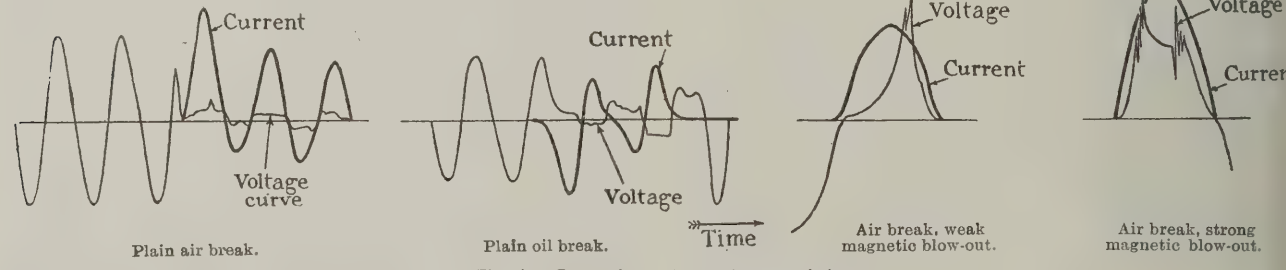


Fig. 1.—Comparison of Arc Characteristics.

circuit breakers would entail considerable expenditure, and if good fuses can be used in their stead it is an unquestionable economy to do so.

A point in favour of the fuse in preference to a circuit breaker is that more consistent protection can thus be obtained. Many distributors, installations, and apparatus are controlled by fuses, and the characteristics of the plant connected are essentially thermal. Therefore, any main circuit-breaking device should preferably have a characteristic time-current curve similar to that of a fuse. The author has not found for this duty any suitable device, other than a fusible cut-out, which consistently reproduces a thermal time-current curve.

Attention was at first concentrated on finding the limitations of and, if possible, devising improvements in existing designs. Afterwards, changes in design were made with a view to eliminating the known troubles At the time this work was commenced, the author could not find any fuse capable of rupturing, with reliability, large currents at moderate or high The time-current curve is therefore difficult to control and almost impossible to maintain with consistency. Deterioration also takes place through mechanical vibration, through innumerable changes in temperature due to load variations, air draughts and other causes, and through electrically induced vibration. The simple fuse will rupture large powers, but that is not the only problem; it must clear the fault without a dangerous explosion and without arcing over to neighbouring parts. Failure under these tests has proved the impossibility of producing a good cut-out of this class. In practice it has been found necessary to limit the continuous full-load current to between one-third and one-half of the minimum fusing current, otherwise cumulative oxidation will be set up. When the oxide film breaks down at a temperature near to the fusing temperature of the metal, as with copper, the process of rupturing is not affected to any marked extent by the presence of the oxide; but with such metals as tin, aluminium and zinc, the oxides are capable of holding up the molten metal after the current has raised the fusible element to it

melting point. With open elements of small size the oxide skin not only increases the rated minimum fusing current, but exerts upon the fusible element a variable effect which cannot be predetermined.

The section of the fusible element plays a part in limiting the current on short-circuit, but the effect is due not so much to the resistance of the element as to the point in the growth of the short-circuit current at which the element melts. In other words, it is possible to prevent the current rising to its full short-circuit value by using a rapidly-acting fusible element. For this, as well as other reasons, it is important to reduce the amount of metal in the element to a minimum, but the limit is set by the risk of introducing oxidation. On a 6,000-volt system with a maximum short-circuit power of 70,000 kVA a 100-ampere fuse of careless construction will pass practically the full short-circuit power before it clears, but if the ratio of fusing current to load current is reduced to the lowest practicable value of 1.2 : 1, a limiting effect will be exerted and the short-circuit power to be ruptured will be of the order of 6,000 kVA.

It is possible to reduce the ratio on a simple fuse to some extent by extreme care in the design of the carrier, by paying attention to cooling and so on; but for best results it appears to be necessary to make radical departures in the design of the fusible element. The functions of melting and heating are separated in one type of fusible cut-out commercially available, and heat is transmitted from a calibrated copper " neck " to a tin and copper fusible element. The tin runs at a lower temperature than the restricted portion of the element and heat is transmitted from the restricted portion in proportion to the load carried by it. When the load reaches a value which causes sufficient heat to be transmitted to the tin portion to melt it, the circuit is broken. With this arrangement it is possible to get a fusing-current/load-current ratio of 1.2 to 1.

At the moment of rupture the metallic fusible element becomes a conducting vapour path. It is important to reduce the temperature rapidly in order to reduce the arc energy to the lowest possible value. In cartridges the filling cools and condenses the metallic vapour, and a sub-divided or multiple element, or the equivalent, gives the dual advantage of a greater surface area in contact with the filler, whilst the increased radiation surface enables a smaller aggregate section to be used for a given current.

A proper magnetic arc blow-out at the point of rupture decreases the arcing time, but, if misapplied, may produce voltage harmonics often of a dangerous amplitude; incorrect form may introduce complex phenomena, resulting in a greater amount of arc energy than with a simple non-magnetic blow-out fusible cut-out. A comparison of arc characteristics to illustrate this point is given in fig. 1. If magnetic blow-out be adopted, it should be of simple and finite form; commercial forms, both for switches and fuses, are far from simple. The most reliable blow-out so far tested for heavy-current fusible cut-outs was obtained by bending the main leads at right angles for a few inches so that there was a tendency for the fuse element to be blown away from the ends of the conductors. In tests with currents ranging up to 100,000 amperes, portions of the fusible elements were blown 300 ft. away.

All fusible elements should be enclosed; many forms of enclosure at present in use are defective. When clearing any considerable amount of power there is a strong tendency for arcing to be set up to the metal housing and to adjacent poles, and no form of internal insulation so far tested has been found capable of preventing trouble of this nature. Fibre, bakelite, glass and similar enclosures are of poor mechanical strength, which is unfortunate, as their proximity to the point of rupture exposes them to high pressures. When rupturing a power of the order of 30,000 kVA per phase, pressures of the order of 1,000-2,000 lb. per sq. in. were measured approximately 1 inch from the point of rupture, and there is reason to believe that higher pressures are set up. The tests have not brought to light any liquid which reduces appreciably the pressure set up at the moment of rupture.

Enclosure in metal containers without damping substances has been found to be inadequate, chiefly because of the unrestricted range of the arc and the explosive effect which results in destruction of the carrier and arcing to the framework. When immersed in oil, the arc is restricted to a comparatively small space, but the pressures set up are not reduced. This necessitates a strong housing and the dimensions of the parts approximate to those usual for oil switches, which increases the cost, but results in apparatus having an intrinsically higher rupturing capacity than fuses of the insulated-container type. The increased rupturing capacity is obtained in a way that has so far proved to be a sound method of investing money in oil-immersed fuses or switchgear, namely, by the provision of mechanical strength. On a 6,000-volt three-phase pattern when rupturing approximately 50,000 kVA, pressures of the order of 600 lb. per sq. in. have been measured within 2 in. of the arc, and up to 200 lb. per sq. in. at the walls of the container.

Oxidation troubles are usually accentuated through the tendency of the filler to support the oxide film. Loosely packed filling avoids to some extent the holding-up action on the fusible element, but introduces a certain amount of oxygen and consequently increases the risk of explosion. A tightly packed filling, although practically eliminating oxygen, supports the fusible element and the oxide film and the molten material of the fusible element is prevented from being driven into the filler to be cooled. Good filling for cartridge fuses can be formed by using a calcium-carbonate base; also it is an effective arc damper, but it is possible for it to assist rather than quell the disruptive agencies; the introduction of a restrainer controls the action. Excellent results have been obtained with simple inert fillers, such as sand, but the gas pressures set up are likely to be higher with a filler of this sort than with fillers of the controlled type.

Fibre has been largely used for tubular fuse containers, but the common forms are not strong enough to withstand the pressure set up, and, furthermore, it is hygroscopic. Porcelain is perhaps better than glass mechanically, and the chief troubles with Bakelite are the non-uniformity of batches, conductivity along the laminæ, and, perhaps, the price. Special bakelised fibre has been found to give the best all-round results. The fixing of the end-caps in cartirdge fuses is an important matter.

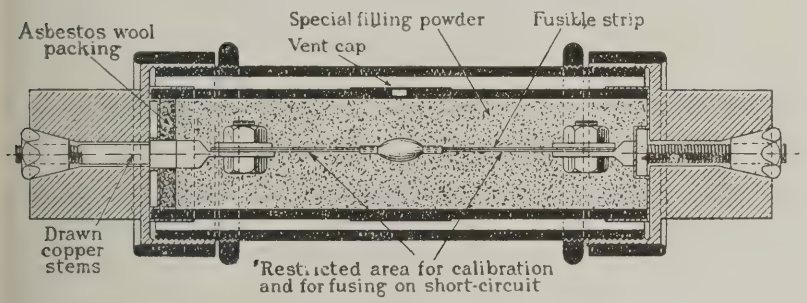


Fig. 2.—Section of Filled Cartridge Fuse.

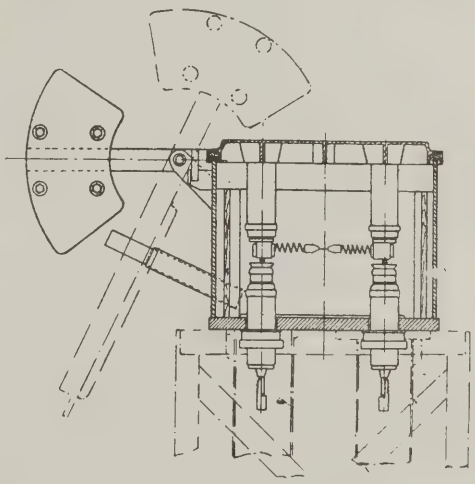


Fig. 3.—Section of Oil-immersed Fuse.

Rupturing Capacity Tests.—A piece of wire stretched between terminals in the open air could be regarded as superior to confining the wire in a carrier. Furthermore, it is a legitimate criticism to object to the carrier on other grounds, *i.e.*, it is usually formed of a comparatively fragile substance which is liable to splinter into dangerous fragments. A piece of fuse wire between terminals will clear short-circuits every time if the gap is large enough. On 6,000 volts a 24-in. gap gives moderate results, the important thing, however, is that the process of rupturing is not materially different from any of the undamped forms of fusible cut-out. Precisely the same experiences were obtained on and below 440 volts; a tremendous destructive explosion took place.

Consider, then, this simple arrangement with a correspondingly shortened break connected to a source of power capable of giving a short-circuit power of the order of 50,000 kVA at 440 volts, a likely condition, as was pointed out in an earlier section of this paper. Some engineers would put the same wire into a porcelain, or other, carrier (an addition of questionable merit) and would then consider, for some obscure reason, that conditions were entirely different. Others would go to the trouble of specifying the dimensions of the carrier, the confining case, size of the contacts and other factors which, from the rupturing-capacity point of view, are irrelevant, whilst neglecting the fundamental insecurity of the arrangement.

The problem must be attacked in a more logical way; let us seek the prime cause of the trouble. The rupturing of the circuit produces a certain amount of thermal energy at the arc, generated in an explosive manner, and the immediate result is the production of an arc and the unnecessary explosion of a quantity of vapour. The proper way to tackle the problem would be to reduce, first, the arc energy, and, secondly, to control the explosive effect; efforts to do this with simple fusing arrangements have met with no material result. The performance of a simple power fuse is described in some detail

in the paper in an attempt to present a picture of the performance of the majority of power cut-outs of this type. The tests were a reproduction of the conditions obtaining with the auxiliary supply in a modern power station, and were similar to the conditions to be found to-day on many a.c. distribution systems.

A three-phase transformer bank consisting of two 1,200-kVA transformers in parallel was coupled to a 6,000-kVA, three-phase, 6,600-volt turbo-alternator capable of giving a maximum of 70,000 kVA on dead short-circuit, and the results were disastrous, there being a huge flash and report accompanied by flying fragments, and it is almost certain that any person or apparatus in the neighbourhood would have been badly damaged.

In subsequent tests the fuses operated with the usual intolerable explosion, with flame and burning fragments ejected in all directions, but cleared the fault, and serve to show that open fuses, however, carefully designed, are inadequate on heavy-duty work and are dangerous alike to the operators and to all apparatus associated with them. Similar tests were carried out on many commercial tubular fuses with liquid, powder, and other fillings, and for various voltages. In the majority of the tests the fuses were totally destroyed, resulting in an open arc and explosion between the main contacts. A representative selection of these tests are described in the paper. Similar tests were carried out on many types of powder filled cartridge fuses, several variations of a modern design of filled cartridge fuse (fig. 2) and an iron-clad oil-immersed fuse of modern design (fig. 3).

Modern, filled, cartridge fuses put up an entirely different performance from the old pattern referred to above. Low-voltage, heavy-current, and high-pressure fusible cut-outs (up to 6,000 volts) were tested with equally good results. One design is that of a robust cartridge fuse with a bakelised fibre container and strong metal ends. For extra heavy duty, a double container is used with a venting arrangement between the inner and outer containers. The vent is quite effective;

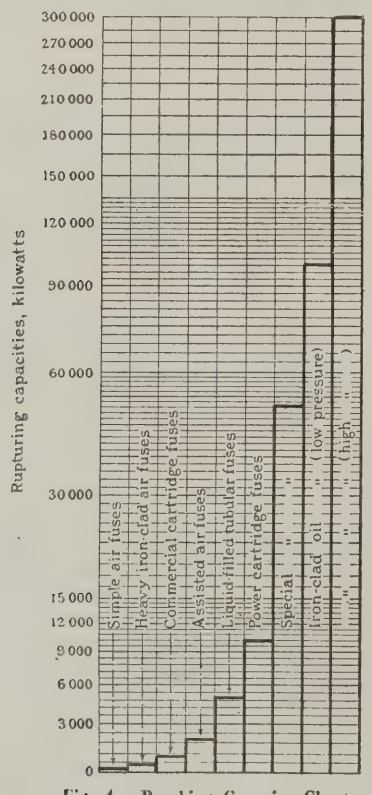


Fig. 4.—Breaking Capacity Chart.

a thin paper seal across a hole of pre-determined dimensions is used. The filling has calcium carbonate as a basis, and in similar tests to those which resulted in the destruction of the plain air and tubular cut-outs, the present one cleared satisfactorily with no sign of flash or flame and no report. It was perfectly safe to be in the vicinity when this cut-out was opening a potential short-circuit of the order of 100,000 amperes.

Another fusible cut-out tested had a single moulded container reinforced with metal bands and a simple inert filler of clean sand. It is capable of standing up to short-circuits of considerable magnitude and at voltages up to 440 and has operated satisfactorily up to 1,500 volts unaccompanied by any noise or flame.

A fourth type was the 600-volt, three-phase, 200-ampere iron-clad pattern with oil-immersed elements. The three phases were mounted within 2 in. of one another and within similar distance of an earthed iron case, yet this fuse broke short-circuits similar to those which destroyed the other fuses, without any sign of operation other than the ejection of a slight spray of oil through a somewhat faulty flange, and at no time was there any dangerous symptom.

As the result of these investigations, a curve has been prepared to assess the rupturing capacity of fuses of various types, fig. 4, and the information has been obtained largely by test. Column 9 (high-pressure oil cut-outs) has been extended to 30,000 kVA on the evidence of the performance of oil circuit-breakers similar in dimensions to these oil-immersed cut-outs.

(To be concluded.)

Discussion in London.

Mr. R. W. Gregory commenced the discussion by characterising the paper as a very valuable one which indicated persistent research. A proper fuse which cleared the short-circuit in the first half-cycle produced the least shock and damage to the plant and itself, in contrast with circuit breakers. High-speed circuit breakers, which had become the fashion in traction stations, were relied upon by the designers of the rotary converters to protect their machines, and they would not guarantee a rotary unless it was provided with such a breaker. The devices described by the author could really be called high-speed breakers for a.c. work, and his industrial type designs would be found very useful. He (the speaker) had attended too many inquests on fuses not to appreciate the value of the author's work, and it was satisfactory to learn how to replace the old dangerous and inadequate types, and to know that oil-immersed and powder-filled fuses were obtainable for modern requirements. High-pressure fuses were a revival and the paper recorded a very great advance in the art of protective gear. There was, however, a lack of knowledge on the subject of sequence discrimination.

Mr. P. D. Morgan pointed out that the paper represented very many tests carried out over a long period, and it clearly indicated that the prevalent idea that fusible cut-outs could not be relied upon for heavy duty was erroneous. Certain terms that the author had used to denote some things in his paper differed from the terms used by the B.E.S.A. and Research Association, an unimportant point perhaps, but it had been known to be the cause of serious misunderstanding. A nomenclature list was at present under consideration by the B.E.S.A. and Research Association, together with the factors which influenced deterioration; much interesting information had been collected and was being embodied in a report on the subject. The author's oil-immersed cut-out tests had been made with a.c. only and it was doubtful whether low-voltage d.c. tests would have produced similar results; a comparison should have been made. The Research Association had recently obtained the use of a large battery of accumulators at the L.M. & S. Railway's Stonebridge Park electricity generating station and it would be used for a series of d.c. tests on fusible cut-outs.

Mr. H. W. Clothier described the paper as a herculean work which would have done credit to a research committee, but the author had not needed anything like so long a time as the former would have done to produce results. He was glad to hear that facilities had been made available for carrying out corresponding d.c. tests. With reference to nomenclature, he remarked that the tests described in the paper had created a new term, *i.e.*, "potential short circuit," which meant that the amount of power plant behind the fuse was taken into account, but the choice of the word "potential" was unhappy because it would be apt to be confused with voltage. In discussing the rating of a fuse, he thought the author too optimistic when he spoke of a fusing current/load-current ratio of 1.2 to 1, which had been obtained from experiments with the fuse illustrated in fig. 2; the functioning of that device would really depend on the heat conducted from the restricted portions of the drawn-copper stems to the fusible strip, and the time factor of heat transmission from the copper to the central bulb was the controlling factor. He was glad the author had made such good use of the metal-clad feature, and his work would have a beneficial influence on the supply of power in rural areas.

Mr. A. Hooker, who said he was speaking on behalf of the student members, was of the opinion that there was a considerable field of usefulness for fusible cut-outs in rural h.p. work. It was high time the subject was given the attention it deserved in the college curriculum, where it had not hitherto featured It was desirable to make the fuse container transparent, if only for inspection purposes, and in that connection silica might be of use.

Capt. P. Dunsheath said the paper would have been improved if the author had recorded the conclusions he reached as he proceeded; he had apparently assumed that readers had studied the subject as much as he had. The one-minute fusing current had not been dealt with, which was a rather serious omission, and another most important point had been overlooked. In the construction of fuses, restriction of the expansion of the gases which formed in the container when the fuse blew had been accidental and was deplored rather than made use of. In a new pattern of fuse which he had constructed, the fusible element was enclosed in a fibre tube (little bigger than the wire itself) that was strong enough to withstand the pressure generated when the fuse operated, which pressure damped the arc and reduced the violence of the explosion. Such fuses had consistently ruptured from 1,500 to 2,000 kW, d.c., at 250 volts, and were four times as good as other types of cartridge fuse of similar dimensions. Engineers should be capable of designing fuse enclosures which would stand pressures up to one ton per sq. in.

Mr. V. Hope referred to the performance figures of "Aeroflex" fuses, remarking that they had from two to three times the carrying capacity of other patterns. He pointed out the large space required for the accommodation of limiting resist-

ances, and said that surely such devices were not necessary if the fuse was made to do its best. With regard to oil-immersed fuses, he was prejudiced somewhat, but the liquid was the wrong one to use for it aggravated matters by creating gases itself and so increasing the pressure generated. However, no one had yet discovered a better liquid to perform the required function.

Mr. H. BRAZIL remarked that the new fuse Capt. Dunsheath had exhibited seemed almost too good to be true. He personally used a combined pressure and oil-immersed type; the glass containers had had to be strengthened, however, and springs were added to hasten the oil immersion. Regarding cartridge fuses, a type filled with marble dust and containing several silver wires had been successful.

The author (Mr. L. C. GRANT), in reply to the debate, intimated that he would deal fully with the various points that had been raised in the I.E.E. *Journal*. It was not advocated that from 10 to 20 per cent. more should be paid for a good fuse, but for one that operated in an entirely different manner (for small powers). Rupturing capacity was fundamental and was the first aspect to be tackled; others (such as rating, in connection with which much remained to be done) had only been introduced where they could not be avoided; regarding omissions from the paper, his difficulty was to keep it within reasonable length. Silica had been considered, but it was very similar to glass in so far as shock, &c., was concerned. Mr. Hope's fuse was known to operate very well.

The president (Mr. R. A. CHATTOCK), in calling for a vote of thanks to the author, said his paper was specially interesting just now when all engineers were trying to cheapen switchgear.

Induced-Current Cooking.

The New "Falkirk" Electric Cooking Apparatus.

As we mentioned in our issue of March 19th, the FALKIRK IRON CO., LTD., has recently introduced a range of electric cooking and water-heating apparatus depending for its functions on the principle of induced electric currents. The feature of the



Fig. 1.—15-kW Inducer Apparatus.

equipment is a transformer or inducer, the core of which is built up of laminated plates in the usual way, securely clamped together. A portion of the core is removable, thus breaking the magnetic circuit, this being necessary to link the cooking utensil or secondary circuit. For this purpose the foot of the utensil is arranged as a loop or one-turn coil of heavy nickelled copper, specially constructed utensils of course being necessary. The primary coils are securely fitted in place, and are



Fig. 2.—Domestic Suite and Separate Inducers.

of enamelled copper strip, bakelised after winding, and are connected in series or parallel to the control switches according to the supply voltage and the heat required.

In the case of single portable models, an outer casing and cover conceal and protect the primary circuit and main terminals, the casing being suitably earthed. The movable portion of the inducer, or keeper, is supported at the back on a suitable standard with springs which hold it above the transformer when the utensil is off, and allow it to close the core when pan is on. The exposed parts of the inducer are covered with a bright polished metal which does not tarnish, and as the demonstrations milk and fat were allowed to boil over on to these parts without harming them in any way. A special automatic switch is fitted to these models to prevent the keeper from being pulled down magnetically if the switch is closed when vessel is off.

The domestic oven, of which only a first model is available for inspection at present, employs induced current for roasting only, ordinary radiant-heat elements being used for other cooking. It is strongly constructed of steel and suitably lagged all round. The resistance elements are built in suitable frames which can be placed at the top, sides, or bottom of the oven as required, pin and socket contacts being employed. The elements are wired for multi-heat regulation and the cooking space may be limited by placing a horizontal element-containing shelf at any required height in the oven, the side or top elements being arranged accordingly.

The induced current for roasting is conveyed to and from the joint by means of special contacts; a steel plate laid in the bottom of the meat pan, and on which the meat rests, forms one of these, and a chain mesh which is laid over the meat forms the other. It is necessary to have lean cuts on the meat for both the top and bottom contacts. It is claimed that the chain is easily kept clean by plunging it into hot water and soda and drying it in an oven. The inducer for roasting is placed externally to the oven and the current is derived from a pair of coils wound so that when the domestic inducer is being used for oven work, it practically becomes an auto-transformer. The keeper is pressed into position and current switched on "high"; a small lever is then raised which acts as a switch for the oven coils and also prevents a pan from being placed in position on the inducer. The oven is used in connection with the domestic suite, fig. 2, which consists of one 3.7-kW and two 2.75-kW inducers and the oven, about 5½ kW, and the larger inducer is equipped for the oven cooking.

For heavy appliances for use in restaurants, hotels or ships, the boiling tables would consist of heavy inducers, 15 kW, fig. 1, let in flush with the table and built up in batteries to suit requirements. Large boiling pans of 20-25 gal. capacity, fish fryers, and water boilers, are equipped with the 15-kW units fixed permanently in the base of the apparatus. In the case of the water boilers part of the induced-current circuit is in the form of a tube through which the water in the tank circulates.

A Hyper-Super Station.—A recent note upon developments at St. Helens was given the heading "32,000,000 Kilowatt Power House" by the *Liverpool Express*. If this became the "selected station" under the Government scheme, it would produce quite enough for the Central Board to deal with.

The Electricity Supply Bill.

Some Comments on the Scheme.

At the annual meeting of the Salt Union, Ltd., on March 23rd, the chairman, Mr. Geo. H. Cox, said there was no subject about which more nonsense had been disseminated of late than that connected with the cost of production and distribution of electricity. The general public might consequently have been misled as to what was practicable. It was significant that the chairmen of several important electrical undertakings had recently expressed themselves strongly concerning the harm that might be done by well-meant Government interference, even if the administration was conducted through a statutory Board. The painful experience of the Mersey Power Company entirely confirmed this, as its progress during the last few years had been tremendously hampered. The Electricity Bill was calculated to create endless trouble and to fasten the dead hand of bureaucracy upon the industry, thereby crushing enterprise and progress. As drafted, it might be used to treat unfairly the existing up-to-date producers and undertakers. This would bear very hardly, for example, on such a concern as the Mersey Power Company, which, after a long and desperate struggle (not altogether unconnected with matters of control) was now within sight of reaping the fruits of its uphill task. Several stations had been equally successful and if let alone the efficient undertakings would quickly fill all the requirements of the country. He agreed with those who regarded the threatened legislation as quite uncalled for, and they would take every available and proper means to get the objectionable clauses of the Bill drastically amended. He did not object to reasonable public control when monopolies were granted such as the sole right to supply certain areas, but this was safeguarded by existing statutes. He also realised that the general interests would be served by the standardisation of frequency as proposed, while the fact that the Bill sought to make electricity much more widely used by means of greatly extended transmission cables was admirable. The estimated sales of current by the Mersey Power Co. this year would be appreciably increased owing to the demand of Crewe, Northwich, &c. New machinery was being installed to enable them to double their output; already they were selling at the rate of over a million units per week.

Mr. H. E. Parkes, president of the Birmingham Chamber of Commerce, in his address at the annual meeting last week, referred to the Electricity Bill. It would, he said, take a good deal to convince manufacturers that the advantage of changing from one periodicity to the other would be worth the enormous expenditure that it would throw upon everyone concerned. It would have been wiser had the Government put a skeleton Bill up for discussion and negotiation before it put a definite Bill before the House of Commons to which it as a Government was committed.

A statement issued on behalf of the Provincial Electric Supply Committee of the United Kingdom, representing practically all provincial electric supply companies, says that the declared object of the Bill is to enable electricity to be generated more cheaply than it is at present, but cheaper generation will not necessarily mean cheaper supplies if it involves, as appears to be inevitable, heavy capital charges, expensive transmission, and costly administration. The fulfilment of the scheme will occupy many years, and the immediate effect is likely to be disadvantageous to electricity users.

The anticipated beneficial results from the Central Electricity Board are based upon a large expansion of the use of electricity. If, after the expenditure of the large sum of money proposed, the increased output is not obtained within a reasonable time, the burden of the interest charges on that sum, with the addition of the administration charges of the Central Electricity Board, will seriously increase the cost of electricity.

The Committee is of the opinion that the Bill, in its present form, will not produce the results which are anticipated. It imposes greater disabilities and restrictions on existing undertakers. Cheap electricity in bulk can be better ensured by giving wider power and relief from existing disabilities and restrictions.

The Committee is of the opinion that it is not in the interest of the technical development of the generation of electricity that this work should be concentrated in the hands of a very limited number of individuals. Concentration in too few hands eliminates that competition of ideas on which progress so largely depends, and tends to stereotype existing methods. This would ultimately react on the efficiency of electricity supply in this country.

The experience of electricity supply companies is that the principal causes at present preventing more rapid development in their areas are:—(a) Uncertainty of tenure; (b) Uncertainty of the price to be paid under compulsory purchase. The Bill does not remove these difficulties.

The Bill is drastic in character, and unless materially altered in Committee is in the highest degree detrimental to the industry.

Electricity is the key of the nation's industries. The Government's Bill, in its present form, fetters private enterprise, and must lead to confusion and higher costs. It is a step in the direction of complete State control of a great key industry and will facilitate the Socialist Party's avowed intention of nationalisation.

In the course of a circular addressed to the shareholders in the Yorkshire Electric Power Company, the Chairman, Mr. Arthur G. Lupton, states that the Power Companies were entrusted with the business of supplying in bulk to authorised distributors, and in face of great difficulties and despite many restrictions placed on them as a result of municipal opposition, they have, by the energy and initiative of private enterprise, built up large undertakings. They supply electricity in some of the most important industrial areas of the country, and their combined sales of electricity amount approximately to one quarter of the total sold by all the authorised undertakers in the country. The average price of the electricity sold by the Power Companies last year was less than one penny per unit. The Government's proposals will involve a serious interference with private enterprise, and a great and needless expense at a time when the burdens of national and local taxation are already becoming intolerable. The establishment of the Central Electricity Board will place the control of generation under a body of persons not directly responsible to Parliament and against whose decisions there is, in many matters, no effective means of appeal. Many thousands of investors have put their savings into electric Power Companies' shares. This Bill, if confirmed, will greatly reduce the market value of these securities, and render it impossible to secure further capital at anything approximating to the same favourable rates. The shareholders of the Yorkshire Electric Power Company have invested over 3¾ millions of capital in the belief that powers conferred by Parliament would not be interfered with; it will be a grave disaster if this faith in Parliamentary obligations is destroyed.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity Bill and Broadcasting.—On March 22nd, Mr. G. Balfour asked the Prime Minister whether his attention had been called to a speech on March 19th, and broadcast by the British Broadcasting Company, describing the Government's electricity proposals as "Socialism in small doses"; whether he was further aware that on the same occasion the Chief Electricity Commissioner, Sir John Snell, in a speech delivered by him and broadcast, advocated the Government proposals; and what action he proposed to take.

Mr. Baldwin said that permission was given for broadcasting the speeches on the usual understanding that the speakers would refrain from controversial statements of a political character. As regarded Sir John Snell, he was informed that he gave a review of the electrical position in this country, and stated his view as to the line of technical improvement desirable. His only reference to politics was a mention of the Bill now before Parliament. He asked the electrical experts present to give constructive criticism.

The Cost of Standardising Frequency.—On March 22nd, Mr. Raine asked the Minister of Transport whether he had consulted any experts with regard to the cost of converting all the electrical plant in the country from 25 periods to 50 periods; and whether any estimate was available as to the probable cost of such conversion.

Colonel Ashley said that a report was prepared by Messrs. Merz & McLellan, the eminent consulting engineers. The results were given in the report of the committee under the chairmanship of Lord Weir.

On the same day Mr. Preston asked the Minister of Transport, if he would authorise the publication of the Merz Report, submitted to the Electricity Commissioners in respect of the standardisation of frequency in Great Britain.

Colonel Ashley said that the conclusions as to the cost of standardisation of frequency proposed by Messrs. Merz and McLellan were given in paragraph 88 of the report of the committee under the chairmanship of Lord Weir. He did not propose to publish the whole report.

Long-Distance Transmission.—On March 22nd, Major Ainsworth asked the Minister of Transport whether, in view of the introduction of the Electricity (Supply) Bill, he proposed to investigate, from the point of view of cost, the conditions of transmission of power over long distances.

Colonel Ashley said that the question of the cost of the transmission of power over long distances entered into, and constituted a part of, the investigation made by the Chairman of the Electricity Commissioners in preparing the memorandum appended to the report of Lord Weir's Committee.

Smoke Abatement.—On March 23rd, in the House of Lords, Lord Gage, in moving the second reading of the Public Health (Smoke Abatement) Bill, said that the first clause of the measure made it possible to take proceedings in respect of smoke nuisances, irrespective of the colour of the smoke. It extended the exemption from legal proceedings to certain premises, chiefly connected with the steel trade, and enabled the Minister of Health, subject to confirmation by Parliament, to exempt other premises. Clause 2 enabled local authorities to set up standards of smoke emission, subject to confirmation by the Minister. Clause 4 enabled local authorities to require that certain new buildings should be provided with arrangements for smokeless heating. While it was obviously impossible to require the alteration of heating arrangements in existing buildings, the Minister considered that it should be possible to enforce smokeless heating arrangements in new buildings. It was considered that the extension of the provisions of the Bill to dwelling-houses would not be compat-

ble with the rapid and inexpensive provision of working-class houses.

The Bill was read a second time.

Municipal Electrical Service.—Elsewhere in this issue we continue the report of the proceedings of the Committee upon the Colwyn Bay Bill, and also deal with the Committee stage of the Doncaster Corporation Bill. The Guildford Corporation Bill was read a second time on March 24th, and, later, Mr. Campbell moved: "That it be an instruction to the Committee on the Bill that they shall leave out Clauses 52 and 53." He said that Clause 52 empowered the Corporation to sell electrical fittings, and Clause 53 sought to confer powers for the establishment of showrooms. It was said, in support of these clauses, that 70 or 80 municipal authorities already possessed those powers, but having been a trader and a merchant all his life, he was opposed to municipal trading.

Sir Harry Foster, who seconded, suggested that before the business of private electrical firms and contractors in this country, employing capital which was estimated to amount to about £3,000,000, was subjected to unfair, rate-aided competition, the matter should be inquired into by a Joint Committee of both Houses.

Sir H. Buckingham, the Unionist member for Guildford, in opposing the instruction, thought that the House had been led away entirely on the question of municipal trading. The present question was not one of municipal trading at all, but purely a matter of business, and if the clauses in question were passed it would mean good business for Guildford. In these modern days all those small houses ought to be wired and equipped with electricity, but in many cases the occupiers or owners were not able to put down the necessary capital for the installation, except on the deferred payment system, and local contractors would not, as a rule, put in electrical installations on such terms.

Mr. Attlee, who also opposed the instruction, said that up to a short time ago Guildford's electricity was supplied by a company. The result was that there were a number of breakdowns, no dividends were paid, and the company did not reduce the price of electricity. The town had now taken over the business, with the result that it now paid its way, there had been no more breakdowns, and the cost of electricity had been reduced from 11d. to 7½d. per kWh.

After further discussion, the motion for the instruction was rejected.

Post Office Tube Railway.—On March 23rd, Mr. Broad asked as to the present position of the Post Office (London) Tube Railway.

Lord Wolmer, Assistant Postmaster-General, said that the permanent way had been completed; the bulk of the electrical plant had been manufactured and its installation was proceeding rapidly. It was anticipated that the railway would be available for traffic in the autumn. The sum provided under the Post Office (London) Railway Act, 1913, was £1,100,000; the sum expended to date was £1,411,000.

The Electricity Bill.—On March 29th, Col. Ashley, the Minister of Transport, moved the second reading of the Electricity (Supply) Bill in the House of Commons.

Before the debate began Mr. D. Herbert, who had on the Order Paper a motion to reject the Bill, submitted that the motion for the second reading could not be proceeded with until the measure had been referred to the Examiners for report as to whether it affected private rights.

The Speaker said that he had examined the Bill carefully, and had come to the conclusion that it need not be submitted to the Examiners.

Col. Ashley said that this country was unfortunately behind many others in electrical development. There were in this country 592 public utility stations, of which 494 belonged to authorised undertakers, many very small. Thirty-two were responsible for 50 per cent. of the total output, while 462 between them were required to generate the other 50 per cent. That was wrong. Experts told him that the question of load factor was the crux of the whole matter. The average load factor was no higher than 25 per cent., which meant that only one-quarter of the plant was working at full capacity. To improve this load factor was really the great object of the Bill and should be the object of all electrical reform. Only one-third of Great Britain was reasonably supplied with electricity. Practically all the rest was supplied by small undertakings, incapable of generating electricity except at an unreasonably high cost. The Bill aimed at levelling up the efficiency of generating stations. The present yearly consumption of electricity per head of the population was only 118 units, as compared with Italy 140, France and Germany 200, Belgium 230, Norway and Sweden 500, U.S.A. 500, Switzerland 700, Canada 900. How could we hold our own in trade while we consumed only half the units per head of population that Belgium did? Some reorganisation was absolutely necessary. There was no fear that if we reorganised our plant we could not produce power as cheaply as our commercial competitors. We must foster the development of mass production by means of large generating units in big interconnected stations. Cheapness was largely a matter of big generating stations. Cheaper electricity would enable more efficient modern machinery to be installed for commercial purposes. It was doubtful whether we had more than 34 per cent. of our industrial equipment engaged in production operated by electricity. It was estimated that in 15 years the annual consumption per head of population in this country should increase to 500 units. If the Bill became law it was estimated that by 1940 the saving to the consuming public would have reached £44,000,000 per year over and above the normal economies which might have been effected if the Bill had not been introduced. They were also pathetically behind other countries in labour-saving devices for housewives. In America 1,000,000 curling irons were operated by electricity and housewives had learned to be happy though servantless. The Bill would also help agriculture.

The Bill rightly emphasised the distinction to be drawn between distribution and generation. Distribution was left in the hands of existing authorities. The Bill maintained the principle of separate authorities with all the stimulus of local management. With regard to generation the Government had no desire to interfere with ownership and management more than was necessary. The sole function of the Central Electricity Board would be co-ordination; it would be essentially an organising body. It would be a commercial concern, and its commercial discretion would be absolutely unfettered. It would not be a Government Department in any sense of the word. The Board would be appointed by the Minister. If there was to be interconnection there must be standardisation of frequency. The extent to which this might be necessary and the time for doing it were left by the Bill to the Board. Under Clause 9 the Board was given power to require standardisation on the understanding that it must bear the whole expenditure, including the cost of altering or replacing the plant of the consumer. The Weir Committee recommended that the cost of standardisation should be met out of State funds and suggested that this expenditure might be repaid, without interest, through the operation of the Board. The Government, however, did not feel justified in putting this burden upon the taxpayer, and after it had gone very closely into the figures it decided that the whole expense should be met by the Board and could be so met without detriment to the scheme, and accordingly the cost was made a capital charge of the Board.

Turning to the finances of the Board and remembering that real economy consisted in a judicious expenditure of money, the Weir Committee decided that the capital required under the scheme would be £25,000,000 and that this sum should be guaranteed as to principal and interest. That estimate had been accepted and when to that had been added the cost of standardisation it would be found that the capital authorised under the Bill stood at £33,500,000 sterling. The primary object of the Bill was to reduce the price of electricity; accordingly provisions were inserted to ensure that any saving in generation should be passed on to the consumer.

Sir J. Marriott asked whether £33,500,000 would be sufficient to cover the acquisition of those stations which were to be shut down?

Col. Ashley said he could not tell how many cases there might be. He could not imagine that there would be many of them.

He asked the House no longer to approach this great question from a parochial point of view, but to use some imagination and faith with regard to it. He could not conceive that this Bill would hurt the gas industry in any way whatever. Such a scheme had never done so in America and in other places, where these two industries were working side by side and sometimes hand in hand. The prosperity of the one had meant the prosperity of the other. He appealed to all the power companies and the municipal authorities which operated and owned electricity stations. They were not asked to give up the ownership of their stations; they were not asked to give up the ordinary management of their stations; but what they were asked to do was to submit to a co-ordinative control as to the hours they should work, what peak load they should put into operation and generally to assent to a general co-ordination all over the country. How could that hurt them at all? They stood to gain substantially in three ways. The whole of their output was guaranteed to be taken. Their stock in his judgment would become gilt-edged and more valuable than it was at present. They would sell a greater number of units under the scheme, and would secure a greater saving per unit than they did before. Their sale of electrical apparatus, such as cookers, &c., would be increased and generally they would do much more business than they were doing at present.

Mr. D. Herbert: The Minister says that these companies would have a guarantee that all their output would be taken?

Col. Ashley: Yes, certainly. The way they are to generate is to be laid down and the whole of their output is to be taken by the Board.

Mr. D. Herbert: By the Board which decides how much they are to generate?

Col. Ashley: Certainly. Proceeding, the Minister also appealed to the owners of the stations which might have to shut down. He knew, he said, that no one liked to have his own pet station and his own pet business done away with, but distribution would remain. It was only generation in small stations which was to be done away with and if one could get something cheaper than one was now making it, then surely it was no great hardship to anyone. In the Bill the Government had endeavoured to carry out the principles in which it believed—that it was not the business of the Government to manage or operate, but to co-ordinate and to control. The State should leave to agencies, private companies, or public authorities those operations which they could carry out themselves. No Parliament working through a bureaucracy could have achieved the progress or made the discoveries in the electrical industry which had emerged in recent years. But the Government could regulate—and rightly regulate—public utilities.

Mr. W. Graham, on behalf of the Labour Party, moved:—"That this House, considering that the urgent need of the nation for a cheap and abundant supply of electricity can best be secured by the development of a publicly owned and controlled system of generation, main transmission, and distribution, cannot agree to the second reading of a Bill which fails

to provide for the co-ordination of the production of coal and its by-products with electrical generation, creates cumbrous machinery, strengthens and extends the hold of profit-making companies over an indispensable public service, continues the limitation of municipal undertakings in confined and uneconomical areas of distribution, and affords to consumers in company areas no adequate protection against excessive charges for light and power." He explained that the Labour Party advocated a solution of the whole question on the principle of public ownership by the State. The Government had been driven to their present proposals by economic forces beyond their control. Administratively the Bill exceeded the worst complication that any member of the Socialist Party could devise, while financially it was rotten.

Mr. D. Herbert, a Unionist, declared that the measure did not place the industry under the control of the Government, but under the control of an autocratic Board, the members of which were appointed not by Parliament but by the Minister of Transport. The entire generation of electricity was to become an absolute monopoly of the Board. The Government had brought forward a thoroughly impracticable scheme, the failure of which would put the industry back for 10 or 25 years.

Mr. P. Harris, a Liberal, supported the Bill.

Mr. R. S. Hudson believed that under the Bill the cheapening of the supply of electricity would make the demand so large that the last possible excuse for nationalisation would be cut away.

Sir C. Wilson declared that the Government were seeking to impose an unjustifiable tyranny on the great municipalities.

Mr. Hardie, a Labour member, objected to the payment of £33,500,000 to wipe up the mess of private enterprise.

Mr. Burman, one of the Unionist members for Birmingham, urged the Government to give some right of appeal from the Central Board, so that the non-standard undertakings might know exactly where they stood, and to give them a certain amount of time to change over.

Mr. T. J. O'Connor, another Unionist, said that the Bill would not, as at present designed, produce cheap electricity. This view was also taken by other Unionists, among them being Mr. P. J. Hannon, who, as one directly interested in electrical undertakings, declared the measure to be impossible.

Major Kindersley based his objection to the Bill on financial grounds. The measure asked them to underwrite in advance a sum of £33,500,000 for an enterprise the details of which had not been examined by the three gentlemen whose report they were asked to accept blindly. If the Bill could not produce a scheme which would stand the scrutiny of the business community it should receive no guarantee from the taxpayer.

Mr. Grotrian said that if left to itself the electrical industry would accomplish everything that the Bill set out to do.

Lord Apsley, one of the few Unionist members who spoke in support of the Bill, believed that they were on the eve of a great enterprise.

Sir G. Hume, another Unionist, considered that without a measure of compulsion, it would be impossible to do anything from a national point of view. The country had made up its mind that something had to be done, and he had heard of no alternative to the Government proposals except the Socialist amendment. He would support the Bill, but he felt strongly that there must be a right of appeal.

Mr. T. Thomson, a Liberal, contended that if the Government had applied compulsory powers to existing legislation it would have achieved greater success than the present extraordinarily hotch-potch measure. There should be more control by Parliament than was provided for in the Bill.

Commander Burney urged that the Bill should provide for the standardisation of pressure as well as of frequency.

Mr. Clarry said that the gas industry would not oppose the Bill, but strongly resented the fact that there was no appeal from the decisions of the Electricity Commissioners.

Major Attlee (Labour) complained that the Bill did not provide for the control of distribution or of the prices charged, which should not be left in the hands of companies.

Lieut.-Col. Moore-Brabazon, Parliamentary Secretary to the Ministry of Transport, said that no one could maintain that the present position was satisfactory. Distribution was not touched by the Bill, but the cost of generation would be greatly reduced. If it were thought right to generate electricity at the pit mouth, or if low-temperature carbonisation became possible, the Bill put no obstacle in the way.

The debate was adjourned on the motion of Mr. G. Balfour.

(To be concluded.)

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from March 24th :—

Sylva (lettering and design). No. 465,335. Class 8. Thermionic valves. No. 465,430. Class 13. Electric lamps (ordinary).—Julius Axelrad, 25, Mornington Crescent, N.W.1, and 14, Leopold Ernst Gasse, Vienna.

Tungstron (lettering and design). No. 465,336. Class 8. Apparatus for use in radio-telephony and telegraphy, but not including electric accumulators. No. 465,431. Class 13. Electric lamps (ordinary).—Julius Axelrad ((address as above).

A.C.C., Ltd. (lettering and design). No. 466,830. Class 8. Thermionic valves, electric lamps (philosophical), vacuum tubes, electric signs, X-ray tubes and apparatus, not for medical or surgical purposes, electric furnaces, &c.—A. C. Cossor, Ltd.

Correction.—The number and correct description of the trade mark applied for by the British Ebonite Co., Ltd. (*vide* our issue of March 19th), are 466,435 and "Becolate."

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

21,289. "Electromagnetic acoustic devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). September 9th, 1924. (248,412.)

26,527. "Electric transformers." S. Z. De Ferranti and Ferranti, Ltd. November 6th, 1924. (248,429.)

26,618. "Electric current controllers." Alloy Welding Processes, Ltd., and R. W. Happe. November 7th, 1924. (248,430.)

28,379. "Loud speakers." H. J. Round and J. G. Robb. November 28th, 1924. (Cognate applications 3,011/25 and 19,492/25.) (248,433.)

28,916. "Sockets for valves, coils, and the like of wireless instruments." T. B. Braid. December 2nd, 1924. (248,450.)

28,938. "Electrical switches." H. B. Stanton. December 3rd, 1924. (248,451.)

29,009. "Lamp-globe holders." J. Stone & Co., Ltd., and J. F. B. Vidal. December 3rd, 1924. (248,455.)

29,036. "Crystal rectifiers for wireless reception." R. G. McLeod and W. J. McLeod. December 3rd, 1924. (248,459.)

29,087. "Electric couplings." A. E. Chapman and C. R. Cook. December 4th, 1924. (248,464.)

29,103. "Transmission and reproduction of sound." J. T. Day. December 4th, 1924. (248,465.)

29,106. "Electrolytic condensers." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. December 4th, 1924. (248,466.)

29,143. "Variable inductances." M. E. Elliott. December 4th, 1924. (248,469.)

29,187. "Electric measuring instruments and relays." Crompton & Co., Ltd., W. G. Smith, and W. F. Jones. December 5th, 1924. (248,473.)

29,221. "Mounting of electron-discharge devices." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. December 5th, 1924. (248,474.)

29,512. "Variable electric condensers." H. V. Flinn. December 9th, 1924. (248,485.)

29,864. "Combined electric switches and electric couplings." J. A. Crabtree. December 12th, 1924. (Cognate applications 29,965/24 and 22,851/25.) (248,496.)

29,973. "Resistances, rheostats, potentiometers, inductances, and the like used for electrical purposes." A. E. Moore. Decembr 13th, 1924. (248,498.)

30,394. "Apparatus for electromagnetically engaging and disengaging claw couplings for shears, punches, presses, or the like." Deutsche Maschinenfabrik Akt. Ges. January 14th, 1924. (227,811.)

30,507. "Systems of electric motor control." British Thomson-Houston Co., Ltd., R. D. Given, W. J. Pool, and H. W. C. Liddiard. December 18th, 1924. (248,503.)

31,138. "Electric generator." J. W. Tyler. December 29th, 1924. (248,516.)

1925.

399. "Radio receiving apparatus." Sterling Telephone & Electric Co., Ltd., and W. M. Holbeach. January 6th, 1925. (248,522.)

887. "Supports for headphones used in wireless telephony and the like." M. Sutton. January 12th, 1925. (248,527.)

2,545. "Combined condenser and inductance-coil holder for wireless instruments." L. Manning and C. E. Needham & Bro., Ltd. January 29th, 1925. (Cognate application 23,940/25.) (248,535.)

4,890. "Expanding and contracting electric illuminated signs." C. G. White and A. Brooke-Irish. February 21st, 1925. (248,550.)

5,969. "Fine-adjustment devices for electrical instruments." A. R. Taylor. March 4th, 1925. (248,559.)

6,105. "Electric insulators." J. A. Brassington, jun. March 6th, 1925. (248,562.)

6,612. "Construction of tumbler switch." W. J. Charles. March 11th, 1925. (248,567.)

8,574. "Magneto-microphonic relays." C. F. Adolph. March 31st, 1925. (248,581.)

9,844. "Loud speakers." Dr. G. Seibt Fabrik Elektrischer und Mechanischer Apparate. June 16th, 1924. (235,529.)

10,048. "Automatic stopping devices for electric lifts." Smith, Major and Stevens, Ltd., and P. H. Stevens. April 17th, 1925. (248,588.)

10,243. "Leading-in tube combined with throw-over switch contacts and spark-gap for use with wireless or other electrical apparatus connected to overhead aerials." P. J. Ambrose. April 20th, 1925. (248,590.)

12,673. "Aerials for use with wireless receiving apparatus." J. W. Hyde. May 15th, 1925. (248,597.)

12,750. "Insulating blocks for electric heaters, resistances, and like apparatus." W. F. Jackson and G. Bray & Co., Ltd. May 15th, 1925. (248,598.)

14,214. "Electron-discharge valves." Compagnie Générale de Télégraphie Sans Fil. June 2nd, 1924. (234,844.)

14,455. "Telephone receiver rests." W. H. King. July 8th, 1925. (248,609.)

15,549. "Illuminated advertisement machine." E. A. Vardy. June 16th, 1925. (248,614.)

15,735. "Electric connectors." F. Kniveton. June 17th, 1925. (248,616.)

19,351. "Multi-filament incandescent lamp." S. Rendes. July 30th, 1925. (248,631.)

21,670. "Variable electric condenser." S. Cohen. August 29th, 1925. (248,647.)

21,940. "Speed-regulating device for electric elevators." Waygood-Otis, Ltd. June 18th, 1924. (Divided application on 235,858.) (239,515.)

23,028. "Electrodes for thermionic valves." A. Emerson, jun. September 3rd, 1925. (248,648.)

22,445. "Immovable electrolyte for dry cells." Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston. September 8th, 1924. (239,547.)

23,210. "Electron discharge devices." British Thomson-Houston Co., Ltd. September 17th, 1924. (240,166.)

24,500. "Electron discharge devices." British Thomson-Houston Co., Ltd. October 1st, 1924. (240,850.)

24,675. "Automatic reduction gear couplings for combined electric starters and dynamos for motor vehicles." P. Dufour. October 4th, 1924. (240,865.)

24,998. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. October 7th, 1924. (241,200.)

25,133. "Multiple or combination electric switches." A. H. Midgley and Auto Sundries, Ltd. October 8th, 1924. (248,661.)

25,248. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. October 9th, 1924. (241,216.)

25,549. "Thermionic discharge devices." Westinghouse Electric & Manufacturing Co. October 14th, 1924. (241,556.)

26,698. "Arc-light high-frequency oscillation generators." C. Lorenz Akt. Ges. February 15th, 1925. (247,517.)

26,781. "Overload time-lag protective arrangements for electric circuits." J. W. Kirkland (Allgemeine Elektricitats Ges.). October 26th, 1925. (248,669.)

26,796. "Electric motor-driven change-speed device." E. C. R. Marks (Hendey Machine Co.). October 26th, 1925. (Addition to 239,395.) (248,670.)

28,305. "Surface condensers." International General Electric Co., Inc. November 10th, 1924. (242,677.)

30,112. "Gasfilled electric lamps." General Electric Co., Ltd. March 18th, 1925. (248,680.)

32,757. "Movable headlights for vehicles." J. W. Reynolds. December 28th, 1925. (248,685.)

1926.

3,632. "Electric couplings." A. E. Chapman and C. R. Cook. December 4th, 1924. (Divided application on 248,464.) (248,692.)

The

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Industrial Lighting Reflectors.

WHILST there is general recognition of the continual progress that is being made in lighting, one recent development—the tendency towards standardisation—deserves special notice. It marks a new stage in illuminating engineering. Lighting is in many respects a very difficult field for standardisation. In the case of most problems, there are many different aspects to consider, and as new lamps and appliances are being constantly introduced, the whole subject is in a state of continual development.

There are, however, some directions in which standardisation would obviously be beneficial. Several of these were indicated at the recent meeting of the Illuminating Engineering Society, when the B.E.S.A. specifications for portable photometers (No. 230/25) and industrial reflector fittings for electric lighting (No. 232/26) were discussed. The former specification should have the effect of materially raising the standard of accuracy and workmanship of photometers; the latter is of particular value as showing the willingness of leading manufacturers of reflectors to adopt standard principles of design.

Discussion of the last-mentioned was concerned mainly with its leading feature—the adoption of an "angle of cut-off" of 20 deg. for reflectors of the enamelled-iron "R.L.M." type. The Home Office Departmental Committee on Lighting in Factories and Workshops has already recommended that, with a view to avoiding glare, the angle between the line drawn from the eye of the operator to the filament and a horizontal plane should not be less than 20 deg. (except in the case of sources within six feet of the operator, where an angle of 30 deg. is specified). Reflectors with an angle of cut-off of 20 deg. could therefore be used in practically any position in a factory without fear that the conditions would be unduly glaring. This is obviously a great advantage. The Home Office Committee made it clear that its requirements could be met in various ways—for example, even very shallow reflectors can be used if located at a sufficient height so as to be out of the direct range of vision. But a user of the standardised R.L.M. reflector would know that he was taking no risks.

One fact brought out very clearly in this discussion, but not sufficiently generally realised, is that angle of cut-off and efficiency are closely related. The more completely the flux of light from a lamp is enclosed by the reflecting source the greater in all probability will be the loss of light. The general opinion seems to be that

enamelled-iron reflectors of this type with a cut-off angle of 20 deg. should have an efficiency of the order of 60 to 65 per cent. Estimates of efficiency of industrial reflectors are apt to be somewhat fanciful; there are certainly very many reflectors in use with an efficiency very much less than the value mentioned above.

The term "efficiency" is often abused. Here is a striking case in which the more "efficient" apparatus is not necessarily the more serviceable. If, for example, one imagines a reflector consisting of a flat disk a comparatively long way above the lamp, intercepting only a small fraction of the light rays, it is apparent that it might have an efficiency of nearly 100 per cent.—simply because it is inactive, and discharges none of the functions of a proper reflector. British manufacturers will do well to continue to aim at the production of reflectors with suitable screening properties and a cut-off angle of at least 20 deg., even though this may occasion some sacrifice of nominal efficiency.

Whilst this specification relates primarily to one particular standard form of fitting—the enamelled-iron reflector of the R.L.M. type—it should be understood that there are other possible methods of eliminating the glare, for instance, by the use of opaque or translucent rings so placed as to screen the source at all angles likely to bring it within the range of vision. By these and other methods sufficient protection against glare, coupled with higher efficiency and desirable properties as regards very extensive distribution of light, may be obtained, and a promising form of fitting of this type was exhibited at the meeting of the Illuminating Engineering Society. The specification, therefore, should not operate as a bar to progress, and may require revision from time to time.

One other point of great importance requires to be noted—the necessity for standardisation of lamps in order that they may give predetermined results in standardised reflectors. In the past much trouble has been caused by variations in the dimensions of lamps of the same wattage. In some cases the dimensions were such that the filament came too far within the reflector; in other cases the filament projected right outside the reflector, giving rise to glare. In either case the expected distribution of light from the reflector would not be obtained, and hence the predetermined conditions of illumination would not be realised.

In order that reflectors designed in accordance with the specification may operate properly, it is of great importance that the position of the centre of the filament with respect to the cap of the lamp should be standardised so that the light source will be located as nearly as possible always in the same place within the reflector. Excellent progress has already been made by the B.E.S.A. Lamp Committee in the direction of standardisation, and lamp manufacturers will no doubt co-operate in the fixing of limits which will ensure yet greater precision in the future.

The Training of Electrical Power Engineers.

Whilst the Electrical Power Engineers' Association in its earlier years devoted its attention mainly, and with ample justification, to securing reasonable remuneration for its members, it has always been proclaimed by the leaders of the Association that it had higher aims—namely, to raise the status of power engineers and, to that end, to improve the training of recruits to their ranks. In this resolve it has enlisted the sympathy and support of the Employers' Side of the National Joint Board, and a scheme drawn up by that Board has been under consideration by the District Joint Boards for some time. We have now received a copy of the scheme as approved by the N.J.B. and recommended for adoption by the District Boards and supply undertakings.

In a brief introduction it is pointed out that modern systems of supply are so complex that the engineers who supervise their operation and maintenance must needs be highly trained; they are responsible for very costly plant, for the continuity of supply, and for heavy outlay, demanding technical knowledge of considerable extent, and the scheme is designed to ensure their possession of the necessary qualifications. A Register of trained engineers is to be established, recording the names of men who have been suitably trained, but there is no intention of restricting employment to those on it.

The National and District Joint Boards will not attempt to supervise the course of training until the men who have completed an approved course in engineering works present themselves for admission to the electricity supply industry, but they will appoint sub-committees to collaborate with the firms concerned and with technical colleges, and to keep in touch with the progress of the trainees during their training within the supply industry and afterwards. The preliminary training involves three or four years spent in a manufacturing engineering works, unless the candidate follows a three-year day course at a technical college or university, in which case the works training may be reduced to two years; and the two years' training within the industry must be spent in an undertaking having not less than 8,000 kW of plant installed. The total period of training in any case must extend over six years, and the candidate must pass a test for proficiency, which may be the A.M.I.E.E. or other approved examination.

The scheme as a whole is commendably brief, practical, and businesslike, and should prove effective in removing the uncertainty which has hitherto surrounded the question of training for the electricity supply industry and in placing it on a higher plane. We are specially pleased to see that it is regarded as essential that the engineer shall possess a knowledge of the commercial side of the industry. The want of this qualification has been a heavy handicap to the industry in the past, and if electricity supply is to be developed as it should be, it is imperatively necessary to include adequate commercial training in the curriculum.

The Electricity (Supply) Bill.

That the Bill would be given a second reading by the House of Commons was a foregone conclusion. The debate, which occupied two days, was in many respects interesting; the Bill was praised for widely different reasons, and no less diverse were the arguments advanced in opposition to its progress, some of which, as was pointed out at the time, were mutually destructive. At this stage, of course, the broad principles embodied in the Bill were alone in question, the details being a matter for the Standing Committee. A brief report of the debate is concluded in this issue.

Unfortunately, as might be expected from the nature of the subject and want of acquaintance with its intricacies on the part of the speakers, misconception of the situation and misinformation as to the actual facts largely detracted from the value of the discussion. Not a little of the latter was due to the Weir Committee's report; in the course of the Attorney-General's closing speech, for example, he made use of a table from the Report purporting to compare the consumption of electricity in this country with that in eleven places abroad, of which only one was truly comparable and relevant. No wonder that such figures were stigmatised by a member as "deliberately misleading"!

It would be tedious to review the debate at length, but we may sum up the result in a few words: a Bill of some kind is essential to repair the damage done by the House of Lords to the Bill of 1919; this Bill is not satisfactory, but can be greatly improved in Committee; when all is said and done, it will not give cheap electricity to everybody—distribution still remains as costly as ever; and, what is of the first importance, progress is being brought to a standstill whilst the electricity supply industry, including the Electricity Commission, awaits the verdict of Parliament. Since the autumn of 1924 numerous schemes of local development received by the Commissioners, and certain schemes devised by them, have had "necessarily to be deferred pending a decision by the new Government as to the policy to be followed. The brake is on all the time—and the slow progress resulting from its application is used as an argument against the industry!

Electrical Progress in Pretoria.

The New Municipal Generating Station.

The first electricity supply installation in Pretoria, which was established in 1891, consisted of five belt-driven generators, and it is interesting to record that Mr. T. C. Wolley-Dod, the present electrical engineer to the Town Council, assisted in the transportation of these units by ox wagons. Within ten years the output of the station had increased to six times that of the original demand, and between 1891 and 1919 the station was reconstructed three times on the original site; and in 1902 it was taken over by the Municipality. Subsequently Mr. G. M. Clark, M.A., M.Inst.C.E., who was appointed as consulting engineer to the undertaking, decided that it was necessary to build a completely new power house equipped with turbine-driven generating plant. A site, convenient for coal and water supplies, was chosen some three miles from the centre of the city, and it was proposed that the new station should be designed for an initial output of 10,000 kW, and that the original station (Schoeman Street) should be used as a converter station and equipped with five 750-kW motor converters. The new station, fig. 1, stands 4,360 ft. above the sea level.



Fig. 1.—Pretoria Generating Station.

The first work to be put in hand was the construction of a dam, by which it was possible to store 100 million gallons of water, with a top-water surface of 35 acres, for cooling the circulating water by natural evaporation.

The power station is of reinforced-concrete monolithic structure, and all the stresses are carried on beams and columns; the foundations are taken direct on to the rocky shale, the bases of the concrete columns being carried to this solid foundation. An important feature in the construction of the building is the provision of large windows on all sides, freely admitting natural light to the semi-basement engine room. The boiler and engine rooms and all the machinery are on the same level, which was determined by the minimum water level to be anticipated in the dam.

The boiler equipment consists of six Babcock and Wilcox marine-type boilers, fig. 5, with electrically-driven chain stokers. Each boiler has a normal capacity of 20,000 lb. per hour, and is fitted with a steel-tube economiser with a main flue above. The chimney stacks are 7 ft. 6 in. in diameter, and are fitted with induced-draught fans. Coal is brought to the sidings in hopper-bottomed trucks, the largest of which is capable of a load of 50 short tons (2,000 lb.). It is belt conveyed to bucket elevators, from which a second conveyor discharges it into overhead steel bunkers, whence it travels, *via* chutes, to the boilers. At the top of each chute is a coal valve which discharges 700 lb. at each filling. About 100 tons of coal is kept in the overhead bunkers, and provision is made for storing and handling up to 3,000 tons on site.

The pump room lies between the engine room and boiler house, and Weir feed pumps, 6,000 r.p.m., are installed, each having a capacity of 7,000 gal. per hour against full pressure. The boiler feed water is taken into drums, from which it is distributed to either or both of the duplicate feed ranges; and a motor air compressor supplies air to all parts of the station for various purposes, including soot blowing from the boiler tubes.

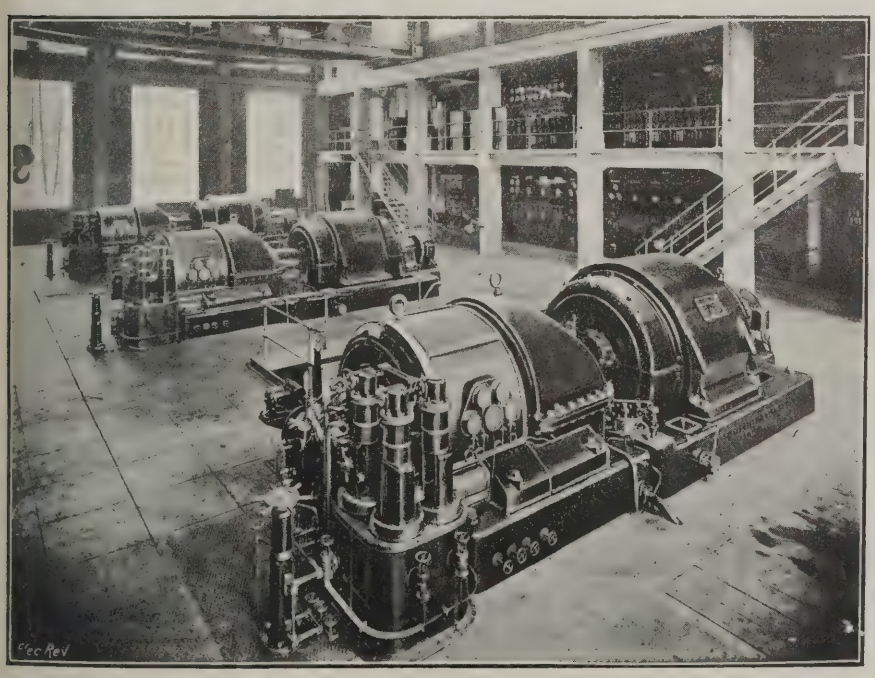


Fig. 2.—Turbine Room.

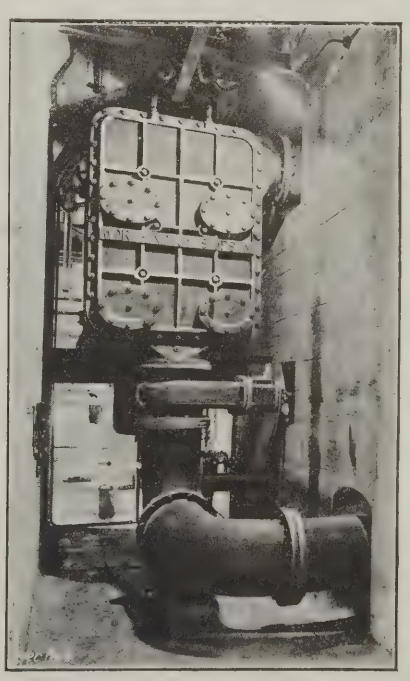


Fig. 3.—6,000-sq. ft. Condenser.

The turbine room, fig. 2, is equipped with three 3,500-kVA, General Electric Co., Ltd., turbo-alternators, running at 3,000 r.p.m., the turbines being of the impulse type designed for a working steam pressure of 350 lb. per sq. in. gauge, with a total temperature of 600 deg. F., and a 95 per cent. vacuum. The steam supply to each turbine is controlled by three throttle valves automatically operated by the governor through oil relays.

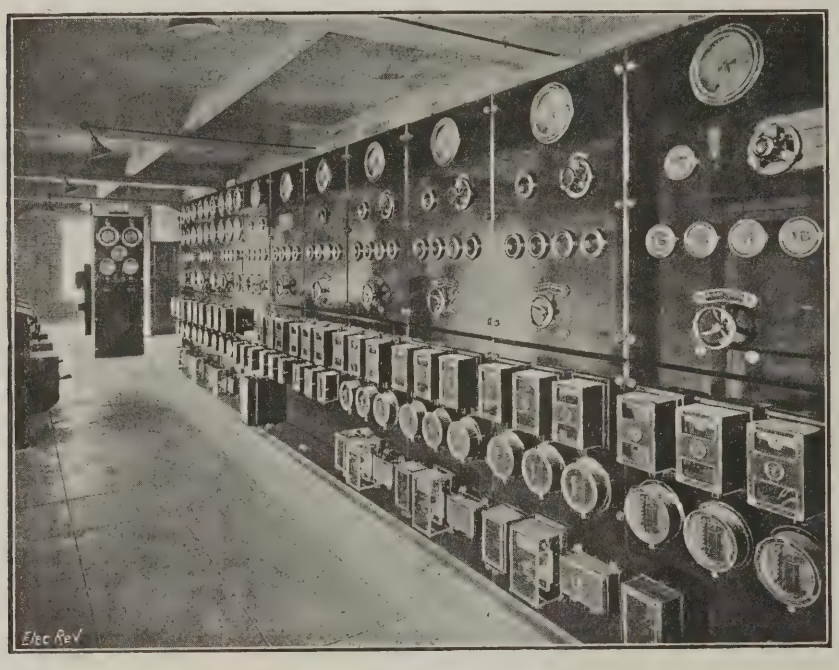


Fig. 4.—6,600-V Cubicle Board.

The first or main throttle valve, which is housed in a separate steam chest, enables the machine to carry ¾ load. The other two carry full load and 5/4 load respectively, and are arranged together in a second steam chest. The steam from the chests enters the steam belt in the high-pressure casing, where expansion nozzles are fixed in the bottom half only. The steam belt of the bottom half casing is closed at the horizontal joint, so that none of the joints, which have periodically to be broken for inspection purposes, are subject to live steam pressure. Worthington-Simpson condensers, fig. 3, are installed, each with a cooling surface of 6,000 sq. ft. The circulating pumps are driven by "Witton" motors, each of which is started by an auto-transformer starter, an oil circuit breaker being also provided for the main control.

The alternators are of the G.E.C. standard type generating at 3-phase, 50 cycles, 6,600 V, and were designed for an 80 per cent. power factor. The ventilation of these machines is such that the air which cools the rotor is kept apart from that which cools the stator during their passage through the machine.

The switchgear, also supplied by the G.E.C., Ltd., is divided into three main sections, a 6,600-V stonework cubicle board, fig. 4, with electrically-operated oil circuit breakers; a steel-plate, slate-front, cubicle board for the 500-V supply for the auxiliaries and lighting; and the auto-transformer starting panels for the auxiliary motors. The control board for the h.p. gear, equipped with the usual modern apparatus, including protective relays, is on a gallery overlooking the engine room, while the steel-plate cubicle board is immediately below. The stonework cells for the oil circuit breakers, links, and instrument transformers are in a room immediately behind the 500-V board and on the same level. The bus-bar cells are situated behind the control board. Three main generator cubicles, one containing a bus-bar coupler, two works cubicles, and three 2,200-kVA feeder panels, accommodate the h.p. switchgear. A duplicate bus-bar system with duplicate links is installed, both sets of links being mounted on the oil circuit breaker side of the cubicle so as to facilitate inspection. The circuit breakers have a maximum breaking capacity of 125,000 kVA, and each phase contact is contained in a separate tank, having a rupturing speed of at least 5 ft. per sec. A coloured-light indicator shows the position of each breaker, "on" or "off." The 500-V board consists of ten panels in all, seven of which control the works supply. The remaining three are a 50-kVA lighting panel; a 50-kVA panel for a charging set; and a busbar disconnecting panel.

It is interesting to note that at the old generating station there is an electrically-operated stonework cubicle system, which is a duplicate of that at the new power house, except that there are four feeder panels, a busbar panel, and five panels for controlling the high-pressure side of the motor-converters. Also in the eight other municipal sub-stations there are installed G.E.C. truck-type cubicle switchboards for the high-pressure circuits, comprising in all some 30 trucks.

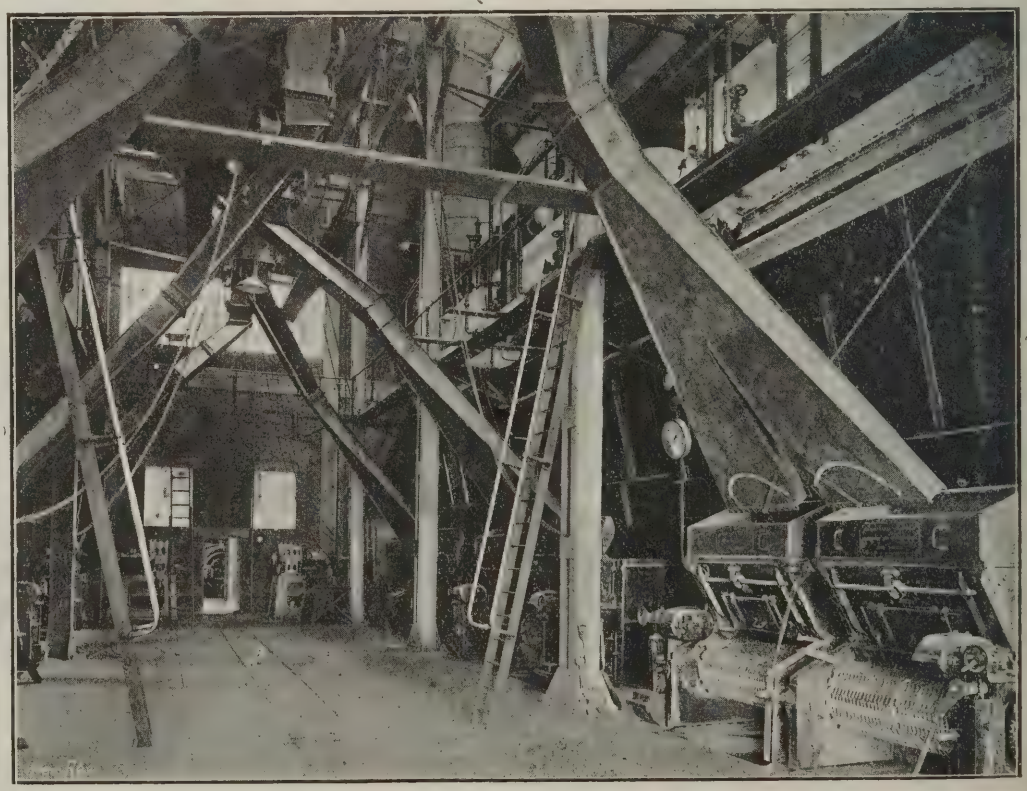


Fig. 5.—The Boiler House.

In the main power house there is installed a petrol engine coupled by belt to a combination machine, which

can be used for battery charging or reversed to supply a.c., while in the event of a shut-down it provides a means for starting the auxiliary motors.

The present output of the station is approximately 1,250,000 kWh per month; the maximum load amounts to 4,050 kW; and the load factor is about 40 per cent. Underground cables transmit the energy to the old power station. Two pairs of cables form a ring main to supply a.c. energy at various points of the western end of the city, while a third cable forms a diameter to the ring and runs direct to the old station. The eastern end of the city is supplied by a second ring from the Schoeman Street station.

The total cost of the station was £250,000, exclusive of the dam and the site. This gives a figure of £25 per kW, of which 10 per cent. was absorbed by transport costs. A further £75,000 was spent on the converter station and mains. These costs are based on 1921 prices. As an indication of the wide use made of electricity in Pretoria, the consumption per head of the white population is about 300 kWh per annum.

Agricultural Electrical Machinery.

Some Features of the Paris Agricultural Exhibition.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

This annual Paris exhibition of agricultural machinery increases in size each year and affords a most interesting illustration of the machinery employed by the French farmer, much of which is radically different in detail from that utilised in England. This year the machinery shown in operation was worked by electric motors, and naturally the stands were electrically lighted. The electric motor in itself is no longer considered to be a novelty, but rather an accepted feature of such an exhibition, and owing to its compactness, it is incorporated as an almost obscure part of many machines. French agricultural electric motors are nearly all of the industrial type, for unlike the special farm motors in use in Germany and Scandinavia, no pains seem to be taken to make them dust-proof. While many of the machines are directly driven with individual motors, there is apparently a very large demand for portable motors mounted on wheeled barrows of various styles. These barrows, without exception, are equipped with a countershaft fitted with several pulleys of different diameters, and the endless belt, connecting the motor to this countershaft, is maintained at the proper tension by a counterweighted jockey pulley. The use of such a pulley also ensures a longer surface of belt contact. The motor starter and a drum for the flexible cable are mounted on the same barrow.

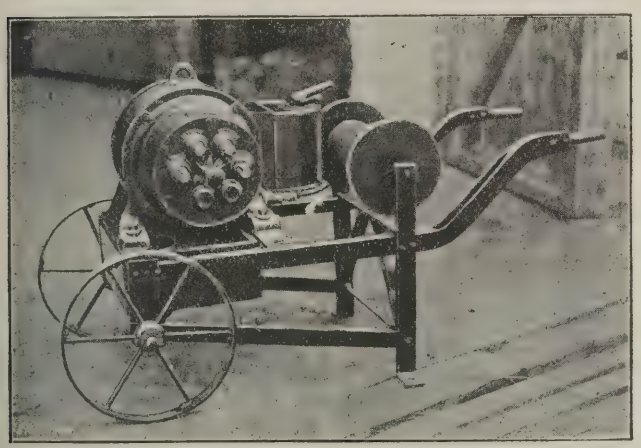


Fig. 1.—The "Law" Motor.

Progress has been made with self-contained geared motors; in fact, in one type, the electric motor has become an accessory which is bolted to the side of the gear box, holes for foundation bolts being provided on the latter. To avoid the trouble of alignment with the various machines that have to be operated, tubular shafts some six or eight feet in length are provided, the ends of which are fitted with Hooke joints; thus the geared motor can be conveniently placed on the floor to drive a machine whose axle is two to three feet above the ground level. Several spindles project from the gear case, fig. 1, each of which is arranged to run at a different speed (say 40, 60, 100, and 200 r.p.m.). The curves (fig. 2) show the advantages of this class of motor, known as the "Law." Figs, 3, 4, and 5 illustrate some of the applications of the machine.

Among the electric thrasher machines, a particularly interesting motor was the Dassenoy, which runs at 3,000 r.p.m.—an unusually high speed for electric-motor drives—and has a sliding armature which facilitates the starting. This method of starting permits the use of a smaller motor than would normally be employed, as it is unnecesary to start on load. Motors of this type are often equipped with a so-called hour meter; really, of course, it is a revolution counter which records the revolutions in units of the hourly number. In this form, the motor is used by French farmers' co-operative societies, and the hire charge to their members is based on the hours indicated on the counter. For these machines the makers claim a better power factor, negligible slip, and a 10 per cent. reduction in consumption for the same work done by motors of the usual type. The motor is also made to run at 1,500, 1,000, and 750 r.p.m.; the standard sizes vary from two to fifteen horsepower.

During recent years, the Ford Motor Co., in order to develop the sales of the Fordson agricultural tractor, have expended a great deal of time and energy in working out various applications of their machine, including farm uses, building operations, and road construction and transport. The manner in which this work has been carried out is a very good object-lesson in the application of the electric motor to farm purposes.

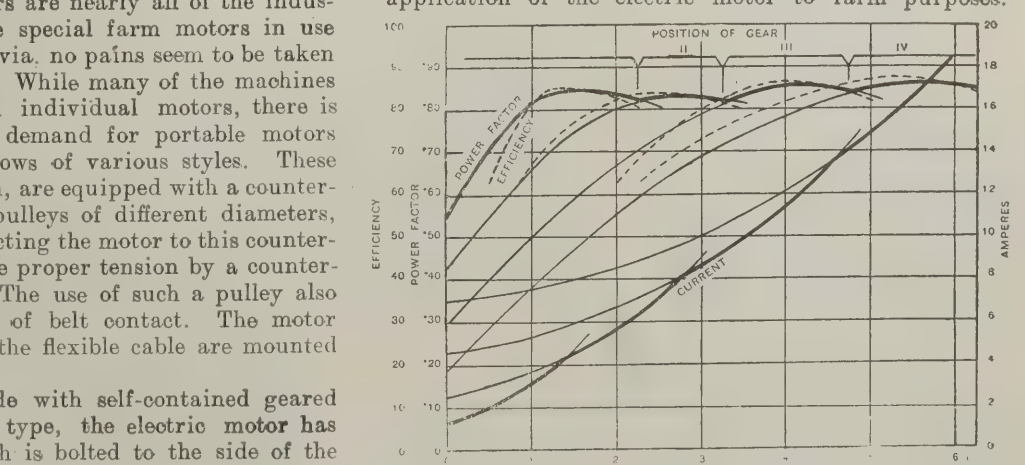


Fig. 2.—Comparison Curves for Geared Motor.

The latest development of Fordson tractor applications is the incorporation of a dynamo. This is accomplished by placing a special cast-steel bracket below and in front of the radiator. The generator is directly connected to the crankshaft at the point where the starting

handle is usually placed. Thus among the numerous duties of the Fordson tractor is now added that of charging the lighting batteries on a farm when required and when the tractor is not employed on other farm work.

On the Continent the mechanical cultivation of vineyards is becoming more and more important, and in this connection a very ingenious plough, somewhat humorously described by the exhibitor as "an intelligent implement," was exhibited. It is provided with a guide in front, which, on coming in contact with any vine stems, momentarily diverts the plough share which follows, thus avoiding any damage to the vine roots. This implement is driven by a Julien & Prat electric motor mounted at the end of a multigear box which gives the choice of special speeds; the final drive is effected by means of an endless belt with a solid cast-iron idler pulley riding upon it to maintain a uniform tension and also to neutralise any shocks, due to stones and such obstacles encountered in the soil which is being ploughed. Though no electric ploughs for ordinary farm work were exhibited, there were several working models; fig. 7 shows an electric plough tractor.

One of the difficulties in operating tractors on the land is that of maintaining a sufficient grip on the soil; almost innumerable types of spuds, strakes, and other non-slipping attachments have been tried, and the latest development is that of the Guerrini "pedorail" chain attachment. This device provides chains which can be mounted over twin rubber tires or pneumatic tires, or else direct on to steel rims. The chain carries a series of eleven feet, mounted on bearings on which the feet can oscillate slightly, enabling two of



Fig. 4.—The "Law" Motor Crushing Corn.

the feet to come in contact with the ground at the same time, thus very greatly improving adhesion, especially on soft ground. While apparently quite satisfactory for slow speeds, such as those of agricultural tractors, the device is not suitable and is too noisy for the higher speeds of lorries, though it is employed by the French War Department for temporary attachment when a lorry has to travel over very rough or very soft soils.

The Renault Motor Co. showed a 20/40-h.p. oil engine driving a 220/127-V, 79-A, 3-phase alternator, running at 1,500 r.p.m., with a 50-V, 20-A exciter. The alternator and exciter were made by the Société Alsacienne de Constructions Mécaniques, Belfort. This type of plant is intended for temporary use in a district pending the construction of overhead supply lines.

The Diluvien automatic watering machine was on view. This consists of a motor-driven pump mounted on a small wagon which progresses automatically. The water is distributed by means of two arms which carry roses at intervals for spraying the water. The apparatus is intended particularly for the use of market gardeners. It will water, it is claimed, a surface of 3,000 to 6,000 sq. yds. per hour and distribute about 7,000 gallons of water during that time. The machine is fitted with a $2\frac{1}{2}$-h.p. motor, and the pump runs on a permanent rail track laid down the centre of the ground that is to be watered. The automatic watering of crops is becoming of more importance, not only to the market gardener but also to the farmer, hence all developments of this nature are well worthy of study.

A new development in self-contained geared motors for the French market is a high-speed motor, 3,000 r.p.m., which follows the lines of some German designs,

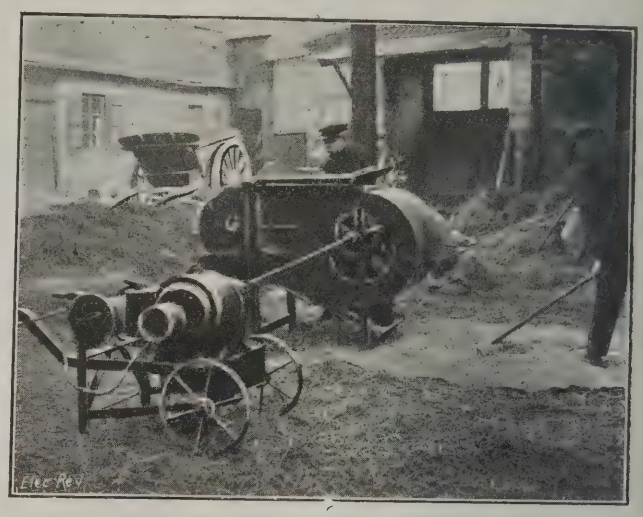


Fig. 3.—Driving a Winnowing Machine.

of one-half to two horse-power. This makes an exceedingly compact machine. It is fitted with a double-reduction gear and drives at one speed only. For the sake of portability a convenient handle is incorporated. A switch is counter-sunk into the motor frame so as to be readily accessible and yet not easily damaged. The connection between the shaft or motor gear box and the machine to be driven incorporates a triple Hooke joint. A tripod stand supports the motor (fig. 6), and it is considerably more stable than the machines employed in other countries, which in practical use are inclined to wobble about. The stability is due to the final adjustment being effected by a sliding vertical tubular support above the tripod.

Among the English firms which exhibited were:—Ransomes, Sims & Jefferies, Ltd.; Ruston & Hornsby, Ltd.; Marshalls; Campbell Gas Engine Co.; and Bamfords.

In the general exhibits of electrical equipment for farm buildings, one was struck with the great variety of applications and the choice of methods of accomplishing each. Taking water pumping as an example, there must have been over forty different designs of pumps on show. The general trend seems to be towards automatic pumps of small horse-power, which provide a high-pressure delivery and yet are of simple design and reasonable cost. The air-pressure tank seems to be falling out of favour, its place being taken by a small cistern, mounted at a considerable height, to provide

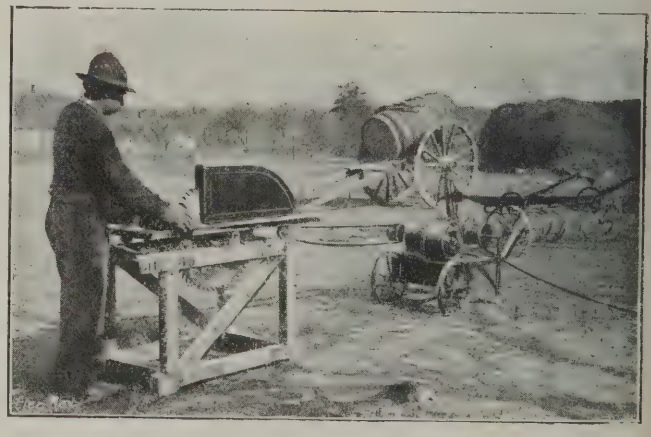


Fig. 5.—Driving a Saw Mill.

the required head. One very good form of float control that was noticed, made by the Société Générale Agricole, consisted of a metal arched tube containing a small quantity of mercury. When the control is operated, by the limits of the change of level of the water, the over-

balancing or spilling of the mercury in the curved tube takes place with less friction than that of a roller weight, hence the switch is operated more positively. There were a great many modern variations of the *chaine hélice* pump on view. In the case of centrifugal pumps, base-plates are often now eliminated; this is accomplished by designing the pump casing as a part of the motor end frame—provision being made for an accessible stuffing box. This makes a very simple, cheap and neat design.



Fig. 6.—Portable Motor on Tripod.

As to washing machines, there are a great many makes from which to choose. The general construction is of such a type that they can be sold at lower prices than those on the British market. Fig. 8 shows a very popular design of this form of machine. It will be observed that galvanised sheet steel is largely used in their construction. One French motor manufacturer is marketing a fractional horse-power electric motor combined with a worm reduction and automatic reversing gear, in one complete unit. This is adaptable for the driving of any horizontal drum type washer. The automatic reversing gear is essential for operating drum-type washers, for the clothes that are being washed would otherwise get too closely pressed or wound together to become properly cleansed.



Fig. 8.—Electric Drive for Washing Machine.

Several working examples of milking machines were on view. A feature of the Alfa-Laval machines is the use of rubber tubing which has extremely smooth interior surfaces, thus avoiding resting places for deleterious bacteria. A Danish machine—the Dana—now largely used in France, employs a new principle in milking-machine design, for its valves are operated by the milk as it is drawn from the cow. This feature enables the cows to be milked quite dry—an operation which, it is claimed, no other machine accomplishes, it being usually necessary after the milking machines are removed for the cow to be "stripped." Further, the "strippings" contain a big percentage of cream, and also if they are not drawn off properly, the cow diminishes her supply of milk at subsequent milkings. Of course, the vacuum pumps of these milking machines could be operated by oil engines, but in practice the farmers appreciate the self-contained electric unit, as the cow is very sensitive to any change in the regularity of the pulsations, reducing her supply of milk if they are erratic.

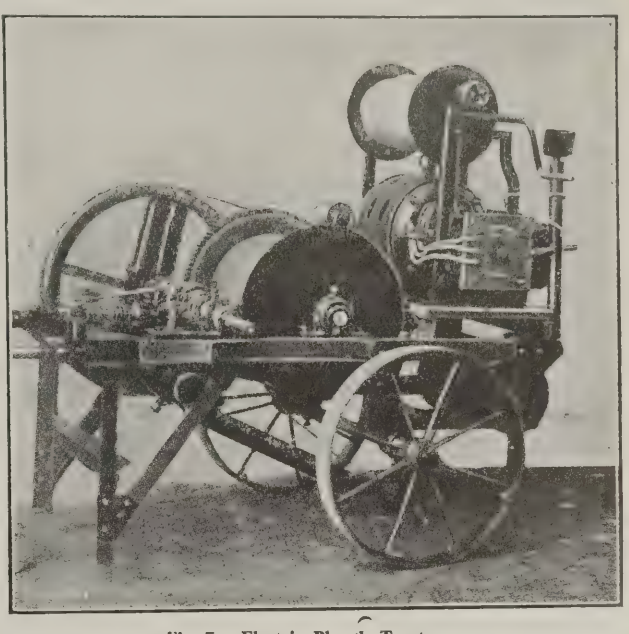


Fig. 7.—Electric Plough Tractor.

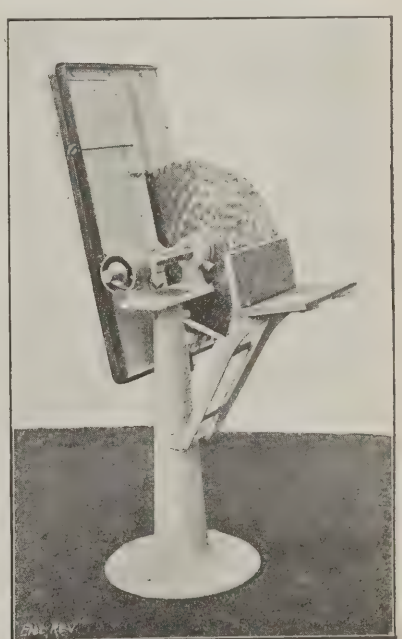


Fig. 9.—Tilting-Table Machine.

An important problem on every farm is the transport of material. On the Continent and in America to-day there is a marked tendency to install overhead transporters of various kinds, and in modern British cow houses the overhead runway is becoming familiar; but the electrically-operated transporter gear is almost unknown here. Several examples of these were on view at the exhibition. They might be briefly described as simple modifications of the well-known Temperley coal transporters, adapted to agricultural conditions and farm limitations of capital costs.

On every farm, a circular saw is a most convenient tool. In France it has developed in a most useful way, many of the machines being adapted to serve for both log and firewood, and also for ordinary odd-job work. This is accomplished by the aid of a tilting table or bascule, fig. 9. There can be no doubt that firewood sawing is made much safer when the wood is firmly supported in double Y-arms, as is done in these double-purpose machines.

Electrically-driven cross-cut log saws have been on the market for some time, and have proved their utility. A new development which was shown at Paris is an electric portable horizontal saw, made by the Société Générale Agricole, for cutting down standing trees. As the result of practical experience, the circular saws used for this purpose are made with four sets of three special teeth. The first two of each set are clearing points of semi-circular shape, while the third is of the usual shape. This same tool can also be used for other circular-saw work when a circular saw of the normal type is substituted, for the power transmission is through two different bevel drives, and that the gear-box casings are arranged for turning at any convenient angle to suit the work in hand.

It will be appreciated from the foregoing remarks that steady progress is being made in the development of new electrically-operated apparatus for the farmer and rural dweller in France. Continental farm labourers are not as a rule so intelligent as the British farm hands, and when electrical distribution in this country reaches the stage it now occupies in many parts of the Continent, we may anticipate an extended use of even more ingenious labour-aiding (a preferred expression to labour-saving) machinery, over the country-side.

Three-Phase Four-Wire Metering.

Comparative Performances of Four Types of Equipment.

By GEO. D. MALCOLM.

In my previous article on the metering of three-phase power,* I confined my remarks to three-wire industrial practice, and endeavoured to prove that the three-wire unbalanced-load meter was the most satisfactory medium for that purpose. The metering of a 3-phase 4-wire supply, which may include under one service 3-phase motors, single-phase motors, and perhaps heating—if the tariff permits—is, however, quite another proposition, and requires a different solution.

Supply authorities generally insist on large lighting installations being separated, and the load more or less equally balanced between the three phases; so once again the question of how best to deal with this form of supply is presented.

One, or even two, of the phases may be temporarily disconnected for some reason or other; one single-phase motor, one radiator, or one small section of lighting may constitute the total load at some period; one 3-phase motor may be in commision alone; a considerable amount of "out-of-balance" may be caused by groups of single-phase units being on load simultaneously; and so on. The combinations of possible conditions are many, and the metering equipment installed should be capable of integrating accurately under all of them.

*Electrical Review, October 30th, 1925, p. 689.

There are two methods which may be employed, *viz.*:—

(1) Three single-phase meters.

(2) One 3-phase 4-wire unbalanced load meter.

The latter method may be again sub-divided into:—

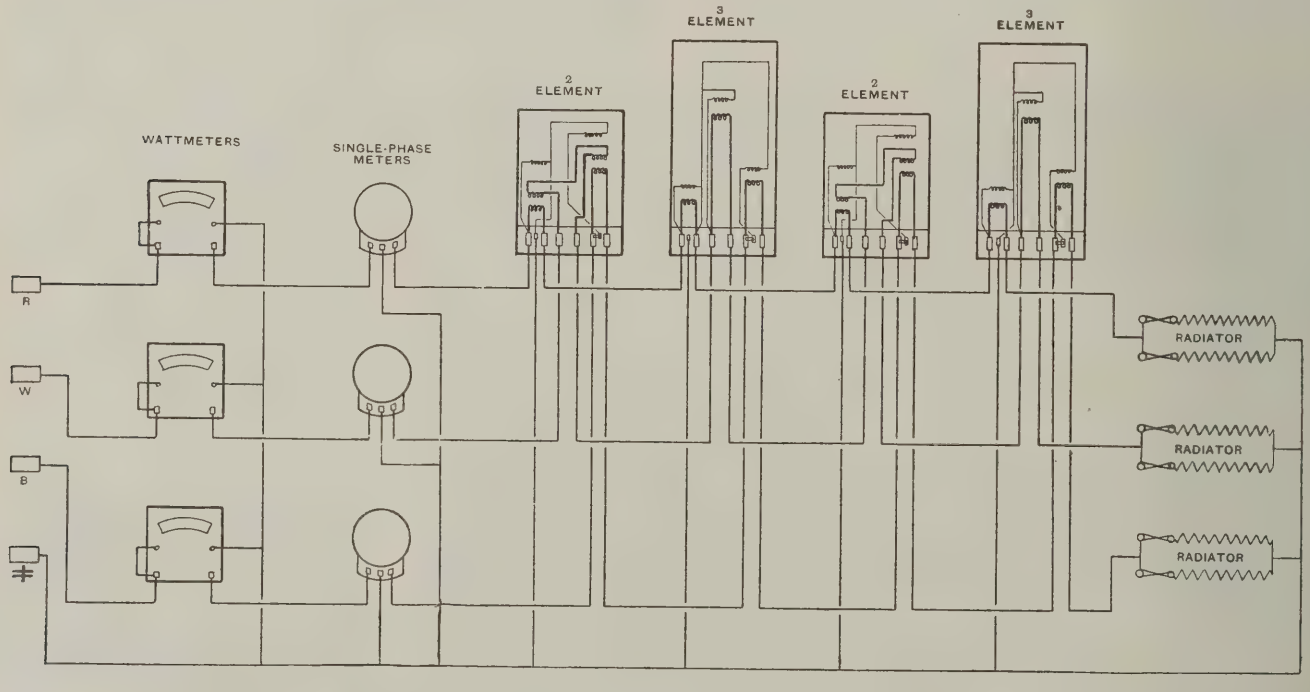
(1) 3-phase 4-wire two element type meter;

(2) 3-phase 4-wire three element type meter (2 rotors);

(3) 3-phase 4-wire three element type meter (3 rotors);

and it is the relative performances of these three types of polyphase meters which present the most interesting features.

Opinions still differ on this point; and whilst some manufacturers state that the 2-element type meter will cope with all conditions likely to arise, others hold that the 3-element, 3-rotor type meter is the only correct type for the task. The experience of supply engineers who have been called upon to deal with this class of supply also seems to vary, and it is hoped, therefore, that the results of tests recently made will be of passing interest to both groups.



Comparisons were made to ascertain which of the following four systems of metering would produce the most accurate record of the consumption on non-inductive and inductive 3-phase 4-wire installations, under normal and abnormal conditions, the equipments employed being:—

System No. 1.—Three single-phase meters.

System No. 2.—One 3-phase 4-wire 2-element polyphase meter.

System No. 3.—One 3-phase 4-wire 3-element polyphase meter (2 rotors).

System No. 4.—One 3-phase 4-wire 3-element polyphase meter (3 rotors).

The tests were carried out "on circuit" under practical service conditions, the meters having been carefully checked in the test room before being installed.

As in the previous series of tests, three 2-element radiators, each controlled by two switches, were utilised to provide the non-inductive loads; but in this case one terminal of each radiator was connected to the neutral of the system, as shown in fig. 1. Various combinations of circuits and irregularities were reproduced, and tests taken on all meters under each condition. The results obtained, reduced to a percentage basis to facilitate comparison, are set out in Table I, column 2 of which indicates the state of balance existing at the time of each test.

TABLE I.

Units chargeable in respect of 3-phase, 4-wire, non-inductive load under four systems of metering.

System No. 1.—Three single-phase meters.
System No. 2.—One 3-phase, 4-wire, 2-element polyphase meter.
System No. 3.—One 3-phase, 4-wire, 3-element polyphase meter (2 rotors).
System No. 4.—One 3-phase, 4-wire, 3-element polyphase meter (3 rotors).

Condition of Load.	Radiator Elements. B.	W.	R.	True Units.	System No. 1.	2.	3.	4.
Full	2	2	2	100	102	99	99	100
Half	1	1	1	,,	101	99	101	100
Blue phase, light ...	1	2	2	,,	101	96	99	101
White ,, ,, ...	2	1	2	,,	102	98	100	102
Red ,, ,, ...	2	2	1	,,	101	98	99	101
Blue phase, heavy ...	2	1	1	,,	102	97	99	102
White ,, ,, ...	1	2	1	,,	102	99	100	100
Red ,, ,, ...	1	1	2	,,	100	98	100	100
Blue switches, open ...	–	2	2	,,	101	99	101	101
White ,, ,, ...	2	–	2	,,	101	97	100	101
Red ,, ,, ...	2	2	–	,,	100	99	100	101
Blue fuse, drawn ...	–	2	2	,,	102	76	103	102
White ,, ,, ...	2	–	2	,,	102	97	105	102
Red ,, ,, ...	2	2	–	,,	100	77	103	101
B. & W. ,, ,, ...	–	–	2	,,	102	98	105	102
W. & R. ,, ,, ...	2	–	–	,,	100	98	104	102
R. & B. ,, ,, ...	–	2	–	,,	102	—	107	103
Neutral ,, ,, ...	2	2	2	,,	102	96	99	102

For the purpose of the inductive series of tests, the radiators were replaced by three choke coils. The figures tabulated in Table II represent, therefore, what might be expected—at some time or another—under industrial conditions, and provide data upon which the choice of the most reliable and straightforward system of metering may be based.

TABLE II.

Units chargeable in respect of 3-phase, 4-wire, inductive load under four systems of metering as in Table I.

Condition of Load.	Choke Coils. B.	W.	R.	True Units.	System No. 1.	2.	3.	4.
3 single-phase units ...	1	1	1	100	100	99	90	100
Blue phase unit, alone	1	–	–	,,	100	97	100	100
White ,, ,, ,,	–	1	–	,,	100	100	102	101
Red ,, ,, ,,	–	–	1	,,	100	97	100	101
Blue phase fuse, drawn	–	1	1	,,	100	106	103	102
White ,, ,, ,,	1	–	1	,,	101	97	101	101
Red ,, ,, ,,	1	1	–	,,	100	46	103	101
B. & W. ,, ,, ,,	–	–	1	,,	101	100	104	102
W. & R. ,, ,, ,,	1	–	–	,,	100	98	104	100
R. & B. ,, ,, ,,	–	1	–	,,	100	—	107	103
Neutral fuse, drawn ...	1	1	1	,,	99	95	98	101

It will be noted that Systems Nos. 1 and 4 integrate accurately under all the conditions produced. The 3-element, 2-rotor meter in System No. 3 tends to speed up during periods of partial disconnection from the mains, due, no doubt, to the elimination of "interference" factors which are present under normal conditions. System No. 2, employing the 2-element polyphase meter, proved most unreliable under certain circumstances. When the red phase or blue phase fuses are "blown" or withdrawn, a very definite source of error is introduced, due to there being only one of the two shunt coils energised at the time. As this coil interacts with the half of the white phase current coil overwound on that particular element, the resultant torque—and in consequence the registration—is affected correspondingly. Under non-inductive conditions, the meter registers only 50 per cent. of the consumption in the white phase circuit. When the power factor of the circuit is below unity, the average error with the blue or red phase fuses withdrawn is 50 per cent., the ratio between the two errors depending on the power factor. It will be noted that with the blue phase fuse withdrawn, the accuracy of the meter improves as the power factor decreases. The reverse effect is produced when the red phase main is disconnected. When both red and blue phase fuses are withdrawn, no registration is recorded in respect of any consumption in the white phase circuit; and although this may appear to be a remote probability, the possibility is one that should not be ignored, even if the duration of the disconnection is short. The chance of one fuse being "blown" or withdrawn is certainly greater, and the possibility of such a large error in the registration of the white phase consumption when this occurs is worthy of consideration when contemplating the adoption of this type of meter. As it is difficult—if not impossible—to ensure that the condition $e1 + e2 + e3 = 0$ is maintained at all times, it is, therefore, impossible to guarantee, or to expect, complete accuracy under all circumstances. Add to this the possibility of either $e1$ or $e3$—or both—being unavailable at the meter terminals, and faith in the reliability of the 2-element meter is seriously undermined.

It has already been shown that the use of three single-phase meters is not entirely satisfactory when dealing with an industrial three-phase power supply, owing to the unbalanced readings obtained, and to the occasional meter reversals which are the cause of so much investigation and frequent dissatisfaction. It would, therefore, appear reasonable to assume that, when both 3-phase and single-phase motors are connected to a 3-phase 4-wire circuit, the choice should lie between Systems Nos. 2, 3 and 4. The 2-element meter has been shown to possess inherent weak points, which become manifest under certain conditions, and we are, therefore, left with the 3-element polyphase meter as the only "error-proof" meter to adopt for this class of load.

For non-inductive loads, Systems Nos. 1 and 4 are equally satisfactory as far as performance is concerned. I would, however, in conclusion, quote an analogy to point a moral. One buys an adding-machine as a step towards increased efficiency, and as a time and labour-saving device. After manipulation, a final total is expected, and is recorded. It is not necessary to add up, say, three independent results to get that total; it is done automatically and accurately by the machine. What a wonderful "adding-machine" the polyphase meter is, accomplishing, as it does, even algebraical sums when occasion arises, and recording the net result on one dial.

An Enlarged Mollier Diagram.—A Mollier diagram on a large scale, plotted by Prof. H. L. Callendar, F.R.S., from his enlarged steam tables, has been published by Messrs. Edward Arnold & Co. for the British Electrical and Allied Industries Research Association. The diagram, which was prepared for the Turbine Section of the Beama, relates to saturated and superheated steam, and measures 660 × 800 mm.; it is admirably printed in three colours, and is very clearly figured, while the scale is so large that a high degree of accuracy is attainable—one millimetre representing 0.001 ϕ and 1.0 B.th.u. per lb. The ranges covered are from 0.2 to 2,000 lb. per sq. in. absolute pressure, 0 to 500 degrees F. superheat, 0.3 to 1,000 cu. ft. per lb., 100 to 1,000 degrees F., 65 to 100 per cent. dryness, and 26 to 29.6 in. vacuum. The corresponding range of entropy is from 1.36 to 2.02, and of total heat per lb. from 700 to 1,500 B.th.u.

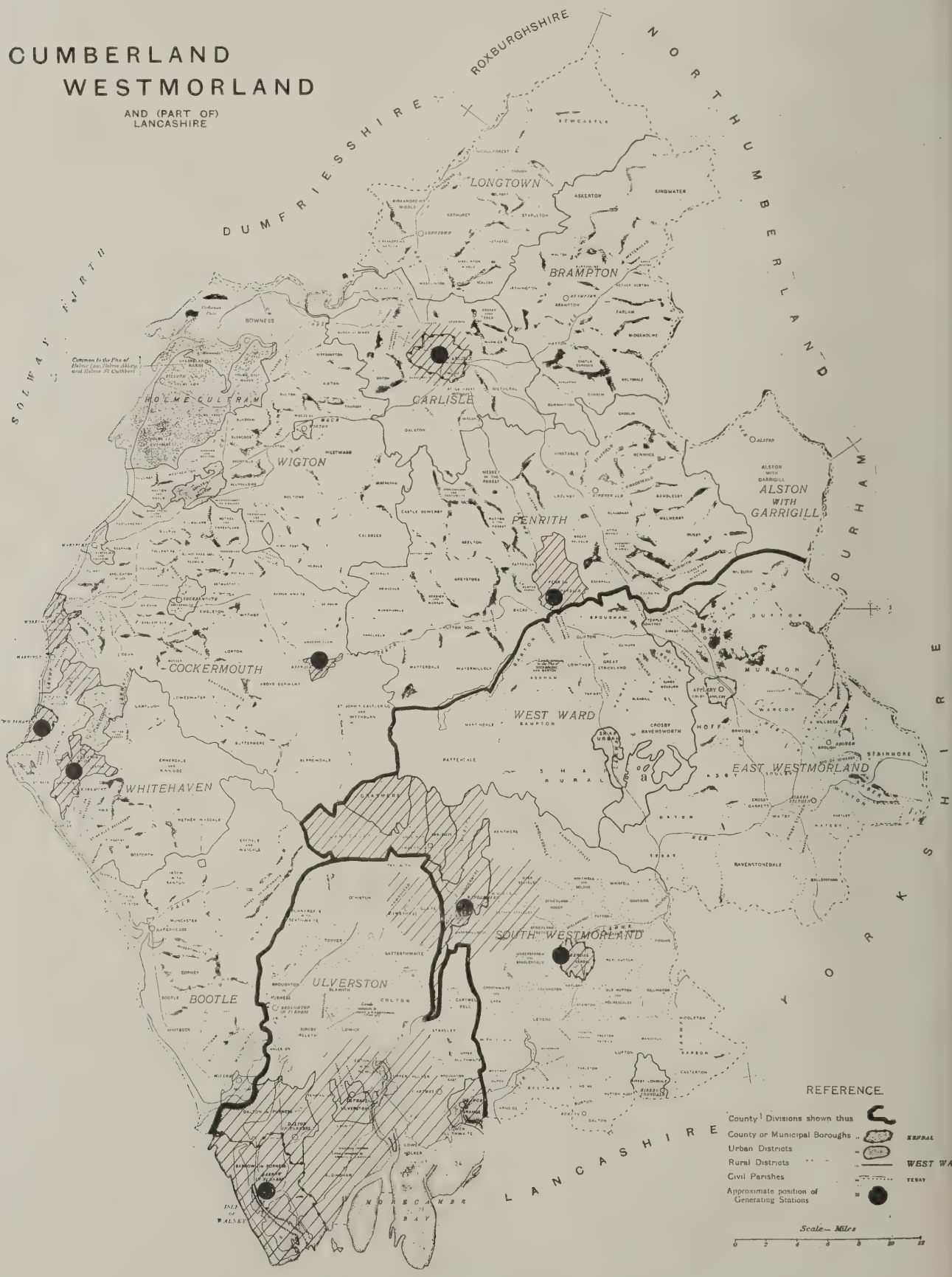
The diagram, which is priced at 4s. net, is a very fine production, and will be very useful to engineers concerned with $H - \phi$ calculations.

Electricity Supply in Great Britain.—XIV.

Cumberland, Westmorland, Lancashire, and Cheshire.

With reference to the accompanying maps, which have been hatched to show the areas occupied and applied-for in respect of statutory powers for general supplies of electricity, it has been found convenient to include the north-west portion of Lancashire with the map of Cumberland and Westmorland. Space will not permit of the map of Cheshire being reproduced, but it is available if required. Prints on art paper of the maps which have appeared in this series, and coloured maps, 4 miles to one inch, are also available.

The 1921 Census gives the following figures for the Administrative Counties and County Boroughs:—



Electricity Supply in Cumberland and Westmorland.

	Acres.	Persons.	Resident families.	Buildings, not containing dwellings.
Cumberland ...	973,086	273,173	59,579	4,214
Westmorland ...	504,917	65,746	14,648	1,897
Lancashire ...	1,194,555	4,927,484	1,108,668	68,300
Cheshire ...	657,950	1,025,724	236,427	12,454
Total ...	3,330,508	6,292,127	1,419,322	86,865

The total number of kWh generated in the above counties has been ascertained by the addition of the outputs of Areas Nos. 2, 3, 5 13, and 17 (as given in Table 8 of the Electricity Commissioners' publication, "Generation of Electricity in Great Britain"), except that Chester and Crewe are excluded and Buxton and Glossop included.

Table No. 1 of this publication gives the description of these Areas as follows:—

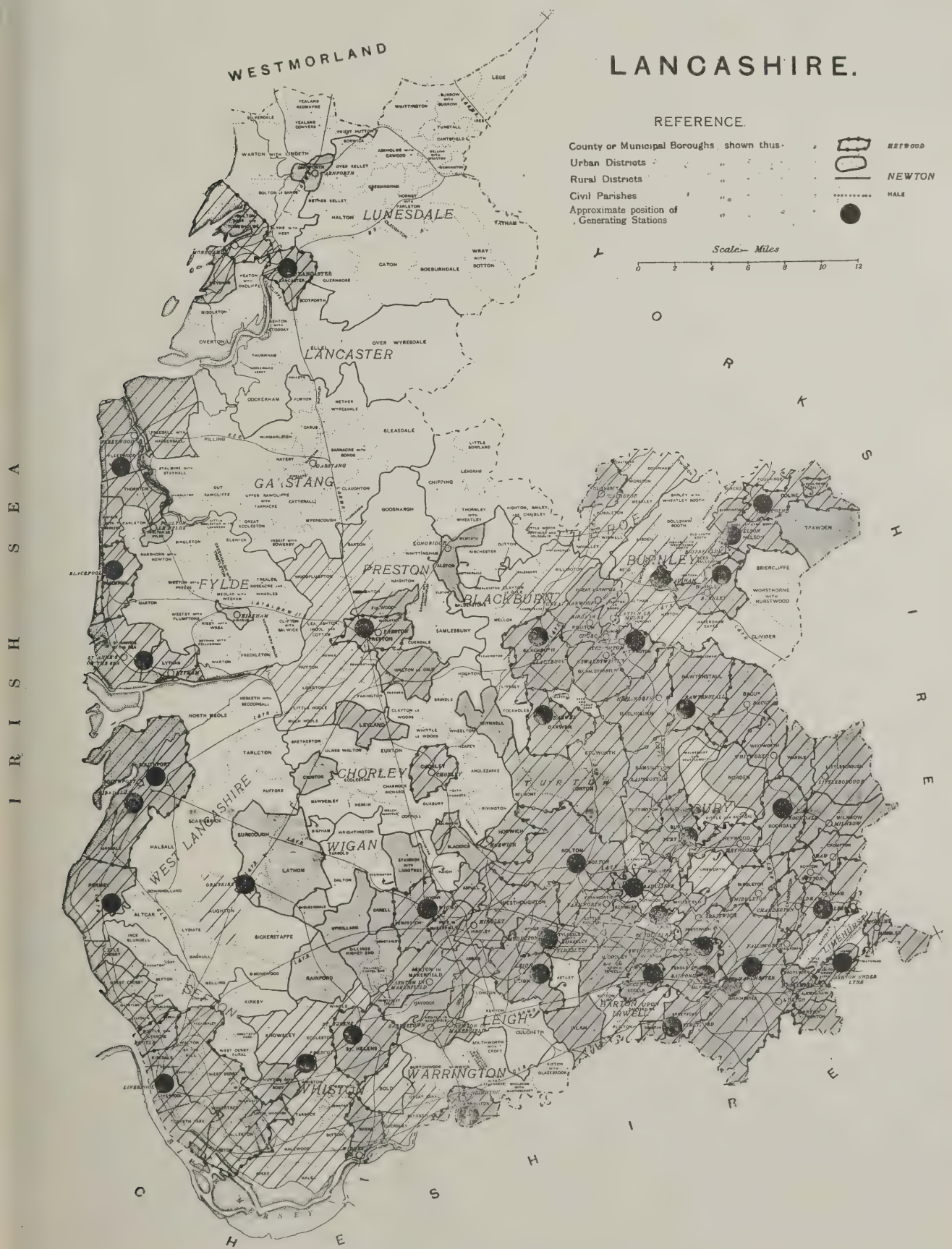
Area No. 2.—The Mid-Lancashire Electricity District as finally determined.

Area No. 3.—The South-East Lancashire Electricity District as finally determined.

Area No. 5.—The Mersey and West Lancashire Electricity District as provisionally determined and amended.

Area No. 13.—The North Lancashire and South Cumberland Electricity District as provisionally determined.

Area No. 17.—The parts of the Counties of Cumberland and Westmorland not included in Area No. 13.



Electricity Supply in the County of Lancashire.

KILOWATT-HOURS GENERATED.

Year ending March 31.	Area No. 2.	Area No. 3.	Area No. 5.	Area No. 13.	Area No. 17.	Total of Areas Nos. 2,3,5,13 & 17
1922	66,209,448	536,292,207	231,943,138	12,503,161	9,066,355	855,954,309
1923	82,413,644	647,284,355	280,552,537	13,263,085	10,737,169	1,034,250,790
1924	93,290,029	741,676,570	340,558,427	15,436,055	12,675,131	1,203,636,215
1925	109,705,708	838,793,340	387,510,032	19,607,893	13,626,560	1,369,243,533

The following is the list of existing authorised undertakers:—

Local Authorities.

Area No.		Area No.	
2	*Accrington Corp.	3	Littleborough U.D.C.
3	Ashton-in-Makerfield U.D.C.	5	*Liverpool Corp.
3	*Ashton-under-Lyne Corp.	2	*Lytham-St. Anne's Corp.
3	Atherton U.D.C.	3	*Manchester Corp.
2	Bacup Corporation	3	Middleton Corp.
13	*Barrow-in-Furness Corp.	3	Milnrow U.D.C.
5	*Birkenhead Corp.	13	Morecambe Corp.
2	*Blackburn Corp.	2	*Nelson Corp.
2	*Blackpool Corp.	5	Newton-in-Makerfield U.D.C.
3	*Bolton Corporation	3	*Oldham Corporation
3	Bredbury & Romiley U.D.C.	2	Padiham U.D.C.
2	Brierfield U.D.C.	2	Preesall U.D.C.
2	*Burnley Corporation	2	*Preston Corporation
3	*Bury Corporation	3	Radcliffe U.D.C.
17	*Carlisle Corporation	2	*Rawtenstall Corp.
3	Cheadle & Gatley U.D.C.	3	*Rochdale Corp.
—	*Chester Corporation	5	*St. Helens Corp.
2	Clitheroe Corp.	3	Sale U.D.C.
2	*Colne Corporation	3	*Salford Corporation
—	*Crewe Corporation	5	*Southport Corporation
2	*Darwen Corporation	3	*Stalybridge, &c., Elec. Board
3	*Eccles Corporation	3	*Stockport Corp.
3	Farnworth U.D.C.	3	*Stretford U.D.C.
2	*Fleetwood U.D.C.	3	Swinton & Pendlebury U.D.C.
5	Formby U.D.C.	2	Thornton U.D.C.
13	Grange U.D.C.	3	Turton U.D.C.
2	Haslingden Corp.	13	Ulverston U.D.C.
3	Hazel Grove & Bramhall U.D.C.	5	*Wallasey Corporation
3	Heywood Corp.	5	*Warrington Corp.
3	Hindley U.D.C.	5	Whiston R.D.C.
3	Horwich U.D.C.	17	*Whitehaven Corp.
5	*Hoylake & West Kirby U.D.C.	17	Whitehaven R.D.C.
3	Irlam U.D.C.	3	Whitworth U.D.C.
13	*Kendal Corporation	3	*Wigan Corporation
13	*Lancaster Corp.	5	Wirral R.D.C.
3	*Leigh Corporation	17	Workington Corp.

* Local Authority Undertakers owning generating stations.

Area No.	Companies.
3	Alderley & Wilmslow Electric Supply, Ltd.
3	Altrincham Electric Supply, Ltd.
5	Birkdale District Electric Supply Co., Ltd.
5	British Insulated Cables, Ltd.
5	Caldy Manor Estate, Ltd.
5	Castner Kellner Alkali Co., Ltd.
17	Cumberland Waste Heat Owners Co., Ltd.
3	Electricity Company of Macclesfield, Ltd.
5	Hightown Gas & Electricity Co.
17	Keswick Electric Light Co., Ltd.
2 & 3	Lancashire Electric Power Company.
5	Mersey Power Co., Ltd.
5	Northwich Electric Supply Co., Ltd.
5	Ormskirk Electric Supply Co., Ltd.
5	Ormskirk Gas & Electricity Co.
17	Penrith Electric Supply Co., Ltd.
13	Windermere & District Electric Supply Co., Ltd.

All the above Companies possess generating stations except the Hightown Gas & Electricity Co., which takes a bulk supply from the L.M.S. Rly., and the Ormskirk Gas & Electricity Co., which has not yet commenced supply.

The area of the Lancashire Electric Power Company has not been hatched, except where statutory powers for general supplies are held or have been applied for. This Power Company has various powers over that part of Lancashire which lies south of the River Ribble, except for certain County Boroughs, and it also holds 18 distribution Orders. The Power Company's generating stations at Radcliffe and Padiham have been indicated on the map. Separate dots have been shown for Manchester Corporation's stations at Barton and Stuart Street, and also for Salford Corporation's stations at Agecroft and Frederick Road.

The generating stations of the London, Midland and Scottish Railway at Clifton and Formby, and that of the South Lancashire Tramways Company at Atherton, have also been indicated on the map.

Applications for Special Orders have been lodged by the following:—

Lancashire Electric Power Company.
Gwynedd Trust, Ltd.
Chester Corporation (Extension).
Millom Urban District Council.
Barton-upon-Irwell Rural District Council and Urmston Urban District Council jointly.

These maps are reproduced by permission of the Controller of H.M. Stationery Office.

The originals were prepared by the Ordnance Survey Department for the 1917 Boundary Commission. Since 1917 many alterations to areas, &c., have been made, of which particulars are available if required.

The Fine Regulation of Resistance.

Some Particulars of the Multi-Step Rheostat.

By R. AMBERTON, M.I.E.E.

The problem of fine regulation over a considerable range of resistance is an old one. There is not much difficulty if the current to be carried is infinitesimal, or if it is permissible to employ a rheostat with coarse steps of relatively high-resistance values, and subsequently to make the final adjustment on one or more separate finely-graded rheostats having a relatively low resistance. This method is the usual one when the final resistance value to be obtained is the only consideration, but it is of no use when it is essential that fine regulation is available throughout the range, and when the "kick" or "jump" caused by moving the coarse rheostat a step backwards or forwards defeats the object of the combination.

The regulation of the exciter fields of alternators and motor converters is a case where smooth regulation over a fairly wide range of resistance is necessary, although, of course, there are many other applications. The employment of separate coarse and fine rheostats being in many cases ruled out on account of the resultant "kick" when the arm of the coarse rheostat is moved, the usual practice is to use an ordinary single-arm rheostat with a large number of steps. This rheostat is graded as carefully as possible, so as to ensure the most satisfactory results at the most critical points. Theoretically, of course, there is no reason why this method should not prove perfectly satisfactory, but there are certain practical difficulties which limit its scope.

If space and cost were of no consequence, it would be possible to imagine a rheostat with a faceplate large enough to have, say, 400 contacts. This would be ample for practically all requirements, but it would involve the use of a faceplate over six feet square. Quite apart from the cost, which would be prohibitive, it is not often that this amount of space is available.

With a more modest rheostat, having between 100 and 200 steps, the faceplate can be kept within a reasonable space, but the difficulty which the rheostat maker has to face is that of making such a large number of satisfactory insulated connections from the contacts of the rheostat to the resistance elements. If the size of the rheostat and its resistance is to be kept within the compass demanded by cost and switchboard space, it must necessarily be run at a reasonably high temperature; and there is only a limited choice of commercial insulated wires which will retain their insulating properties over a period of years when subjected to heat and friction due to expansion and contraction when the connections are bunched up with a couple of hundred of their fellows.

The makers of exciter field rheostats and the manufacturers of dynamo-electric machinery are aware of the difficulties, and take them into account. The result is a compromise, and whilst the rheostat maker has on

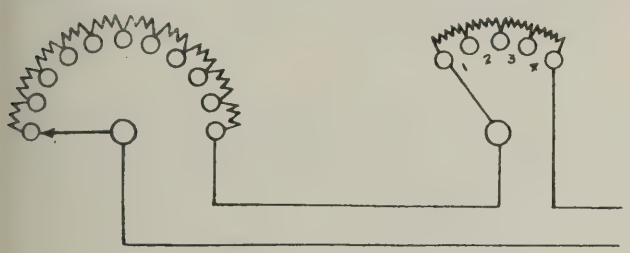


Fig. 1.—Fine and Coarse Rheostats in Series.

occasion to supply exciter field regulators with rather more steps than is quite convenient, the designer of the machine has to put up with rather fewer than he would like. From time to time attempts have been made to solve the problem, and the most popular method has been the combination of coarse and fine rheostats operated by a single hand-wheel. One of these was described on page 673 of the Electrical Review, published on May 7th, 1915.

In view of the fact that previous attempts have been made to combine two rheostats to obtain even regulation over a wide range, it is as well to point out why they have hitherto not fully achieved their object. Fig. 1 shows a coarse rheostat in series with a fine one. Assuming that the whole of the resistance of the fine rheostat is equal to one step of the coarse rheostat, it is obvious that the total number of resistance values which can be obtained with the combination, is the product of the number of steps of fine and coarse. It is equally true, but not quite so obvious, that with the electrical connections as shown it is absolutely impossible to avoid a " kick " when the coarse rheostat is moved from one step to another. This difficulty remains and must remain, whatever forms the rheostats take, or whatever the mechanical arrangements may be, so long as the electrical connection between the two rheostats is

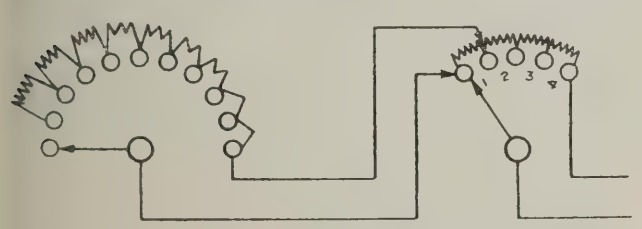


Fig. 2.—Principle of the Multi-Step Rheostat.

in effect a series connection. It is curious that this point should have been consistently overlooked, but the fact remains.

The solution is quite simple, as will be seen from fig. 2, and it is on these lines that the multi-step rheostat (Patent No. 212,089) is constructed. It is clear that without moving the arm of the coarse rheostat it is possible to cut out its first step by means of a left to right movement of the fine rheostat, and, if the resistance of the latter is suitably graded, resistance will be cut out in equal increments.

Having short-circuited the first coarse step in gradual stages by means of the fine regulator, the arm of the coarse rheostat can be moved forward one step, thus taking up the short circuit and enabling the fine rheostat to be disconnected from the coarse one without electrical change. The arm of the fine rheostat is now returned to the " off " position, and its terminals are connected to bridge the second step of the coarse rheostat ready to cut out this step in a manner similar to the first. After cutting out the second step by gradual stages the cycle of operations can be continued until all the resistance is cut out. Similarly, by reversing the procedure the whole of the coarse resistance can be put in by equal increments.

It now remains to be shown how these somewhat cumbersome operations can be translated and co-ordinated into a practical method of combining a coarse and a fine rheostat so that the whole of the resistance of the former is cut out in equal fine gradations and without " kicks " by means of a unidirectional movement of one hand-wheel. To do this it is necessary to introduce a third rheostat, or rather a third set of contacts interconnected with the coarse and fine rheostats in such a manner as to facilitate the changes of connections which are necessary after cutting out one step, and before starting to cut out the next.

In the diagram (fig. 3) the essential parts are; the main rheostat with its insulated brush A, the auxiliary rheostat with its insulated brush B, and the fine rheostat with its insulated brush C. Brushes A and B are carried on a common arm (afterwards referred to as the main arm) and move in unison. Brush C is carried on a separate arm (which will be referred to as the short arm) intermittently coupled to the main arm in such a manner

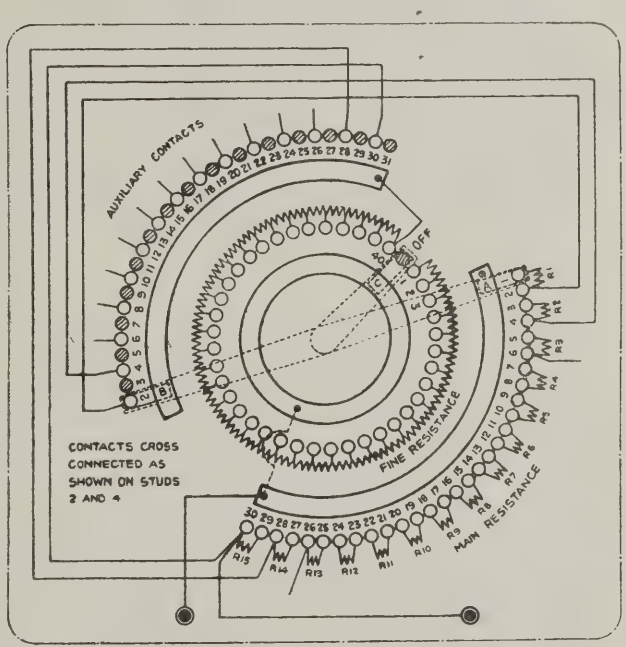


Fig. 3.—Multi-Step Rheostat: Diagram of Connections.

that for each complete revolution of the short arm the main arm moves over one section of resistance, *i.e.*, from one dotted line to the next.

Brush C is shown on its " off " position, and if the diagram is studied it will be found that if it is moved in a clockwise direction on to its first contact, the total resistance of the fine rheostat is in parallel with R1, the first step of the main resistance. Continuing the clockwise movement, the resistance is gradually cut out until when the fine rheostat reaches its " full on " position, all its resistance is cut out and the first step of the main resistance is short-circuited. At this point the gearing between the short and the main arms comes into mesh, and the following changes of connections occur :—

1.—Brush A moves forward one contact (to stud 2), thereby taking up the short circuit of the first coarse step (R1) which C established. Brush B moves forward one contact on to a shaded stud, thereby disconnecting itself, since the shaded studs are not connected to anything. Brush C moves on to its " off " position. These movements are all simultaneous.

N.B.—Various connections have been changed, but there is no change of electrical resistance.

2.—The movement being continued, brush A moves forward one contact to stud 3 which, however, being directly connected to stud 2, which it has just left, causes no electrical change. Brush B moves forward one contact to stud 4, and is now connected to the remote side of R2, the second main step of resistance. This movement by itself does not effect any change of resistance, but as soon as brush C (which is moving simultaneously) reaches its No. 1 contact, the whole of the fine resistance is in parallel with R2, the second step of the main resistance. Just before this stage is reached the mechanical gearing between the short and the main arms comes out of mesh, so that a continued clock-wise movement of C will cut out R2 in gradual stages, just as R1 was previously cut out.

By continuing the movement R3, R4, R5 and all the rest of the main steps are successively cut out by equal increments, and a reversal of the movement at any stage

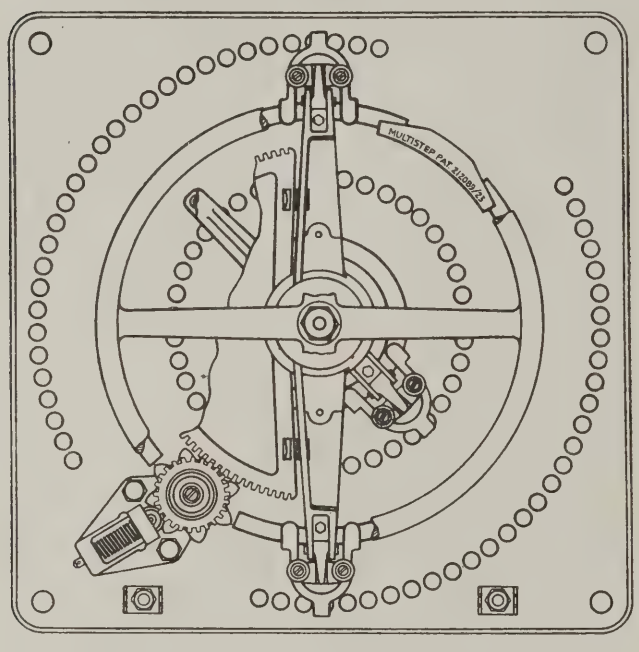


Fig. 4.—General Arrangement of Rheostat.

will cut in resistance in a similar way. Fig. 4 is a drawing of the complete rheostat. The functions of the arms have already been explained, so that it only remains to describe the mechanical arrangement. The operating hand-wheel is directly coupled to the main spindle of the rheostat. The short arm is pinned to the main spindle, and rotates with it. The main arm is loose on the spindle, and friction is reduced by ball bearings, as the main arm has to remain stationary during the bulk of the movement of the spindle. It is important that the relative positions of the two levers should always be correct during their period of engagement. To ensure this a ram has been included, bearing on the blunt-toothed driving wheel, which thus also acts as a star wheel.

The short arm carries a striking pin with roller on its tail piece. Once in every revolution it engages with the blunt-toothed star wheel and moves it round one notch. This blunt-toothed wheel carries a small pinion which engages with the semi-circular rack carried by the main arm, so that during the period of engagement between the striking pin on the short arm and the star wheel, the main arm (carrying brushes A and B) moves correspondingly.

It is obvious that by increasing or decreasing the size of the rheostat a larger or smaller number of steps can be provided. The illustration shows a standard multi-step rheostat with 15 sections of coarse resistance, and 40 sections of fine, thus giving 600 effective steps without "kicks" and by means of a unidirectional movement. As a maximum, 55 connections are required from the two sets of studs to their respective resistances. In practice, a smaller number of insulated connections is required as a rule, as at one end of the fine rheostat, the resistance values are generally so low as to enable the requisite resistance to be obtained by means of short lengths of rigid self-supporting resistance wire directly connected to the studs.

To move the main arm from the "all in" to the "all out" position fifteen revolutions of the hand-wheel are requirevd. If it were ever necessary to move the main rheostat arm rapidly from one end to the other this could be quite easily provided for by the addition of means for directly engaging the small pinion, but for ordinary purposes it would be an unnecessary complication. As constructed, the hand-wheel of the multi-step rheostat can be moved from end to end in less than ten seconds. In practice this extreme movement would hardly ever be required, as the normal position of the rheostat in operation would be somewhere about midway, and variation would start from there.

Whilst 600 equal steps will be found satisfactory and sufficiently fine for most purposes, there is nothing to prevent graduation of the main resistance of the multi-step rheostat. With such an arrangement the fine regulator of the combination would be stepped to give equal

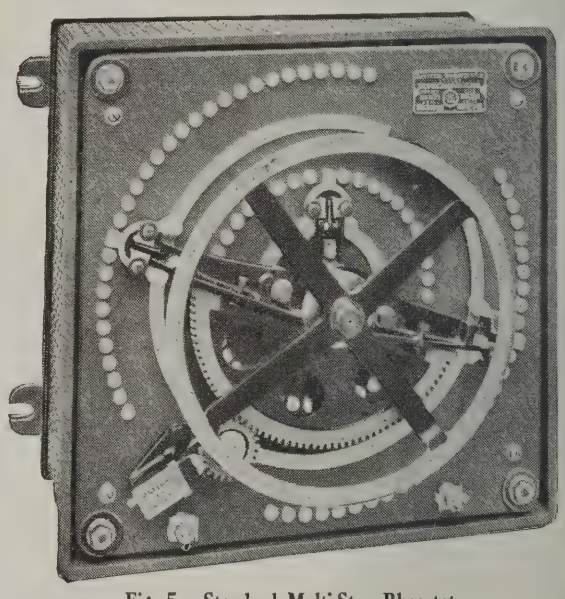


Fig. 5.—Standard Multi-Step Rheostat.

gradations over the important portion of the range, giving increments of, say, 1/1,200th to 1/1,800th of the total resistance per step. The effect of this at the unimportant parts of the curve may result in unevenness equivalent to, say, 1/300th to 1/200th of the total resistance—in other words smoother regulation at the unimportant parts of the curve than was formerly obtainable at critical points, and infinitely better regulation at the point where it is wanted.

Fig. 5 shows externally the complete multi-step rheostat.

The Audiophone.—A telephone receiver that fits into the lower cavity of the ear has been developed for the use of those who are hard of hearing. The new receiver is exceedingly small, weighing only six-tenths of an ounce with the connecting cord, which is but little more conspicuous than an eye-glass ribbon. This comfortable device is used in combination with a transmitter and batteries, and has been made possible through use of the magnetic alloy "permalloy," says the *T. and T. Age*. The outfit, of which the receiver is part, is known as an audiophone. It was developed for the Western Electric Co in the Bell Telephone Laboratories as a by-product of fundamental research into the field of sound. It comprises a microphone "as large as a stack of half a dozen fifty-cent pieces," an amplifier containing two tiny vacuum tubes, the necessary batteries and the "ear" receiver. The outfit will normally comprise a microphone, worn in the coat lapel, an amplifier in a box, which may be carried in the hand or placed on a table or desk, and the receiver, which is worn in the ear. Using it, a person who has lost sixty per cent. of his hearing can again follow the conversation in any ordinary sized room. Without the audiophone's aid, such a person, or one of only fifty per cent. loss, could not understand anything of an ordinary conversation. The cartilages of the outer ear are rigid enough so that when an impression is taken and a moulded fitting made and inserted, they will support the little receiver with complete comfort to the wearer. The use of permalloy, the nickel-iron alloy, in the magnetic circuit of the tiny receiver makes it more sensitive; it also prevents acoustic shock

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Engineering Merger Confirmed.—The scheme for the malgamation of the Mirrlees, Watson Co., Ltd., and Mirrs, Bickerton & Day, Ltd. (outlined in our issue of March th, p. 456), was confirmed at an extraordinary meeting on pril 2nd. The increasing of the company's capital to 90,000 was approved and additional directors were apointed.

New Municipal Showrooms and Offices.—Last week the ord Mayor of Belfast informally opened the new offices and owrooms recently constructed in connection with the Elecicity Department of the city. We have received a set of hotographs from Mr. Johnstone Wright, the city electrical ngineer, which show the new premises to be very commoous and well laid out; they include an installation departent and test house. Buildings at the old East Bridge Street ation have been adapted for the purpose, an existing glass oof being retained to provide ample lighting both by day and

A Report Upon Uruguay.—Mr. H. W. Reid Brown, British Vice-Consul, Montevideo, has forwarded to the Department of Overseas Trade a report upon the financial and economic conditions in Uruguay (Stationery Office, 9d. net). This shows that Great Britain held the second position in Uruguayan import trade with a share of $11,393,046 out of a total of $62,228,753 for 1924.

Wages in the Engineering Industry.—Speaking at the annual dinner of the Machine Tool Trades' Association on March 30th, Mr. J. T. Brownlie, president of the Amalgamated Engineering Union, said that, although at present adverse conditions prevailed in the engineering industry, he was not without hope that it would soon come back into its own, and that skilled workmen would receive the wages to which they were entitled. Referring to threats of a national lock-out, he said that the country would not permit such action. He hoped that when the unions and the Engineering



Fig. 1. Exterior.



Fig. 2. Inquiry Hall.



Fig. 3.—The Kitchen.



Fig. 4.—A Corner of the General Showroom.

Belfast's New Offices and Showrooms.

ight (in the latter case exterior roof lighting is employed). he showrooms consist of a Jacobean entrance hall, an oakanelled inquiry office, a general showroom for small domestic ppliances, fires, fittings, &c., a waiting room furnished as a itting room with a "Magicoal" antique hearth fire, an lectric kitchen, and a bathroom. Provision has also been ade for a demonstration hall. The offices and showrooms are ll electrically heated. Fig. 1 is a view of the exterior of the remises; fig. 2, the inquiry hall; fig. 3, the kitchen, in which lternative patterns of cookers, washers, &c., are shown; and g. 4 depicts a corner of the general showroom devoted mainly o fires of various types.

The Accrington Corporation Electricity Department is to rect new electricity showrooms at the junction of the Whalley nd Burnley roads, at a cost of £3,000.

On April 8th, the Birkenhead Corporation will open ts new electricity showrooms in Grange Road West. The round floor is set aside for general lighting fittings, fires, table tandards, &c., and the first floor for kitchen accessories, carpet leaners, washers, &c.

and Allied Employers' Federation came together in conference in a few weeks' time wiser counsels would prevail, and that the Federation would adopt the suggestion which he had made 18 months ago that the employers should mortgage the future by granting increased wages. That would be the soundest investment that they had ever embarked upon.

The German Radio Industry.—At a meeting of the Verband der Funkindustrie, held in Berlin at the end of last month, it was stated that, despite the extraordinary increase in the number of users of radio apparatus, many factories engaged in the production of such apparatus had been closed. Since the beginning of broadcasting in Germany 59 per cent. of the firms who had engaged in the manufacture of wireless apparatus had been compelled to discontinue production, leaving it in the hands of a limited number of efficient firms who turn out superior apparatus.

Lantern Slides.—Messrs. Petters, Ltd., of Yeovil, have prepared a series of lantern slides, illustrating their oil engines, which they will be pleased to lend to authors of lectures and papers on internal-combustion engines.

The Sydney Electricity Department.—According to the Sydney *Daily Telegraph*, the Labour aldermen of the City Council are determined to give preference to Australian tenders for the generating plant required by the Council, in spite of any recommendations to the contrary. Reporting upon the Council's proposal to sell electrical appliances and fittings, the acting general manager of the Electricity Department (Mr. S. Y. Maling) says:—"It is almost certain that great opposition will be met if efforts are made by the Council to purchase apparatus in bulk locally, but local buying should be given a trial. If this fails, then apparatus should be bought in bulk abroad; and while the general manager (Mr. Forbes Mackay) is abroad is an opportune time to launch this scheme, as he could make arrangements for purchase and shipment." At a meeting of the Electricity Committee it was alleged that electrical appliances were being imported and sold at extortionate prices. Despite a good deal of adverse criticism, the Committee decided to recommend the Council to adopt a trading scheme.

Calendar.—As Easter comes round, the Metropolitan-Vickers Electrical Co., Ltd., issues from Trafford Park a "Girl" calendar for the coming year. This time the Company's Publicity Department has again made a pleasing selection—Miss Violet Hemming, who is at present playing in "Rose Marie" in America, and whose portrait—accidents omitted—will adorn our walls until the end of March, 1927.

Metro-Vick House.—During the present month the London district office and London erection staffs of the Metropolitan-Vickers Electrical Co., Ltd., will be transferred to the company's new premises, Metro-Vick House, Charing Cross Road, which will also become the home of Metro-Vick Supplies, Ltd. The administrative and executive departments of the Metropolitan-Vickers Electrical Co., Ltd., with the Traction Bureau and the Metropolitan-Vickers Electrical Export Co.'s staffs will continue at 4, Central Buildings, Westminster, which remain the registered offices of the company.



The New London Premises of the Metro-Vick Supplies, Ltd.

Sydney Alderman and a Directorship.—The Sydney *Daily Telegraph* reports that a prospectus was recently issued by a company formed to manufacture electrical fittings, and among the directors was Alderman J. H. Mostyn, described as "Chairman, Electricity Committee, City Council, Sydney." In another part it was stated: "This means that for new work alone 156,000 small fittings are required for the Sydney City Council service." In an interview, Alderman Mostyn denied that the company was floated to supply special fittings to the Council as some people thought; it was formed to give an opening to an Australian invention which could be manufactured and sold in Australia.

The Swedish Electrical Industry.—The *Swedish Econo Review*, the official journal of the Swedish Board of Tra states that the machinery industry showed a decided impro ment during 1925. The exports of electrical machinery rose value from 17.7 million kronor (£983,333) in 1924, to 21 mill kronor (£1,166,666) in 1925. At the same time the value exported telegraph and telephone apparatus fell from 7.5 r lion kr. (£416,666) to 7 million kr. (£388,888). The exports this apparatus for January were very low, reaching a va of only 198,000 kr. (£11,000).

The E.D.A. Staff at Olympia.—The staff of demonstrat at the "Electric House" arranged at the recent Ideal Ho Exhibition, Olympia, by the British Electrical Developm Association, had a very busy time and did much to furt



The E.D.A. Staff at Olympia.

the "electrical idea." We reproduce a photograph of th ladies and gentlemen; the ladies appear to be grea attached to their charges.

East Kent Contractors' Dinner.—The East Kent Bra of the Electrical Contractors' Association held its ann dinner on March 24th. Mr. D. McKellar (chairman) presid and he was supported by Mr. T. E. Alger (president of E.C.A.), Mr. L. C. Penwill, and Mr. P. A. Bennet, secret of the branch. Mr. G. M. Willis, of Ramsgate, in welcom the Mayor of Margate (Councillor T. D. Wood), touched u the subject of municipal electrical trading. He said that w contractors had no objection to municipal authorities supply electricity or gas, they considered that the wiring of buildi and the supply of fittings should be left to them. The May in reply, said that he knew little of the subject. He exten an invitation to the E.C.A. to hold its 1927 meeting at M gate. The Chairman proposed the toast of the Associati and mentioned that the branch had increased in size by 30 cent. during the past year. Mr. T. E. Alger, who respond spoke against municipal trading, and said that every r department set up by a local authority created another se officials. Contractors should not imagine that the Gov ment's Electricity Bill was going to increase their busi immediately. It might have that effect in eight or ten ye time. Reverting to municipal trading, he said that to s time and expense, a Committee of both Houses of Parliam should be set up to settle the matter once and for all. considered that the Committee on the Colwyn Bay Bill prejudiced from the start; the Association had been n successful regarding the Doncaster Bill. Mr. Alger appe to contractors to become registered, and he also expressed regret at the recent death of Mr. L. G. Tate. Other to submitted were "The Electrical Supply Authorities," propo by Mr. J. Martin and replied to by Mr. C. F. Hume (Ra gate and District Electric Supply Co., Ltd.); and "The Ma facturers and Wholesale Traders," proposed by Mr. C. Roberts and responded to by Messrs. H. F. Roberts (G.E and T. Hudson (Henley's).

South Shields Tramways Dispute.—The *Newca Chronicle* reports that the Electrical Power Engineers' A ciation has warned the South Shields Tramways Commi that it will deprive the system of power by the withdra of some of its members unless the notice of dismissal gi to Mr. F. R. Batey, the assistant engineer, is reconside Mr. Batey is one of three officials whose services are be dispensed with by the Committee on the score of red dancy. The Mayor, when interviewed, stated that the missals were part of a reorganisation scheme by which, it hoped, the department would become a paying concern. notice tendered by the E.P.E.A. was to take effect yester (Thursday), and the matter was to be considered by the Tc Council the previous day.

Recent Contracts.—The Mirrlees Watson Co., Ltd., recently supplied to the Ilkeston and Heanor Water Board electrically-driven bore-hole pump capable of delivering 35, gallons of water per hour.

The Automatic Telephone Mfg. Co., Ltd., has recer completed an automatic exchange (2,000 lines) at Ipswich.

Electromobile, Ltd., has secured large orders for elec trucks in connection with Spanish railway developments, an order for Australia for an electric locomotive. Recent Hc orders include standard electric trucks for Home concer

ectric tractors and crane trucks for the L.M.S. Railway; nall electric locomotives for the Admiralty and War Office; id tower wagons for municipal tramway undertakings.

Among the orders recently received by International Comıstion, Ltd., are one for complete steam-generating, Lopulco" combustion equipment, &c.; and "Lopulco" uipment for the large station in Buenos Aires for the Cia. ispano-Americana. The company has also been appointed ain contractor for the new "super" station at Congella, urban.

Trade Announcements.—Mr. A. Wright (Inventum Electical Appliances, &c.) has removed to 124, Chancery Lane, .C.2.

Messrs. Thompson & Co. have centralised their business their warehouse address:—1 & 3, Old Swan Lane, Upper ames Street, London, E.C.4.

Catalogues and Lists.—Messrs. David Brown & Sons Huddersfield), Ltd., Park Works, Lockwood, Huddersfield. An illustrated brochure dealing with the design and manucture of worm gearing.

British Central Electric Co., Ltd., 6 and 8, Rosebery venue, E.C.1.—An illustrated catalogue of switchgear, bles and wires, wall plugs, adaptors, &c.

Metro-Vick Supplies, Ltd., 4, Central Buildings, Westminer, S.W.1.—An illustrated and priced folder advertising Cosmos" gasfilled, vacuum, and colour-sprayed lamps.

The Damard Lacquer Co., Ltd., Warwick Road, Greet, Birmingham.—A brochure dealing with the moulding of Formite" bakelite materials.

Siemens & English Electric Lamp Co., Ltd., 38-39, Upper ames Street, E.C.4.—List No. 99, containing illustrations d prices of "Silvaray" one-piece glassware lighting fittings.

Messrs. John Armstrong & Co. (Manchester), Ltd., Barn Square, St. Ann's Street, Manchester.—A blotter adversing the company's electrical contracting business.

Messrs. Ferguson, Pailin, Ltd., Higher Openshaw, Manester.—Catalogue Sections Nos. 25/S1, 166/S1, and 166/S2, aling with oil-immersed metal-clad switchgear.

The General Electric Co., Ltd., Magnet House, Kingsway, .C.2.—Publication O.V. 4,082, describing the company's 2-V, 12-A radio valves introduced a short time ago. Also the Osram Bulletin" for March, containing notes and news of Osram" illumination schemes, valves, and appliances, and illustrated leaflet announcing reduced prices for "Magt" electric fires (stocktaking bargains).

Mr. Albert Morgan, 138, Gower Street, W.C.1.—Illusated pamphlets giving details of wall cranes, pulley blocks, c.

Trelleborg Ebonite Works, Ltd., Audrey House, Ely lace, E.C.1.—Pamphlets advertising the firm's ebonite.

Midland Flexible Metallic Tubing Co., Ltd., Bridge Street, ong Eaton, Nottingham.—Twenty-four page illustrated catague relating to the company's flexible metallic tubing and nnections. Views are given of various departments of the orks, also particulars of flexible arms or standards for electric ghting, and electric wire and cable armouring.

Dixonia, Ltd., 4, Portsmouth Street, Kingsway, W.C.2.—An ustrated and priced catalogue of automobile accessories—ainly lighting fittings.

Shell-Mex, Ltd., Shell Corner, Kingsway, W.C.2.—A rochure dealing with "Shell" lubricating oils.

Messrs. L. McMichael, Ltd., Wexham Road, Slough, ucks.—A priced and illustrated pamphlet advertising the M H" loud speaker filter.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, .W.1.—April blotter, advertising the company's new boiling ate.

The Westinghouse Electric & Manufacturing Co., East ittsburgh, Pa., U.S.A.—A number of illustrated pamphlets aling with synchronous motors, motors for chemical works, c.

The Marconiphone Co., Ltd., 210-212, Tottenham Court oad, W.1.—Publication No. 428A, containing particulars and rices of "Marconiphone" amplifiers.

Messrs. Cooper & Co., Abbey House, Victoria Street, ondon, S.W.1.—Leaflet describing the "Homelite" illuinated nameplate device for connecting to the hall-light witch.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—Descriptive leaflet 261 devoted to high-speed air-break circuit breakers up to 1,500 V d.c.; Circular 1,292 escribing "Type K" metal-clad compound-filled switchgear p to 35,000 V. Illustrated.

Bankruptcy Proceedings.—W. S. Miles, Worston Road, Burnham-on-Sea, Somerset, radio engineer.—The first meeting f creditors was held on March 31st at the Official Receiver's ffices, Bristol. The statement of affairs showed gross liabilies of £769 of which £761 was expected to rank, against net ssets of £43, leaving a deficiency of £718. Debtor attributed is failure to taking over a liability to his late partner of £600 nd other causes. The case being a summary one, was left vith the Official Receiver as trustee. The following are reditors:—

	£		£
Curtis, Thomas	600	Reynolds, W. M., Ltd.	24

A. Richardson, electrical engineer, 36, School Road, Sale, Cheshire.—First meeting, April 9th, at the Official Receiver's ffices, Byrom Street, Manchester; public examination, May 4th, at the Court House, Manchester.

C. G. Hofman (L. J. Chambers & Co.), wireless components manufacturer and electrical engineer, Andrew Works, Courthope Road, Wandsworth Road, S.W., and 7a, Victoria House, South Lambeth Road, S.W.—Bankrupt's discharge suspended until March 5th, 1928.

D. C. Fielding, wireless dealer, 48a, Cloth Market, Newcastle-on-Tyne.—Trustee, Mr. J. C. Blakey, 28, Pilgrim Street, Newcastle-on-Tyne, released March 12th.

Company Liquidations.—Johnson, Savage & Co., Ltd., wholesale electrical and radio suppliers, 66, Margaret Street, W.—A meeting of creditors was held on March 31st at the offices of the London Auction Mart, when the chair was taken by Mr. P. Barber, who had been appointed to act as liquidator in the voluntary liquidation of the company. A statement of affairs was presented, which disclosed liabilities of £1,647, all due to unsecured creditors. In addition, there were debentures and interest amounting to £632. The net assets were £61, leaving a deficiency of £1,586. The liquidator said that the debentures were issued in 1924 for cash advanced to the company by Mr. Archard and his son. The liquidator further stated that he had been appointed receiver for the debenture holders on March 16th last. The company was formed in June, 1922, with a nominal capital of £1,000. The subscribed capital was £615, of which £395 represented cash and £218 the consideration for the business taken by the company. The accounts for the year to June, 1923, showed a turnover of £5,502 and a net profit of £52. For the following year the turnover was £5,640, and there was a net loss of £838, and for the year to June, 1925, the turnover was £5,229, and there was a further loss of £209. The meeting broke up without any resolutions being passed; therefore the voluntary liquidation of the company will be continued with Mr. Barber as liquidator. The following are creditors:—

	£		£
Foster Engineering Co.	59	London Commercial Electric Stores	49
Hirst Bros. & Co., Ltd.	23	Grotte & Sohne	45
Engineering Supplies, Ltd. ...	36	Power Equipment Co.	27
Hornby, Robert, & Co.	26	Stewart, J. H., & Co.	81
Wilkins & Wright, Ltd.	20	Leigh Bros.	26
Prek, J.	35	Kersans Mfg. Co.	24
Bedford Electric Radio Co., Ltd.	41		
Lighting, Heating & Glass, Ltd.	111		

Domestic and General Electrical Co., Ltd., Hampden House, Kingsway, W.C.—A meeting of creditors was held on April 7th at the offices of Messrs. Corfield & Cripwell, E.C. Mr. W. A. J. Osborne, the liquidator, submitted a statement of affairs which disclosed liabilities of £619 and net assets of £190, leaving a deficiency of £429. Mr. Osborne stated that the company was registered on December 6th, 1924, with a nominal capital of £1,000, divided into 100 preference and 100 ordinary shares of £5 each. There had been issued 30 preference and 100 ordinary shares, or a total of £650. All the preference shares were allotted for cash. The ordinary shares were issued to the vendor, Mr. H. A. Purdie, in satisfaction of the purchase price of the business which was sold to the company. Mr. Osborne said that, so far as he could see, the company had carried on business at a loss from its inception. The deficiency, as regarded the shareholders, was £1,079, and that amount was accounted for by goodwill written off, depreciation of assets, and losses on trading. A resolution was passed confirming the appointment of Mr. Osborne as the liquidator of the company. The following are creditors:—

	£		£
Capel & Co.	54	Sun Electrical Co., Ltd. ...	27
General Electric Co., Ltd. ...	112	Hornby, Robert, & Co., Ltd. ...	52
Macintosh Cable Co., Ltd. ...	26	Smitherman, W. H.	33
Power Laundry	47	Purdie, F. S.	28
St. Helens Cable & Rubber Co., Ltd.	67	Purdie, H. A.	95

Bucks Electric Wire & Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C. Meeting of creditors, April 15th, at Balfour House, E.C. Particulars of claims to the liquidator by May 10th.

Ingleby & Co., Ltd.—A meeting of members is called for May 13th at 6, South Parade, Leeds, to hear an account of the winding up from the liquidator, Mr. R. E. Starkie.

Private Arrangements.—W. A. Simester, Brighton, wireless factor, &c.—A meeting of creditors was held recently at the offices of Messrs. Orbell & Kirk, Brighton. The statement of affairs showed liabilities of £813 and net assets of £374, leaving a deficiency of £439. It was stated that the debtor's wife was a cash creditor, and her claim could not rank in competition with those of the other creditors. The debtor commenced business in 1919. He had little or no capital of his own, and borrowed £123 from his wife, which was still outstanding. The debtor had carried on business as a factor, his turnover averaging about £2,500 per annum. The deficiency was accounted for by loss on trading and bad debts. The latter had amounted to more than £200. A resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. A. E. Orbell as trustee, with a committee of the three principal creditors. The following are creditors:—

	£		£
London Engineering Works, Ltd.	55	Stentophone Motor Accessories, Ltd.	144
Edmonds, H., & Co.	120	Webb, W. F. & M.	22
Maglen, A. P., Ltd.	43	Woolf, M. & A.	34
Ward & Goldstone, Ltd. ...	123		

Dissolution of Partnership.—F. H. Barrell & Co., electrical and general engineers, 2a and 2b, Church Street, Staines.—Messrs. F. J. Slough, A. V. Keale and F. H. Barrell have dissolved partnership. Mr. Barrell will attend to debts.

Unemployment.—The total number of registered unemployed on March 22nd was 1,039,400, as compared with 1,070,833 on March 15th and with 1,201,315 on March 23rd, 1925.

Book Notices.—"Reid's Handy Colliery Guide for Northumberland, Durham, Yorkshire, Cumberland, and Westmorland," 1926 edition. Pp. 242. Newcastle-upon-Tyne: Andrew Reid & Co., Ltd. Price 3s. 6d.—This new issue has been revised and brought up to date from the latest official returns and other sources of information. A list of colliery owners in the respective counties, together with particulars of the collieries and their management is included. The Coal Mines Act, 1911, is reprinted in this work, which also includes the various statutory rules and Orders issued since the Act came into force.

"The Great Public Services of Italy," by Constanzo Ciano (Italian Minister of Ways and Communications). (15 pp., illus.). London: Italian State Railways Touring Office.—This booklet has been prepared to show the improvements which have been made in the past year or two in means of travelling and communication in Italy. It shows, *inter alia*, that the electrified mileage of railways increased from 288 km. in 1913-14 to 457 km. in 1920-21, and 855 km. in 1924-25.

"The Municipal Year Book, 1926." (Pp. lxxxiii+896). London: Municipal Journal, Ltd. Price 15s. net.—This handy reference work has been brought up to date and, as usual, includes a section giving the latest available financial results of the working of municipal electricity undertakings. It is worthy of note that only 12 undertakings out of over 300 failed to make a profit.

"Elementary Electrical Engineering, Theoretical and Experimental," by O. R. Randall. Pp. vi+233; figs. 177. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Loud Speakers: Their Construction, Performance, and Maintenance," by C. M. R. Balbi, A.M.I.E.E., A.C.G.I. Pp. xv.+96; figs. 57. London: Sir I. Pitman & Sons, Ltd. Price 3s. 6d. net.

"The *Journal* of the South African Institution of Engineers." Vol. XXIV, No. 8. March, 1926. Price 2s.

New French Company.—La Compagnie Electrique du Midi is the name of a new undertaking which has lately been organised in Toulouse with a capital of 2 million fr. to establish electricity distribution systems in the Rouergue, Query, and neighbouring districts.

New Businesses.—The following new electrical businesses have recently been started:—

"Mellowtone" (wireless manufacturers), Triumph House, 189-191, Regent Street, W.1.

Sleaford Electric Supply and Battery Service (general electrical and other repairs), 89a, Southgate, Sleaford.

Gibson, Wyatt & Co. (electrical engineers and suppliers), 40, Finsbury Square, E.C.2.

William Watson & Co. (electrical engineers and contractors), 16, New Durham Road, Sunderland.

Reliance Radio Manufacturing Co. (manufacture of wireless components), Little Gransden, Sandy, Beds.

Stubbs Wireless Depôt, 471, Green Street, Upton Park, E.

Uneeda Magneto Co. (general electrical repairers), 5, Cross Fountain Street, Leeds.

Reliable Battery Service (accumulator charging), 597, Green Lanes, N.8.

Electric Automatic Sign Co. (manufacturers and distributors of electric signs), 54, Gracechurch Street, E.C.3.

Old Swan Accumulator Co. (accumulator charging), 26, Stoneville Road, Old Swan, Liverpool.

Stanley & Co. (wireless and electrical engineers), 122b, Chase Side, Enfield, Middlesex.

Service Supply Co. (electric lamps and wireless valves), 1, Bangor Street, Cardiff.

Electric and Model Engineering Co. (manufacturers of electrical fittings, radio and general engineers), Station Approach, New Malden, Surrey.

York Radio Supplies (factoring radio goods), Coffee Yard, Stonegate, Yorks.

Rendel Supplies (dealers in radio and electrical equipment, &c.), 5, Hope Street, Brierfield, Lancs.

Universal Bracket Co. (aerial equipment supply), Alpine Steelworks, East Molesey, Surrey.

P.W Radio Service, wireless retailer, at 47, Barking Road, Canning Town, E.16.

Jackson's Nofolt Wireless, wireless dealer, at 6, Warwick Street, W.1.

T. Hamnett, electrician, at Curon Street, Plymouth Grove, Chorlton-on-Medlock.

The Radio Stores, wireless accessories and repairs, at Southey Street (over J. Peel's), Keswick.

Westminster Electrical Co., electrical and wireless wholesalers, at 2, Tanswell Street, Lambeth, S.E.1.

Delcoe Accumulator Service Station, general maintenance and sale of accumulators, electrical engineering, at 165a, Percy Road, Shepherd's Bush, London.

For Sale.—Messrs. H. Butcher & Co. will sell by auction on April 15th and 16th, at the Strode Engineering Works, Herne, Kent, miscellaneous electrical stores, lighting sets, batteries, cables, &c.

Local Exhibition.—Evesham.—The Shropshire, Worcestershire, and Staffordshire Electric Power Co. recently organised an electrical exhibition at Evesham, and a number of leading firms participated. Domestic appliances and lighting fittings were shown by the General Electric Co., Ltd., the British Thomson-Houston Co., Ltd., and the Cable Accessories Co. Ltd. The B.T.-H. Co. also installed radio reproducing apparatus. Messrs. W. & T. Avery showed scales and the Singer Sewing Machine Co., Ltd., exhibited examples of electrically-driven machines. The Power Co. itself arranged a suite of rooms—dining-room, kitchen, scullery, bathroom and bedroom—and equipped each room with appropriate electrical appliances. In addition, the company set up a model shop-window with special lighting arrangement. Films dealing with electrical subjects were exhibited during the show, and lectures were given by Miss Margaret Partridge, B.Sc. (E.A.W.), Mr. V. Dale (E.D.A.), and Mr. G. F. Francis (B.E.A.M.A.).

Manchester.—A Better Housing and Housekeeping Exhibition is to be held from to-day (Friday) to May 1st. Among the exhibitors is the Central Cables & Accessories, Ltd., which is showing the "Central" vacuum cleaner with a rotating brush and the "Centralette" pattern with a fixed brush.

A Report on East Africa.—Mr. C. Kemp, Deputy Trade Commissioner, has forwarded to the Department of Overseas Trade a report upon the trade and commerce of the Uganda Protectorate, Kenya Colony and Protectorate, Zanzibar and the Tanganyika Territory (Stationery Office, 1s. 6d. net). In the course of this it is stated that, while the United Kingdom still secures practically the whole of the trade offering in electrical goods and apparatus, a certain amount of competition from Germany is in evidence, and will probably increase at a later date. The large increases in the imports of machinery are said to be direct evidence of the recovery of the market. An appendix to the report contains the following information relating to the imports of electrical goods and apparatus for the first six months of 1924 and 1925, the figures in parentheses indicating the percentage supplied by the United Kingdom:—Kenya and Uganda: 1924, £19,9[illegible] (91); 1925, £13,555 (97); Tanganyika: 1924, £6,229 (8[illegible]); 1925, £4,210 (85). Zanzibar: 1924, £27,423 (95); 1925, £4,[illegible] (76). The figures for the whole of 1924 were:—Kenya and Uganda, £28,945 (96); Tanganyika, £9,626 (80); and Zanzibar, £17,636 (84).

The Osaka Electrical Exhibition.—In the scientific domain nothing has made such wonderful progress in Japan as the application of electricity to all branches of activity. It was in 1918 that the first Japanese electrical exhibition was held in Tokio. This exhibition was a colossal success, and proved a considerable stimulus to the development of Japan's electrical industry, which has since made great strides. A second exhibition in two parts is being held in Osaka, one near the Osaka Harbour and another at Tennoji Park, both simultaneously under the auspices of the Electrical Association of Japan. The exhibits comprise electrical plant and machinery, electric furnaces, motors, ship's electrical appliances, testing instruments, radio sets, household electrical appliances, medical instruments, agricultural implements and in fact, all kinds of equipment, appliances, inventions and devices in any way connected with the use of electricity. Demonstrations of the various exhibits are being made under actual working conditions. The exhibition will remain open until May 31st. The keen interest with which the exhibition is regarded by the public may be gauged by the fact that more structures than originally planned had to be built in order to meet the demand for exhibition space.—*Reuter's Trade Service* (Osaka).

Social Events.—The staff of the Woolwich Borough Council Electricity Department held its second annual dinner at the Old Town Hall, on March 27th. Mr. S. H. Penning, A.M.I.E.E. (deputy borough electrical engineer), presided, and he was supported by the Mayor of Woolwich (Councillor W. Barefoot, J.P.), Councillor T. Davis (chairman of the Electricity Committee), Alderman T. Watt (vice-chairman of the Electricity Committee), Councillors J. Newman, R. W. Marsh Allen, V. Lisk and H. Sykes, Mr G. W. Keats (borough electrical engineer), Mr. J. C. Williams (Erith), Mr A. J. Abraham (Bexley), Mr. F. H. Edwards (Dartford), Messrs. L. C. Chasteauneuf and J. A. Turnbull. The chairman proposed the toast "His Worship the Mayor of Woolwich," and the Mayor expressed the thanks of the Council to the staff for the success of the electricity undertaking. Councillor T. Davis proposed the toast of "The Electricity Undertaking and Borough Electrical Engineer," and said that this year the undertaking was giving the ratepayers an "Easter egg" of £25,000. Mr. Keats, in responding, stated that the Woolwich undertaking was second in London and seventh in Great Britain for efficiency, a position which was a great credit to the men in every department. Furthermore, the Woolwich undertaking had carried out more pioneer work than any undertaking in the Kingdom. He referred particularly to the all-electric houses at Eltham. Alderman T. Watt proposed the toast of "The Staff and Employees of the Electricity Undertaking," and Mr. S. H. Penning replied. Mr. G. R. Smith proposed the toast "Our Guests," and Mr. J. C. Williams responded. An excellent musical programme was carried out.

The annual dinner of the staff of the Ilford Council's Electricity Department took place on March 29th. Mr. A. Shaw, the chief electrical engineer, was in the chair, and during the course of the function was presented with an oak bureau cupboard to mark his completion of 25 years in his present position. A number of speakers testified to Mr. Shaw's ability and the progress of the Department under his guidance. A first-class musical entertainment was provided.

Polish Foreign Electrical Trade.—*The Board of Trade Journal* reports that the imports of apparatus, conductors, and other electrotechnical materials into Poland during January were valued at 2,267,000 zloty (about £60,000), and the exports of these goods at 96,000 zloty.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. report, April 7th: No change in electrolytic copper prices.

Messrs. James & Shakespeare report, April 7th: Copper bars (best selected), sheet, and rod, no change; English pig lead, £31 5s., 10s. dec.

Messrs. Edward Till & Co. report, April 7th: India-rubber, Para fine, 2s. 2½d., ¼d. dec.

Lighting and Power Notes.

Aberdeen.—WIRING OF SMALL HOUSES.—The Corporation Electricity Committee has recommended the introduction of a scheme by which the Town Council will wire houses through private contractors on the deferred payment system.

Accrington.—NEW SUB-STATIONS.—New sub-stations are being erected in Sydney Street at an estimated cost of £1,600; in Willows Lane, at a cost of £887; and in Oswaldtwistle, at a cost of £1,640.

Argentina.—BUENOS AIRES.—A contract has been signed with the Compania General de Obras Públicas for the construction of a hydro-electric power station at the Port of Buenos Aires. Five 130,000-h.p. generators are to be installed. Two sets only will be proceeded with at first, one of which, it is expected, will be in operation by the end of 1927.—*Reuter's Trade Service* (Buenos Aires).

Barking.—PRICE REDUCTION.—The Urban District Council has reduced the charge for electricity to small consumers for lighting from 7d. to 5d. per kWh.

Beckenham.—LOAN.—The Electricity Committee has decided to apply for sanction to an additional loan of £20,000 for mains and services.

Bexley.—NEW ELECTRICITY TARIFF.—The Urban District Council has adopted a new tariff for the supply of electricity. Lighting for domestic and business purposes is to be charged at a flat rate of 6½d. per kWh, and heating and cooking at a flat rate of 1d. There will also be a contract rate of 2s. 6d. per quarter for each 50 watts or portion thereof installed for lighting purposes, plus 1d. per kWh for electricity consumed for lighting, heating, power, &c.

Blackburn. — LOAN. — The Corporation is applying for sanction to the borrowing of £100,000 for mains and services.

Bognor.—PRICE REDUCTION.—The Bognor Gas Light and Coke Co. has reduced the price of electricity for lighting to 7d. per kWh, flat rate.

Chester.—OBJECTION TO SCHEME.—At a recent meeting of the Electricity Committee, the town clerk stated that he had sent a letter of protest to the Electricity Commissioners against the proposal of the North Wales Power Co. to erect a transmission line from Helsby to Crewe, passing through the area in which the Corporation was seeking powers to supply electricity, before the Corporation had had the opportunity of stating its case in support of its application.

Cirencester. — ELECTRICITY SUPPLY. — The Rural District Council has consented to the applications of the West Gloucestershire Power Co., Ltd., to supply electricity in the Council's area, and the Cirencester Electric Supply Co., Ltd., for the extension of its overhead mains to Stratton.

Continental.—SWITZERLAND.—The Swiss Government has granted a concession to Buss & Co., of Basle, and the Lonzawerke Gesellschaft, of Waldshut, for the establishment of a new hydro-electric station at Rekingen on the Rhine, to utilise the power of the river between Eglisau and Rheinfelden. The capacity of the plant will be about 43,000 h.p.

BELGIUM.—The Société de Gaz et d'Electricité du Hainaut reports that during the past year concessions were secured for the supply of electricity to five additional communes, bringing the total supplied up to 69. Work on the new power station at Farciennes has been somewhat delayed by labour disputes, but it is expected to be ready for operation within a few weeks.

AUSTRIA.—It is proposed to establish a large central electricity station at the coke-making plant at the Ignatz collieries of the Berg und Huttenwerk Gesellschaft at Marienberg, near Mahr-Ostrau. The electricity generated is to be transmitted to the distribution system of the Mahrisch-Schlesischen Elektricitats Gesellschaft.

Dalkeith.—PURCHASE OF UNDERTAKING.—The Town Council, on April 1st took over the control of the electricity undertaking which has been purchased from the Electric Supply Corporation, Ltd., at a cost of £18,000. Mr. R. Smith is resident engineer. An agreement has been entered into with the Lothians Electric Power Company for a bulk supply of electricity. Messrs. Buchan & Partners, Edinburgh, are the consulting engineers.

Eccles (Lancs.).—LOAN.—The Town Council has applied for sanction to a loan of £6,000 to replace the original mains laid down in 1893.

Glossop.—PROPOSED PURCHASE OF UNDERTAKING.—The Corporation has appointed a committee to carry out negotiations with regard to the proposed purchase of the local electricity undertaking.

Hardingstone.—ELECTRICITY SUPPLY.—The Rural District Council has granted permission to the Northampton Electric Light & Power Co., Ltd., to erect overhead cables at Quinton and Courteenhall, and overhead and underground cables at Roade for the supply of electricity.

Harwich.—LOAN.—The Electricity Committee is applying for sanction to the borrowing of a further £1,000 for electricity services.

High Wycombe.—PRICE REDUCTION.—The High Wycombe Electric Light & Power Co. has announced a reduction in the price of electricity for lighting, from 9½d. per kWh for the first 100 kWh per quarter, and 9d. beyond, to 9d. and 8d. respectively.

Leeds.—ELECTRICITY SUPPLY.—In connection with the City Council's proposal to erect a new power station on Red Cote Farm estate, the Electricity Commissioners have intimated their reluctance at the present time to favourably consider an application for sanction to proceed with the construction of a new electricity generating station, being of the opinion that the present shortage of generating plant in Leeds and neighbouring towns can be temporarily met by linking up the various centres, and have requested the undertakings concerned to allow their engineers to meet in conference to consider this suggestion and, if possible, to submit their conclusions to the Commissioners at an early date. The Committee has decided that the manager be instructed to attend the conference.

The Committee has recommended the acquisition of the Red Cote Farm estate, at a cost of £18,500, for electricity purposes.

Llandudno.—ELECTRICITY CHARGE.—The Llandudno and Colwyn Bay Electric Railway, Ltd., has written to the Council pointing out that the reduction in the price of the electricity offered by the Council is inadequate, and suggesting that, having regard to the requirements of the company and to the fact that the supply is taken at the switchboard at the works, the rate should not exceed 1.20d. per kWh. The Electricity Committee has decided to adhere to the terms agreed to at its last meeting. It was decided to call the attention of the company to the amount outstanding for electricity supplied and to ask for an early settlement.

Mansfield.—WIRING OF SMALL HOUSES.—The Town Council has adopted a scheme for the assisted wiring of houses for electric lighting. The scheme is to apply only to houses and shops already supplied with gas, and not to new property, and the additional charge will be 2d. per kWh. Consumers will buy their own lamps after the first installation, and for a period of six months contracts are to be entered into with local firms for the wiring of blocks of houses on the Chesterfield lines.

Special Orders.—Application has been made to the Electricity Commissioners for a Special Order by the Farnham Gas and Electricity Co. authorising it to supply electricity in certain parts of the rural district of Farnham.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Brecon Corporation to supply electricity in the borough and in the parishes of Castle Inn and Christ's College in the urban district of Brecknock; the South Wales Power Distribution Co., in the parish of Llantrisant, in the rural district of Llantrisant and Llantwit Fardre; the Bedford Corporation, in the urban district of Ampthill and parts of the rural districts of Ampthill and Biggleswade.

Tilbury.—ELECTRICITY SUPPLY.—The Urban District Council has decided to enter into an agreement with the County of London Electric Supply Co., Ltd., for a supply of electricity, and to take the necessary steps to apply for a Special Order to supply electricity in the town.

Twickenham and Teddington.—ELECTRICITY CHARGES.—As a result of the recent inquiry, the Ministry of Transport has fixed the maximum rate to be charged for electricity by the Twickenham and Teddington Electric Supply Co., Ltd., at 9d. per kWh. The company has given notice that the following scale of charges has been adopted from the reading of meters at the end of the March quarter:—Lighting, 8d. per kWh, subject to a reduced minimum charge. Power: First 3,000 kWh per quarter, 2½d.; next 30,000, 2d.; above this amount, 1½d. Contract tariff: 2d. per kWh. Heating: First 100 kWh per quarter, 3½d.; beyond, 2d.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical World*, plans are under way for a consolidation of the Carolina Power and Light Co., the Yadkin River Power Co., the Asheville Power and Light Co., the Pigeon River Power Co., and the Carolina Power Co. The new company will be called the Carolina Power and Light Co., and steps will be taken immediately on construction work, which will involve the expenditure of approximately $20,000,000. Included in the contemplated construction work is a new hydro-electric plant on the Yadkin River at the Norwood site. This plant is to be designed for an ultimate capacity of 85,000 kW. The initial installation will be 63,000 kW. Another hydro-electric plant on the Pigeon River on a site near the Tennessee State line will be constructed. This plant will be designed for an ultimate generating capacity of about 75,000 kW, and will have an initial installation of 50,000 kW.

Uttoxeter.—Electricity Supply.—The Power Development Co., Ltd., has informed the Rural District Council of its intention to apply for a Special Order to distribute electricity in the rural districts of Uttoxeter, Cheadle and Stone, and in the urban district of Uttoxeter, and has asked for an opportunity of discussing the matter with the Council, whose consent is asked for. The Council has decided to await the decision of the Urban District Council on the matter.

West Lancashire.—Electricity Supply.—The Rural District Council is to apply for an Order to enable the townships of Maghull and Lydiate to obtain a supply of electricity from the Liverpool Corporation at the Aintree boundary. At a recent meeting of the Council it was objected that the price proposed by the Liverpool Corporation was 2¾d. per kWh, whereas a cheaper supply might be obtained from the L.M. & S. Railway Co., which was supplying Formby at ¾d. per kWh. The clerk said that the Council was already pledged to go forward with the scheme.

Wetherby.—Electricity Supply.—At a recent meeting of the Rural District Council notice was received from the Electricity Commissioners that they were granting the Electrical Distribution of Yorkshire, Ltd., power to supply electricity to Wetherby. The company has issued notice of its intention to commence laying mains at Collingham, Linton, Wetherby, Thorner, Boston Spa, and East Keswick within a month.

Tramway and Railway Notes.

Blackpool.—Tramway Improvements.—The Corporation proposes to spend £143,808 on tramway improvements during the next financial year. The proposed improvements include new cars and equipment, £15,650; mineral sidings, £16,698; permanent way renewals, £65,601; South Shore tramway extension, £10,809; new motor 'buses, £13,000; and new garage, £12,000.

Cardiff.—New Cars.—The Tramways Committee is to purchase 30 single-deck tramcars at an estimated cost of £73,050.

Continental.—Switzerland.—Negotiations are in hand in connection with the electrification of the railway between Munster and Lengnau.

Austria.—The Austrian State Railway authorities have recently put in operation four electric locomotives, for use in connection with express trains, which embody the use of vertical spindle motors. The engines are intended for use on hilly sections, on which they are required to pull a 500-ton train at 25 m.p.h. and a 300-ton train at 28 m.p.h., the maximum speed on the level being 53 m.p.h. They are of the six-axle type, the central four being each separately driven by an electric motor through bevel gearing, a special flexible connection being provided between the bevel wheels and the axles. The brush gear is located at the upper end of the motors. The engines weigh 91½ tons and have an overall length of 46 ft. and a wheel base of 36 ft. The front and rear pairs of wheels are 3 ft. 5 in. in diameter and the driving wheels 4 ft. 5in.

Edinburgh.—Tramway Extension.—The new extension of the Corporation tramway system from Craiglockhart to Colinton was recently inaugurated.

Japan.—Tokio.—The Tokio correspondent of the *Daily Mail* reports that the first section of the Tokio subway system will be completed in June next year, and regular service over this section, a mile and a half long, will start in the following month, according to a statement by the managing director of the company constructing the new service. A 4-minute service, with trains to accommodate 600 passengers, is planned.

Osaka.—The Osaka municipal officials have approved in principle of the formation of a company, to construct an underground railway in the city.

Maidstone.—Railless Cars.—The Town Council is recommended to install railless cars on the Barming route, where overhead lines are at present in use, at an estimated cost of £18,662.

Salford.—Through Running.—Arrangements are now complete for the new tramway service between Salford and Walkden. The through service is the outcome of negotiations between Salford Corporation and the Lancashire United Tramway Co. It is hoped to run a similar service between Bolton and Salford, and this will entail the doubling of the existing tramway track.

United States.—New Electric Railway.—According to *Electric Traction*, an electric railway for Florida is being planned. This proposed line would link up central Florida cities with the east and west coast and open up the great ridge and lake sections of interior Florida. A corporation to be known as the Florida Service Electric Railways Company will be formed with a capital of $10,000,000. The line is to be constructed in three sections. The first will run from Orlando through Apopka and north to Palatka, the second from Orlando to Tampa and St. Petersburg, and the third through Sanford to Daytona Beach and ultimately link up with Jacksonville to the north with Miami as its Southern terminus.

Philadelphia Subway Extensions.—Extension of the Broad Street subway, Philadelphia, is proposed at an additional cost of $20,117,000. This estimate includes the construction of a two-track line under the east side of the street, five stations at half-mile intervals, and operating equipment. The present subway under construction will cost $100,000,000.

Uruguay. — Railway Electrification. — The State-owned railway between Montevideo and Santiago-Vazquez is to be electrified. The work will be undertaken on behalf of the State by the Compañia Tranvias la Transatlantica of Montevideo.—*Reuter's Trade Service* (Montevideo).

Telegraph and Telephone Notes.

Canada.—Storm Damage.—Sleet and wind storms swept Central and Eastern Ontario, portions of Quebec, and the maritime provinces on March 31st. The telephone and telegraph companies were the chief sufferers owing to the unprecedented destruction of poles carrying the wires. In the Toronto district alone over 1,200 telegraph and telephone poles came down, and all services were badly interrupted.—*Reuter* (Toronto).

Czecho-Slovakia.—Telephone Economy.—Owing to the need for economy, the telephone cable extension programme for 1926 of the Czecho-Slovakian Post and Telegraph Department has been materially cut down. The line between Prague and Brunn is, however, being extended to Iglau; a cable is also being laid between Prague and Aussig to provide a connection at Dresden with the German telephone system. It is also contemplated to lay a cable between Prague and Pilsen to provide another connection with Germany at Plauen.

Germany.—Telegraph Cable.—The German Atlantic Telegraph Co., Berlin, reports receipts of 738,226 marks in 1924, and it is proposed to pay a dividend at the rate of 6 per cent. on the preference shares, as in the previous year. The directors state that the work of producing the cable that is to be laid between Emden and the Azores, where it is to be connected with the cable of the Commercial Cable Co. and the Western Union Telegraph Co., is in full course, and it is reckoned that the connection will be completed during the present year.

Guernsey.—Telephone Service.—The revenue statement and statistics of the State telephone department for the year ended December 31st, 1925, show the gross revenue to have been £16,730 (an increase of £837 on the previous year), and the net profit was £275 (£45 decrease). Subscribers' lines increased by 179 to 3,104 and the total number of lines, including junctions, by 227 to 3,730. Overhead metallic circuit wire increased by 62¼ to 2,385¼ miles, and the underground circuits increased by 778¼ to 3,928 miles. (Single wire mileages are double these figures.)

Holland.—Automatic Telephony.—The L.M. Ericsson Telephone Company has obtained a definite order for another automatic telephone station at Rotterdam, the value of the order being about Kr. 2,540,000. The Company has previously constructed two stations of this kind at Rotterdam.—*Reuter's Trade Service* (Stockholm).

Hull.—Automatic Equipment.—The Municipal Telephone Committee has received a report from the telephone manager to the effect that, in order to be in readiness for anticipated future demands, it has become necessary to advertise for tenders for additional automatic equipment. The proposal is for 2,000 lines of additional equipment, 40 per cent. to be installed in the existing premises at Wincolmlee, to relieve congestion in the Central exchange, and the remainder divided between two new exchanges situate in North and South Newington respectively. The manager has been instructed to advertise for tenders.

India.—The Telegraph System.—Our Indian correspondent reports that the Government of India is determined to rapidly modernise the telegraph system. The Creed-Wheatstone automatic system of working has been entirely replaced by modern multiplex systems, *i.e.*, Baudot, Murray and Murkrum; laboratory experiments on the Echelon method of working (*i.e.*, between more than two stations on the same wire) have been carried out with a view to its early introduction. A considerable amount of experimental work has been carried out with Baudot re-transmitters in the Research Laboratory; a four channel set, with single-disk distributors, has been designed and tried in conjunction with two quad terminal sets through artificial lines. After a number of preliminary trials, a scheme of connection has been evolved which has now been adopted with entire success as the standard in the Department. Experiments in connection with multiplex working were also carried out in the laboratory with Western Electric valves and relays and with valves only; the experiments were very encouraging.

When purchasing stores, increasing use is being made of local sources of supply: The value of stores purchased locally rose from Rs. 5 lakhs in 1923-24 to Rs. 12 lakhs in 1924-25, while the value of stores obtained on English indent fell from Rs. 27½ to Rs. 18¼ lakhs. Hard-drawn copper line wire is now being manufactured satisfactorily in India, and over 600 tons of this wire of local manufacture was purchased by the Department in 1924-25. Glass battery jars of local manufacture are also being obtained. The telegraph workshops show an increased output. The training of men in the manufacture of

high-speed apparatus has been very successful, and complete Baudot instruments and all spare parts, which were previously received from England, are now manufactured at the workshops at very favourable rates. A special machine was designed and made in the workshops to convert Wheatstone tape into Baudot tape, to prevent the loss which would have been incurred by scrapping a large stock of Wheatstone tape. In the construction branch of the workshops, 30,020 galvanised tubes for telegraph poles, and 185,214 brackets with fittings for supporting line wires were made. The output from the iron foundry weighed 664 tons.

The total line and wire mileages of the Indian telegraph system were at 94,037 and 477,839, respectively, on March 31st, 1925. There has been a considerable increase in traffic recently.

Radio-telegraphy. — RUSSIAN SERVICE. — It has been announced by Marconi's Wireless Telegraph Co., Ltd., that a radio-telegraph service from London to Moscow (Russia) was inaugurated on March 31st. Commercial and private messages are accepted at any Marconi office.

Russia.—SHORT-WAVE RADIO EXPERIMENTS.—For some time past experiments with short waves have been in progress at the Russian Soviet Government Laboratory at Nishni-Novgorod and it is reported that by the use of a 1,520-W transmitter devised by Prof. Bontch-Brouyevitch (head of the laboratory) and Herr Tabarinow, messages have been successfully transmitted to Chile and Porto Rico on wave-lengths of 83, 102, and 104 metres. The object of the experiments is to provide a practicable form of radio communication with remote parts of Soviet Russia which are not provided with telegraph communication. Prof. Boutch-Brouyevitch is also reported to be experimenting with a 100-W transmitter for use at the Chabolovka radio-telegraph station, near Moscow.

The Telegraph Service.—FOREIGN TELEGRAM RATES.—The Postmaster-General has announced that on April 1st the rates of charge for ordinary telegrams to Italy, Switzerland, Albania, Bulgaria, Danzig, Esthonia, and Jugo-Slavia, were increased by ½d. a word, and the rate to Turkey by 1d. a word. These increases were necessitated by the decision of the International Telegraph Union to raise the maximum terminal rates chargeable by the various European administrations for telegrams passing between them.

The Telephone Service.—BIRKENHEAD POLICE SYSTEM.—The Birkenhead Corporation recently installed a Relay automatic telephone equipment at the Central Police Office. The automatic system, which replaces the former common-battery method, serves 77 departments, all of which are able to communicate directly with each other without the interference of an operator The arrangement embraces an automatic switchboard which replaces the former branch exchange and a smaller manual board, which deals with incoming and outgoing calls. The reorganisation is estimated to have cost over £2,000.

LONDON CHANGES.—An important alteration in the telephone system of London came into operation on March 29th. Within a radius of ten miles from Oxford Circus all telephone numbers now consist of a minimum of four figures. For example, "Central 56" becomes "Central 0056," which alteration has been necessitated by the coming introduction of the automatic telephone. Last year the names of certain exchanges were altered, and numbers composed of single figures were abandoned. A new exchange, to be known as Primrose Hill, has been installed to relieve Hampstead. Some 900 subscribers have been taken over, and the exchange will be extended until it deals with some 3,000 subscribers.

LONDON SUBSCRIBERS.—On March 31st there were 486,800 telephone subscribers in the London area, and they were increasing at the rate of 1,000 per week; it is declared that there are now six subscribers in London to every 21 in New York per 100 of population. London is, however, ahead of Berlin and Paris.

Radio Notes.

Australia.—NEW STATION.—A new radio-broadcasting station was opened in Sydney on March 30th.

Pennant Hill is the location of the station, which has an aerial 400 ft. high, and its maximum power is 10 kW. Reports from British listeners who may hear this transmitter will be welcomed by the B.B.C.

Frequency Control.—QUARTZ CRYSTAL METHOD.—The recent international decision to redistribute wave-lengths by the allocation of exclusive and common wave-lengths in Europe adds interest to methods of controlling transmitter frequencies. In this connection the first high-power station to utilise a quartz crystal for this purpose is the American General Electric Co.'s development plant, which is known as WGY. A piece of quartz crystal, less than one inch square and ground to a thickness a shade less than an eighth of an inch, is controlling the 50-kW transmitter's 790-kilocycle frequency assigned to the station by the United States Department of Commerce. Quartz has been utilised for controlling the regular 5-kW transmitter of WGY for several months. Beside the large transmitter's bank of eight 20-kW water-cooled tubes are two small copper-covered cabinets with dials, switches, and meters built in their faces; one of these boxes contains the crystal and a single exciting tube; in the second box is a single amplifying tube, while successive stages of amplification up to 1 kilowatt are placed in separate panels. The small slab of quartz crystal is enclosed in a metal chamber and is connected to work directly on a 5-watt tube, which, in combination, act as a high-frequency generator whose output is determined by the contraction and expansion of the crystal. The interaction of crystal and tube may be described as the setting up of a mechanical force, which is converted into an electrical force of a definite fixed frequency dependent upon the dimensions of the piece of crystal used; the thinner the crystal the higher the frequency. The five-watt tube that is directly connected to the crystal works into a 50-watt tube, resulting in the amplification of the original energy at the fixed frequency. Still further amplification is obtained by connecting the 50-watt tube to a 250-watt tube, and then a fourth stage is secured by connecting the output of the latter to a 1,000-watt tube; all the valves used up to this point are air cooled. In the next stage a metal water-cooled tube rated at 20 kW is introduced as a part of the transmitter; it was formerly used as the master oscillator (a self-excited generator), but now is excited by the preceding stages of crystal amplification, and the 20-kW tube then excites the bank of eight 20-kW power tubes of the transmitter. The General Electric Co., of America, claims to have demonstrated that crystal control may be successfully adapted to any practical power; besides the reduction of inter-station interference, there is also evidence that fading tends to decrease when the frequency is constant.

Holland.—BROADCASTING AGREEMENT.—The Commercial Secretary at The Hague (Mr. R. V. Laming, O.B.E.) informs the Department of Overseas Trade that a new contract has been concluded between the N.V. Nederlandsche Seintoestellenfabriek (of Hilversum) and the Hilversumsche Draadlooze Omroep, which terminates the contract of May, 1925, between the parties mentioned, to be operative from March 1st, 1926. Article 1 places at the disposal of the H.D.O. certain hours per week for transmission purposes, and the N.S.F. binds itself to allot the remaining hours for transmission to the H.D.O. as desired, in so far as they are not already granted to others, and not to grant the use of the transmitting apparatus to other bodies before having given the H.D.O. the option of refusal. Article 2 stipulates that so soon as the Government grants permission for the use of the second transmitter, it shall be ready for use by the H.D.O. within two months thereof, but in any case not before June 1st, 1926; it will operate on the same wave-length as the existing transmitter, and with at least the same capacity in the aerial. The H.D.O. guarantees a minimum of 31 hours per week for the old transmitter at present in use. The N.S.F. is to see that the old and new transmitters function properly, including the provision of the material and *personnel* for the control thereof. The H.D.O. binds itself not to utilise the transmitter for advertising on behalf of firms or persons competing with the N.S.F., to submit its weekly programmes fourteen days in advance to the N.S.F., and to remunerate the latter for the use of the old and new transmitters, *personnel*, materials, licence, studio, and a maximum of two line transmissions per 31 hours on the old transmitter, and 40 hours on the new transmitter. On the eventual conclusion of a permanent contract with a probable national broadcasting body, the present contract is not to be referred to as a precedent.

Licences.—STILL INCREASING.—The number of broadcast radio-telephone receiving licences in force in Great Britain on February 28th was 1,906,000; when the March returns are available it is expected that they will record over 2,000,000.

Venezuela.—BROADCASTING CONCESSION.—A concession has been granted to a native company to establish and develop broadcasting in Venezuela. The Government proposes to erect a high-power station in Caracas and stations in each of the other States. Hitherto there have been no privately-owned radio-telegraph stations, clubs, or societies in the Republic, although permission has been given to one or two oil exploration companies to erect radio-telephone stations exclusively for communication between the oilfields and their offices. Hitherto this permission has not been availed of.—*Reuter's Trade Service* (Caracas).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (March 19th.)

May 10th. Coal-unloading, storing, and reclaiming plant. (See this issue.)

May 11th. Switchgear and accessories, transformers and piping equipment. (March 26th.)

Belfast.—April 17th. Electricity Department. Automatic rotary converters with transformers, h.p. and l.p. switchgear and automatic control gear. (March 26th.)

Belgium.—April 14th. Belgian State Railway authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. 60 kilometres of lead-covered electric wire. Particulars on application for Cahier des Charges Special, 4-326.

Bentley-with-Arksey.—April 20th. West Riding Education Committee. Electric lighting installation at Bentley Road school. Specifications, Education Department, County Hall, Wakefield.

Bolton-upon-Dearne.—April 22nd. Dearne District Electricity Board. Electric cables and accessories. (April 2nd.)

Bristol.—April 16th. Electricity Department. 140 14 in. ×14 in.×35 ft. ferro-concrete piles. (See this issue.)

Chile.—Santiago.—August 20th. Chilean State Railways. Signals, telegraphs and telephones, electrical material for sub-stations, aerial lines, and lighting.*

Dartford.—April 21st. Electricity Department. Coal for 6 or 12 months. (See this issue.)

Dover.—April 14th. Electricity Department. 6,250 yd. e.h.p. cable. (March 26th.)

Dundee.—April 20th. Education Authority. Electric lighting at new central Advanced School at Blackness Road. Schedules from Messrs. Maclaren, Soutar & Salmond, architects, 16, South Tay Street, Dundee.

Exeter.—May 11th. Electricity Department. Boiler-house plant complete:—Two water-tube boilers with economisers, pumps, coal bunkers, conveyor, and accessories. Self-supporting steel chimney, induced-draught fan, and accessories. (See this issue.)

Ferry Fryston (Yorks.).—April 20th. West Riding County Council. Electric lighting installation at Ferry Fryston, Airedale, new school. Specifications from Education Department, County Hall, Wakefield.

Glasgow.—April 13th. Lighting Department. Materials for one year from June 1st, including electrical fittings and accessories. Specifications, &c., from office of Lighting Department, 20, Trongate.

Halifax.—April 12th. Town Council. Wiring for electric lighting of 80 houses, Booth Lane and Nursery Lane. Particulars from Mr. P. Saunders, town clerk, Town Hall.

Harrogate.—April 25th. Electricity Department. H.p. and l.p. switchgear for sub-stations. (See this issue.)

Hull.—Telephones Committee. Supply and installation of automatic telephone exchanges. (April 2nd.)
April 15th. Electricity Committee. 36-in. c.i. pipework, chamber and penstock. Form of tender, &c., from Mr. H. Bell, city electrical engineer and manager, Electricity Works, Sculcoates Lane, Hull.

India.—April 30th. India Store Department. 22,000-V cables. (April 2nd.)
May 7th. 15 motor coach underframes and bodies, 30 motor bogie trucks. (March 12th.)
May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

Irvine (Ayrshire).—April 12th. Town Council. Electric lighting installation at 25 blocks, consisting of 100 houses. Plans from Mr. Robert Frew, architect, 3, High Street, Irvine.

London.—Hammersmith.—April 14th. Electricity Department. H.p. insulated cables, air-cooled and oil-cooled transformers, and h.p. sub-station switchgear. (April 2nd.)

Manchester.—April 13th. Tramways Committee. Copper, silicum, and cadmium bronze trolley wire. Forms of tender from Mr. H. Mattinson, general manager, 55, Piccadilly.

Middlesbrough.—April 16th. Electricity Department. Six or 12 months' supply of cables and 12 months' supply of meters. (March 26th.)

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*
Wellington.—May 12th. Post and Telegraph Department. 18 switchboards.*

Perth.—April 12th. Electricity Department. One water-tube boiler, capacity 27,000 lb. per hour. (April 2nd.)

Salford.—Corporation Gas Department. One 5-cwt. electric passenger lift at Bloom Street offices. Form of tender from Gas Engineer, Gas Offices, Bloom Street.

Southend-on-Sea.—April 19th. Electricity Department. 1,450 current limiters. (April 2nd.)

Spain.—Madrid.—May 9th. Compania de los Caminos de Hierro del Norte. Overhead line, converting sub-stations, locomotives and motor coaches for the electrification of the lines from Barcelona to Manresa and San Juan de las Abadesas in one contract. The constructors are to obtain as many of their supplies from Spanish industries as possible.—*Reuter's Trade Service* (Madrid).

Stoke-on-Trent.—April 13th. Electricity Department. 12 months' supply of mains and cables, a.c. and d.c. meters, sub-station switchgear, and static transformers. (March 26th.)
April 12th. Gas Committee. Electrical and other machinery, gas engine and dynamo. Contract No. 35. Particulars (20s.) from the Chief Gas Engineer, Gas Works, Etruria, Stoke-on-Trent.

Walthamstow.—April 13th. Electricity Department. Steel overhead bunkers and boiler-house buildings; and coal- and ash-conveying plant. (March 12th.)

Warrington.—April 26th. Electricity and Tramways Committee. L.p. paper and lead-covered cables. (See this issue.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (See this issue.)

Westhoughton (near Bolton).—April 14th. Urban District Council. Metallic-filament lamps required during year ending March 31st, 1927. Form of tender, &c., from Mr. G. Hayes, surveyor, Council Offices.

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barking.—Electricity Department. Accepted:—
L.p. switchgear.—Edison Swan Electric Co., Ltd.

Belfast.—Corporation Tramways. Accepted:—
Incandescent lamps.—Edison Swan Electric Co., Ltd.

Bury.—Town Council. Accepted:—
Electric lighting installation, Fishpool housing scheme.—Direct Electric Service, Ltd.
Coal for the electricity works.—Wigan Coal & Iron Co., Ltd.

Cardiff.—Electricity Committee. Accepted:—
10,000-kW turbo-alternator (£31,301).—Fraser & Chalmers Engineering Works (General Electric Co., Ltd.).
Condensing plant (£6,791).—Cole, Marchent & Morley, Ltd.
Dust collectors (£1,600).—Davidson & Co., Ltd.

Hastings.—Town Council. Accepted:—
Electrical cooking apparatus for White Rock Pavilion (£811).—Jackson Electric Stove Co., Ltd.
22,000-V, 3-phase overhead lines and cables (£26,554), e.h.p. and l.p. underground cables (£24,658).—W. T. Glover & Co., Ltd.

Hull.—The City Council, to whom the Telephones Committee had referred the selection of tenders for telephone equipment, accepted the lowest British offers in preference to German tenders, which were stated to be 48 per cent. cheaper. The contracts were awarded to Messrs. W. T. Glover and Co., Ltd., the Union Cable Co., Ltd., and Bullers, Ltd.

Telephones Committee. Accepted:—
Dial switches (£146).—Siemens Bros. & Co., Ltd.
Wall telephones (£174).—British L. M. Ericsson Mfg. Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Traction lamps for car lighting for 12 months.—Siemens & English Electric Lamp Co., Ltd.

London.—Admiralty.—Accepted:—
Switchboard for Devonport Dockyard.—Edison Swan Electric Co., Ltd.

Stepney.—Electricity Supply Committee.
Two 150-kVA transformers (£348).—Hackbridge Electric Construction Co., Ltd. (accepted).
100 single disconnecting boxes (£115).—W. Lucy & Co., Ltd. ((recommended).
50/TC/C disconnecting boxes (£107).—Universal Electrical Manufacturing Co. (recommended).
Cables for 12 months (£27,611).—W. T. Henley's Telegraph Works Co., Ltd. (recommended).
3,000 maximum demand indicators.—Reason Manufacturing Co., Ltd. (recommended).

Manchester.—Electricity Committee. Accepted:—
Cable.—Hackbridge Cable Co., Ltd., and Callender's Cable & Construction Co., Ltd.
Equipment of louvre doors for cooling tower at Stuart Street.—Clyne Engineering Co., Ltd.
E.h.p. switchgear for Oldham Road a.c. sub-station.—A. Reyrolle & Co., Ltd.
Refractor street lanterns.—General Electric Co., Ltd.; Wardle Engineering Co., Ltd.

Tramways Committee. Accepted:—
Motor controller spare parts.—British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Tram rail bands.—T. Bolton & Sons, Ltd.; Forest Clay Electric Co., Ltd.

Housing Committee. Accepted:—
Electric light installation at Moston and Burnage estates.—Mr. J. V. Pyatt.

Margate.—Town Council. Accepted:—
Wiring and fitting 72 houses for electric light (£4 7s. 6d. per house).—W. J. Cannon & Co.

Research in Australia.—Sir Frank Heath, Secretary of the Department of Scientific and Industrial Research, reporting to the Australian Federal Government as special commissioner, recommends the development of the Science Institute into an important department resembling the British Research Departments and co-operating with them. The annual cost, which would begin at £40,000, would rise to £100,000, says the *Daily Mail*. Sir Frank Heath suggests the appointment of a scientific expert on the staff of Australia House in London, and thinks that the recent creation of a research committee of the British Cabinet as a civil counterpart of the Imperial Defence Committee makes such an appointment particularly necessary.

Forthcoming Events.

Electrical Power Engineers' Association.—Friday, April 9th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Boiler-house Plant Developments in Association with Powdered Fuels," by Mr. F. H. Rosencrants.

Diesel Engine Users' Association.—Friday, April 9th. At Caxton Hall, Westminster, S.W. Paper on "Industrial Combustion Engines," by Mr. W. A. Tookey.

Chief Technical Assistants' Association.—Saturday, April 10th. At Holborn Restaurant, W.C. At 6.45 p.m. Annual dinner.

Society of Engineers.—Monday, April 12th. At Burlington House, W. At 5.30 p.m. Paper on "An Inquiry into the Ugliness of Engineering Structures," by Mr. H. B. Creswell.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, April 12th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "The Linking Together of Wireless and Wire Communication Systems," to be opened by Capt. P. P. Eckersley.

(Wireless Section).—Wednesday, April 14th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Rugby Radio Station of the British Post Office," by Mr. E. H. Shaughnessy.

(North-Eastern Centre).—Monday, April 12th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Lecture on "Some Impressions of Chicago and U.S.A.," by Mr. C. Vernier.

(Scottish Centre).—Tuesday, April 13th. At the Royal Technical College, Glasgow. At 7.30 p.m. Paper on "The Design of Electrical Plant, Control Gear, and Connections for Protection Against Shock, Fire, and Faults," by Mr. H. W. Clothier. Annual general meeting.

(Western Centre).—Monday, April 12th. At University College, Exeter. At 5.45 p.m. Lecture on "Electro-Farming: or the Application of Electricity to Agriculture," by Mr. R. B. Matthews.

(South-Midland Centre).—Wednesday, April 14th. At the University, Birmingham. At 7 p.m. Discussion on "The Government Electricity Bill."

Institution of Civil Engineers.—Tuesday, April 13th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The Influence of Electric Welding in the Design and Fabrication of Plant and Structures," by Mr. J. N. Reeson.

Wednesday, April 14th. At 6 p.m. Informal meeting. Discussion on "The Young Engineer: His Training and Prospects," to be introduced by Mr. G. W. Tripp.

Radio Society of Great Britain.—Wednesday, April 14th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Informal meeting.

Institution of Engineers-in-Charge.—Wednesday, April 14th. At St. Bride Institute, Bride Lane, E.C. At 7.30 p.m. Paper on "Modern Electric Wiring," by Mr. H. D. Wilkinson.

Saturday, April 17th. Social dance.

Meter Engineers' Technical Association.—Thursday, April 15th. At Anderton's Hotel, Fleet Street, E.C. At 7.30 p.m. General meeting.

Junior Institution of Engineers.—Friday, April 16th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Automobile Lighting, Starting, and Ignition," by Mr. T. L. Allison.

Institution of Mechanical Engineers.—Friday, April 16th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Modern Development of Paper-mill Plant," by Mr. W. Worby Beaumont and Mr. L. N. Burt.

Salford Technical and Engineering Association.—Saturday, April 17th. At the Royal Technical College. At 7 p.m. Paper on "Switchboard Instruments," by Mr. A. H. Higgs.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 17th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Lecture on 'Auto-Synchronous Motors," by Mr. E. E. Tasker.

Notes.

Royal Air Force Cadetships.—The Air Ministry announces that the next examination of candidates for entry as flight cadets to the Royal Air Force Cadet College, Cranwell, in September, 1926, will begin on June 22nd, when not less than 35 cadetships will be offered. Forms of entry, obtainable from the Secretary, Civil Service Commission, Burlington Gardens, W.1, must be sent in not later than May 6th. Facilities are given to R.A.F. officers to specialise in, among other subjects, engineering and wireless telegraphy.

Lecture.—On Monday next, under the auspices of the Brighton and Hove Health and Food Reform Society, at the Hove Town Hall, Mr. H. G. Massingham will give a lecture on "The Past and Future Developments of Electricity and its Bearing on Pure Light, Pure Air, Pure Food and Health."

The Volta Centenary Celebrations. — Great preparations are being made in Italy to commemorate next year in suitable form the centenary of the death of the great Italian scientist, Alessandro Volta. All the leading scientific and technical associations are joining together in organising a comprehensive programme which will comprise, among other items, International Congresses on Physics, Telegraphy, and Radio Communication, while an International Exhibition of Electrical Communications is to be held in Como.

Appointments Vacant.—Three car-shed foremen (Rs. 650-40-850 per mensem) for the electrified services of the Indian State Railways. General assistant and draughtsman for the Newark-on-Trent Electricity Department. Lecturer in Electrical Engineering for the Bradford Technical College. Assistant engineer for extension work (£504) (temporary), and Draughtsman (£300) (temporary) for the Dublin Corporation Electricity Department. (See our advertisement pages today.)

Stockport Electricity Works.—OPENING OF EXTENSIONS.—A civic inspection of the new generating plant at the electricity works of the Stockport Corporation took place on Wednesday, March 31st, when the 12,000-kW turbo-alternator set, built by the English Electric Co., Ltd., was inaugurated. The visitors were received by Mr. Ralph Lomax (whose connection with the department dates from 1902 and who has been the borough electrical engineer since 1906) and his deputy, Mr. R. H. Lee, who explained the details of the plant. The plant includes three 5,000-kW turbines, one of 5,500 kW, and the new turbo-alternator, which is capable of a continuous output of 12,000 kW at 0.8 p.f., at a pressure of 6,000 volts, three-phase, 50 cycles, and runs at a speed of 3,000 r.p.m. New main switchgear is under erection, consisting of a remotely-controlled electrically-operated cubicle switchboard, supplied by the English Electric Co., Ltd. A Tudor battery of 3,000 ampere-hours has been installed. There are also two 1,500-kW and two 1,000-kW rotary converters of the English Electric Co.'s construction and one 1,000-kW La Cour converter by Messrs. Bruce Peebles & Co., Ltd.

A notable feature in the history of the Stockport electricity supply has been the way the capital charges have been kept down, with the result that last year there was a gross profit of 10.94 per cent. upon the capital expended and of 17.97 per cent. upon that outstanding. There are 7,714 consumers, and although the town has suffered from the prevailing depression in the cotton trade, the authorities are optimistic with regard to the future, and have provided plant to meet the coming needs. The cost of the new turbo-generator, new boilers, and structural alterations, will be about £100,000, and the cost per kW of plant installed works out at a little over £12. When the site is developed to its present accepted limits of 50,000 kW installed capacity it should work out at £10 per kW. During the last two years the supply of electricity in bulk has been extended to the Hazel Grove and Bramhall Urban District Council and the Bredbury and Romiley U.D.C., whilst supplies to the authorities at Marple and New Mills are under consideration.

After the inspection of the new plant, Councillor James Harrison, as chairman of the Electricity Committee, christened the 12,000-kW turbo-generator the "George Ball," in honour of the first chairman of the Committee, and then started the machine. Subsequently luncheon was served at the Town Hall, when the Mayor (Councillor J. Greenhalgh, J.P.) presided over a full attendance of leading public men.

Mr. P. H. Symonds, in proposing "Success to the Stockport Electricity Undertaking," said that the Stockport station was the first of its size in order of merit according to the Electricity Commissioners. With regard to the Electricity Bill he hoped there would be as little control as possible. The electricity undertaking wanted to develop on sound commercial lines. Stockport enjoyed low capital charges, and tribute should be given to the sound commercial instincts of their electrical engineer, Mr. Ralph Lomax.

Alderman George Ball, who until recently was chairman of the undertaking from the first, replied, and said they would be able to generate a cheap and abundant supply of electricity for a long time to come. He eulogised the services of Mr. Lomax, whose advice had been most useful to the Committee.

The Optical Convention.—At the meeting of the Scientific and Technical Circle of the Institute of Journalists on March 29th, presided over by Mr. L. Gaster, a survey of the aims and objects of the Optical Convention, to be held at the Imperial College of Science and Technology from April 12th to 17th, was given. The British optical industry has for long had to contend with great difficulties, but from the scientific standpoint it is an exceedingly important one, and the vital consequence of "optical munitions" during the war was strikingly demonstrated. Recognition of its national value is afforded by the fact that the Prime Minister, Mr. Stanley Baldwin, is to open the Convention. At the meeting of the Circle, Mr. Frank Twyman, F.R.S., gave a good summary of the variety of apparatus, cameras, telescopes, microscopes, projectors, surveying instruments, &c., of which lenses form a part. Journalists should not forget that every process block also requires the use of an optical lens. Many of these instruments have done invaluable service in opening up new fields of knowledge. Professor F. J. Cheshire, in the course of an account of some experiences as director of the Department of Optical Munitions during the war, referred to their applications in range-finders. Generally speaking, the optical industry, like illuminating engineering, finds its main justification in the statement that before one can act one must *see*.

At the Convention there will be many papers and exhibits of scientific interest. Public interest is to be aroused by many ingenious optical illusions and entertainments, some of which were described at the meeting by Sir Richard Paget. One of the most attractive of these is the "Fairy Theatre," wherein fairy figures only 6 inches high will perform; these dramatic performances have been arranged with the assistance of Mr. Kenneth Barnes, M. Komisarjevsky and the students of the Royal Acadamy of Dramatic Art. Amongst the exhibitors will be Messrs. C. A. Parsons & Co., Ltd. (searchlight reflectors), Henry Hughes & Son, Ltd. (compasses, sounding machine), the Cambridge Instrument Co., Ltd. (pyrometers, photometers, &c.), the Foster Instrument Co. (pyrometers), the Thermal Syndicate, Ltd. (mercury pumps, wireless valves in fused quartz, &c.); and the National Physical Laboratory, the Imperial College technical optics department, the Illuminating Engineering Society, and other scientific bodies will be represented in the Experimental and Research Section.

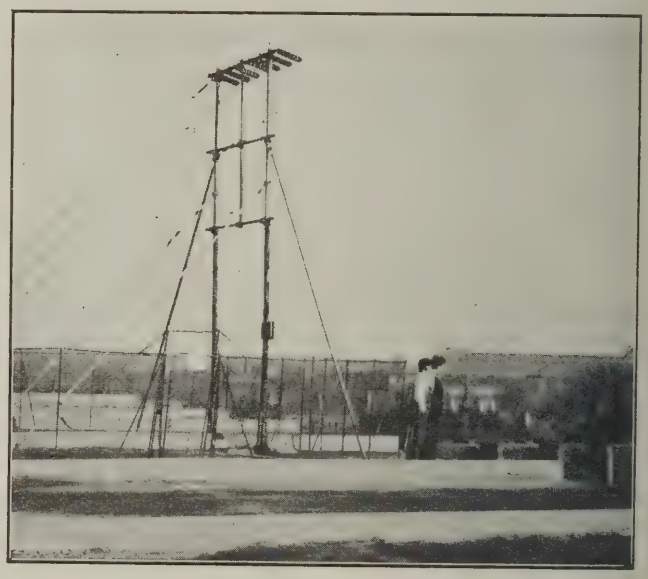
Nitrogen Fixation.—Speaking at the Princeton Chemical Club, U.S.A., Dr. Frederick G. Cottrell, chairman of the Fixed Nitrogen Research Laboratory at Washington, estimated that approximately 44 per cent. of the world's inorganic supply of nitrogen would be obtained this year by atmospheric fixation, against less than one-fourth that amount

before the war. While the 10 per cent. made in this way before the war was almost wholly by the arc and cyanamide process, nearly 70 per cent. of this year's fixation will be through the direct synthesis of ammonia.

An Electric Railway Project.—It is stated that the Spanish Northern Railway Co. proposes to convert to electric traction the lines between Barcelona and Manresa, and Barcelona and San Juan de las Abadesas. Offers for the delivery of the material, including the rolling stock, and its erection, are to reach the Compania de los Camions de Hierro del Norte, Estacion del Norte, Madrid, by May 9th. Further information on the requirements and the conditions may be obtained from the electrification bureau of the company in Madrid.

A French Broadcasting Station.—One of the Continental broadcast radio-telephone transmitting stations which English listeners have become accustomed to hear in this country is that of L'Ecole Supérieure des Postes et des Télégraphes at Paris. It is known by its call signal FPTT, its nominal wavelength being 458 metres and power 500 watts; part of the transmitting apparatus is illustrated in one of the photographs here reproduced, whilst the other shows one of the aerial masts





Part of Transmitter, and Roof Aerial Mast, of L'Ecole Supérieure Broadcasting Station, Paris.

on the flat roof of the Central Telegraph Office building. The height of the mast may be gauged by comparison with the two men standing nearby and the arrangement of the aerial wires themselves will be noted with interest, differing as it does from that in use in this country. It is one of the three well-known Paris stations, and is housed in the training college itself, in the Rue de Grenelle. From small beginnings it has come to be one of the best known in Europe, and now transmits each evening from 8.30 p.m. Notwithstanding its small power its signals are received well within a radius of 1,200 miles, and are heard regularly over the whole of Western Europe from Sweden to Spain, as well as in Northern Africa.

Electric Dredges for Mining. — We learn that five electrically-operated mining dredges, to be used in the mining of platinum, are to be installed for the Platinum Trust of the Soviet Government of Russia for service in the territory of the Ural Mountains. They will be supplied from transmission systems at 40,000 and 10,000 V, 3 phase, 50 cycles, the working pressure being 440 V. The equipment is to be supplied by the G.E.C., America.

Electrical Association for Women.—On March 26th, a party of members of the Association paid a visit to the demonstration rooms and laboratories of Holophane, Ltd. Mr. L. M. Tye gave a short review of "Scientific Progress in Illuminating Engineering." Special colour demonstrations were made and films were exhibited showing shop window and interior lighting. Mr. L. Gaster, secretary of the Illuminating Engineering Society, and Mr. Loveday (E.D.A.), were with the party.

The first meeting of the Birmingham and Midland Branch of the Association was held at the Council House on March 29th. Professor Burstall, D.Sc., Dean of the Faculty of Science at Birmingham University, pleaded with humour and fervour for a forward movement amongst women towards electrical self-help in the home. He declared that he had himself "spring-cleaned" a room in twenty minutes—with an electric vacuum cleaner. Women should adapt their houses to their own strength, eliminate servants, and acquire good labour-saving devices, thus keeping their houses cleaner and giving themselves time to develop their own lives in other more congenial directions. It was essential that they should understand the assistance that electricity offered.

Mr. E. J. Jennings, secretary of the Electric Supply Department, reported an increase last year of 8,600 consumers in Birmingham, double the increase of the previous year and ten times the annual pre-war increase. He said there was a possibility of the power tariff in Birmingham being reduced to ¾d. (against the present 1¼d.).

Miss Haslett, Director of the Association, said that women must *clamour* for the help electricity could give them in their homes, but first they must understand what they were asking for. To teach this was the mission of the Association.

Cheap Electricity at Southport. — Mr. E. Moxon, A.M.I.E.E., borough electrical engineer to the Southport Corporation, informs us that during the two summer quarters the charge for electricity for heating is to be reduced from 1¼d. to 1d. per unit. The inclusive domestic tariff, made up of a fixed charge of 3s. per scheduled room per quarter, and a running charge of 1d. per unit for all electricity consumed, subject to a minimum charge equivalent to 2s. per scheduled room, has been adjusted by a reduction of the unit charge from 1d. to ¾d. per unit, the fixed and minimum charges remaining unchanged. A circular letter that has been sent out to all consumers points out that no one need have coal fires after April 1st, for six months, as electric radiators will give better, cleaner, and more efficient service, whilst cooking can be done in cool comfort, and hot water obtained with immersion heaters. These and many other electrical appliances can be obtained on hire or hire-purchase from the new Corporation showrooms, where demonstrations of electric cooking are given twice a week; the showrooms are kept open till 9.30 p.m. on those occasions. This, we believe, is an excellent way to develop domestic electricity supply.

Institution Notes.

Institution of Fuel Technology.—The first meeting of the Organising Committee of the above Institution was held on March 23rd, when the name of the Institution was definitely confirmed as above. Within the limits of its powers of co-option of additional members, the Committee is extending invitations to other organisations to be represented on it. A sub-committee was appointed to draft the constitution and by-laws. The draft will be considered in detail by the Organising Committee and eventually a copy will be sent in advance to everyone interested for consideration, prior to a second public meeting which will be called to adopt or amend the draft as the potential members may think fit. It is the intention that the new Institution shall be thoroughly representative of every branch of the wide subject of fuel. The support so far received has exceeded all expectations. All communications should be addressed to the Hon. Secretary (pro tem.), Mr. Edgar C. Evans, Caxton House (East), Tothill Street, Westminster, S.W.1.

Institute of Transport.—Circumstances have arisen which necessitate the postponement of the dinner of the Institute, which was to have been held on Wednesday, April 21st.

The I.M.E.A. Convention, 1926.—In the official preliminary programme of the Convention, abstracted in our last issue, it was stated that a paper on "Industrial Heating" would be read by Mr. A. P. M. Fleming. We now learn that this will be a joint paper, his collaborator being Mr. J. H. Crossley, Wh.Ex., B.Sc., industrial heating expert to the Metropolitan-Vickers Electrical Co., Ltd.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

Halifax Corporation Tramways Committee received 33 applications for the post of tramways manager, vacated by Mr. B. Hall, who goes to Portsmouth. The list was reduced to five.

The appointment of Mr. F. E. Spencer, A.M.I.E.E., as Borough Electrical Engineer to the Birkenhead Corporation has been confirmed.

Mr. A. H. Darker, of Messrs. J. Stone & Co., Ltd., who is on a business tour of the world, has concluded his tour of India, Burma and Ceylon, and was, according to advice dated February 20th, on his way to Australia and New Zealand.

Dr. H. R. Wright, who succeeds the late Mr. Francis Hird as managing director of Siemens Brothers & Co., Ltd., was born in 1877. From early days his father, Mr. Henry S. Wright, of London, who was connected with chemical works in Manchester and Widnes, interested his son in scientific matters, encouraging him to make experiments in chemistry and physics. As evidence of the interest thus evoked, he thought out and himself constructed a coin feed apparatus when only about 10 years old. He commenced his scientific and engineering training at the Regent Street Polytechnic,



Dr. H. R. Wright.

London, under Professor H. Spooner, and continued at the Technical High Schools at Munich and Karlsruhe under Arnold, and at the University of Munich, where he took his doctor's degree at the early age of 21. Before returning to England, he acquired practical knowledge of Continental dynamo design at Vienna under the well-known Austrian designer, the late Professor Pichelmayer, and then obtained an appointment with Siemens Brothers & Co., Ltd., at Stafford. When the company decided to interest itself in the field of telephony and to extend its works at Woolwich, he joined, in October, 1907, the new organisation at the request of his former chief, Mr. F. Hird, at one time works manager of the Stafford works of Siemens Brothers Dynamo Works, Ltd., who had taken charge at Woolwich of this new work. During the 24 years of his service with the Siemens undertakings, he has been successively concerned with the activities of nearly every one of the departments, from designing large generator units to the introduction of mass production of small dry cells. During later years he was drawn more and more on to the administrative side, and in 1925 was appointed general manager to the company.

Mr. J. S. Peck, M.I.E.E., Fellow Amer.I.E.E., chief electrical engineer of the Metropolitan-Vickers Electrical Co., Ltd., sailed on April 2nd for New York, where he will attend, as one of the British representatives, the meetings of the International Electrotechnical Commission.

Mr. Alan A. Campbell Swinton, F.R.S., M.I.E.E., &c., is retiring from the electrical and general consulting engineering practice that he has carried on for the past 37 years at 66, Victoria Street, Westminster, S.W.1. He will continue special consulting work, also his electrical and engineering directorates and scientific activities, from his residence at 40, Chester Square, London, S.W.1.

There were 150 applications for the position of charge engineer to Mersey Power Company, and Mr. H. Pollard, Grad.I.E.E., of South Shore, has been appointed.

On March 31st, Mr. C. Furness, borough electrical engineer, Blackpool, was presented by the staff with a portrait of himself. The presentation was made by the Mayor at the annual meeting of the Electricity and Tramways Employés' Institute. Mr. Furness, in acknowledging the gift, gave interesting statistics respecting the great growth that had taken place in the electrical undertakings since his appointment in 1902.

Mr. H. J. Nisbett, for 12 years manager of the Torquay Tramways Co., who has retired, has been presented by the staff and employés with a book-case.

At a meeting of Accrington Corporation, recommended increases to heads of departments, including Mr. A. W. Clegg, electrical engineer, were negatived. The Electricity Committee recommended that the bonus of Mr. Clegg be increased from £166 to £214, which would have made his total remuneration £914 per annum.

Mr. A. Baxendale, who has terminated eight years as depôt superintendent for the Rawtenstall Tramways, and has been appointed rolling stock and works superintendent for the Wallasey Corporation, has been presented with a reading lamp and fountain pen by the staff and employés of Rawtenstall Tramways Department.

The Industrial Australian and Mining Standard states that Mr. R. W. Dalton, H.M. British Trade Commissioner in Australia, who is at present on a visit to New Zealand, will leave there early in April bound direct for London. During his absence, which is expected to be for 12 months, Mr. A. Simpson will act as senior Trade Commissioner. Mr. Simpson will remain in Sydney. The office in Melbourne will be in charge of Mr. F. W. Colman.

Obituary.—Mr. G. S. Corlett.—With further reference to the career of the late Mr. G. S. Corlett, the moment is appropriate for reminding our readers that he was one of the pioneers of the application of electricity to the coal-mining industry, and at a comparatively early date foresaw the great developments which have taken place in the mining electrical world. We understand that he was actually responsible for the installation of the first three-phase motor in any mine in this country. In March, 1923, Mr, Corlett had a serious breakdown in health, from which he never recovered. In spite of this handicap, he continued, almost up to the end of his life, to take a very keen interest in all that concerned the electrical world.

Mr. P. Dicks.—The death has taken place suddenly, at the age of 66 years, of Mr. Philip Dicks, head of the firm of Dicks, Ltd., electrical engineers, of Winchester. Mr. Dicks was a member of the committee of the Hampshire and District Branch of the Electrical Contractors' Association.

Herr A. Thyssen.—The death is reported of Herr August Thyssen, the celebrated German steel magnate, at the age of 85 years. He started with a very small capital, and in course of time amassed an immense fortune from industry, giving employment to 50,000 workmen. He continued business personally at his office right to the end.

Wills.—The late Mr. Leonard G. Tate, of the Electrical Contractors' Association, left £4,133 gross and £2,046 net personalty.

Sir Thomas D. G. Carmichael, Baron Carmichael of Skirling, a director of a number of companies, including the British Thomson-Houston Co., Ltd., and the Lanarkshire Tramways Co., Ltd., left £35,005 gross and £31,781 net personalty.

New Companies Registered.

City and General Radio Co., Ltd. (212,819).—Private company. Registered March 30th. Capital, £250 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and electrical apparatus and goods, &c. The subscribers (each with one share) are:—C. L. Bradley, 48, Norland Square, Holland Park, W.11, radio engineer; T. H. Smith, 25, Addison Way, Golders Green, N.W.11, merchant. The subscribers are to appoint the first directors. Solicitors: Lloyd, Richardson and Co., 115, Shaftesbury Avenue, W.C. Registered office: 79, Cannon Street, E.C.

Essex Radio Supplies, Ltd. (212,892).—Private company. Registered March 31st. Capital, £1,500 in £1 shares. Objects: To carry on the business of engineers, advisers, experts, consultants and contractors in connection with wireless telephony or telegraphy, &c. The subscribers (each with 5 shares) are:—A. Reich, 65, Lordship Road, N.16, merchant; Raie Reich, 65, Lordship Road, N.16, clerk. A. Reich is permanent director. Qualification, £5 shares.

Quain Sunlight Lamps, Ltd. (212,795).—Private company. Registered March 29th. Capital, £5,000 in 3,500 8 per cent. preference and 1,500 ordinary shares of £1 each. Objects:—To acquire any interests in patents relating to medical, surgical, therapeutic, hygienic, or general appliances of any kind, particularly electric and other lamps of all kinds, for producing light and heat, &c. The subscribers (each with one ordinary share) are:—P. R. Pitts, 28, Merton Road, Walthamstow, E.17, solicitor's managing clerk; E. Brooks, Harrow Cottage, Knockholt, Kent, solicitor's managing clerk. The subscribers are to appoint the first directors. Qualification, 100 ordinary shares or stock. Solicitors: Roche, Son & Neale, 1, Church Court, Old Jewry, E.C.2. Registered office: 17, Victoria Street, Westminster, S.W.1.

Sign Construction Co., Ltd. (212,809).—Private company. Registered March 29th. Capital, £1,000 in 2s. shares. Objects: To carry on the business of electricians, manufacturers of, and dealers in electrical and other advertisement signs, indicators, and apparatus, to construct, lay down, and fix all necessary cables, wires, lines, accumulators, lamps, and works, &c. The directors are:—H. S. Coleman, 5, Winchester Street, Victoria, S.W.1, electrical engineer; C. E. H. Fitch, address not stated; S. H. Instone, address not stated.

Alton District Electricity Co., Ltd. (212,738).—Registered March 27th. Capital, £5,000 in £1 shares. Objects:—To carry on in the United Kingdom or elsewhere the business of an electric light and power company in all its branches. Minimum cash subscription, 500 shares. The first directors are:—K. A. S. Moncrieff, "The Clough," Oxted, engineer; E. H. F. Reeves, Field House, Friern Park, North Finchley, N.12, director of a public company; Sir Home Gordon, Bt., 44, Park Lane, W.; J. Eustace, "Elmhurst," London Road, Chelmsford, engineer; Lt.-Col. G. C. Stowell, "Glendale," Church Road, Hanwell, secretary of public companies. Qualification, £100. Remuneration as fixed by the company. Solicitors: Wilkinson, Bowen, Jackson & Curran, 34, Nicholas Lane, E.C.4. Registered office, 424, Salisbury House, London Wall, E.C.2.

Official Returns of Electrical Companies.

Scammell & Abbott, Ltd.—First mortgage debenture dated March 17th, 1926, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Scammell, 20, Primrose Lane, Hall Green, Birmingham.

C. T. Briscoe & Son, Ltd. (173,926).—Capital, £5,000 in £1 shares. Return dated March 8th, 1926. 2,000 shares taken up. £110 paid. £1,890 considered as paid. Mortgages and charges, nil.

H. P. Electrical Co., Ltd. (187,715).—Capital, £1,000 in £1 shares. Return dated September 30th, 1925 (filed February 18th, 1926). 654 shares taken up. £654 paid. Mortgages and charges, nil.

Reflek Radio Co., Ltd.—F. Davies, of 245, Kingsland Road, E.2, was appointed receiver on March 18th, 1926, under powers contained in debentures dated December 22nd, 1925.

Flather & Co., Ltd. (74,602).—Capital, £20,000 in £1 shares. Return dated November 10th, 1925 (filed March 20th, 1926). 11,044 shares taken up. £9,544 paid. £1,500 considered as paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Marconi International Marine Communication Co., Ltd.

Mr. F. G. Kellaway (deputy chairman and managing director) presided at the annual meeting on March 31st, in the absence of the chairman, Senatore G. Marconi. In presenting the report, Mr. Kellaway said that the remarkable increase in the net profit—over £35,000—was due to the drastic administrative economies which had been effected and to the settlement of war-service claims against the Italian Government. The work of retrenchment was still proceeding and further reductions should be effected during 1926. The directors considered it unwise to pay too large a dividend and it was their intention to build up a substantial reserve for obsolescence and to carry forward a greatly increased amount. They intended to maintain their predominant position by keeping all their plant up to date. While the net profit had shown a substantial increase, it had not regained the level of some previous years; that was due to the continued depression in the shipping industry. Nearly 200 ships per annum had had to be dismantled with a consequent loss of business to the company. There had been a slight improvement, particularly on the Clyde, but it would be some time before the new tonnage would have its effect. They could therefore not look forward to any considerable expansion in new business during the current year, but they must look for the maintenance of their present favourable position and to a continuation of their retrenchment policy. The chairman then proceeded to review the accounts (*vide* Elec. Rev., March 26th, p. 509). Referring to the strike of wireless operators, Mr. Kellaway said that after three months the men had agreed to negotiate. It was hoped that the result would be to place the relations of the operators and the companies on a foundation of mutual confidence and respect. On the technical side, great improvements had taken place in the Marconi system of direction finding. An increasing number of shipowners were realising the value of the direction finder and many reports praising the instrument had been received. During 1925 the Marconi public-address system had been applied in ships to relay the music of ships' bands, &c. Mr. Ogle, the secretary of the company, had left to take up a position with Marconi's Wireless Telegraph Co., Ltd., and Mr. B. O. Collis, formerly assistant secretary, had taken his place. The report and accounts were adopted.

British Aluminium Co., Ltd.

The annual meeting was held on March 30th, Col. S. H. Pollen, C.M.G., presiding. In moving the adoption of the report, the chairman said that the net profit for the year had amounted to £550,434, as against £491,973 for the previous 12 months, and the trading profit was £517,105, as compared with £476,709, an increase of £40,396. The past year had been a favourable one for the company. They were fortunate in having an ample supply of water for the hydro-electric installations, and the output of metal from the works showed a record tonnage. Trading conditions continued to be satisfactory, and the demand for their products had, on the whole, been well maintained. Prices remained fairly steady and favourable. As the result of research work, continuously carried out by the staff, there had been improvement in methods of production, which had gone far to counterbalance the prices of raw materials and other charges incidental to production, which showed no indication of decrease. The development of non-corroding alloys had led to a marked increase in the use of aluminium in marine construction, and the textile industry was also adopting the metal more extensively. Among the newer uses, particular interest attached to aluminium alloy road wheels. The electrical industry year by year augmented its demands for aluminium for transmission lines, bus-bars, and other applications. The proposals of the Government for the more general distribution of electricity throughout the country should, if proceeded with, lead to a greater extension of overhead transmission lines, and they hoped that the aluminium industry would benefit from that development. The world's annual use of aluminium to-day in tonnage was approaching double the consumption of tin, and the world consumed in greater quantity only three other non-ferrous metals, namely, copper, lead and zinc. During the year they had added to the capacity of the alumina plant at Burntisland, and had found it necessary to further expand their rolling mills. Considerable extensions had been carried out at the works in Norway, in which they had a part interest, and the benefit from those would begin to accrue during the current year in the form of an increased supply of metal. Substantial progress had been made in the carrying out of the civil engineering portion of the Lochaber water-power scheme. The principal work to be undertaken was the driving of the main tunnel from Loch Treig to Fort William. That tunnel would be 16 ft. in diameter, and would have a total length of 15 miles. To enable this work to be tackled on a broad front and to be pushed with energy, it was necessary to carry out preliminary and temporary works of considerable magnitude, including the construction of a temporary hydro-electric station which involved the driving of a tunnel over a quarter of a mile long and the installation of plant of 4,500 h.p. capacity to provide power for the whole of the constructional work. Twenty-four miles of h.p. transmission lines had been erected, connecting up motor-driven air-compressing plants. Those various temporary works had been carried out by the contractors, Balfour, Beatty & Co., Ltd., with great expedition, and were now practically completed, and tunnelling operations were proceeding satisfactorily. It was a matter of great satisfaction to the directors to be able to submit accounts which exhibited still further improvement in the affairs of the company, and to be in a position to recommend, in addition to a dividend at the rate of 10 per cent. per annum, a bonus of 2½ per cent. As to the future, they would not expect him to prophesy, but he could say that up to the present no disturbing factor was evident. They could not expect all conditions to be always favourable, but they had no reason to anticipate that the results of the year now entered upon would prove otherwise than satisfactory. The report and accounts were adopted.

Llanelly and District Electric Supply Co., Ltd.

The annual meeting was held on March 30th. Mr. A. R. Holland, the chairman, in presenting the report, said that although the number of customers had increased during the year, the depression in the district had impeded the company's normal progress. The directors had adopted a progressive policy, laying a network of mains in districts which were expected to show future development. Given an improvement in conditions, there was little doubt that the company's business would show a substantial increase. Referring to the new Electricity Bill, Mr. Holland said that he did not think that the measure would encourage the development and use of electricity or cheapen the cost of generation and distribution. It was obvious that the provisions of the Bill would need considerable amendment before they could be held to deal fairly with the rights of private enterprise, which had done so much to further the development of the industry. There were indications of a slight improvement of trade in the company's area, but there were also considerable difficulties to be surmounted. The purchase of the property of the Gorseinon Electric Light Co., Ltd., had been completed; the undertaking would prove a satisfactory addition to the company's assets. The transport section of the business had been adversely affected by uncontrolled omnibus competition. Debenture stock and preference shares had been issued during the past year, and further capital was necessary to meet extra expenditure, including the connecting-up of a large colliery undertaking. The directors regretted that the ordinary dividend was lower, but they considered that they were adopting the best course.

British L. M. Ericsson Mfg. Co., Ltd.

The annual meeting was held on March 30th under the chairmanship of Mr. W. M. Crowe. In presenting the report, the Chairman mentioned that 1925 had been a record year for the company. There were definite signs of an improvement in industry and that the period of trade stagnation was passing. As indicating the amount of potential business which existed in this country, Mr. Crowe said that Great Britain was fourteenth in the list of the world's telephone users. There had been an enormous expansion in the United States and Canada, largely on the automatic system, and most progressive countries were developing along that line. At the Beeston works they had an efficiently managed automatic telephone department which would be capable of undertaking exchange work of almost any dimensions. The report and accounts were adopted, and at a subsequent extraordinary meeting an increase in the capital of the company to £500,000 was sanctioned. It is proposed to issue about 100,000 preference shares of £1 each for cash, and, later, to capitalise part of the reserve and issue ordinary shares to the present shareholders. It is also intended to raise the preference dividend from 6 to 7 per cent.

South London Electric Supply Corporation, Ltd.

Sir Harry Renwick, K.B.E., presided at the annual meeting on March 30th, and in the course of his speech, said that the results for the past year were satisfactory from every point of view. He quoted figures to show the progress which had been made since 1918 when the company commenced to take a partial bulk supply from the County of London Electric Supply Co. The dividend in 1918 was 5 per cent.; 15 per cent. had been paid for the last three years. He considered that those figures were eloquent. Referring to the reorganisation of supply in the

London area, Sir Harry said that the companies concerned hoped to be able to deal with the matter during the current year. In the meantime, the company was arranging to take a greater bulk supply from the County of London Co. They were of the opinion that they would not be affected by the Government's Electricity Bill, but the directors were watching the company's interests. The prospects for the current year were favourable, and the progress in new business was so far satisfactory. The report and accounts were adopted.

Electric Supply Corporation, Ltd.—The gross earnings for 1925 amounted to £101,024 and the sum taken into net revenue account to £46,971. After meeting charges, including the preference and interim ordinary dividends, there remains a surplus of £36,858. It is proposed to transfer £5,000 to general reserve, and £12,000 to depreciation, to write off balance of expenses of share issue, &c., £2,000, to write off £1,058, the cost of obtaining Orders for Hitchin and Exmouth, and to pay a final dividend of 6 per cent. on the ordinary shares (making 10 per cent. for the year), together with a bonus of 1 per cent. This will leave £6,300 to be carried forward. The amount of energy sold fell from 9,397,486 to 8,762,994 kWh. The report states that the Hendon Electric Supply Co. has paid a dividend of 15 per cent., but the Dumbarton Tramways Co. has again been unable to make any distribution. Meeting, April 15th.

Bath Electric Tramways, Ltd.—The annual meeting was held on March 31st. In the course of his speech the chairman (Mr. E. H. R. Trenow) said that the accounts showed a slight general improvement. The fare arrangement under which the company operated, somewhat heavily penalised it. In addition to the fact that while labour and materials cost about 100 per cent. more than in pre-war days and the fares were only about 40 per cent. higher, the company had to provide for renewals out of revenue each year. During 1925 nearly two miles of track had been overhauled and reconstructed and some of the loops had been extended. The number of passengers carried showed a satisfactory increase, but the average revenue was lower. So far this year the improvement was being maintained.

A. Reyrolle & Co., Ltd.—The profit for the past year was £70,621 and the addition of £19,206 brought forward gives an available balance of £89,827 (as compared with £82,709 in 1924). The directors recommend that a dividend of 12½ per cent. shall be paid on the ordinary shares (as in 1924), that £15,000 shall be transferred to reserve, and that £29,873 shall be carried forward. The capital expenditure during the year was £43,355, representing additions to offices, increased storage accommodation, and new machines. The recreation ground has been completed and a sum of £2,038 has been provided out of the year's profits. The work completed during the year was substantially larger than in 1924 and the exports of the company's manufactures continued to increase. The meeting is to be held to-day (Friday).

London Electric Wire Co. & Smiths, Ltd.—Sir George H. Fisher-Smith (chairman) presided at the annual meeting on March 31st, and in moving the adoption of the report and accounts, said that although the past year started with considerable promise there was a distinct slackening off during the course of the year. As a result the company's output had declined and the profit was £5,856 lower than in 1924. With regard to the current year the company was receiving a fair share of orders. If the legislative assistance promised to the electrical industry could be arranged to function quickly, good should result, but the maximum benefit would not be obtained unless individual effort was given full scope and unless there was complete co-operation between the interests concerned.

Lancashire Dynamo and Motor Co., Ltd.—After providing for debenture interest and depreciation, the available balance from 1925 is £20,201, to which is added £204 brought forward, making £20,405. The preference dividend has been paid and it is proposed to distribute 7½ per cent. on the ordinary shares, to transfer £5,000 to reserve and to carry forward £2,147. The report states that the results were again somewhat better than those of the preceding year, and the output was larger. The Company appears to be getting a good proportion of the orders which are being placed. The Crypto agreement has again worked satisfactorily in the interests of both companies.

Bournemouth and Poole Electricity Supply Co., Ltd.—The report for 1925 shows a balance on the revenue account of £153,407, to which is added £10,881 brought forward, making £164,288. After the payment of debenture interest, interim dividends, &c., and transferring £65,000 to general reserve, £25,000 to depreciation, &c., reserve, and £2,500 to staff superannuation reserve, there remains £40,192. It is proposed to pay a final dividend at 5½ per cent. on the ordinary shares (making 10 per cent. for the year), plus a bonus of 4 per cent., free of tax, leaving £10,076 to be carried forward. The capital expenditure during the year was £90,380. The amount of energy sold was 9,715,129 kWh. The meeting is to be held on April 15th.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The annual meeting was held on March 26th, Mr. F. Stirling Newall presiding. In the course of his speech, the chairman said that the accounts were satisfactory. They had expended £1,719 on capital account, the balance of the capital expenditure on the provision of the extension to the Horden power station. That completed their capital commitments, as they had no additional proposals before them at the moment. Their investments had been increased by £10,424, which was invested in Government securities. The company was in a good financial position. The output from the stations was satisfactory, being more than 13 per cent. over the total output in the previous year. Two of the stations had not worked during the latter half of 1925, but in spite of that the aggregate output had gone up, mainly due to the operation of the Horden station extension.

Richmond (Surrey) Electric Light and Power Co., Ltd.—The profit for the past year was £36,239, and the addition of £1,823 brought forward gives an available balance of £38,062. After meeting debenture interest, &c., reserving £2,000 for staff superannuation and £7,250 for depreciation, &c., and transferring £7,000 to general reserve, there remains a balance of £5,763. Out of this the directors recommend the payment of a dividend of 10 per cent. on the old ordinary shares, leaving £2,630 to be carried forward. The amount of energy sold increased to 2,522,274 kWh. During the year an issue of 168,670 ordinary shares of £1 each was made. Meeting, April 15th.

Cork Electric Tramways and Lighting Co., Ltd.—The accounts for 1925 show an available sum of £22,881 (including £7,337 brought forward), after providing for debenture interest, &c., and transferring £4,500 to general reserve, and £15,000 to depreciation and renewals reserve. Interim dividends absorbed £9,613, and it is proposed to pay a final dividend of 3 per cent. (making 6 per cent. for the year) on the ordinary shares, and to carry forward £9,818. The receipts for the year were lower owing to the reduction of charges, a decrease in tramway traffic, &c. Meeting, April 15th.

River Plate Electricity Co., Ltd.—After meeting expenses, the profit for the past year is £47,292, and the addition of £12,169 brought forward makes £59,461. It is proposed to pay a dividend of 11 per cent. upon the ordinary shares (3 per cent. already paid) to transfer £14,701 to general reserve, and to carry forward £7,318. The directors also recommend that £34,701 of the general reserve shall be capitalised and allotted to the ordinary shareholders in the proportion of one to ten. The dividend for 1924 was 10 per cent. The meeting was to be held yesterday (Thursday).

Ransomes & Rapier, Ltd.—In their report for 1925 the directors state that although the results were satisfactory having regard to the state of the engineering industry, they consider that the future presents not a little anxiety. The amount available, including the balance brought forward, is £32,639. A dividend of 7 per cent., free of tax, is recommended on the ordinary shares (as against 12 per cent.), and a balance of £23,231 is carried forward.

South Wales Electrical Power Distribution Co., Ltd.—The balance on working for the past year was £96,762. After providing for debenture interest and depreciation, £7,073 remains. The dividend is to be paid on the 5 per cent. preference shares, and a balance of £807 is to be handed over to the South Wales Power Co. Meeting: April 16th.

South Wales Power Co.—The report for 1925 states that the administration of the undertaking was re-vested in the South Wales Electrical Power Distribution Co., whose report is dealt with above. The company's accounts show a net surplus of £18,441, after meeting debenture interest and preference dividends. It is proposed to put £10,000 to reserve and to carry forward £8,441. It is stated that apart from the adverse conditions prevailing in the area, some time must elapse before the expenditure upon extensions becomes more fully productive. Meeting: April 16th.

Italian Company.—*La Società Ligure Toscana d'Elettricità*, of Milan, reports that during 1925, the output of the company's stations reached a total of 171,094,400 kWh, as compared with 147,974,700 kWh in 1924. The net profit advanced from 10,956,308 to 14,013,131 lire, which enables a dividend of 10 per cent. to be paid. In order to provide for further extensions, the capital of the undertaking is being increased from 80 to 120 million lire.

German Company.—The *North German Cable Works Company*, Neukolln, proposes to carry forward the comparatively small net profit earned in 1925. The directors state that business in the current year has been very satisfactory and shows a considerable improvement over that in 1925.

Belgian Company.—The *Société des Constructions Electriques Belgique* (Liége) reports a net profit of 109,140 fr. for the last financial year, as compared with a loss of 761,303 fr. in 1924.

English Electric Co., Ltd.—The directors announce that, while the profit for 1925 is sufficient to permit of the payment of the full preference dividend, they are unable to recommend any dividend on the ordinary shares. Five per cent. was paid for each of the four preceding years, while in 1919 and 1920 eight per cent. was paid.

J. Stone & Co., Ltd.—The balance from 1925 (including £135,037 brought forward) is £296,115. It is proposed to transfer £130,000 to reserve, to pay a dividend of 2s. per ordinary share, and to carry forward £67,075.

Calcutta Electric Supply Corporation, Ltd.—It is stated in the financial Press that an offer of additional ordinary shares at a price providing a considerable bonus will shortly be made to the existing ordinary shareholders.

Stocks and Shares.

Tuesday Evening.

Holiday influences are very obvious in the Stock Exchange markets. Business became slack and uninteresting after the accumulation of post-orders had been dealt with on Tuesday morning. Prices are not greatly changed from those of a week ago. The principal alteration is a drop of 4s. 6d. in English Electrics, upon the wholly unexpected passing of the dividend.

It had been taken for granted that the English Electric would pay at least 5 per cent. for 1925, the same as in the four previous years. People are unable to account for the directors' decision, and they await, almost impatiently, the report and the meeting, for the unravelling of what is a genuine mystery in view of the impression that such companies as the English Electric had enjoyed a good year's trading.

The effect of this announcement caused sympathetic, if unnecessary, dulness in General Electrics, where the ordinary drooped to 30s. 9d. and the preference to 23s. The cable manufacturing shares are steady. Siemens at 32s. 6d. have gained 1/16. India Rubbers are sixpence lower. Both classes of Metropolitan-Vickers have gone ex dividend. As is usual at this time of year, a number of electricity prices are now ex dividend, and the present changes this week in our price-lists represent, in many cases, the deductions of the dividend amounts from the previous quotations.

It may be of service to observe, here, that when a price is officially quoted ex dividend in the Stock Exchange, the practice is to take off, as nearly as possible, the net amount per share paid by the company. In other words, the income-tax is duly taken into consideration. Where prices are regrettably wide, as they are, for example, in certain electricity issues, the deduction is of necessity approximate and not exact. Free acknowledgment may be made of the fact that official quotations are less misleading than they used to be, but there remains wide scope for further improvement in the way of narrowing the margins between the nominal purchase and sale prices, of which the middle figures, taken from the Stock Exchange official sources, are those given in our tables.

When prices are marked ex dividend, and there is no immediate recovery, the yields assume, of course, a more attractive aspect. As an example, Brompton ordinary may be cited, the return, on this week's price, being £6 3s. per cent., or about 5s. higher than that before the holiday. The critic will promptly, and correctly, maintain that this difference should be rectified, from the mathematical point of view, by making allowance for the accrued dividend in last week's price. To carry this into practice, however, and to calculate, every week, the increasing amount of dividend carried in every price, would not only entail doubling or trebling the work, but might lead seriously astray those who are interested in shares upon which the dividends fluctuate.

Apart from some half-score of ex dividend markings, the electricity supply share list is nearly unchanged. The market regarded with composure the second reading of the Electricity (Supply) Bill. It is assumed that the real modifications will come in the next stage upon which the Bill is about to enter.

The dramatic rises in Tube Railway stocks which occurred last week have been well maintained, and the glorious weather that prevailed throughout the holidays formed an added incentive to the previous cheerfulness. London Electric ordinary stock has strengthened to 49, showing a gain of 7 points in three weeks. Underground £10 shares are 5s. higher this week at 3¼.

Electric Supply Corporation shares are slightly harder at 33s. upon repetition of the 11 per cent. dividend. Gross earnings for 1925 were £101,024, or £360 below those of the previous twelvemonth. Midland Electric Corporation Power ordinary have risen to 53s. 9d. Bath Electric Tramways 5 per cent. preferred went back to 11s. 3d., in spite of the 1 per cent. increase in the dividend, which gives the shares 3½ per cent. The chairman, at the meeting last week, spoke hopefully of the company's outlook: he mentioned trade conditions and the weather as being two important factors which are beyond the board's control. The Cork Electric Tramways took less and spent less, last year, the upshot being the maintenance of a 6 per cent. dividend on the ordinary shares, and an increase in the carry forward.

Cromptons have gone back to 15s., and the preference to 17s. British Electric Transformer 7 per cent. preference at 19s. 6d. are about 9d. higher on balance.

Anglo-Argentine Tramways continue depressed for the reasons set out in our notes a week ago. Brazilian Tractions, after being 89, rallied to 90½. British Columbia preferred is better and a slightly better tendency is manifest in Mexican Utility issues.

Cable stocks and shares have few variations in their group. Marconis maintain their advance at 23s. 9d. The company announces inauguration of a wireless service to Moscow. Mr. Marconi has recently undergone an operation from which he is recovering rapidly, Mr. Kellaway stated at the meeting of the Marconi International Marine Company. Shipping showed a little improvement in 1925, said that chairman, but the depression had shifted to the shipbuilding industry. "Since 1921," he observed, "British shipping has passed through one of the worst periods in its history."

Engineering shares are not affected, so far, by the recommendations of the Coal Commission. Babcocks keep close to 53s. 9d. Rubber shares show but trifling signs of activity. The Stock Exchange view is that most markets are likely to move upon humdrum lines until people know what is going to be disclosed by the Budget.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price Apr. 6. 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	—	60/9	—	4 13 4
Brompton Ordinary	1	10	10	1⅝xd.	—	*6 3 1
Charing Cross Ordinary	1	14½	15	45/9	—	6 11 2
do. do. 4½ Pref. ...	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2½xd.	—	5 16 8
City of London	1	15	15	44/6xd.	—	6 14 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/6xd.	—	5 16 5
County of London	1	15	15	57/-xd.	—¼	5 5 3
do. do. 6 % Pref.... ...	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/6	—	5 19 2
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation ...	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	13⅜xd.	—	5 9 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—	6 0 0
Newcastle-on-Tyne Ordinary ...	1	7	7	1⅛xd.	—	6 4 5
do. 5% Pref. ...	1	5	5	18/-xd.	—	5 11 1
do. 7% Pref. ...	1	7	7	24/6xd.	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅝	—	5 13 10
South London...	1	15	15	2½xd.	—	6 0 0
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/9	—	6 17 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	20/-	—	7 10 0
Yorkshire Elec.	1	8	8	25/6	—	6 5 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66½	—	7 10 5
do. District	,,	3½	3½	50	—	7 0 0
Underground Electric Ordinary ...	10	Nil	Nil	3¼	+¼	Nil
do. do. "A" ...	1/-	Nil	Nil	10/-	—	Nil
do. do. Income ...	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	Dividend. 1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23¾	—	6 6 4
Automatic Telephone	1	3	6	2 7/16	—⅛	4 2 0
Chili Telephone	5	6	5	6⅞	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	17⅞xd.	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17⅞	—¼	*5 12 8
do. do. Pref.	10	6	6	10⅝	—	5 11 7
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45⅞	—	*4 13 5
Marconi...	1	10	10	1 3/16	—	8 8 6
Marconi Marine	1	10	7½	18/9xd.	—	8 0 0
Oriental Telephone Ord.	1	12	12	2 1/16	—	*5 16 4
United R. Plate Tel....	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2 1/16	—⅛	9 7 2
do. do. 2nd Pref. ...	5	6	6	2½	—	12 0 0
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord. ...	,,	6	6	122½	—	4 18 0
do. do. 6% Pref. ...	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	91	—½	5 10 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	84½	—	5 18 4
do. do. Preferred ...	,,	96/-	96/-	105½	+1	*4 9 4
do. do. Deferred ...	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb. ...	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	62½	+1	8 0 0
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	62½	—	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	12	53/9	—	*4 9 4
British Aluminium Ord.	1	5	10	42 5/16xd.	—	4 18 5
British Elec. Transformer Pref. ...	1	Nil	7	19/6xd.	+9d.	7 3 7
British Insulated Ord.	1	15	15	3½xd.	—	4 16 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 1/16	—	4 14 10
do. 6½% Pref....	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	15/-	—1/9	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 1
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	14/6	—4/6	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—6d.	5 13 1
,, Ord.	1	5	7½	30/9	—6d.	4 17 7
Henley	1	15	16	3⅜	—	4 5 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber...	1	5	5	1⅛	—6d.	*4 9 0
Johnson & Phillips	1	10	10	3	—	3 6 8
Met.-Vickers Ord.	1	8	8	24/6xd.	—	6 10 0
do. Pref.	2	8	8	2⅜xd.	—	6 14 9
Siemens Ord.	1	—	7½	1⅛	+1/16	4 12 4
Telegraph Construction	12	20	10	28½xd.	—	*4 4 9

*Dividends paid free of Income Tax.

India's Electrical Imports.

Principal Sources of Supply.

FULL details of India's import trade in 1924-25 in electrical goods, showing the principal countries of supply, have recently been issued. From these the following particulars have been extracted. The corresponding figures for 1923-24 have been added for purposes of comparison and a note of increases or decreases given.

	1923-24. Rs.	1924-25. Rs.	Inc. or dec. Rs.
Control and switchgear.—			
Total	3,618,000	3,647,000	+ 29,000
From United Kingdom ...	3,046,000	3,410,000	+ 364,000
,, United States	236,000	94,000	− 142,000
Generators, alternators and dynamos.—			
Total	3,920,000	3,185,000	− 735,000
From United Kingdom ...	2,953,000	2,948,000	− 5,000
,, United States	845,000	87,000	− 758,000
,, Switzerland	4,000	38,000	+ 34,000
,, Germany	35,000	69,000	+ 34,000
,, Italy	23,000	8,000	− 15,000
Motors.—			
Total	7,226,000	3,972,000	−3,254,000
From United Kingdom ...	4,631,000	3,345,000	−1,286,000
,, United States	1,754,000	343,000	−1,411,000
,, Sweden	449,000	51,000	− 398,000
,, Germany	209,000	127,000	− 82,000
,, Switzerland	17,000	37,000	+ 20,000
,, Italy	41,000	12,000	− 29,000
Transformers.—			
Total	1,539,000	1,322,000	− 217,000
From United Kingdom ...	958,000	1,096,000	+ 138,000
,, United States	542,000	182,000	− 360,000
,, Germany	8,000	11,000	+ 3,000
,, Italy	11,000	6,000	− 5,000
,, Holland	—	25,000	+ 25,000
Turbo-generating sets.—			
Total	1,111,000	407,000	− 704,000
From United Kingdom ...	800,000	252,000	− 548,000
,, Denmark	245,000	—	− 245,000
,, United States	66,000	139,000	+ 73,000
Other electrical machinery.—			
Total	4,844,000	7,693,000	+2,849,000
From United Kingdom ...	3,985,000	6,606,000	+2,621,000
,, United States	655,000	673,000	+ 18,000
,, Switzerland	17,000	3,000	− 14,000
,, Germany	49,000	143,000	+ 94,000
,, France	6,000	21,000	+ 15,000
,, Italy	35,000	28,000	− 7,000
,, Belgium	14,000	14,000	—
,, Czecho-Slovakia ...	—	14,000	+ 14,000
Electric fans and parts.—			
Total	2,915,000	2,553,000	− 362,000
From United Kingdom ...	1,733,000	1,315,000	− 418,000
,, Italy	466,000	482,000	+ 16,000
,, United States	345,000	178,000	− 167,000
,, Germany	325,000	558,000	+ 233,000
Wires and cables, rubber insulated.—			
Total	2,716,000	2,902,000	+ 186,000
From United Kingdom ...	2,450,000	2,681,000	+ 231,000
,, United States	99,000	33,000	− 66,000
,, Germany	32,000	139,000	+ 107,000
Ditto, other insulation.—			
Total	2,228,000	1,966,000	− 262,000
From United Kingdom ...	1,828,000	1,837,000	+ 9,000
,, United States	200,000	10,000	− 190,000
,, Germany	69,000	92,000	+ 23,000
,, Holland	80,000	17,000	− 63,000
,, Switzerland	26,000	—	− 26,000
Telegraph and telephone wires and cables.—			
Total	896,000	212,000	− 684,000
From United Kingdom ...	892,000	180,000	− 712,000
,, Germany	—	18,000	+ 18,000
,, Japan	—	12,000	+ 12,000
Bare copper wire, electrolytic, other than telegraph and telephone wire.—			
Total	1,135,000	1,584,000	+ 449,000
From United Kingdom ...	1,053,000	1,430,000	+ 377,000
,, Germany	14,000	25,000	+ 11,000
,, Holland	7,000	96,000	+ 89,000
,, Japan	52,000	25,000	− 27,000
Telegraph and telephone instruments and apparatus.—			
Total	3,240,000	865,000	−2,375,000
From United Kingdom ...	3,197,000	760,000	−2,437,000
,, United States	20,000	66,000	+ 46,000

	1923-24. Rs.	1924-25. Rs.	Inc. or dec. Rs.
Electric glow lamps.—			
Total	1,486,000	1,232,000	− 254,000
From United Kingdom ...	577,000	407,000	− 170,000
,, Holland	582,000	531,000	− 51,000
,, Germany	209,000	163,000	− 46,000
,, Austria	39,000	77,000	+ 38,000
,, United States	24,000	18,000	− 6,000
Electric lamps, other sorts.—			
Total	592,000	275,000	− 317,000
From United Kingdom ...	158,000	47,000	− 111,000
,, Germany	141,000	46,000	− 95,000
,, United States	207,000	152,000	− 55,000
Batteries.—			
Total	624,000	729,000	+ 105,000
From United Kingdom ...	370,000	371,000	+ 1,000
,, United States	203,000	203,000	—
,, Germany	45,000	150,000	+ 105,000
Electric carbons.—			
Total	64,000	89,000	+ 25,000
From United Kingdom ...	59,000	75,000	+ 16,000
Accumulators.—			
Total	265,000	1,206,000	+ 941,000
From United Kingdom ...	214,000	987,000	+ 773,000
,, United States	38,000	176,000	+ 138,000
Electric condensers (nearly all from U.K.)—			
Total	2,000	29,000	+ 27,000
Electric bell apparatus.—			
Total	4,500	13,500	+ 9,000
From United Kingdom ...	2,600	2,200	− 400
,, Germany	1,800	6,300	+ 4,500
,, United States	—	4,300	+ 4,300
Lighting accessories and fittings, including switches.—			
Total	902,000	1,392,000	+ 490,000
From United Kingdom ...	695,000	861,000	+ 166,000
,, Germany	144,000	157,000	+ 13,000
,, United States	31,000	332,000	+ 301,000
Meters.—			
Total	524,000	645,000	+ 121,000
From United Kingdom ...	375,000	437,000	+ 62,000
,, Germany	82,000	161,000	+ 79,000
,, Switzerland	37,000	8,000	− 29,000
,, United States	24,000	35,000	+ 11,000
Electro-medical apparatus.—			
Total	105,000	106,000	+ 1,000
From United Kingdom ...	72,000	46,000	− 26,000
,, United States	13,000	27,000	+ 14,000
,, Denmark	—	15,000	+ 15,000
,, Germany	21,000	8,000	− 13,000
Switchboards (other than telegraph and telephone).—			
Total	719,000	408,000	− 311,000
From United Kingdom ...	488,000	389,000	− 99,000
,, United States	205,000	10,000	− 195,000
,, Germany	500	5,000	+ 4,500
Electrical goods and apparatus, unenumerated.—			
Total	4,038,000	3,219,000	− 819,000
From United Kingdom ...	2,934,000	2,154,000	− 780,000
,, Germany	475,000	599,000	+ 124,000
,, United States	397,000	285,000	− 112,000
,, Japan	107,000	101,000	− 6,000

Export Credits Insurance.—The report is to be issued immediately of the Committee appointed last July by Mr. A. M. Samuel, Parliamentary Secretary of the Department of Overseas Trade, to consider the question of insurance against bad debts in export trade. The task of the Committee was to see whether it was possible to devise a scheme for the issue of policies for the insurance of bills which may be drawn for British goods sent into foreign countries, where there may be risk of default owing to war or political trouble, in addition to the ordinary risks of commercial credit. It is understood that the Committee has found it possible to devise a scheme, which, it is believed, answers the necessary requirements. As the Committee comprised representatives of the banks, accepting houses, insurance companies, Lloyd's, the Association of British Chambers of Commerce, and the Federation of British Industries, together with the Comptroller-General of the Department of Overseas Trade, there is every hope that the scheme will find general acceptance.—*The Times.*

High-Power Fusible Cut-Outs.

Some Factors which Influence their Rupturing Capacity, and Research Developments.

By L. C. GRANT, A.M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers.)

(*Concluded from page 560.*)

Iron-clad Oil-immersed Cut-outs.—Appropriate samples have been tested on short-circuit up to 6,600 volts with satisfactory results, but no tests have been carried out by the author on the higher-voltage patterns. Fuse length and current density are together responsible for the energy loss and consequent heating of the oil. A satisfactory fixed break was evolved for low-pressure work, but for high pressure springs were added to ensure a rapid and long break, and, finally, the contacts were so arranged that in breaking a 50,000-kVA short-circuit

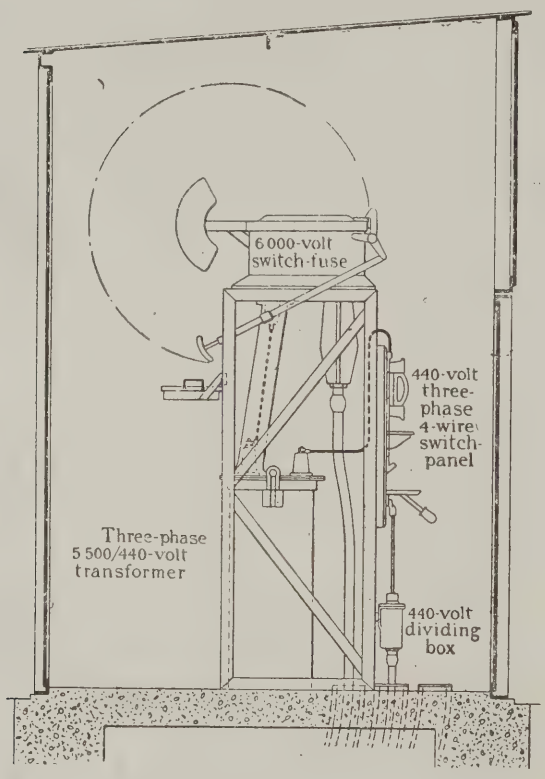


Fig. 5.—Oil-immersed 6,600-V Fuse Installation.

at voltages up to 6,600 V, the distance between the contacts is about four times the maximum arcing distance. In reducing the fuse length, a limit is reached when the end connections exert an appreciable effect on the cooling of the fuse wire. A length of 1½ in. was finally adopted as a workable value; a certain amount of cooling is exercised by the contacts on a fuse wire of this length, but it is consistent, and accurate calibration is possible.

Extinguishing the arc within the first half-cycle, which has been shown by test to reduce the shock to plant, mains, &c.,

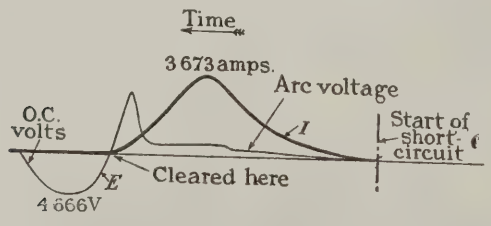


Fig. 6.—Short-circuit Test on Stabilised Arc Fuse at 5,000-V.

to a remarkable extent, necessitated a speed of 30 ft. per second, and the spring was finally arranged for 40 ft. per second. This gives the maximum speed of break without introducing the risk of pressure-rises through enforced decay of the current, an important point. It is of the utmost importance that the speed of break should not be too high, or else the arc will be lengthened too rapidly, a condition analogous to introducing resistance into the circuit.

After oil fuses of this pattern had been in service for some time, the fusible elements gradually became covered with a brown deposit and the metallic portion appeared to be reduced in section cumulatively, until finally the element would melt on reduced current, or even spontaneously. This appeared to be a recrudescence in a new form of the old oxidation trouble experienced with air cut-outs, and in oil was experienced with any ratio of fusing current to load current lower than 3 to 1. In order to avoid this trouble, while retaining a reasonable fusing factor, bi-metallic fusible elements having a copper core sheathed with tin or tin-lead were finally adopted.

In short-circuit tests at 6,000 volts, when breaking 10,000 kVA, the sustained pressures in oil tanks averaged 20 lb. per sq. in. At 20,000 kVA the average of a number of tests was 35 lb. per sq. in., and at 60,000 kVA the pressures reached 150 lb. per sq. in. several times, but averaged more nearly 80 lb. per sq. in.

Oil-immersed fusible cut-outs are suitable for controlling power-station auxiliary motors, for large power industrial work, for networks, &c. They are rated at voltages up to 660 between phases and, with modifications, for 3,000-volt industrial work as an alternative to the high-pressure (proper) oil fuse. It has been found necessary, as with the high-pressure fuses, to use bi-metallic elements. The fuses are not held by any tensioning arrangement, but are retained between fixed contact blocks of considerable mass to reduce heating and the effects of arcing. They withstand the full starting current for 2 seconds without blowing, but should clear a sustained stalling current.

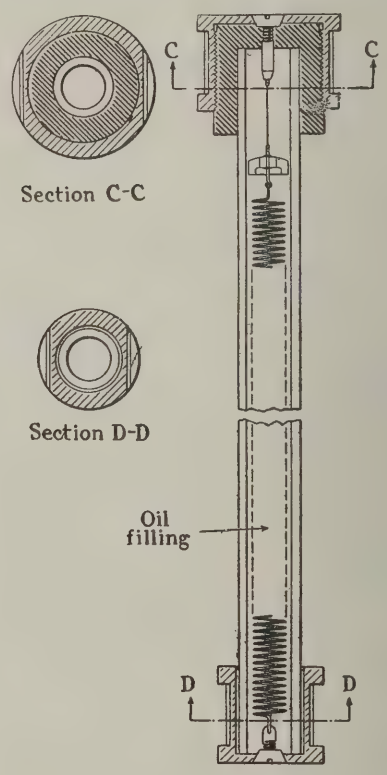


Fig. 7.—Section of Resistance Fuse.

The oil-fuse has been proved capable of breaking load current and isolating a high-pressure circuit by simply swinging back the lid without affecting the fusible elements; it is possible to close it on full load and moderate short-circuits with safety. Fig. 5 shows a typical 6,600-volt oil-immersed fuse installation. A new form of cut-out has its fusible element oil-immersed and the arc characteristic can be consistently reproduced, fig. 6; the arc voltage is quite stable, there being none of the vicious harmonics usually found in an arc characteristic. The process of rupture, as shown in the oscillogram, is clean and rapid and the performance quite different from anything previously experienced. In the test illustrated, the fuse cleared a short-circuit power of 3,673 amperes at 4,666 volts without any visible or audible evidence of its having operated at all. The overall dimensions of the fuse are comparable with many of the old forms of cartridge fuse in common use, which in the test described in this paper proved to be inadequate.

Limiting Resistance.—The majority of the better designs of tubular fuses can be made to function quietly with a series resistance which limits the short-circuit power. Upon reducing the value of the limiting resistance, two things happened: Failure of the fuses commenced and it was found difficult to produce a resistance which could safely be put forward for enclosure in switchgear structures. It was therefore reasoned that the resistance and fuse could well be enclosed in a single container, thus obtaining a dual advantage. A short spring-

controlled fuse was immersed in oil in a tubular container as shown in fig. 7. The resistance wire was made in the form of a spiral to obtain the requisite resistance and to take advantage of the magnetic effect of the turns of the spiral in obtaining a rapid break, and finally resulted in a workable arrangement which could be connected directly across a high-pressure circuit and which interrupted the resultant power without noise, flash, or other unwanted phenomena.

Particulars of a series of tests on ordinary fuses suitable for potential transformers and small power supplies at high pressures are given in the paper. The fuses, rated for 3,000 to 11,000 volts, were of various forms and fillings were employed in a great many. It appears to be the rule that unless such light fuses can be designed to break early in the first half-cycle, they will immediately be destroyed and a dangerous arc across the main contacts be set up. It is not sufficient to ensure that the circuit is cleared in half a cycle, as the current may rise to a maximum in such circumstances. The limiting effect which is so essential is secured only if the fuse is melted on the initial rising current curve.

Conclusions.—It is considered that all cut-outs should be capable of clearing the maximum short-circuit power without any explosive effect, and the investigations have proved that there are now available :—

(*a*) Fuses capable of handling short-circuit powers up to 70,000-100,000 kVA at a maximum voltage of 600.
(*b*) High-voltage tubular fuses capable of interrupting up to 40,000 kVA.
(*c*) A further class of high-voltage fuses capable of interrupting several hundred thousand kVA.
(*d*) Resistance-fuses suitable for any small work, such as the control of small services, potential transformers, and other and more unusual offices, such as the control of wired-wireless equipment.

Truck-Type Switchgear.

A Ferguson, Pailin Composite Installation.

Truck-type switchgear is deservedly popular. Only recently, however, has its suitability for duty involving high rupturing capacity been realised. In the case of an installation manufactured by Messrs. Ferguson, Pailin, Ltd., for a Canadian hydro-electric scheme, the gear is of the composite pattern, the busbars, current transformers, &c., being mounted in a stonework cell structure, the circuit breaker only being of the draw-out truck type.

A general view of one of the switch trucks is shown in fig. 1, the rear view of the same truck being given in fig. 2. The flanged wheels are mounted on roller bearings and grooved rails ensure correct registration; a skeleton framework for receiving the truck portion is accommodated in the circuit-breaker compartment of the cell structure. To facilitate plugging home and withdrawal, truck pinions are fitted which engage with two racks on the stationary framework, and are operated through bevel gearing by a detachable handle at the front of the truck. Interlocks make it impossible to insert this handle until the circuit breaker is off, or to close the circuit breaker until the handle is removed.

Due to the heavy currents involved, it was found impracticable to use the standard cylindrical isolating plug and socket arrangement. Consequently a V-bar and finger type of contact was specially designed so as to have full self-aligning features. The supporting insulators are capable of withstanding large cantilever forces; fig. 3 illustrates the type used, and it will be noticed that the plug insulators are provided with long back connections suitable for passing through the cell walls into the other compartments of the structure. The shortness and rigidity of the connections between the circuit breaker terminals and the isolating sockets should also be noted.

Each truck unit is equipped with a type PA triple-pole oil circuit-breaker rated at 1,200 amps. at 15,000 volts, a common top plate being provided for all three phases, heavily ribbed and giving a large air space above the oil level. A baffled vent is fitted on each phase and is provided with a gas separator which returns ejected oil to the tank when the pressure has subsided. The tanks are elliptical in shape, supported from the top-plate by a steel cradle and down-rods, a rope gasket preventing oil throwing. The rope and pulley tank-lowering mechanism is operated by the same detachable handle as is used for racking the unit in and out, and it is impossible to insert the handle until the truck is withdrawn.

The glazed porcelain insulators are cemented into clamping rings which are bolted to the top plate, thus facilitating renewals. The switch contacts are of the standard Ferguson-Pailin finger and inverted V-bar type, the apex of the V being truncated to allow the opening motion to squirt fresh oil on to the contacts; arcing contacts of large capacity are fitted.

Electrical operation by means of d.c. solenoids is used throughout. The mechanism is energised by a single-pole contactor, both contactor and solenoid being mounted on the front sheet of the truck. The operating and tripping supply is brought in by means of auxiliary finger contacts on the truck which make contact with auxiliary bars on the side of the stationary framework; they are clearly seen in the illustrations. The auxiliary bars are of such a length that the truck can be withdrawn a safe distance for isolation without interrupting the auxiliary supplies, thus enabling the circuit breaker to be tested, but interlocks prevent the operation of the breaker if insufficiently isolated.



Fig. 1.

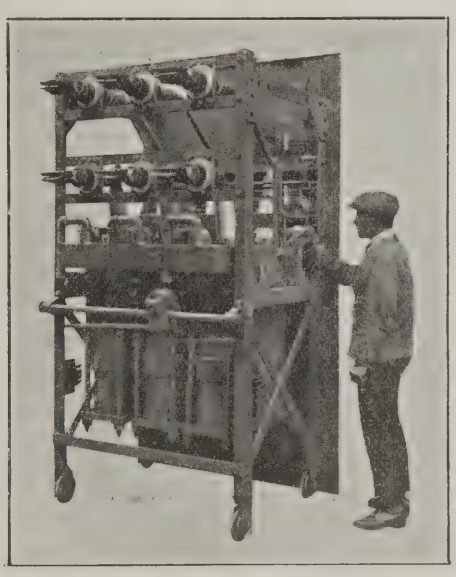


Fig. 2.

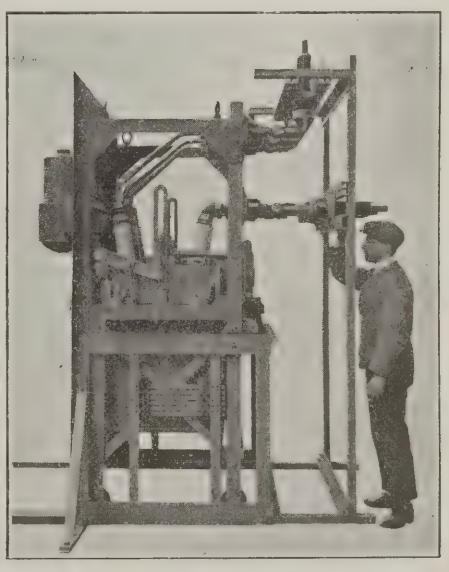


Fig. 3.

A Ferguson, Pailin 1,200-Amp., 15,000-Volt Draw-out Switch Truck.

Canadian Water Power Dispute.—The *Daily Telegraph* states, with regard to the debate in the Dominion Parliament in favour of drastic action through the British Government to enforce Treaty engagements entered into by the United States concerning water rights in the Great Lakes, that the whole question has become more acute of late years, owing to the reduced level of the water in the canals and the resulting bad effects on important water-power developments, not only in Canada, but also the United States. There has been continual agitation on the part of Canada, and also of the Eastern American States, to have these defects rectified. The difficulties are rendered more acute by the increasing water demands of Chicago simultaneously with similar demands of Canada and the United States for water for navigation and power purposes. The Canadian point of view for the moment is that the legal rights of the Dominion shall be backed up by the British Government and the British Ambassador at Washington, in order that Chicago may be forbidden to break the existing Treaty, which, in effect, limits the amount of water to be used either by Canada or the United States. Canada now realises that the time has arrived for the United States to take the necessary measures to prevent the increasing diversion of water. Any representations on the subject would be made through the Governor-General of Canada, the Dominions Officer in London, and the British Ambassador in Washington.

The Propagation of Radio Waves.

Some Results of the Radio Research Board's Investigations.

By J. HOLLINGWORTH, M.A., B.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

The paper outlines the results obtained from a systematic study, by the National Physical Laboratory on behalf of the Radio Research Board under the Department of Scientific and Industrial Research, of the received intensities of various long-wave transmitting stations at four receiving stations over a period of nearly two years. The weekly averages of the results are studied, and it is shown that they are inconsistent with any law of stead decay. The results also show very marked periodic variations.

Seasonal Intensity.—The most striking feature of the observations (over the period June, 1924, to December, 1925) is the fact that in the early months one station recorded signals equal to, and even greater than, those at another, although the distance were 695 km. and 485 km. Also on the few individual days when variations did occur, they usually appeared at all stations, but not necessarily in the same direction. An unusually high value at one station was generally accompanied by a low value elsewhere.

During September, 1924, although the change in weekly averages was mostly small, day-to-day variations became much larger; and at the same time it was noticed that the bearings were becoming unsteady and the minima poor. In October, however, big changes began to occur, culminating in sudden and enormous variations in the week October 25th to November 1st. The first, and most striking, characteristic was the simultaneity of the changes. In these few days signals from stations far apart at receivers far apart, showed abrupt changes, amounting in some cases to over 100 per cent. The effects were not merely transient, as in most cases, although the day-to-day unsteadiness was very marked, there was in the following weeks no definite reversion to the summer values.

It is hardly possible to avoid the conclusion that these changes were not due to local variations, but to some main cause operative over a large area, and the possibility is also suggested that all signal-strength variations might be due to this cause, differing in degree rather than in kind. Also, in view of the fact that signals were practically equal when their path was entirely over land and entirely over sea, it does not seem possible to admit the conductivity of the ground as a major controlling factor.

Intensity/Distance Distribution.—Space-distribution curves (*i.e.*, intensity plotted against distance and not against time) obtained by means of a portable measuring set on four tours, one extending to Aberdeen, are entirely free from anything in the nature of a steady decay, and seem to justify very definitely the claim for the existence of an interference phenomenon.

General Inferences.—An interference phenomenon demands two waves. The velocity of propagation of a "surface" wave over a semi-conductive layer is slightly different from that of a "free" wave in space. At first sight, this suggests a possible explanation of the phase-changes necessary to produce an interference effect, but calculation shows that by the time a sufficient phase-change had occurred due to this cause, the "surface" wave would have been attenuated to a negligible intensity. Therefore, the explanation must be found rather in difference of path length than in velocity of propagation, and this leads at once to the idea of the upper layer, which forms the basis of most of the methematical work on the subject, but it has been claimed that all observed phenomena can be accounted for without its assistance. Assuming the existence of such a layer, but with its characteristics unspecified, all the results obtained in the paper can be accounted for if certain definite constants are attributed to it. At this stage of the work it is impossible to give a decision as to the actual physical nature of the layer, its constitution, or its sharpness of definition. Consequently, it cannot be said definitely whether the effect is strictly one of refraction or reflection, or, as seems likely, of an intermediate nature. In all that follows the word "refraction" is used in this indeterminate sense and must not be more strictly interpreted.

The distances at which maxima and minima should occur for various heights of layer have been calculated and plotted. With regard to these curves, it is very important to note that the actual positions of the maxima and minima are independent of the attenuation of either of the waves, a fact which is of great value, as it eliminates some of the most uncertain of the unknown factors. The actual intensities at these points are, however, entirely dependent on the attenuations, so that the interference phenomena will exhibit all degrees of intensity. At short distances, where the surface wave is strong and the refracted wave weak, due to the small angle of incidence, the maxima and minima will follow in rapid succession as the distance varies; but their actual excursions will probably be so small as not to be definitely separable from the irregular momentary and daily variations. As the distance from the transmitter increases, the effects will become more and more marked, and an almost total extinction may be obtained; whilst at greater distances, due to the large attenuation of the surface wave, the effect will again diminish, if by this time it has not totally disappeared, as the last minimum will be at the point at which the two paths differ by half a wave-length.

It thus appears that, at any rate up to this date, all the major elaborate variations observed are explicable on the assumption of a refracting layer at a height of about 75 km. during the summer months, rising somewhat abruptly during October to a height of about 90 km.

This does not, of course, definitely prove the existence of such a layer, and all that can be said at present is that it offers what appears to be the simplest explanation, which, at the same time, covers all the most marked observed phenomena.

Seasonal Variations.—The abrupt transition at the end of October appears to mark a distinct line between summer and winter, and it seems impossible that the winter change is merely a reversion to normal night conditions. The two may be related, and probably are, but they do not seem to be identical.

For the daylight stations the results appear to group themselves into two sections, that from May to September being marked by its relative stability, and that from October to May both by average values differing largely from the summer ones, and also by a very pronounced day-to-day instability. Also, it has been shown that the marked change at the end of October is consistent with a rise in height of the layer from 75 to 90 km., so that it seems natural to suggest that some, at any rate, of the winter variations are due to the same cause.

One point in connection with the layer appears to be very striking. A change in height of only about 10 km. may be sufficient to convert the signal at a given point from a maximum to a minimum; now the readings during the summer show that the day-to-day variations at any given point are often only a few per cent., and that even the weekly average for the same week in successive years may not differ by more than this amount. Consequently, although it appears that the layer undergoes a nightly change, it must go through a cyclic change of extraordinary constancy over periods measured by weeks, if not by months.

Sunset Effects.—Summer intensity went through a very marked cycle of change, which was repeated daily with only very minor modifications. Whilst the same thing was true at every station, the actual curves obtained had entirely distinctive and different shapes. The effect can no longer be classed under the general heading of "night increase," but must be, although perfectly systematic, of a much more complex nature. Now it is generally held by the supporters of an upper-layer theory that, with the removal of sunlight, the effective height of the layer increases. Following out this idea, the variations at all stations are explicable on the basis of a rise in effective height from 75 km. to 90 km., bearing in mind the fact that a minimum is not necessarily a zero.

Another interesting, though tentative, calculation can be made from these results; it is possible to determine the actual values of the maximum or minimum attained at each station, and sometimes both, depending on the range of the curves. The intensity of the diffracted wave can also be calculated from the formula given by Watson and by Van der Pol, and hence the intensity of the reflected wave is known. From this the equivalent reflecting power of the layer can be deduced, on the assumption that the intervening air is a perfect dielectric.

These results are interesting, especially as showing the rapid falling off of reflecting power for larger angles of incidence, which is not altogether unexpected, but like many other figures in the paper they must be subject to further verification.

Conclusions.—Whilst many of the ideas suggested cannot at present be regarded as much more than guesses at a possible state of affairs, it may be as well to state some of the definite facts that rest on experimental evidence.

(1) Long-wave signal intensities over medium distances ($< 1{,}200$ km) remain extremely steady over the period May to September, during daylight hours.

(2) Their distribution does not correspond to the Austin-Cohen formula for anything less than yearly averages, in which case the distance is not large, and the law of decay is not uniform.

(3) During the sunset period each station goes through a distinct and individual cycle of change, which is repeated daily.

(4) Towards the end of October all observed stations showed simultaneous and large departures from their summer values; this is the beginning of a period of marked day-to-day instability, which persists until the following May, by which time all stations have settled down to their normal summer values.

(5) Careful plotting of a day-time intensity distance graph gave an undulating curve, showing, under certain conditions, practical extinction at a definite distance.

(6) In addition to the slow periodic changes, there appear to be more rapid fluctuations superimposed; during the summer months they are comparatively small, but assume big intensities during the winter; there is not yet evidence to decide whether these are due to fluctuations of layer height too small and rapid to be definitely detected by present methods, or whether they are due to some totally separate cause.

The actual results in this paper are definitely confined to medium distances and long waves:

(*a*) *Long distances.*—The interference phenomena discussed above have a definite upper limit of distance for two reasons: The first is that, on the assumption that they are caused between a refracted and a diffracted wave, the attenuation of the latter is so large that at great distances its effect is negligible. Secondly, the effects cease when the difference in path length for the two waves becomes less than half a wave-length; and this, together with the curvature of the earth, places a definite geometrical limit on the possible distance, there being also a maximum range for a first reflection with a given height of layer. The idea of multiple reflection cannot, however, be excluded, and it is conceivable that the signal from a distant station would consist of the vector sum of a series of multiple reflections.

(*b*) *Short waves.*—There is danger in applying these results directly to wave-lengths below 1,000 metres, for, whilst the presence of such a suggested upper laver would be a very important factor in short-wave propagation, the difference in frequency is so great that there is no doubt but that the actual observed phenomena would be entirely different.

Northern Telephone Development.

Progress Achieved on the North-East Coast during 1925.

THE continued depression in the staple industries of the North-East Coast has not been without its effect on the telephone service, but this is reflected more in the number of calls made than in the number of orders obtained for new telephones, and substantial progress was made in 1925 in the number of telephones in use. These facts are made apparent by the annual reports of the Chamber of Commerce Telegraph and Telephone Advisory Committees for the Newcastle-on-Tyne and Middlesbrough areas, of which copies (abstracted below) have been sent us by Mr. J. R. M. Elliott, M.I.E.E., superintending engineer, Northern District, Post Office Engineering Department.

Newcastle-on-Tyne Area.

In the Newcastle district at the end of December, 1925, there were 29,813 telephone stations, a net increase of 75 per cent. since January 1st, 1912, the rate of increase comparing favourably with the pre-war increase. The retrograde effect of the war has been overtaken, and since the war development has been well maintained.

The total number of stations (29,813) includes 28,517 subscribers' exchange telephones, the remainder representing call office, service, and private wire stations. The total number of private householders renting circuits at the reduced residence rates was 3,441, a percentage of over 12. Exchanges numbered 113; call office station 446; street telephone kiosks 37; new exchanges opened under the rural development scheme of 1922, 18; and rural party line stations 94; while one rural railway station was connected with an exchange system. During the period January to December, 1925, the increase in the system, inclusive of 1,789 transferred from the Middlesbrough district in August, amounted to 3,280, the net figure being 1,491 stations. Agreements for the erection of street kiosks have been completed with seven municipal corporations and with three urban district councils, and 21 public call offices were opened at small post offices where telephone facilities did not exist previously.

The exchange at Whitley Bay was removed to a new building and a modern common-battery exchange to afford accommodation for 800 subscribers' lines installed; this work involved the replacement of all the old subscribers' telephones. Three other exchanges were removed to more commodious premises and (as well as at four other centres) new equipment of the common-battery signalling type installed. Switchboard extensions have also been made at 18 places, while extensions are now in progress at 10 exchanges and three new rural exchanges were established.

Trunk and junction lines joined up numbered 88 and over 27,500,000 effective originating local and junction fee calls were made, whilst the number of trunk calls was in excess of 2,300,000. Telegrams received by telephone from the public exceeded 310,000. The minimum deposit required from subscribers in respect of trunk and local call fees was reduced by 10s. as from July 1st, 1925, affecting 8,600 subscribers whose average quarterly use did not exceed 30s.

Particular attention is paid to the telephone possibilities of undeveloped areas and those in which building reconstruction is likely to take place; the whole of the larger exchange areas in this district have been covered and the studies made during 1925 included 17 areas, following which comprehensive systems of underground plant in 20 places have been carried through to completion during the present year, while 16 local underground schemes are in active progress and further works of this nature will shortly be commenced. In large buildings containing several suites of offices it is now the practice to make a development study and then cables containing a sufficient number of wires to meet all probable requirements are led into the building and distributed from the basement within the building. Six buildings in Newcastle-upon-Tyne have received attention in this way.

Intertown and long-distance service cables which have been completed in the Northern Engineering District during the current year and are now being gradually brought into use number 12, in addition to others at present being provided. The Newcastle-Catterick cable will provide underground telephone communication throughout between Newcastle, Leeds, Hull, Manchester, Liverpool, Sheffield, London, and other towns; the Newcastle-Catcleugh cable will provide underground communication from Newcastle to Edinburgh and Glasgow, and both cables will be used for communication between Scotland and the South, East, and West of England.

It is not usually appreciated that an open wire telephone circuit possesses inherently a much higher transmission value than a circuit of similar gauge contained within a cable, but conversation over long distances by means of cable circuits has become possible with the aid of Pupin loading coils and the thermionic telephone repeaters. The former are fitted at distances of approximately 2,000 yards apart and repeater stations at 50 mile intervals; two of the latter have lately been completed in the Northern Engineering District at Catterick (Yorks.) and Kenton (near Newcastle), and it is expected that both will be brought into use during the early part of 1926. As a temporary measure, however, a provisional repeater station has been installed in Newcastle, through which certain long-distance underground circuits are at present working.

The conversion from manual to automatic working of the telephone system within a radius of five miles of Newçastle has been decided upon, and building operations have been commenced. The three automatic private branch exchanges that have been installed are giving every satisfaction.

The total mileage of underground main lines (trunk and telegraph) increased from 12,545 to 40,819 in 1925, while the total underground local (subscribers') line mileage increased from 46,925 to 55,816, the grand total being 96,635 miles.

Middlesbrough District.

In this area development proved to be fairly satisfactory under the very adverse trade conditions prevailing; the depression in the iron, steel, and shipbuilding trades particularly was to a great extent responsible for the cessation of many telephones, the number on December 31st, 1925, being 10,514, as against 11,603 at the end of December, 1924, but on August 1st last, 1,789 telephones were transferred to the control of the Newcastle Telephone District, and the net increase during the year for the Middlesbrough District was therefore 700 telephones.

Two new rural exchanges were opened and one was removed to more commodious premises and exchange equipment of increased capacity installed. Extensions of exchange equipment have been carried out in nine cases and two others are in progress.

At Hartlepool and West Hartlepool new automatic exchanges are in course of construction, and the opportunity is also being taken to considerably augment the underground plant; it is anticipated that the change over will take place in July. Automatic working has been decided upon for Middlesbrough, South Bank, Linthorpe, and Stockton-on-Tees, and building operations of an extensive character are already in progress. The installation of modern common-battery equipment at two exchanges has been decided upon.

There has been a large increase in the number of call offices during the past two years, which development has been accelerated by the provision of kiosks in public places; twenty are now working in the district, one is in course of erection, and negotiations are in progress for four more. The total number of call offices at end of 1925 was 229.

In the Middlesbrough District, following development studies, comprehensive underground systems have been carried to completion in six places and at present local underground schemes are in active progress at 11 places. The effective trunk calls actually brought to account during the quarter ended December 31st last reached 278,620. Telegrams received by telephone from the public exceeded 40,400, whilst the local effective calls handled and charged for were slightly in excess of 159,000.

The total mileage of main underground lines (trunk and telegraph) increased during the year from 5,925 to 18,458, and that of the local (subscribers') lines from 12,984 to 14,605, the grand total being 33,063 miles.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A Direct-Reading Portable Wheatstone Bridge.

A recent production of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., Silvertown, London, E.16, takes the form of an instrument of the above description, fig. 1, which has been designed to fulfil the demand for a cheap and reliable design of portable Wheatstone bridge for the rapid measurement of conductor resistances. The apparatus is self-contained, and rotary switches for varying the adjustable-arm resistance are mounted on the under side of the panel. The resistance values are indicated through circular openings in the switch covers and the ratio arm can be set to read directly or in multiples of 10. The instrument is fitted with a moving-coil galvanometer of suitable sensitivity, and battery and galvanometer keys are provided, the battery of dry cells being fitted into a compartment in the bottom of the teak case. The apparatus is claimed to be suitable for hard usage and always ready for immediate use.

The switches are provided with rubbing contacts of ample proportions, thereby ensuring clean contacts of negligible resistance. There are only two connections to make when using the instrument, the resistance terminals, and technical knowledge of the Wheatstone Bridge is not necessary on the part of the operator.

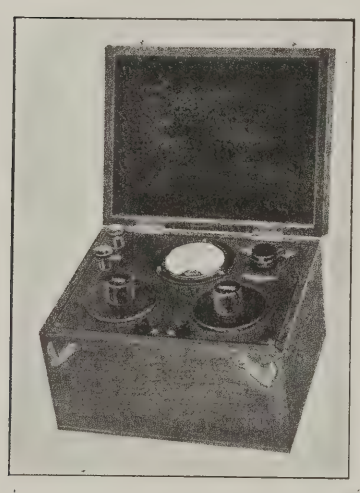


Fig. 1.—Portable Wheatstone Bridge.

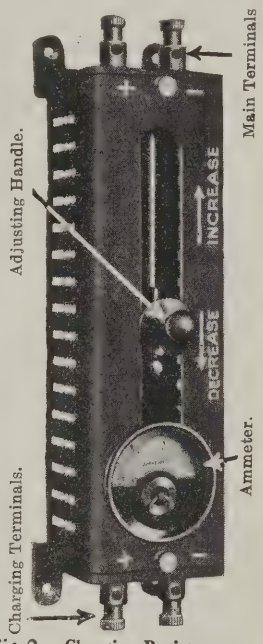


Fig. 2.—Charging Resistance.

A New Charging Resistance.

In order to meet the demand for a simple and cheap apparatus which will enable h.p. wireless accumulators of small capacity to be charged from the supply mains, the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has introduced a d.c. charging resistance, fig. 2. The unit consists of a slate former, wound with resistance wire of ample rating and low-temperature rise, the complete winding being treated with heat-resisting cement. The current regulator consists of a self-aligning brush, which slides over the turns of wire, and the regulation obtained is claimed to be suitable for controlling the charging of a 60, 100, or 150-volt accumulator at 150 milliamperes, from a 110 or 220-volt d.c. supply. The complete apparatus is self-contained with a dead-beat ammeter and incoming and outgoing terminals, mounted between two cast-iron end pieces with a sheet-metal cover, finished black.

An Improved Electric Iron.

The Coventry Electrical Accessories, Ltd., Conduit Yard, Fleet Street, Coventry, has recently marketed an electric iron, Patent Point, fig. 4, in which is incorporated a special device for heating the nose of the iron. A piece of material of high heat conductivity is introduced into the base of the iron at the nose, and it is claimed that this attracts the heat to that part of the apparatus, resulting in a constant temperature there. It is claimed that the introduction in this iron of the heat-conductivity piece renders it only necessary to have the iron on circuit for about three minutes for a half to three-quarters of an hour's working, resulting in an energy saving of 80 or 90 per cent.

A Solid-Contact Lampholder.

The J.K.W. Manufacturing Co., Ltd., 1 and 2, Bridge Street, Middlesbrough, has recently produced a solid-contact lampholder which embodies closely the design features of the ordinary lampholder without, it is claimed, the disadvantages of the previous designs of this type. The contacts are each of one solid piece and they are embedded in a porcelain base of the usual "S" design. The outstanding feature is the single spring which controls the two plungers together through the porcelain block. This rests on internal projections in the top part of the case, so that it always

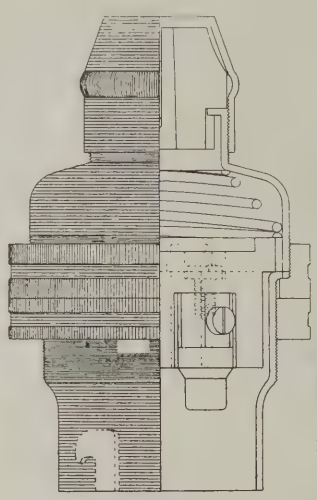


Fig. 3.—Solid Contact Holder, Part Section.

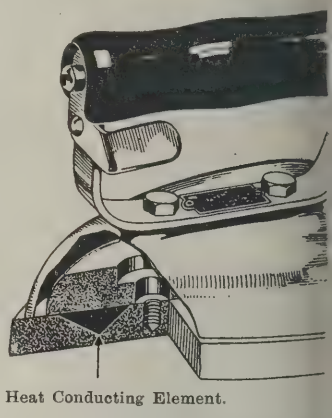


Fig. 4.—Improved Electric Iron.

remains in place when the porcelain is removed. The design of the device is such as to necessitate no departure from the usual method of wiring the holder, and it has exactly the same external appearance as the ordinary holder. Fig. 3 shows the device externally and in section. Electrical continuity is ensured by the solid contacts, and the latter are self-aligning. Arrangements are being made for the manufacture of types of bayonet holders other than that illustrated.

A Switch Development.

Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, London, E.1, have sent us a sample of their new flush-pattern "Adnil" press-button switch, which they have recently introduced, complete with the necessary conduit box. The switch is constructed on an ebonite block which forms the face of the device, the mechanism being entirely enclosed

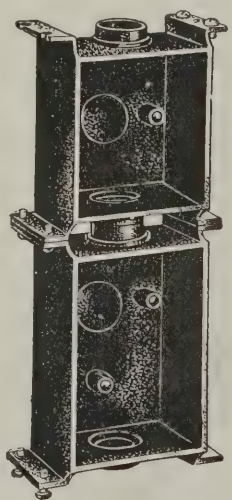


Fig. 5.—Conduit Boxes.



Fig. 6.—Press-Button Switches.

in the conduit box to which the switch is screwed. The action is positive and the break is quick and controlled by a V-shaped flat phosphor-bronze spring. The two press-buttons, "on" and "off," are also of ebonite, rendering the appliance shock-proof, and they are permanently attached to the switch contact arms. The external appearance is pleasing, and it is recommended for use in hospitals on the grounds that the plain polished surface will not harbour dust and that there is no risk of shocks.

The conduit box appears to be constructed of stamped sheet-iron and is fitted with external lugs and screws which enable two or more boxes to be coupled together where more than one switch is required. The box is provided with three entry holes for ¾-in. conduit, and reducing nipples are supplied in cases where it is required to use smaller conduits. Figs. 5 and 6 show two of the switches and two of the iron boxes mounted together.

Commercial Electric Cooking.

Final E.D.A. Conference of the Session.

Mr. D. N. Dunlop (B.E.A.M.A.) presided at the final Salesmanship Conference of the E.D.A. this session in London on March 26th. The subject for discussion was "Progress and Prospects of Commercial Electric Cookery," and Mr. J. J. McKenna, in presenting a paper on the matter, said that the rapid progress of the domestic electric cooker had been due mainly to the hiring out system, the low cost of electricity, the improvements in design to meet the requirements of the modern home, and the increasing reliability of the elements. The progress of commercial cooking, though not so rapid, was nevertheless satisfactory. There were numerous equipments all over the country giving excellent service and paying their way, proving effectively that electric cooking was not expensive and unreliable. Some of those commercial equipments had been in daily use for ten years and were still as serviceable as ever. There was still an enormous and practically untouched field for development, with a vast potential source of revenue for the supply authorities and a remunerative outlet for the energies of the salesman. It should be remembered, however, that the conditions governing the installation and use of kitchen equipment were not so favourable as those appertaining to the domestic electric cooker. Apart from the fact that the latter had the advantage of established hiring schemes to further its progress, the commercial equipment, on the other hand, was more often purchased outright and had the extra disadvantage that its operation was in the hands of a paid staff who probably would not handle it so carefully as the housewife. Future development should take account of the cost of energy, the suitability of the apparatus, and the question of reliability and quick operation. A good deal of spade work had been done in introducing electric cooking on a large scale into many canteens and restaurant kitchens, but sales in themselves should not be regarded as the main thing, because a good deal more harm than good could be done by pushing electric cooking of any description in circumstances where the conditions were adverse to the economic and smooth working of the equipment. For instance, it was directly harmful to push electric cooking where the charge for energy was 1½d. per kWh or over, unless the cost of gas was correspondingly high. There were cases, of course, where the quality of the cooking was of greater importance, but these were rare and too often the reputation of electric cooking suffered because the cost of energy was too high. It was fairly well established, from the records of electric kitchens that had been in daily use for a period of years, that the consumption of energy might vary from 0.2 kWh per meal cooked in a canteen using a combination of electricity and steam to 1.5 kWh in a canteen with an all-electric kitchen. The cost of energy should not exceed 1d. per kWh where competition was keen and should in most cases be in the region of ¾d. per kWh. Equally important was the necessity for supplying the right type of equipment for the requirements of the particular case. The general lines on which the needs of the purchaser should be studied were set out as follows:—The number and type of meals that were being served; the period during which the service of meals took place; the availability or otherwise of hot water for washing up and for cooking, also whether it was proposed to use a combination of steam and electricity for cooking, or electricity only; and the space available in the kitchen and servery. Care should be taken not to over-estimate the capacity of the equipment. Maintenance costs were at present high and they could be traced almost entirely to the failure of heating elements used in the boiling of liquids, and it was those same elements which were responsible for the majority of complaints regarding the slowness of operation of electric cooking apparatus. The manufacturer was therefore faced with the problem of producing a really quickly operating and efficient boiling plate, of limited dimensions containing a practically indestructible element. The solution would appear to lie in the use of a high resistance material other than nickel-chromium wire, if this were obtainable, or else in an absolutely enclosed and air tight element free from possibility of oxidation, *i.e.*, an element embedded in a substance of good insulating properties, of a high thermal conductivity and free from any tendency to powder through the "breathing" of the element wire. Such a material could confidently be expected in the near future. Once this difficulty had been overcome, there was nothing to stop the universal adoption of electric cooking for all purposes except the cost of energy. It was necessary to provide better facilities in large towns for the training of chefs and cooks in the use of electric cooking apparatus.

Discussion.

The ensuing discussion turned mainly upon questions affecting domestic electric cooking, and had little bearing upon the paper.

The Chairman himself dealt with the domestic cooking aspect by giving an indication of the progress that is being made by way of sales of apparatus. In the June quarter of 1924 he said there were more than twice as many domestic cookers installed as in the corresponding period of 1923, that number being six times as many as in 1922, and 30 times as many as in the June quarter of 1921. The figures for 1925 had not yet been completed but there were indications that they showed a considerable increase.

Mr. Rayner (Manchester) spoke of the rapid development of the domestic electric cooking load there and also mentioned that electric cooking was being taught at the Manchester College of Domestic Economy.

There were differences of opinion as to whether simple hire or hire-purchase was the better arrangement and Mr. Leevers (Hotpoint Electric Appliance Co.), who advocated the former, spent some time giving the outstanding features of the electro-inducer system which was described in our last issue.

Several speakers also severely criticised the shortcomings of the usual boiling plate, although one speaker said that its success depended upon sensible use by the operator.

Mr. C. H. Hayes put in a plea for a greater degree of standardisation of electric cooking apparatus as an important means for reducing maintenance costs.

Mr. Edinburgh commented on the difficulties encountered in inducing the chefs in large establishments to change over to a new method.

Several speakers urged the necessity for lady demonstrators of electric cooking apparatus rather than men.

Mr. E. P. Lovell (Stoke Newington) said that he had found an American cooker to suit his purpose best. What, he asked, was to be the attitude to adopt in such a case? Should he adopt British apparatus because it was British, or should he recommend the American? He was inclined to the latter view.

Mr. McKenna briefly replied and expressed his disappointment that so little had been said regarding commercial electric cooking. He particularly stressed the need for training kitchen staffs.

In all, there were 22 speakers in the discussion but there were practically no contributions towards the subject of the paper.

Mr. Beauchamp, in closing the series of conferences for the session, said that he was convinced that commercial electric cooking was going to be a big thing and he urged manufacturers to keep the Press informed, through him, of the progress and new developments that were being made.

Russian Electrical Notes.

The Schatur Generating Station. — The activity of the Schatur station in 1924-25 has just been reported on to the Supreme Council of National Economy. It is stated that the station carried out its supply programme to the extent of 81.5 per cent. and earned net profits amounting to 7,600 roubles.

Works for the extension of the station are reported to be in full progress, and the erection of three new boilers and the foundation for a third turbo-generator are proceeding, this machine being intended to be started next autumn. It has been decided to install two further 35,000-kW turbo-generators and the necessary steam-raising plant. The capacity of the station will then be 118,000 kW, as compared with the 83,000 kW originally contemplated.

The Accumulator Trust.—The report of the Accumulator Trust for 1924-25 shows that the production represented a value of 2,035,000 roubles, of which a total of 82.6 per cent. was sold. It is now proposed to increase the output of products which are in most demand. The Trust is said to have incurred a loss of 90,000 roubles in the past year.

The Electrical Bank.—At a recent meeting of the shareholders in the Electrical Bank, it was stated that during the eleven months ended with last November it had been possible for the bank to carry on without any subsidy from the State and that it had been able firmly to stand on its legs and take up a stable position among the large banks in Soviet Russia. The bank had recently been able to enter into an agreement with the National Commissariat of Finance under which the funds allotted for works of electrification in 1925-26 will be paid into the electrical bank. The net profits are stated to have amounted to 1,179,000 roubles in 1924-25; the share capital is to be increased to 15,000,000 roubles, and the term for short loans has been raised to one year and that for long loans to ten years.

Lamp Production.—The electrical section of the conference on the restoration of industrial capital has decided that it is necessary to organise the manufacture of lamps at the former Provodnik works, which has been leased to the General Electric Trust. The adaptation for this purpose will involve an expenditure of 2,700,000 roubles, of which 1,800,000 roubles is required for the acquisition of equipment. In connection with this scheme it is considered that the output of lamps should be increased to 67,000 per day and the costs of production largely reduced. It is also proposed to hand over to the Accumulator Trust the production of primary batteries.

The Shteroff Station.—As a result of delays in the receipt of certain equipment from abroad it is not expected that the Shteroff station will be opened for service until next May. The station will be the first of its kind in Russia to utilise pulverised coal as fuel. It will be equipped with 80,000 kW of plant, of which two Vickers turbo-generators, each of 10,000 kW, have been erected.

New Stations.—Schemes for the construction of various new generating stations have been placed before the Electric Planning Commission for consideration. Besides these particular projects the commission will deal with the proposal to erect a new large station to use South Moscow coal for supplying Moscow, and a committee will shortly meet to decide on the actual site to be adopted for the purpose of the station, which is to have a capacity of from 80,000 to 100,000 kW.

Growth of Electricity Supply.—According to information issued by the General Electric Commission, considerable expansion in the supply of electricity took place in the fiscal year ended with last September, particularly in the large industrial centres. The total production of the stations which are under the supervision of the Commission, forming 95 per cent. of the capacity of the public stations, is stated to have amounted to 1,131,000,000 kWh in 1924-25, as compared with 904,000,000 kWh in the previous year. The Moscow stations occupied the first place in 1924-25 with 365 million kWh, the Baku stations were second with 283.4 millions, and the Leningrad stations third with 211.6 millions. Including the other stations of public utility, the total output in the past fiscal year is stated to have been 1,200,000,000 kWh, while if the output of the private generating stations at industrial works is added the aggregate for the Republic comes to about 3,000,000,000 kWh.

Railway Electrification.—A commencement is to be made upon the electrification of the Russian suburban railways, the National Commissariat for Railways having recently placed orders with Soviet works for the construction and delivery of five motor cars and ten trailers for the Moscow suburban railways. Each train will be composed of one motor-car and two trailers as a rule. The trains will run on the Moscow-Losinoostrovska line and all the works are to be completed this year, while traffic will be commenced in the spring of 1927. An extension of the working is proposed as far as the stations of Pushkino and Schelkovo, together with other stations. The estimated total expenditure on the work is put at 30,000,000 roubles (£3,000,000).

The Productive Programme.—The State Planning Commission has approved a report relating to the electrical manufacturing programme for 1925-26. In 1924-25, based upon the list prices which prevailed in 1913, the value of the production of electrical manufactures amounted to 64.4 millions of roubles or 68 per cent. more than in the previous year. The gross value of the output in 1925-26 is estimated at 104.9 millions, of which 87.8 millions will comprise heavy products and the balance low-pressure manufactures. In addition the two trusts which are not subject to the Commission will turn out cables and other manufactures to the value of 25 millions of roubles. The execution of this programme will necessitate an increase in the number of workers from 20,500 to 27,000. The capital expenditure on the extension of the productive capacity of the works is estimated at 13,000,000 roubles, while a further sum of 12,500,000 roubles is needed to place the credit conditions of the industry in order, and most of this sum is to be advanced from the loan for the restoration of industry.

The White Sea Cable.—A special expedition is to be organised this year for the restoration of the cable between Archangel and Murmansk, which is now out of service, the length being about 500 miles.

Heating Apparatus Manufacture.—The General Electric Commission has decided that the bulk production of electric heating apparatus both for domestic and industrial purposes shall be embarked upon at the works of the State Electrical Trust.

Peat Fuel Station. — Having considered alternative schemes the Electric Planning Commission has decided that it is necessary to provide an additional capacity of 40,000 kW at the Krasny Oktyaber station for assisting in meeting the requirements of Leningrad. The Commission has referred the technical side of the problem to a committee to decide whether one or two sets should be installed.

Delays in Deliveries.—Complaints have been made by the Rural Electrification Department of difficulties in obtaining the delivery of electrical equipment. Applications and orders on the part of the peasant companies are increasing, but the department is unable to accept them owing to these difficulties. In the case of portable steam engines the Maltsov works states that it is unable to execute such orders in less than 10 months and even then only on receiving the necessary materials. Moreover, the works of the General Electrical Trust require from 14 to 18 months to carry out orders for generators and motors.

Development in Transcaucasia.—It is announced from Tiflis that the State Planning Commission has approved a five years' scheme of works, including the completion of the construction of the Erivan and several other stations during the current year. An investigation is also to be made of water power resources with a view to the establishment of various hydro-electric works in this region.

A Coal-Dust Station.—The Planning Commission has approved a scheme for the construction of a steam power station at the Artem Colliery in the Vlasovsk district, near Rostoff on the Don. By agreement with the Donetz Coal Trust it is proposed to fire the boilers at the generating station with anthracite dust to be obtained at a fixed price for a period of five years. The capacity of the station is to be 32,000 kW, of which one half will be installed initially.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity Bill.—The following is a continuation of the debate, the first portion of which was given in our last issue, on the second reading of the Electricity (Supply) Bill.

Mr. G. Balfour said the Bill conflicted with traditional freedom and constitutional practice, as it set up a new authority answerable only to a Department with a right to allocate a State subsidy. Although our consumption of electricity per head was lower than in other countries, it did not follow that we were behind them. In 1905 private power companies supplied quite small consumers far out in country areas at figures like 0.673d., 0.712d., and 1.03d., in the county of Fife, and at 0.6d. in Lancashire, prices that were never touched in the United States. The American population had increased enormously, and the new-comers had no means of light or power but electricity. In 1922 the average price of electricity in the United States was 2.66 cents. The Commonwealth Edison Co., with an output of 3,091 million kWh, supplied electricity at an average price of about 1d.; other large companies at 1.125d. and 1.3d. The Lancashire and Fifeshire companies started at too low rates, with disastrous results. The cost of electricity used in industry generally amounted to only 2 or 3 per cent. of the cost of the finished material, in the United States and in this country. The Government relied on the Weir report, but the evidence on which it was based was not before the House; he declined to accept it, as in its main conclusions it was utterly untrustworthy. It was pointed out by the Minister of Transport that the Report did not represent a definite proposal, but that under the Bill a scheme would be constituted by the Board; the Electricity Commissioners had not produced a scheme in six years: would the Board produce one in ten? The Williamson Report was issued under war conditions; the Weir Committee accepted it, and called it the Weir Report, plus certain reports by the Electricity Commissioners. The Williamson Report stated that local rating applied to electric transmission mains must greatly interfere with the supply of cheap power and that the rating of electricity undertakings should be revised; the Weir Committee said that the selected and new stations and main transmission lines should be exempted from rating, but they did not propose to exempt the electricity supply industry from rating. Some large undertakings paid in rates sums of 25 to 35 per cent. of the amount of the coal bill, but the Williamson Committee's recommendation, which would have cheapened electricity, had not been followed. With regard to the change of frequency, some of the largest non-standard undertakings had unanimously resolved to oppose it, pointing out that the cost would be many times that calculated by the Government. The benefit of improved load factor could not be given to the consumer. They would find that America had not a "grid-iron." Mr. Alexander Dow, who was quoted in the Weir Report, said the Detroit Edison System was not a closely connected unity served by several power houses; loose linking throughout the entire System was their ideal. Economy was subordinate to the first purpose of interlinking, namely, mutual assistance. Mr. A. K. Baylor said that the effect of interconnection was greater availability and reliability of power rather than reduction in the cost of supply. There was danger in linking too large regions together and causing trouble over a large area. It was a mistake to suppose that wherever the grid went the rural areas would be supplied. Mr. Baylor stated that about 60 per cent. of the cost of supply in the cities and 90 per cent. in rural districts was for delivery, so that if energy could be generated for nothing, the charges for rural supply would not be materially affected. There were more power stations relatively to the population in America than in this country. The all-in price to customers at the Luton station was 1.05d.—the price aimed at under the Weir Report by about the year 1940. The Bill was merely a competitive political stunt pressed by the Executive, and would establish a bureaucracy of departmental control.

Sir Philip Dawson supported the Bill, subject to necessary alterations in Committee. Industry, he said, had been hampered by parochial legislation. The head of the A.E.G. in Berlin constantly told him that English works were not so well equipped as those of the United States; electrical power would increase their output. Some of our modern stations were amongst the most efficient in the world, but whilst some four million people benefited by the installation of electricity, a far larger proportion of the other 30 millions ought to have cheap electricity to carry on their work and improve their homes. If they could gradually go on reducing the cost of electricity throughout the country, it would increase the use of electricity in the home and the factory. He considered that technically and economically the proposals in the Bill would be useful to the spread of the electrical industry. The Williamson Committee's conclusions were as correct now as when its report was issued, and in addition the Weir Committee benefited by the valuable experience gained by the Electricity Commissioners during six years. The Commissioners were men of great experience, and their views were supported by the consulting engineers who advised the Weir Committee. Col. Morcom said the Weir report gave a true picture of what was needed to stimulate electrical development. Sir C. Wilson had said, in effect, that in Leeds they did not want to be interfered with by anybody; that proved the necessity of a

Bill of this kind. Cheap electricity for power, with cables along our main lines of communication, would make railway electrification feasible and assist the electrical industry by the railway load. Nothing was done for London's electricity supply until practically compulsion was used to bring about agreement in the London power area. To supply cheap electricity in the Greater London area it was necessary to scrap all the inefficient stations and to have capital stations interlinked with one another. According to Mr. Alexander Dow, stations were interlinked for safety and economy; but he saw no ground for the idea that they should be solidly connected up. If the big stations knew that they were bound to co-operate they would soon come together and work out an efficient system most advantageous to all of them. The Commissioners had produced no schemes because everything was voluntary, and the people would not work together. The system of interconnection had been carried out in the United States and Germany. The standardisation of frequency was desirable, but nothing in the Bill said that the frequency would be immediately changed everywhere. The 33¼ millions would be spent as, if, and when required. Frequency changers could be used if the amounts of power to be transmitted were not excessive. It was not suggested that the cost of electricity would be immediately reduced all over the country; it would be done gradually. Those who were producing cheaply should be willing and anxious to support other suppliers, so as to enable them to reduce their costs. Electricity must be pooled and sold by one selling authority; if any rights of existing companies or local authorities were endangered, he would oppose the clauses in the Committee stage. A selected station would be certain of selling practically the whole of its output, and of being paid for it, so that it would become a gilt-edged security, and there would be no difficulty in finding private enterprise to build new stations. It was not suggested that there would be immediate benefit for all rural areas, but he was satisfied that the benefits would become available gradually. When he visited Germany in 1921 with Mr. Hannon, he found the work on farms carried out by means of electricity, effecting a great saving in cost and an increase in output; waste heat from coke ovens was also used to supply gas and electricity over large areas. No body of men had helped the electrical industry more than the Electricity Commissioners, but a fundamental error would be committed if the new Board were to be a department of the Commission. It must be entirely independent; the best business men were needed, and in his opinion they could not be got together if they felt they were simply a department of another quasi-Government department. An appeal should lie to the judges or some entirely independent body. The Electricity Commissioners would continue to carry out their functions, but the great questions of policy and commercial management should be entirely in the hands of the Board and not subject to any other body. The Electrical Committee of the Federation of British Industries on March 24th resolved *nem. con.* that whilst it was in favour of the Bill receiving a second reading, it was not in agreement with various important clauses, including those governing the relations of the Board with the Electricity Commissioners. He suggested that the Board should be elected by the various interests connected with electrical supply, with an independent chairman.

Mr. Lloyd George declared that this country was in a humiliating position in comparison with other countries. It was about time we got along with the job, and if the Government could make a better job of the matter he and his friends would all be delighted to help them in committee. The Bill represented such real progress in the matter of the electrification and equipping of our industries with electrical power that he felt bound to vote for the second reading.

Sir R. Barnett, a Unionist, said he could not vote for the second reading because he objected to the Government's setting up a bureaucracy to control a great key industry. He also disliked the financial proposals of the Bill.

Mr. Snowden, winding up the debate for the Labour Party, said that the object of a publicly-owned undertaking was to supply a public need, and where there were profits, these profits were not distributed to useless shareholders, but went to the benefit of the community. This Bill was necessary because of the failure of private enterprise to give the public a satisfactory supply of electricity. Unionist members feared nationalisation through the Bill, but whether the Bill was passed or not, the sheer necessity to get relief from the inconveniences from which the public suffered would compel some Government—it might be a Tory Government—to go many steps further on the lines of nationalisation. The present measure did not go as far in that direction as the Bill of 1919. The Labour Party opposed the present Bill because it would not bring about effective co-ordination, and it did nothing at all with regard to distribution. Generation was important, but the most important thing of all was to get electric power and light in the factories and homes of the people. The Bill would do little or nothing to extend the use of electric light and power in the country.

Sir Douglas Hogg, the Attorney-General, replying to the debate, said that, while the Government would, in committee, resist to the utmost any amendment designed to wreck the Bill and to destroy its usefulness, they did not pretend that improvement was impossible or that a measure of this necessary complexity could not be modified and made more useful by the united efforts of the House of Commons. There were three questions which he thought a member might have put to himself in considering whether to take the responsibility of rejecting the Bill:—(1) Is the present position satisfactory? (2) If not, what is the best remedy from a technical point of view? (3) Does this Bill embody that remedy? The Weir Committee's Report showed that the cost of electricity to the people of this country was over 2d. per unit, but if adequate generation and transmission were provided, it should not be more than a penny. That showed that the present position was not satisfactory. As to the second question, as matters were not satisfactory, what was the right remedy from a technical point of view? Here they had a very large measure of agreement. Nobody seriously challenged the position that the right way to reduce general costs was, first, to have stations in the right place and of the right size, and, secondly, to link those stations up one with another, so that they might afford mutual assistance and lead to a reduction of costs. Those were the proposals contained in the Weir Report, and they were, also, in effect, the proposals of the Williamson Committee, so far as that part of the case was concerned. There could not, therefore, be any doubt that that was, electrically and technically, the right method to adopt. Did the Bill embody that scheme? It was an essential provision on which the whole machinery of the Bill turned that by the creation of a suitable body a scheme should be worked out under which the most suitable stations should be chosen and those stations linked together, and under which the generation of electricity would take place under the most favourable conditions and at the minimum cost. He regretted the attack which had been made on the Weir Committee, and paid a tribute to the Committee's work. The Weir Committee had consulted, among others, Mr. Merz, who was called in to advise not only by the biggest electricity undertakings in this country, but by undertakings all over the world. The Weir Committee had also taken the advice of Mr. Kennedy, who was electrical adviser to the London Power Company, electrical adviser at one time to the Southern Railway, and had advised a great number of the municipal undertakings in this country and abroad. These were the electrical experts who had been so scornfully described as men with no practical experience! Mr. Samuel Insull, who had had the greatest share in developing electrical enterprise in the United States, also gave evidence before the Weir Committee, and had since stated that, in his view, the scheme embodied in the Weir Report was the only scheme which could develop and save electrical enterprise in this country. He had offered his assistance in an advisory capacity in any way the Government might desire it. Mr. Dow was also in favour of the scheme. If any independent person in the country had been asked to name the people best qualified by means of their practical experience to advise on problems of this kind, they would have selected those whose names he had given. It had been suggested that another committee should be appointed; but there came a time when, as the Weir Committee itself said, it was time to take a decision and to give up taking evidence. "We suggest," the Committee said, "on the lowest computation that the magnitude and importance of the subject demands immediate and decisive action." There had been five committees considering this problem. They all said it was urgent and that something should be done. Yet after 10 years they were told that they must appoint another committee. He was not surprised that that suggestion was put forward only by those who quite honestly said that their object was to wreck and destroy the Bill and not to make it a workable one. As far as the Government was concerned they accepted the view of the Weir Committee that it was time to take action, and they invited the House to assist them. It had been said that the power companies would not work the scheme. He thought better both of the patriotism and the common-sense of those responsible for the power companies than to take that view. The power companies ought to be as anxious as the Government was to co-operate in producing what was an urgent public need—cheaper electricity for the people. Under the scheme they were guaranteed that they would have for the current produced the whole of the cost price of its production, including amortisation and interest on the capital necessary for its generation. Why should they not produce for the public good the current which was desired from their stations when, apart from motives of civic and patriotic pride, they knew that as a result of their doing it they were guaranteed, under the full responsibility of this State scheme, the whole of the cost of their generation, including interest and depreciation of their capital? He did not believe that any power company would be so short-sighted or so selfish as to refuse to work the scheme. It had been suggested that the amount allowed for standardisation was too low. They had asked Mr. Merz and his firm to spend some time in going through one of the typical districts—Birmingham—in order to ascertain motor by typical districts—Birmingham—in order to ascertain motor by motor what it would cost to effect standardisation. Mr. Merz had supplied a detailed estimate from which those responsible were able to approximate very closely to what the cost all over the country would be. It was from those figures, which had been approved by the Electricity Commissioners, that they had arrived at the figures which they had put in the Bill. If they applied to the investing public to lend £33,500,000 for this purpose on a five per cent. basis and without any State guarantee, they would not get a very adequate response. In order to cheapen the cost of electricity it was necessary to raise this money cheaply. The chairman of the London Joint Electricity Authority had given his unqualified support and approval to the Bill. No alternative proposal which had been put forward could compare with the proposals adum-

brated in the Bill, which he thought would be an unqualified success.

The Labour amendment to reject the Bill was defeated by 325 votes to 127—Government majority 198; and the Bill was then read a second time. A Unionist attempt to refer the Bill to a Select Committee instead of a Standing Committee was defeated by 416 to 45—Government majority 371.

Modernising Admiralty Generating Stations.—On March 24th Mr. Davidson, Financial Secretary to the Admiralty, informed Lt.-Commander Kenworthy that the establishments at which modernisation of the electric generating stations was being proceeded with were Portsmouth, Devonport, and Chatham Dockyards. The estimated costs were as follows:—Portsmouth, £254,000; Devonport, £166,000; and Chatham, £107,000. The work at Portsmouth and Chatham was well in hand. It would be completed at Chatham in 1926 and at Portsmouth in 1927. The Admiralty would keep in close touch with the Ministry of Transport about the progress of the general electricity scheme, but it was satisfied that there was no ground for postponing the fulfilment of the urgent needs of the dockyards on that account.

Weir Committee Witnesses.—On March 30th, Colonel Ashley informed Mr. B. Peto that the witnesses examined by the Weir Committee were:—Sir John Snell, Chairman of the Electricity Commission; Mr. A. Page and Sir H. Haward, Electricity Commissioners; Mr. J. S. Highfield, past-president, Institution of Electrical Engineers; Mr. R. A. Chattock, electrical engineer, City of Birmingham; Mr. C. H. Merz (Messrs. Merz & McLellan); Mr. J. M. Kennedy (Messrs. Kennedy & Donkin); Mr. S. Insull (Chicago, U.S.A.); and Mr. A. Dow (Detroit, U.S.A.).

"Selected" Generating Stations.—On March 30th, Mr. T. Thomson asked the Minister of Transport what was the number and capacity of the existing generating stations which it was contemplated would be selected stations when Section 5 of the Electricity (Supply) Bill became operative; and the number and capacity of existing generating stations which would not be selected stations.

Colonel Ashley referred the hon. member to Clause 4 of the Bill, where it was stated that the choice of the generating stations would be determined by the scheme which would be prepared by the Board, and submitted to the Commissioners who would inquire into the proposals. It would then be open to all interested parties to make representations on the proposals of the scheme, and only after this consideration by the Board and the Commissioners would it be possible to say which were the most suitable stations. The forecast which was contained in the Report of the Committee on National Electrical Supply, would not, of course, be binding on the Board.

An Increased Demand for Electricity.—On March 30th, Mr. Thomson asked the Minister on what investigations he had based the anticipated increased demand for electricity which, it was contemplated, would be met by the proposals contained in the Electricity (Supply) Bill.

Colonel Ashley said that the considerations on which the forecast was based were broadly set out in the Report on National Electrical Supply.

Direction-finding Apparatus.—On March 30th, Sir P. Cunliffe-Lister, President of the Board of Trade, informed Mr. Hayes that the number of British ships fitted with direction-finding apparatus on December 31st, 1925, was 263.

Bristol Corporation Bill.—On March 31st, on the second reading of this Bill, Lt.-Commander Kenworthy moved its rejection, as he took objection to Clauses 17-25, which, he said, enabled the Bristol Corporation to build a new generating station subject only to the consent of the Electricity Commissioners. This super-power station would be one of 120,000 kW; he suspected that the station was required for territory outside the city.

Col. Ashley, Minister of Transport, pointed out that the Corporation was not seeking powers to put up a station, but asked that, if and when the Electricity Commissioners should give it permission to erect a station it should be able to use land at Portishead for that purpose.

Lt.-Commander Kenworthy, however, objected to the granting of these powers. He feared that the West Gloucestershire Power Company—a private company—would be affected by the proposals of the Bill.

Mr. Hannon also took this view, and explained that the West Gloucestershire Power Company had established a station at Lydney and was already covering a large area, and he thought it would be very hard if a private company in which a considerable amount of public money had been invested should have its rights prejudiced.

Mr. R. Hudson and Sir T. Inskip denied that the interests of the Power Company would be prejudiced in any way. Sir T. Inskip said that the Corporation was determined to ask for powers to put up another station which would be adequate for the needs of its ratepayers and consumers. The Bristol Corporation area was not sought to be enlarged by this Bill, and the West Gloucestershire Power Company would have its hands full in supplying the area allotted to it.

The amendment was finally withdrawn, and the Bill was read a second time.

Legal.

Friend v. Chagford and Devon Electric Light Co., Ltd., and the Light and Power Finance Corporation, Ltd.

In the King's Bench Division on March 30th, Mr. Justice Rowlatt heard a motion for judgment in default of due delivery of a defence in the action brought by Mrs. Emma Friend, of Brixham, against the companies named above.

Mr. L. W. J. Costello, for the plaintiff, explained that the claim was in respect of preference shares which Mrs. Friend alleged she was induced to purchase by reason of false and fraudulent misrepresentations contained in two prospectuses issued by the defendants. She was making very serious allegations against the two defendants, and her case was that the whole thing was a ramp so far as those shares were concerned. In the circumstances it would have been thought that the defendants would have been only too anxious to put in a defence at the earliest possible opportunity. The statement of claim was delivered on February 9th, 1926, and under an order for directions the defence was due on February 19th. Nothing at all was heard from the defendants or their solicitors until March 9th, when they wrote a letter to the plaintiff's solicitors asking for further time in which to put in a defence. The reply of the plaintiff's solicitors was that their instructions did not admit of their giving them any more time. Nothing happened at all after that intimation. In the circumstances plaintiff waited another week to give the defendants an opportunity to apply for leave to extend the time, but as that was not done, notice of the present motion was served on the defendants on March 16th, 1926. The result of that service was that two days afterwards a document purporting to be a defence was brought to the office of the plaintiff's solicitors. That document was simply a carbon copy of another document signed by the defendants' solicitors. In the document the defendants put in a general traverse of all the allegations made by the plaintiff.

Mr. Justice Rowlatt: But if they have put in a defence now, I can't give judgment on this notice of motion.

Mr. Costello: They were a long way out of time.

His Lordship: I know; but the point of law is settled, is it not?

Mr. E. B. Calvert, for the defendants, said the defence to the action was a total and absolute denial of the allegations.

His Lordship: Oh, yes, a most eloquent denial!

Mr. Calvert: It is quite as likely to be true as the assertions now made on behalf of the plaintiff.

His Lordship: I dare say. There will be no order on the motion, except that the costs will be plaintiff's. They will be taxed and are to be paid within three weeks. If they are not paid, then the defence must be struck out.

Theft Charges.

At Old Street Police Court on April 1st, Walter F. Crispe, traveller, Mitcham, was charged on remand that being bailee of £6 15s. 9d., the money of John Eastwick, wireless manufacturer, Bunhill Row, E.C., he fraudulently converted it to his own use. Defendant was bound over for 12 months with his father as surety in £5.

At Old Street Police Court, on April 1st, Henry Vichion, a railway porter, was charged on remand with stealing and receiving a wireless condenser, the property of his employers, the London, Midland and Scottish Railway. There were now further charges against him of stealing and receiving a wireless transformer and clothing, also the property of the Company. Defendant, who pleaded "Not guilty" as regarded the transformer and the clothing, was sentenced to 14 days' imprisonment.

Patrick Corry was charged at Wigan Police Court, last week, with the theft of 140 yards of cable (value £7 4s.), the property of the Wigan Corporation. He was sent to prison for three months.

Hydro-Electric Power in Italy.—The *Board of Trade Journal* quotes some figures from a recent report relating to hydro-electric development in Italy during 1925. It is stated that during the year 55 new companies were formed with an aggregate capital of 25.1 million lire, bringing the total investment to 1,721.9 million lire. The capacity of hydro-electric stations was increased by 340,000 h.p. to 3,200,000 h.p., about 2½ times the 1914 figure. The consumption rose from 2,400 million kWh in 1914 to 7,600 million kWh in 1925. The consumption per head in Northern Italy is between four and five hundred kWh, but in Southern Italy the figure is only 50 kWh. It is estimated that 10 million tons of coal, valued at over 2,000 million lire, was saved during 1925. The necessity of thermal stations is gradually being reduced by the construction of large reservoirs. In addition, the transmission systems between North and South Italy have the same effect. Water power in the North is most abundant during the spring and summer when the Alpine snow melts, while in the South and Central regions winter rains swell the torrents of the Apennines. At the close of 1925 there was over 45,000 km. of h.p. transmission lines in operation, about 1,600 km. of which was operating at pressures above 100,000 V.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Private Generating Stations.

In your issue of March 26th you suggest that the Census of Production ought to furnish ample data to ascertain particulars of the above, but in your current issue it is reported that this Census is not yet available.

Now, as it has been estimated that the output (including traction) of private generating stations brings up the present annual consumption per head from 117 to 220 kWh, surely it is important that it should be somebody's job to get in touch with the owners of private generating stations, without waiting for the publication of the Census of Production. The owners of private generating stations are to be given special protection under Section 4 of the Electricity (Supply) Bill, and under Section 21 the Board is authorised to enter into arrangements with them for the purchase of their surplus electricity.

In his evidence before the Royal Commission on the Coal Industry (1925) Sir John Snell pointed out the several advantages to be obtained if owners of private generating stations joined up with a system like that which is proposed for the Central Electricity Board.

According to their annual reports, the Electricity Commissioners, under the provisions of Section 11 of the Act of 1919, have prescribed or approved the type of current, frequency, and pressure to be used at 32 new private generating stations proposed to be established during the period from January, 1920, to March 31st, 1925.

Perhaps further information could be obtained from the manufacturers of electrical generating plant, if it could be shown that such assistance would not operate to their disadvantage.

Grid.

London, *April 3rd*, 1926.

The Economical Loading of Power Plant.

The article appearing in your March 19th issue under the heading "Economical Loading of Power Plant," by Mr. J. S. Pillans appears to me to be somewhat misleading in so far as heat economy is concerned. The "Willans" lines shown in fig. 1 of the article are based on the assumption that two sets with identical steam-to-electrical conversion properties are run in parallel with the pass-out principle of steam extraction applied to one set only. The statement that the combined steam consumption of the sets is the same irrespective of loading is correct only when it is assumed that the increased steam consumption of one set is not utilised for power production. In other words, increased no-load steam consumption of the set in question.

In the case quoted by the writer, the major loading of the set, with the higher steam consumption, would be the most economical from a thermal view point, due to the saving in fuel obtained by the increased overall thermal efficiency of the plant resulting from the pass-out principle of heat reclamation.

On the other hand, take two sets, running in parallel, with a difference in steam consumption of two pounds per kWh generated, and assume that either the pass-out or bleeder method of latent heat recovery is applied to the set with the higher steam figure. In this case the resultant economy from heat recuperation would be offset by (1) increased steam consumption of the loaded set in producing the major portion of the power; and by (2) the inefficiency of running the lower steam-consuming unit on light load.

The fact remains, however, that, apart from recognised lines, there is a line of demarcation that decides overall heat economy. This may be obtained in graphical form from the potential heat expended as fuel, as ordinates, with the electrical output as abscissæ. The latter may be taken as being the criterion of efficient operation, and, in conjunction with the factor of equivalent fuel heat value, a truer and more reliable basis of comparison of power plant performance is obtained in preference to the existing antiquated and ambiguous pounds of coal and/or steam per unit generated.

W. D. W.

Hinckley, *March 29th*, 1926.

Doncaster Corporation Bill.

I have read the report of the evidence given before the Select Committee of the House of Commons as published in your issue of the 2nd instant.

I am more than surprised at the statements made by Mr. Purse, of West Ham, in referring to the South Shields Corporation Assisted-Wiring Scheme. Such statements as made by him are a direct reflection not only upon the Town Clerk to the South Shields Corporation, but also on the Electricity Commissioners, who sanctioned the borrowing of money in connection with the scheme.

I think Mr. Purse, before committing himself in the manner he did, ought to have had the courtesy to have communicated either directly with the Town Clerk or with the undersigned, who was responsible for the drafting of the scheme.

For his information I would state that the South Shields Corporation have full powers to carry out their wiring scheme in the manner in which they are doing it, under Clause 22 of the South Shields Corporation Act, 1915.

James Edgar,
Borough Electrical Engineer.

South Shields, *April 6th*, 1926.

Reviews.

The A.B.C. of Relativity. By Bertrand Russell, F.R.S. Pp. 231; figs. 7. London: Kegan Paul, Trench, Trubner and Co., Ltd. Price 4s. 6d. net.

The author of this book has a reputation which is world-wide, and well deserved, as a master of mathematical philosophy; he has also the gift of clear exposition, and abounds in happy analogies and apt illustrations: no writer of English excels him in bending simple language to the expression of difficult thought. All these qualities are much needed for the theme of the book before us, and all are conspicuously displayed. Notwithstanding this, the book demands concentrated attention from the reader. This is in the nature of the subject; but among the crowd of volumes now competing to inform the public concerning the intricacies of this difficult matter of Relativity, there are few, if any, so likely to give satisfaction to inquiring readers. Besides the Universe as conceived by Einstein, it contains some account of De Sitter's Universe which, unlike the former, does not require us to place a limitation on the infinite, or to believe in the possibility of "ghostly" stars; but makes *time* stand still where the distance is infinite. There seems some corroboration of such a possibility in the spectra of remote nebulæ, though nothing very convincing. When mathematical philosophers begin to present us with a choice of possible universes in which to believe, we begin to feel ourselves more at liberty to reject any one of them, and it may yet be that we shall come to reject them all, on the ground that the contradictions they raise are as flat as the contradictions they reconcile. At present the most simple and obvious sequence of events with which we are acquainted demands a *geodesic* to explain it, and the interval separating the events must be measured by a standard which confuses time and space in such a way that there is no telling one from the other. Such a standard is inconceivable to man. So the simplest and most obvious thing we know, is to be explained by something we cannot even conceive; as is pointed out in a book we recently noticed, "The Ego and Physical Force": and it certainly does seem odd to call such an explanation scientific. However, anyone interested in such problems cannot do better than consult Bertrand Russell's book on the subject.

Elementary Electrical Technology. By A. M. Parkinson, B.Sc.Eng.(Lond.). Pp. x + 179; figs. 129. London: Oxford University Press. Price 6s. net.

A book on Electrical Technology would be expected, naturally, to deal with the basic science underlying some branch, or branches, of electrical engineering, but in that respect the title of the book before us is quite misleading, for it is concerned entirely with calculations on the electric and magnetic circuits. The author's main purpose is to provide the reader with an assortment of formulæ for solving problems on circuits and, having set out a number of worked examples, to give him a series of exercises in the application of these formulæ. Provided the book is used in conjunction with another which deals adequately with Electrotechnology, or is used by students attending a sound course of lectures in that subject, it may be very useful, but not otherwise.

It is a strange thing that so many writers and teachers regard the young of our species as born with an instinctive knowledge of the laws of the hydraulic circuit. Thus our author says that the loss of pressure when water flows along a pipe is "obvious," that we may discuss the hydraulic circuit and, by applying the same process of reasoning (*sic*), draw conclusions regarding the drop of pressure in electric conductors. This is merely cheating the elementary student, who is next told that "the convention for the direction of flow of an electric current is that current flows from the higher pressure to the lower pressure, *as compared with the earth* (our italics), or, as generally stated, from positive to negative." The student who really wants knowledge may search through the book in vain, however, for some hint of how he is to distinguish the higher from the lower pressure, or identify the positive and the negative. Shortly afterwards the author says that "the various terms for denoting electrical pressure are used somewhat loosely," and the reader will agree.

The beginner has few stumbling blocks in his path which are so difficult to surmount as the magnetic quantities, yet the author blithely puts him in the way of making calculations on the magnetic circuit, without ensuring that he attaches any adequate meaning to B and H.

The chapter on the alternating current circuit is by far the best part of the book, though it suffers from superficiality like the rest.

The last chapter is on the oscillating circuit, and if the students for whom the book is intended can really assimilate this, then the material in the thirteen appendices, which

contain, for the most part, concise proofs of the formulæ used in the book, might have been interspersed through its pages and the treatment might have been made more logical even if more forbidding.

Judging from the very large number of elementary textbooks which continue to be written, it appears that the difficulty of the task is not appreciated by those who essay it, and intending authors would do well to take as their model a classic by some master teacher such as S. P. Thompson's "Electricity and Magnetism."

There is evidence that Mr. Parkinson is not without qualifications for this task, but he would be well advised to lay more stress on fundamental principles.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 31st, 1926 :—

Timeoscope. No. 466,356. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—Ideal Radiotelefon & Apparate Werk Gesellshaft, 10a, Kupenicker Strasse, Berlin. (British representative: Lewis W. Goold, 5, Corporation Street, Birmingham.)

Phœnix (lettering and design). No. 463,156. Class 8. Thermionic valves.—Thermionics, Ltd., 639, Salisbury House, London Wall, E.C.2.

Four Green Stripes (design only). No. 465,315. Class 8. Electric cables having braided covering.—Callender's Cable & Construction Co., Ltd.

Agnit. No. 467,088. Class 8. Instruments and apparatus for use in radio-telephony.—A. W. Lotinga, trading as Lotinga & Co., 25, Midland Street, and 47, George Street, Hull.

Lustrolux. No. 466,798. Class 13. Electric lamps (ordinary).—Lustrolux, Ltd., Albert Road, Bollington, Ches.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

21,467. "Mercury-vapour lamps." J. Nisbet. September 11th, 1924. (248,796.)

21,488. "Means and methods for electrolytically treating ferrous metal objects." E. Potter (Madsenall Corporation). September 11th, 1924. (248,797.)

21,539. "Telephony and telegraphy." P. Joly. September 11th, 1924. (248,798.)

21,961. "Protection of electrical apparatus from overloads." H. Tinsley and J. H. Cox. September 17th, 1924. (248,804.)

21,962. "Control and protection of electrical apparatus." H. Tinsley and J. H. Cox. September 17th, 1924. (248,805.)

26,336. "Method of winding electrical coils of one or more layers for use as inductances and the like for radio-telegraphy, radio-telephony, and the like." E. R. Lees. November 5th, 1924. (248,809.)

28,664. "Wireless receiving apparatus for eliminating disturbances." L. Levy. November 30th, 1923. (225,570.)

29,338. "Submarine cable and like telegraph systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 6th, 1924. (248,822.)

29,339. "Submarine cable and like telegraph systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 6th, 1924. (248,823.)

29,586. "Electric cooking stoves." W. Guy-Pell. December 9th, 1924. (248,825.)

29,591. "Telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (B. A. Turkhud). December 9th, 1924. (248,826.)

29,701. "Cracking of either liquid or readily-fusible organic complexes by means of an electric arc." C. Longhi. December 10th, 1924. (248,830.)

29,738. "Receivers for type-printing telegraphy." R. S. Smith. December 10th, 1924. (248,836.)

29,784. "Telegraphic transmission of pictures, diagrams, and other impressions." T. Thorne-Baker. December 11th, 1924. (Cognate application, 3,957/25.) (248,837.)

29,804. "High-frequency signalling systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 11th, 1924. (248,838.)

29,815. "Control gear for electric motors operating winches or other machinery." British Thomson-Houston Co., Ltd., and R. D. Given. December 11th, 1924. (248,840.)

29,932. "Loud-speakers for wireless-telephony and the like." J. S. R. James. December 12th, 1924. (Cognate application, 14,482/25.) (248,845.)

30,008. "Inductance and electrical coil." L. C. Turner. December 13th, 1924. (248,849.)

30,041. "Circuits of two-grid valves." Compagnie Générale de Télégraphie sans Fil. December 15th, 1923. (Addition to 223,580.) (226,228.)

30,052. "Plug-and-socket connectors for electrical apparatus." J. H. Hewitt. December 15th, 1924. (248,850.)

30,122. "Electric hand warmers adapted for attachment to the steering-wheels of motor-cars and the like." T. O'M. Farrell. December 15th, 1925. (248,852.)

30,135. "Positive electrodes for electric batteries." Soc. Anon. Le Carbone. November 19th, 1924. (243,300.)

30,136. "Variable electric condensers." B. Hesketh. December 15th, 1924. (248,855.)

30,427. "Means for supplying electric current to wireless apparatus from direct-current supply mains." F. Baker & Sons, Ltd., and F. C. Clarkson. December 18th, 1924. (Cognate application No. 3,118/25.) (248,861.)

30,428. "Means for supplying electric current to wireless apparatus from direct-current supply mains." F. Baker & Sons, Ltd., and F. C. Clarkson. December 18th, 1924. (248,862.)

30,603. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. December 19th, 1924. (248,865.)

30,712. "Wireless systems." B. H. N. H. Hamilton and J. Robinson. December 20th, 1924. (248,868.)

30,770. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 22nd, 1924. (248,869.)

30,796. "Low-frequency or other electric transformers." H. Weiland. December 22nd, 1924. (Convention date not granted.) (226,815.)

30,944. "Electric couplings." W. E. Barber and H. A. Watts. December 24th, 1924. (248,870.)

30,974. "Coke ovens and batteries thereof." Koppers Co. April 10th, 1924. (232,173.)

30,976. "Electric couplings." J. A. Crabtree. December 24th, 1924. (248,871.)

31,360. "Radio-receiving apparatus." C. E. Ogden and P. V. Ogden. June 30th, 1924. (236,156.)

1925.

292. "Wireless receiving circuits." H. Tyler. January 5th, 1925. (248,876.)

1,639. "Electric accumulator casings." W. Haddon. January 19th, 1925. (248,881.)

1,882. "Automatic electric circuit breakers." E. M. Johnson, G. A. Juhlin, W. H. Thompson, and Metropolitan-Vickers Electrical Co., Ltd. January 21st, 1925. (248,883.)

2,174. "Apparatus for heating or cooking by electricity." Sir F. W. S. Stokes. January 24th, 1925. (248,884.)

2,857. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. January 31st, 1925. (248,891.)

3,361. "Electric cables." British Insulated Cables, Ltd. (formerly British Insulated & Helsby Cables, Ltd.), and H. G. Nisbett. February 6th, 1925. (248,896.)

3,603. "Circuit arrangements for automatic telephone systems and the like." Siemens Bros. & Co., Ltd., and W. G. Patterson. February 9th, 1925. (248,899.)

3,736. "High-frequency two-way telephone systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). February 10th, 1925. (248,900.)

3,959. "Thermionic discharge devices." Westinghouse Electric & Manufacturing Co. February 20th, 1924. (229,655.)

4,989. "Electro-acoustic devices." Marconi's Wireless Telegraph Co., Ltd. (J. P. Minten and A. S. Ringel). February 23rd, 1925. (Convention date not granted.) (229,706.)

5,695. "Spark plugs and method of making same." E. C. R. Marks (A. C. Spark Plug Co.). March 2nd, 1925. (248,915.)

5,817. "Signal device for indicating a broken electric circuit." A. A. Thornton (Telatail Co.). March 3rd, 1925. (248,919.)

5,954. "Electrical terminals." Belling & Lee, Ltd., C. R. Belling, E. M. Lee, and H. O'Connell. March 4th, 1925. (248,921.)

6,373. "Loaded signalling conductors." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). March 9th, 1925. (248,922.)

6,802. "Electric transformers." S. Z. De Ferranti and Ferranti, Ltd. (Cognate application, 13,890/25.) March 12th, 1925. (248,925.)

6,982. "Variable-capacity electric condensers." Igranic Electric Co., Ltd., and F. R. Griffiths. March 14th, 1925. (248,928.)

7,004. "Holders for inductance coils." A. P. Portway and Goswell Engineering Co., Ltd. March 14th, 1925. (248,929.)

8,483. "Electric insulators and means for making the same." R. Haddan (Corning Glass Works). March 30th, 1925. (248,934.)

9,336. "Means for receiving alternating-current signals." F. E. Pernot. April 8th, 1925. (248,941.)

9,401. "Electric cells." C. Gaiser. April 8th, 1925. (248,942.)

11,364. "Cathodes for electric discharge devices." General Electric Co., Ltd., and M. Thompson. May 1st, 1925. (248,956.)

11,554. "Amplifying tubes for wireless telephony." Schweiz Gluhlampenfabrik Akt.-Ges. and K. Burk. May 7th, 1924. (233,697.)

12,672. "Mounts for coils used in wireless apparatus." H. E. Bowen. May 15th, 1925. (248,964.)

13,204. "Manufacture of non-sagging spiral filaments of highly-refractory metal." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 24th, 1924. (234,489.)

13,348. "Manufacture of electric cables." B. Kolanczyk. May 21st, 1925. (Addition to 218,975.) (248,968.)

13,593. "Electromagnetic apparatus for recording or reproducing sound or like vibrations." British Thomson-Houston Co., Ltd. July 21st, 1924. (237,223.)

13,923. "Electric rotors and their method of manufacture." W. J. Mellersh-Jackson (L. Allis and E. B. H. Tower, Jun.). May 27th, 1925. (248,970.)

14,156. "Process and apparatus for increasing the ultra-violet radiation from mercury-vapour lamps made of quartz." H. George. May 30th, 1924. (234,834.)

14,717. "Electric switches." Benjamin Electric, Ltd. June 5th, 1924. (235,221.)

15,820. "Apparatus for use in installations for amplifying electric oscillations by means of discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 20th, 1924. (235,904.)

16,000. "Supply of electric power to high-frequency signalling systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). November 13th, 1924. (242,948.)

18,405. "Ignition apparatus for internal-combustion engines." A. R. Müller. July 19th, 1924. (237,280.)

19,574. "Electrical accumulators." A. Wiener. May 30th, 1925. (249,004.)

19,659. "Headlights for motor vehicles." C. F. Young. August 26th, 1924. (239,183.)

20,064. "Combined switches and wall connectors." C. L. Arnold and M.K. Electric, Ltd. August 10th, 1925. (249,006.)

20,386. "Loud-speaking telephones." Marconi's Wireless Telegraph Co., Ltd. August 15th, 1924. (238,558.)

21,623. "Electrolytes for lead accumulators." A. J. Andre de la Porte. August 28th, 1925. (249,016.)

22,776. "Methods of and means for the telegraphic transmission of pictures, diagrams, and other impressions." T. Thorne-Baker. December 11th, 1924. (Divided application on 248,837.) (249,020.)

22,777. "Telegraphic transmission of pictures, diagrams, and other impressions." T. Thorne-Baker. December 11th, 1924. (Divided application on 248,837.) (249,021.)

22,840. "Regulating of motors fed by constant current." Siemens-Schuckertwerke Ges. September 13th, 1924. (239,882.)

24,390. "Electric gas-purifier plants." Siemens-Schuckertwerke Ges. October 1st, 1924. (240,844.)

25,001. "Magnetic testing apparatus." British Thomson-Houston Co., Ltd. October 8th, 1924. (241,203.)

27,183. "Sealing-in machines for the manufacture of electric incandescent lamps and the like." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 4th, 1924. (242,628.)

27,292. "High-frequency device for electromedical objects." K. G. Sikor. October 31st, 1924. (242,302.)

28,740. "Oscillatory circuits and tuning means therefor." Telefunken Ges. für Drahtlose Telegraphie. November 15th, 1924. (243,018.)

29,347. "Electric motors." British Thomson-Houston Co., Ltd. November 29th, 1924. (243,717.)

29,382. "High-frequency transformers." Soc. Française Radio-Electrique. November 21st, 1924. (243,379.)

29,521. "Electric motors." British Thomson-Houston Co., Ltd. November 29th, 1924. (243,720.)

30,133. "Illuminating appliances." Holophane, Ltd., and E. Stroud. November 28th, 1925. (249,046.)

30,303. "Automatic shunt resistance for lamps or the like in series." Dr. A. Lampl. May 9th, 1925. (249,048.)

30,361. "Spark plugs for internal-combustion engines, and method of cooling the same." H. Fischer. December 4th, 1924. (244,090.)

30,513. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 2nd, 1924. (Divided application on 28,882/24.) (249,049.)

30,896. "Means for securing bolts in electric insulators." Siemens-Schuckertwerke Ges. December 15th, 1924. (244,459.)

1926.

1,145. "Submarine and the like cable signalling systems." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 6th, 1924. (Divided application on 248,822.) (249,057.)

1,957. "Junction boxes for electric lead-covered cables and the like." E. C. R. Marks (Max Sieverts Fabriks Aktiebolag). November 7th, 1924. (Convention date not granted. Divided application on 26,650/24.) (246,503.)

The

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Electricity Supply Data.

IN view of the frequent comparisons instituted between this country and the United States in respect of the development of electricity supply, some figures extracted from the *Electrical World* of January 2nd, 1926, may be of interest. These show that in 1913 the average price of electricity for lighting was 8.7 cents, say 4.35d., per kWh; in 1925 it was 7.5 cents, or 3.75d. There are 6,000 light and power systems in the United States, with 17,937,160 customers; the population being about 116 millions, there are nearly 52 undertakings per million residents. In this country there are 565 authorised undertakings and perhaps 30 unauthorised, a total of 595, and the population being 43½ millions, we have only 13.7 undertakings per million. There are in the United States 4,800 generating stations, or 41.5 per million inhabitants; we have 584 authorised stations and, say, 30 non-statutory, or only 14.1 per million inhabitants. The plant installed aggregates 26,830,000 kVA, say, 21,500,000 kW, or 185,000 kW per million, against our 3,100,000 kW. or 71,500 kW per million. The central-station output in the United States in 1925 was 59,517 million kilowatt-hours *generated*, or 514 kWh per head; the energy *consumed* was 47.997 million kWh, or 414 per head.

Here we must pause for a moment, as an important question arises. In a recent issue we discussed the validity of the data published by the Government for the consumption of electricity in this country, and we note with interest that a question has been addressed to the Minister of Transport in the House of Commons asking for the figures for 1925, including the amount of energy generated by private plant. The answer may not be known in time for inclusion in this issue. In the meantime, we wish to direct attention to the American data. The Report of the Weir Committee states (p. 5) that the consumption of electricity per head of population in the United States, according to the latest available returns, is 500 units. The latest figures available at that time must have been those for 1924, namely, 54,413

million kWh generated and 43,893 millions consumed. Taking the then population of the United States at 114 millions, *the energy generated was 477 kWh and the energy consumed 385 kWh per head.* It appears, therefore, that the computer of the Weir Committee's figure made the serious mistake of basing it upon the *energy generated*, and comparing the result with the British figure for *energy consumed.*

The relative figures for energy consumed per head in 1924 should therefore read as follows:—

United States	385
Great Britain	117

not 500: 110 as given in the Weir Report, for electricity supplied by central stations.

In the Third Annual Report of the Electricity Commissioners (p. 7) it was stated that the Commissioners had a "substantially complete list of the owners of *all* generating plant in operation during the war for public and individual purposes, inclusive of non-statutory and private undertakings," which, they thought, might serve as a valuable basis for the preparation of a census of the generating plant installed, which would constitute a "valuable asset" in dealing with the reorganisation of electricity supply. That valuable asset, unfortunately, has not been realised, as in his evidence before the Coal Commission, Sir John Snell could only give an estimate of the output of private plant, bringing the total consumption from 117 kWh up to a probable value of 220 kWh per head. In the United States the number of private industrial power stations is known—namely, 8,157, and their output is 12,000 million kWh (1925). Disregarding possible losses in distribution, probably small, we may add this figure to the consumption of consumers on the public mains, making a total of 55,893 million kWh in 1924, or 490 per head. The comparison on a just basis is therefore—

United States	490
Great Britain	220

or 2.23 to 1, for electricity obtained from all sources.

The average price received in the United States in 1925 was 1¼d.; here it was 2.05d.

According to our contemporary, "the central-station industrial field as it exists to-day is only 37 per cent. developed" in the United States, though "almost 55 per cent. of the population of the nation is now living in electrically-lighted dwellings." "During the last year commercial efforts were concentrated on building desirable new loads." Great stress is laid on the necessity of making the increased consumption per domestic customer a foremost task for the years to come.

Nearly one-third of the whole output in the United States is derived from water-power, and whilst we agree with the statement often made that electricity generated by water-power is often no cheaper than that obtained from fuel, we would point out that water-power can only be distributed by conversion to electricity, whereas coal and oil can be distributed and utilised for power production without such conversion. There can be no doubt, therefore, that countries liberally endowed with water-power are certain to make a better electrical showing than those dependent mainly on fuel. Moreover, it is a characteristic of water-power that, as a rule, the standing charges are entirely predominant in the cost of generation, so that there is the strongest possible inducement to develop long-hour loads and high load factor; consequently enormous outputs in kWh are obtained from installations of comparatively small kilowatt capacity. On the other hand, when energy is derived from fuel, as in this country, the cost of the fuel is the predominant factor in the working costs when long-hour loads are in question, and there is not an equal incentive to strive after the development of such loads. In this connection it should be observed that the cost of distribution to large industries is relatively a minor factor; in the case of domestic consumers, of course, it is by far the largest item, and may reach 90 per cent. of the total when rural supply is in question. It is vastly more important to reduce the cost of distribution than to reduce the cost of generation.

Between 1920 and 1925 the total consumption in the United States rose by 50 per cent.; the estimated consumption for lighting increased by 80 per cent., for power by 43 per cent., and for railways by 34 per cent.

The Lighting of Printing Works.

It has been frequently pointed out that problems in industrial lighting are best solved with the help of the Joint Industrial Councils, on which both masters and men are represented. It is pleasing to observe that the Joint Industrial Council of the Printing and Allied Trades is taking great interest in illumination. Mr. L. Gaster, who has delivered several lectures on the lighting of printing works, again dealt with this matter in a lecture arranged by the Aylesbury and District branch of the Council last month. Printing works in the neighbourhood were well represented in the audience, and the discussion raised several points of interest. Amongst these were the effect of changes in the shape of compositors' frames, and the effect of polished reflection from new type. The trouble of glare from such bright surfaces can be partly checked by proper shading and diffusion of light. At the same time, diffusion should not be carried too far, as a certain amount of shadow is desirable to throw the type into relief and enable it to be clearly seen. Illuminations of 10 to 20 foot-candles are not uncommon, and even higher values are recommended in some quarters. It may be recalled that the conditions of lighting desirable for compositors' work are now being studied by the Committee on Illumination working under the Department for Scientific and Industrial Research. The recommendations of this Committee should carry considerable weight, and the results of its work are awaited with much interest.

The Coal Mining Industry.

The very broad acceptance by the Mining Association of the recommendations of the Coal Commission merits the appreciation of the workers and of the general public, and augurs well for the future of the coal-mining industry; it is to be hoped in spite of the intransigent attitude adopted by the delegate conference that was held in London on Friday last, that the Miners' Federation will consider the subject in a like spirit, and that the parties will speedily arrive at an amicable agreement on the points on which they have been at difference, some of which, we fear, will not prove easy of settlement. Leaving these controversial matters on one side, it is for us to note that the Association offers no opposition to the proposed amalgamation of small mining properties, or the establishment of a National Fuel and Power Committee, and welcomes the principle of extended research, the proposal to set up official stations for the sampling and analysis of coal, and measures to secure the adoption of larger railway wagons. All these proposals closely affect the electrical industries for the most part in a favourable sense. The amalgamation of small collieries would facilitate the adoption of electric power; research is sure to bring its own reward; the purchase of coal to specification will at last become feasible, and improvements in the means of transportation will tend to lower the cost of fuel in the bunkers. But of the proposal to establish a Fuel and Power Committee we are deeply suspicious; coming from that quarter, it implies, as we have previously suggested, the subordination of electrical interests to those of the mining industry, amounting in effect to a veiled subsidy, and for that we have no liking. We have suffered too much already from the politicians to wish to be controlled by any body having external interests to serve.

How One should Buy Electric Vacuum Sweepers.

An Outline of Genuine Tests which will Prove the Merits of a Machine.

By H. HARRISON DENT.

The Need for Tests.

The electrical appliance market has been developing strongly in Great Britain, and there are numerous makes of different types of appliance on the market. The trade purchaser and the general public are confronted with so many alternatives that they both need some guide or some satisfactory methods of testing the appliances they are about to invest in.

Advertising in the trade and general Press is the principal means of drawing attention to the products of manufacturers, and while "Truth in Advertising" is a delightful and ideal slogan, we must beware of accepting all the claims, sometimes almost obviously extravagant, which are put forward for certain makes of appliance.

The electric vacuum sweeper is one of the most popular of these appliances, and is of great importance to the buyer—trade or public—because it is an expensive item representing a big stock investment, and is the most important appliance in the home. At least this is probably the opinion of the majority of housewives.

To the trader and the merchandising supply authority the question of terms, discounts, manufacturer's publicity service and repair service, &c., is a very vital consideration, and these points he will investigate amongst the various manufacturers whose potential customer he is. But the public is not interested in the trader's financial and stock problems so much as in the answer to the question: "Is this vacuum sweeper the best on the market, or is it the best combination of moderate price and efficient working?"

The answer lies in testing the different makes one against the other by simple, standard tests which give absolute proof. This article will attempt to lay down some of the more important of these tests as the result of experience in handling competitive types of machine, and will also indicate some of the spurious or "trick" tests that have been used by unscrupulous selling agents to demonstrate apparently superior performance against what is actually a more efficient machine.

We would premise as the result of this experience that the most advertised machine is not necessarily the best, but that every make possesses certain good points, and has its own standards of performance and peculiarities of construction.

General Features of Design.

The electric vacuum sweepers on the British market may be classified under two types, those which combine suction with brushing and those which use suction alone.

In considering the merits and demerits of these two types we must bear in mind that the primary object of the machine is to clean the carpet thoroughly without harming it. It is taught by experience that a too high vacuum is injurious to a carpet. The ideal method is to have a brush gently beating the pile of the carpet or rug with an adequately powerful vacuum lifting the dust and dirt into the bag. The purely suction type will lift loose dust but it cannot efficiently tackle dirt that is embedded in a carpet as the result of wetness and dust—the compound familiarly known as mud.

Of the brush-driven class of cleaner there are two types, the flat-nozzle machine with castors, specially designed to lift the carpet and then brush it, and the simple brushing and suction type. For the first type a more thorough cleaning power is claimed by the makers, but it is held by some authorities to be damaging to carpets.

Most rugs are backed by a species of shellac or glue sizing which prevents dirt from penetrating through to the floor; it is contended that the drawing-up and bending of a rug buckles up the backing and tends to dislodge it from the rug, spoiling its strength and appearance.

Having discussed main design features we will consider the tests that should be made where possible to show comparative or actual performance.

Carpet and Rug Cleaning Test.

A simple test for two different makes of machine, say, "A" type and "B" type, is to obtain an old and dirty rug or carpet, divide it into two equal portions for cleaning purposes, and operate each vacuum sweeper the same number of times each on its respective half. The two bags must be completely empty before commencing, and should be weighed. At the end of a predetermined time or equal number of strokes over the carpet halves, the bags are taken off and weighed again. The increase in weight of each bag will then represent the weight or quantity of dust that each machine has been able to get out of the carpet. If "A" machine records twice the difference in weight recorded by "B" machine, then "A" machine is the better carpet cleaner. If desired, instead of weighing the bags before and after test, the dust itself can be weighed after emptying. When the difference in volume of dust is very great this second version of the test will be sufficiently accurate.

The machines "A" and "B" should now be transferred to each other's half of the carpet. "A" will operate on the half previously covered by "B," and "B" will operate on "A's" half, again for a definite time or number of strokes. The time must be longer at this second attempt as a large amount of dirt will have been already extracted.

The weighing methods will be repeated. It is apparent that if "A" succeeded in getting double the amount of "B" in the first test, then "A" should again show a better performance, for the half "A" is now working on cannot be so clean as the half "A" worked on first of all. The results of this double test are, therefore, very conclusive.

A test for the cleaning-up of embedded dirt can be improvised by mixing up flour and water and putting this mixture on a rug and allowing it to dry. After a few minutes a purely suction type vacuum sweeper should be run over the caked mixture to test how much can be removed. A brush and suction machine should then be tried on the same rug and the comparative performance noted.

Considering relative carpet cleaning abilities we may try yet another simple test. Using two machines "A" and "B" type, clean a strip of carpet, and then take off the bags and run either machine until no more dust is seen coming out of the air pipe outlet. Select the apparently weaker machine, say, "B," and run it over the cleaned strip for four complete strokes, with the bag off, and hold a piece of moistened paper at the air pipe outlet, gathering any dust blown forth on the paper. Then repeat this performance with the "A" machine and compare the quantities of dust gathered on the two moistened pieces of paper.

Suction Power.

Apart from its carpet cleaning power, suction is of special importance when using the various cleaning tools, for the brush is now not operating and suction power alone is the dust removing force.

A simple test is to take " A " and " B " machines and disconnect the brushes. To do this some types have to be turned upside down and the rubber belt disconnected from its driving pulley, while a metal plate is removed. In the more advanced type of vacuum sweeper a simple switch is provided on the motor carriage to cut the brush out of gear, avoiding unnecessary labour and time wasting. With both brushes off the two flexible extension tubes should be fitted on, and the end of one tube connected to the end of the other. A rubber sleeve will do this effectively. This connection puts the two suctions in opposition, and it is obvious that when both machines are running the more powerful one will gradually deflate the bag of the weaker machine. If there is no difference in suction power both bags will remain inflated.

This is a comparative test which anyone can make between two machines. A very exact test can be made with a simple water gauge known as a manometer. This consists of a " U "-shaped glass tube containing water, mounted on a board marked in inches of height along the tubes. A rubber connection tube is provided for attachment to the flexible tubing of the vacuum sweeper. Each machine is operated and a definite figure of suction-power in inches of water on the gauge will be recorded, showing the relative power.

Spurious Tests.

There are certain spectacular but useless tests against which the unsuspecting potential purchaser should be warned.

A common example is to take two different makes, " A," which the demonstrator is trying to sell, and " B " the rival make. After running " B " machine several times over the carpet or rug chosen, the ingenuous demonstrator will run his " A " machine over the same portion of carpet with the bag off; and out flies a cloud of dust! The apparent inference is that " B " machine has not done a proper job and that " A " machine is superior. This is sheer rubbish, as had the two machines been reversed the identical performance would have occurred. The truth is that no single vacuum sweeper can clean a carpet or rug perfectly the first few times it is run over, and, moreover, if it did do so it ought to be destroyed in the interests of housewives. A machine capable of removing all dust and dirt in a few strokes would be so powerful that it would damage the carpet badly. Gradual cleaning is essential with electric vacuum sweepers.

In any case, it is not a fair comparison to run one machine with the bag off against another machine with the bag on. The first machine has extra suction power as its fan does not have to work against the back pressure of the air in the bag.

A further point of interest lies in the fact that an adequately strong machine would not balloon dust into the air when its bag was off, but would project it some distance in a column of air—say, six or eight feet away.

Other Features.

Certain machines when running transmit considerable vibration to the handle of the cleaner, a rather unpleasant feature. This may be caused by too rigid a fixture of the handle and by the method of mounting the motor.

Motors are mounted either horizontally or vertically on the carriage of the cleaner, and the vertical type tends to set up vibration. Generally, the vertically mounted motor needs more frequent oiling than the horizontal type.

All vacuum sweepers are provided with a long flexible cord ending in a plug for plugging into lamp sockets. Each machine possesses a motor switch to start and stop the motor.

Of the brush and vacuum type machines there is at present, as far as it is known, only one make on the market which has a special switch for cutting the motor out of action. All the other types need turning upside down, taking off a plate, and slipping off the pulley belt.

The brush should be of strong construction, but the bristles must not be too stiff or the speed of rotation too high. The best type of design utilises a high-speed motor to obtain the necessary suction with a gear for connecting up the brush and operating it at a much slower speed, avoiding the possibility of damaging a carpet.

For ease of operation certain makes are automatically adjusted to any type of carpet while others need special adjustment for different types of rugs and carpets.

These are minor details of design which, however, are quite important from the point of view of the housewife who likes to have a machine which gives the least amount of trouble and needs the least amount of adjustment.

The question of " finish " is worth noting, as appearance is a strong selling point. Some machines are equipped with straight handles, others with the end of the handle curved downwards for ease of operation.

The lugs on which the trailing lamp-socket lead is wound should be finished the same colour, polished metal, enamel, &c., as the handle; the bag should be strong, simply fitted, and easily undone and replaced, and fitted with a dust trap or valve to prevent dust falling out when the bag is removed. Some types use a metal dust container in lieu of a bag. While this feature adds to the weight of the machine it does not appear to possess any advantage over the bag type. This is a feature decided upon by personal taste.

The change over from brushing to suction should be simple, and the extra equipment for general cleaning should be complete. Every machine should have in addition to the braided flexible suction tube, a suction wall-brush, a curved suction fitting for upholstery and picture-rails, and a flat-ended pipe for cleaning the recesses of armchairs, &c. In addition, an extension piece for reaching high places and a curved tube for adjusting in all directions should be provided. One type makes a special feature of supplying in addition a vacuum-mop for cleaning floors and oilcloth. No doubt the variety of extra tools will increase as manufacturers hit on new ideas for improvements. The brushes or mops forming part of the extra tools should be capable of easy removal from the body of the tool for cleaning purposes.

Comparative suction power is of greatest importance when considering the use of these extra fittings. Apart from the initial force of suction the fittings must be so designed that there is no chance of leakage or power loss when in use, and the final tool should not have too large an open end. It is obvious that the suction at this point will vary inversely with the area of the open end, *i.e.*, the smaller the area the greater the suction.

These are the main points which should be investigated carefully before the retailer decides to stock a particular pattern of machine, and before a private individual decides to purchase. The claims of the rival schools of thought, brush and " no brush," must be impartially weighed in the light of the functions to be performed.

In the experience of the writer there is no question but that the brush and suction type secures more dirt than the purely suction type, and there is no evidence to show that brush operation damages a carpet.

The primitive method of carpet beating by man (or woman) power applies considerable force to the carpet and much of the dust beaten out settles on it during the process, and is beaten in! A rotating brush does not apply such a violent impact, and runs tangentially to the carpet surface instead of applying a direct force. The brushes used for this work are far more soft and pliable than the primitive stiff bristle broom, and while their operation is fast there is no evidence to prove that they are harmful. Nor is there any reason to suppose that the pure suction machine causes any damage unless extremely high suction has been used to compensate for the absence of a brush.

The only countries where sufficient accumulated experience of the effects of these machines on carpets and materials is available are the United States and Canada, and the huge growth of sales of both types of machine in past years in these countries is the most significant defence of the efficiency of the electric vacuum cleaner.

The "Gyro Gasification" of Coal.

The Use of Powdered Kent Coal at the Dover Corporation Electricity Works, on the Lindley Duffield System.

So far as is known, the distinction of being the first and only electricity generating station in this country to produce the whole of its output of electrical energy by the utilisation of pulverised coal belongs to the Dover Corporation undertaking. This is no mean achievement, for the inherent difficulties encountered, both in the coal-pulverisation process itself no less than in the firing of water-tube boilers with the powdered fuel, are diverse and numerous; so much so, in fact, that the different fuel-pulverising installations which have been, are being, or are to be installed in British power stations are regarded as somewhat in the nature of experimental plant which has yet to prove its worth, notwithstanding the apparently satisfactory operation of similar equipment abroad.

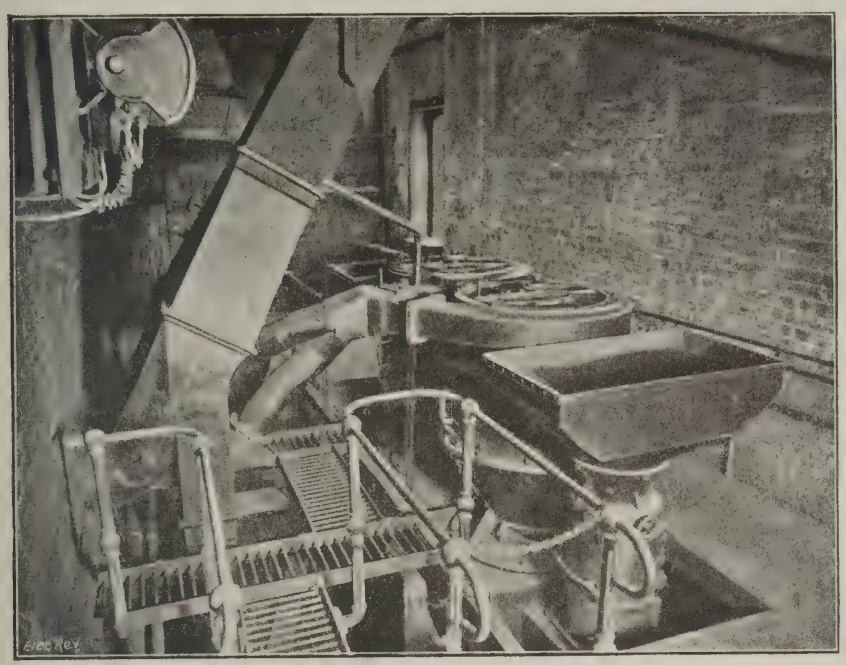


Fig. 1.—General View of Pulverisers.

The successful application of the principle at Dover is claimed to be due to the fact that the well-known difficulties already alluded to have been substantially overcome by the utilisation of methods recently introduced by Messrs. Lindley Duffield & Co., Ltd. The system that is in commercial operation at Dover is of more than ordinary interest, for it differs wholly in several material respects from the orthodox process, and seems to be very promising.

The Vickers-Spearing boiler concerned has a nominal capacity of 30,000 lb. of steam per hour; it is equipped with a superheater and a superimposed Green economiser. Due to the nature of the sub-soil—the boiler-house floor being but 17 ft. above sea level—adequate foundations could not have been built for the installation of chain-grate stokers, an outstanding feature of the "gyro gasification" method of firing being the comparatively small headroom needed below the boiler tubes; as is indicated in fig. 2. little room is required for the accommodation of the pulverisers and auxiliary plant. Two separate 15-h.p. motor-driven "gyro" pulverisers, the dimensions of which are indicated in fig. 3, have been installed, so interconnected that either, or both, can feed either, or both, boiler furnaces as shown in fig. 1. Kent coal is burned, obtained mostly from the Tilmanstone and Chislet pits; it is broken up in a roll crusher, passed through a jigging screen (for the removal of stray pieces of metal and other heavy foreign matter), and then hand shovelled into the hoppers of the pulverisers (a temporary expedient pending the installation of conveyors). At the bottom of the hopper is a preliminary conical crusher which further reduces the size of the coal before it drops on to a stepped pusher plate, worked by an eccentric, which feeds the fuel forward into the bottom of the pulveriser. As will be evident from fig. 3, the pulveriser consists of a series of members on a vertical spindle rotating at approximately 1,450 r.p.m., with a clearance of about an inch between them and the casing; the latter is lined with deeply serrated plates, against which the coal is thrown by the beaters. A fan on top of the machine, driven by the same spindle and 15-h.p. motor, induces an air current to flow upwards from an opening below through the pulveriser, with the result that so soon as the coal is reduced to such a fineness that it loses its susceptibility to centrifugal force and becomes buoyant in the air draught (which is the controlling factor of fineness), it is sucked away from the beaters towards the centre of the machine and thence upwards and out at the top, whilst the larger and heavier particles of fuel remain behind until thoroughly disintegrated. It is thus clear that the Duffield "gyro" pulveriser is of the impact type; the fuel is not ground, and, as it enters at the bottom of the machine where the beater arms are shortest, fig. 3, pulverisation commences at a lower linear speed, the impact violence increasing as the finer particles rise into the zone of the longer beater arms, so graduating the linear speed according to the size of particle. Moreover, in consequence of the finely



Fig. 2.—Part of the Boiler House, Showing New Plant.

powdered coal being afforded continuous egress out of the machine, the beaters' action on the larger particles of coal is neither impeded by the cushioning effect of the unnecessary presence in the machine of finely-powdered fuel, nor are they burdened by having to churn particles which are already sufficiently fine. These features are power-saving, and at Dover it is found that on commercial load the pulverising process (including all fans and auxiliary plant) absorbs 3 per cent. of the energy (kWh) generated. Tests show that 1 ton per hour of Scottish washed nuts (2,450 lb. devoid of fines) can be pulverised

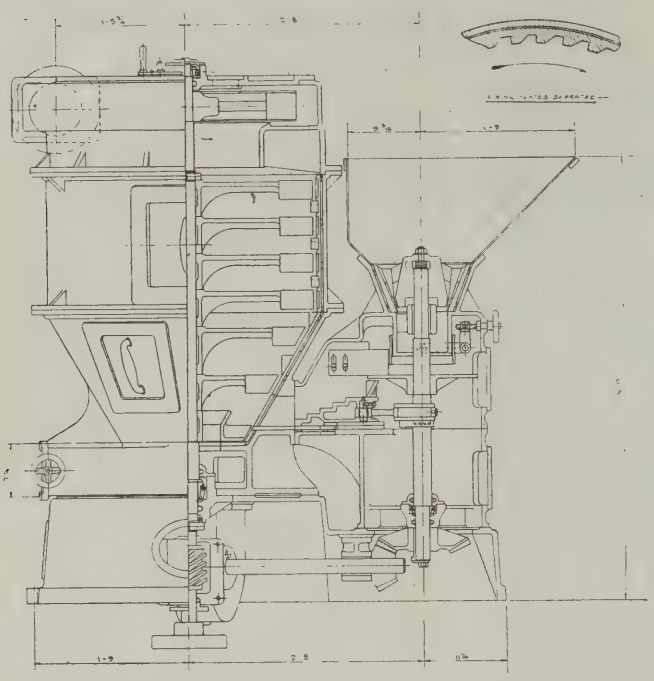


Fig. 3.—The Lindley Duffield Pulveriser.

for 15.6 h.p. inclusive; indeed, it is probable that a slight modification of the design of the pulveriser casing and a rearrangement of the fans and motors driving them would reduce these figures. At Dover it is not found necessary to dry the coal before it is pulverised, as Kent coal contains less than 5 per cent. moisture.

The most interesting portion of the equipment, however, is the furnace itself, both from the point of view of size and arrangement. In place of the enormous combustion chambers which have become associated with boilers fired with pulverised fuel, requiring about 1 cu. ft. of space per 1 lb. of coal fired per hour, two slightly oval "gasifiers" are used (one-tenth the above-mentioned volume). The compactness of these chambers reduces the amount of refractory lining required, and consequently enables high-grade aluminous bricks to be employed for that purpose, *i.e.*, "Leolite," made of special clay imported from India. Such bricks, which are understood to withstand a temperature of 1,850 deg. C., are somewhat expensive, but the smallness of the chambers justifies the expense; the number needed to line a gasifier is only 2,500 6-in. bricks, equivalent to 1,666 9-in. bricks (an American standard combustion chamber for firing the same amount of coal would require approximately 11,500 9-in. bricks), and we are told that the annual cost of brick renewal in the case of a boiler of the size of that at Dover need not exceed £50. The brick work at Dover has been guaranteed for two years, and it is not called upon to resist an impinging flame, for the fire is ingeniously controlled so as to protect the lining.

It is shown in fig. 4 that the fuel is injected tangentially, so that it sweeps round the furnace and forms a powerful vortex. The secondary air necessary to complete combustion is also admitted tangentially in the same direction as the coal, partly round the fuel-inlet pipe and partly at a lower level of the gasifying chamber. The division of the secondary air in this manner affects the position of the combustion zone, for by admitting the preponderance at the bottom of the chamber, more expansion accrues from the greater opportunity it has of becoming preheated, and consequently the passage of the gases upward through the gasifier assumes a higher velocity, so that complete combustion ensues at a greater altitude, and *vice versa*.

At Dover the secondary air is furnished through the duct visible in figs. 1 and 2 by a separate 5-h.p. motor-driven fan on an overhead platform, but a more recent design incorporates the fan in the pulveriser (thus dispensing with one motor), the motor for driving the whole set being located above instead of below the floor as at Dover.

The combustion process also is novel. The tangential injection of the fuel and air causes a whirling motion, and the finely-powdered coal, igniting immediately, moves towards the centre of the vortex and escapes upward readily; the larger particles, however, are forced to revolve at the periphery of the chamber until such time as they become gasified (hence the term "gyro gasification"), when the action of centrifugal force diminishes and the products of combustion escape over the lip of the chamber. It is thus apparent that the Lindley Duffield method of firing pulverised coal is similar to the manner in which a Bunsen burner combines gas and air preparatory to complete combustion at the top of, and exterior to, the mixing chamber. Thus the brickwork escapes that high temperature which obtains in large combustion chambers, and is characteristic of a soaking pit.

It will be appreciated also that the circulation of the larger particles of fuel during the gasification period on the outside of the vortex ensures the hottest area being inside, away from the combustion chamber walls; moreover, slag is deliberately allowed to deposit on the walls to form a constantly renewed protective coating, and it is fortunate that Leolite bricks are slag resisting to a marked degree. The bulk of the fused ash content of the fuel is thrown out of the flame vortex by centrifugal force and adheres to the brickwork; fig. 4 shows the appearance of the chamber wall around the fuel inlet pipe. A few hours after starting a new gasifier, a lining is thus formed from 2 to 3 in. thick, beyond which it does not grow, for thenceforward the surface is maintained at a temperature that keeps it viscid, so that the surface layer flows down gradually under the influence of gravity, assisted by the whirling action of the gases, into the ash hopper. In falling, it meets the



Fig 4.—Interior View of Gasifier.

uprising secondary air which is admitted at the bottom, whereupon it is aerated and reaches the bottom in the form of friable honeycomb-like clinker, which resembles pumice stone, containing not more than 1 per cent. of carbon. The secondary air thus cools the ash, at the same time preheating itself, employing the sensible heat in the ash, which otherwise (apart from its loss) might cause the ash to remain in a fluid state, a condition most difficult to deal with. This has been proved on very light loads (5,000 lb. evaporation per hour).

The boiler has a separate smoke stack to itself, and is provided with a 5-h.p. motor-driven induced-draught fan on the Prat system; no real smoke is emitted, although a Parker centrifugal grit catcher, made by the Tipton Tub & Tube Co., Ltd., is being installed.

The high-velocity injection of fuel is a departure from existing practice, and its mixing, gasification, ignition, and combustion occur in progressive stages of completeness. The combustion zone being controllable as to locality, the maximum heat thereof can be applied at the point of service, while another characteristic of the "gyro gasifier" is its occupation of the full area of the boiler setting; unobstructed by combustion arches, its radiant heat is thus directly applied just below the boiler tubes and prevents "nesting" between them.

The efficiency of combustion attainable with this plant is indicated by Table I, which gives the results of an eight-hours' test, and it should be emphasised that the 83 per cent. thermal efficiency recorded was reached with the boiler drum unlagged. Satisfactory as these figures are, Mr. R. C. Harpur, chief electrical engineer to the Dover Corporation, and Mr. C. S. Grieff, his station superintendent, assured us on the occasion of our visit of inspection that even better conditions have since been attained, notwithstanding the fact that the new boiler is not yet operating at its full steam pressure. The possibility of successfully utilising very low-grade fuels has not been overlooked; indeed, at Dover, Chislet coal (originally of 12,000 B.th.u. and has on more than one occasion been on fire in the bunkers) of a calorific value of 6,930 B.th.u. per lb., containing 22.78 per cent. ash and 1.1 per cent. moisture, has given satisfaction.

TABLE I.—BOILER TEST.

Guaranteed Conditions.

Heating surface, boiler	5,060 sq. ft.
superheater ...	870 sq. ft.
economiser ...	3,000 sq. ft.
*Steam, pressure (gauge) ...	200 lb. per sq. in.
temperature (final)	548 deg. F.
superheat	160 deg. F.
Water temperature, economiser feed	120 deg. F.
Water temperature, boiler feed	240-260 deg. F.
Evaporation, actual	30,000 lb. per hour
from and at 212 deg. F.	37,000 lb. per hour
Fuel, calorific value	11,500 B.th.u. per lb.
ash content	15-20 per cent.
moisture	5 per cent.
Thermal efficiency (guaranteed)	80 per cent.

Summary of Observed Figures.

*Steam, pressure (average, gauge)	161.1 lb. per sq. in.
temperature (average, final)	547 deg. F.
Water temperature, economiser feed	113 deg. F.
Water temperature, boiler feed	255 deg. F.
Evaporation, total water	119,100 lb.
total per hour ...	14,887 lb.
equivalent per hour	18,610 lb.
Air draught, at furnace	0.109
at boiler exit ...	0.186
at economiser exit	0.208
Furnace temperature, max. observed	2,462 deg. F.
Gas temperature, at superheater	932 deg. F.
at boiler exit	429 deg. F.
at economiser exit ...	318 deg. F.
CO_2, mean	9.83 per cent.
Fuel (prox. analysis), volatile matter	20.79 per cent.
coke	75.84 per cent.
ash	15.38 per cent.
fixed carbon	60.46 per cent.
moisture (free)	0.78 per cent.
moisture (hygroscopic) ...	2.59 per cent.
calorific value (as received)	12,314 B.th.u. per lb.
calorific value (lower) ...	11,450 B.th.u. per lb.
Deductions: fuel (lower calorific value)	11,450 B.th.u. per lb.
evaporative power of fuel	11.82 lb.
thermal efficiency ...	9.81/11.82×100=83 per cent.

*Note.—Steam is required at 160 lb. pressure only at present.

Colliery Power Stations.

The Layout of Generating Plant.

By A. LANGLEY.

The development of generating plant in old mines, or its installation in new ones, requires very careful consideration by the engineer as to the type of plant to be used to effect an economic operating cost under ordinary working conditions. The power required for winding, haulage, compressing air, and ventilating fans, as well as for coal-screening plant, washeries, workshop lighting and power has all to be considered in the scheme to give the best working results as an independent power plant and to compete favourably against a scheme of purchased power.

It is proposed to describe the development and utilisation in an old mine of existing plant for the generation of electrical energy, and the necessary lay-out arrangements to result in the minimum operating costs.

In this case the boiler plant is of the ordinary Lancashire type, arranged with superheaters, economisers, a feed heater, and a filter, installed by many colliery owners, and the fuel used has a calorific value as low as 9,000 to 10,000 B.th.u. Under these conditions it is possible to obtain an equivalent evaporation of 7 pounds of water per pound of fuel, with an ash content of 20 per cent. and a moisture content of 7 per cent., the average steam pressure being 110 lb. per sq. in. The annual electrical consumption is in the region of 4 to 5 million kWh.

Mixed-pressure turbo-alternators are installed working almost exclusively upon low-pressure steam exhausted from the steam winders, steam-driven fans, and from the steam-driven half of the compressed-air plant; the other half is electrically driven. The air plant, screening plant and washeries, the workshop power and lighting, and the underground haulages are all provided for electrically.

With the power station equipped with two turbo-alternators, a good arrangement provides for the sets to be on load alternately, acting as stand-by to each other, and supplying the system with energy at a power factor of 80 per cent., with a 70 per cent. load factor. Steam is received at 3 to 4 lb. per sq. in. above atmosphere, and exhausts to a vacuum of 27½ in., the temperature of the cooling water being 75 deg. F. The machines are directly-coupled and have a l.p. steam consumption of 31.7 lb. per kWh. The condensing plant, with motor-driven extractor pumps, is capable of dealing with 34,000 lb. of steam per hour and 1,990 gallons of cooling water per min. The circulation pump works under a 78-ft. head, and the capacity of the air pump is 60 lb. of dry air per hour. The cooling tower has a capacity of 1,500,000 gal. per hour.

The alternator cooling equipment is capable of dealing with 5,000 cu. ft. of air per min. The main switchboard in the power station is of the cubicle type, and consists of a voltage regulator, alternator, interconnector, and feeder panels, and the necessary synchronising and regulating equipment.

With this arrangement of plant, the development of which was taken up after most careful consideration, it was possible to bring down the operating cost per kWh to 0.26d., and a further reduction might be possible with further development of the boiler plant. This compares favourably with the supply company's costs, and points to the use of individual plant.

In the event of extensive developments in the future, the engineer would be faced with a problem requiring the most careful consideration on his part. Should electric winders be installed, and the compressing plant and ventilating fans be electrified, so as to take energy from the supply company, the initial cost of the developments would have to be borne in mind. The depreciation and interest upon the extra capital expenditure, and the question whether the supply company would give the consumer such a low rate that the debt incurred by complete electrification would more than balance the money spent on it, would also warrant consideration.

Testing Porcelain Insulators under Artificial Rain.

By R. T. FLEMING, A.M.I.E.E.

The development of outdoor sub-stations and extensions in transmission lines, &c., have necessitated developments in the design of protective weatherproof insulation for switchgear, transformers, &c. The class of insulation which is adopted is in almost every case porcelain, and with the ever-increasing pressures, larger and larger insulators have had to be designed and manufactured, and during the course of this development, it has been necessary to carry out all manner of tests, both on materials and designs. Porcelain insulator manufacturers have had to carry out tests on the insulators themselves, and further investigational work has become necessary when these insulators are fitted to the various pieces of apparatus with which they have to operate. Testing equipment to carry out this class of work is both bulky and expensive, and in many cases limited space has precluded a satisfactory layout for this class of work.

In this article it is proposed to deal with only one group of tests, namely, "Tests under Artificial Rain." The High Tension Laboratory of Metropolitan-Vickers Electrical Co.'s Research Department is fully equipped for carrying out all such tests.

In fig. 1 a floor plan of the test area is shown; the floor is made of concrete, and the particular portion which is used for rain testing is surrounded by a gully 3 in. broad by 6 in. deep. The entire floor slopes towards this gully, thereby being efficiently drained during testing operations. The rain spray consists of a 1½ in. diameter steel bar, 108 in. long, on a cast bedplate, supporting an arm holding the spray nozzles, fig. 2. The nozzles are known as Drake & Fletcher "Mistifier Jnr." nozzles, and were originally designed for the purpose of spraying fruit trees. This type of nozzle is specially suited to artificial rain testing, as it is capable of adjustment, thus any form of rainfall, from a fine mist to a heavy downpour, may be imitated. Adjustments on one nozzle give a range from a well-diffused fine spray 2 to 3 ft. wide close up to the nozzle, up to a long powerful drenching spray 20 ft. high. An illustration of this nozzle is shown in fig. 3. Eight nozzles are placed on the movable arm of the sprayer, and are so arranged that a large area can be covered with a uniform spray at one time. The extreme nozzles are controlled by valves thus, 8, 7 or 6 can be used at one time as desired; if it is found necessary to use less than this, the nozzles can be easily blanked out. The two cross arms are movable, thus giving facilities for covering any particular area, and the whole arm can be set at any desired angle. This last feature is necessary for studying the effect of the angle of inclination of the rainfall and for complying with specification tests, most of which call for rain falling at an angle of 45 deg. to the vertical. The nozzles are connected by flexible tubing to a special water tank, fig. 4.

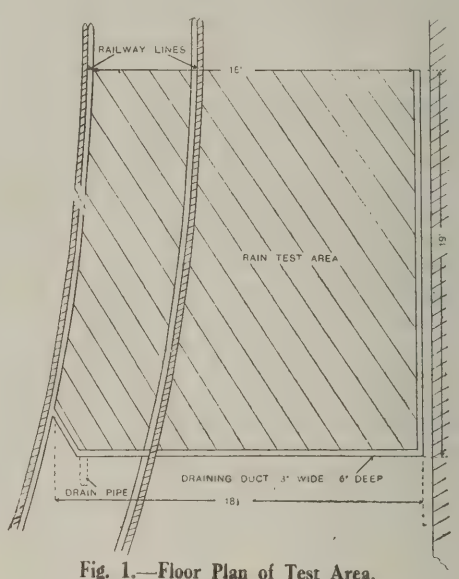


Fig. 1.—Floor Plan of Test Area.

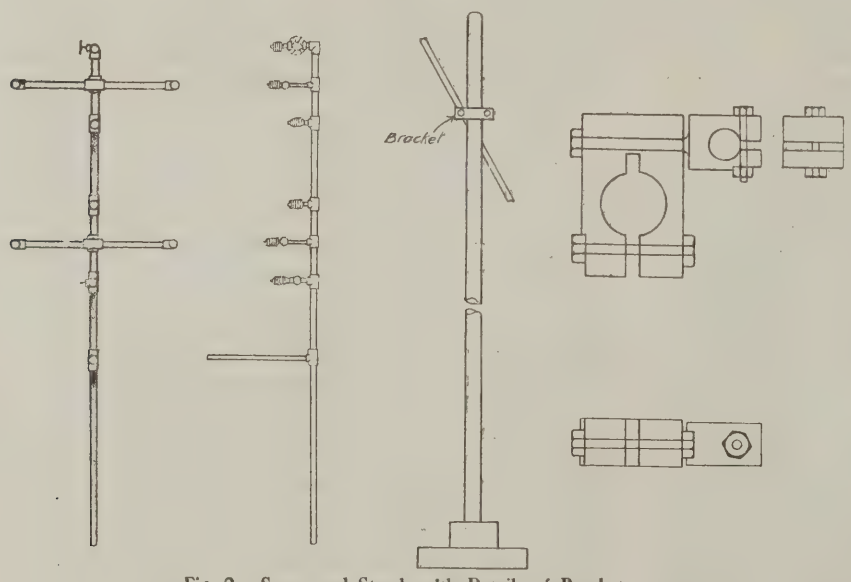


Fig. 2.—Spray and Stand, with Details of Bracket.

It is essential to use water from a container over which one has control, as on many occasions it is necessary to vary the rate of precipitation and the electrical resistivity of the water. The use of water, therefore, straight from a main pipe line is inadequate. The container is a welded tank made of mild steel with interior stays through the ends, constructed to operate at an air pressure of 60 lb. per sq. in., and tested up to 170 lb. per sq. in. The interior of the tank is painted to preserve the metal and reduce contamination of the water to a minimum. The tank is fitted with a water gauge, a pressure gauge up to 100 lb. per sq. in., compressed air and water inlet and outlet valves, sampling taps, and a valve for liberating the air pressure.

The advisability of operating this tank by compressed air is twofold; in the first case it is more convenient to locate it at floor level on account of accessibility, and secondly, variation in air pressure is the easiest method of controlling the rates of rain precipitation. In the case of this laboratory, connections are made to the factory compressed air supply, thus avoiding the neces-

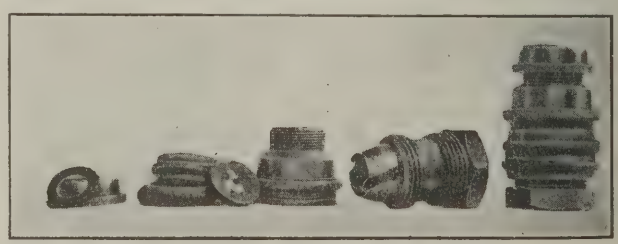


Fig. 3.—Parts of Spray Nozzle.

sity of the installation of a special compressor. A cover at the top of the tank can be removed with ease, enabling the addition of salt solutions, &c., to be carried out. In addition to the equipment already mentioned,

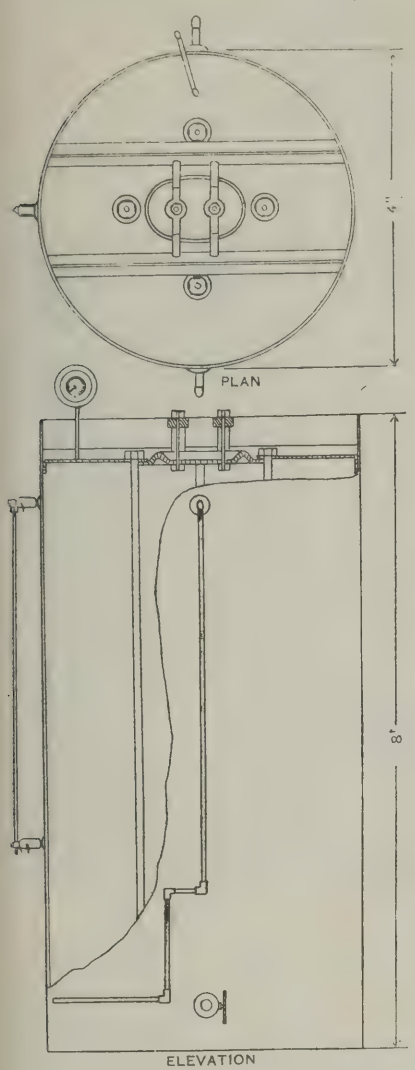
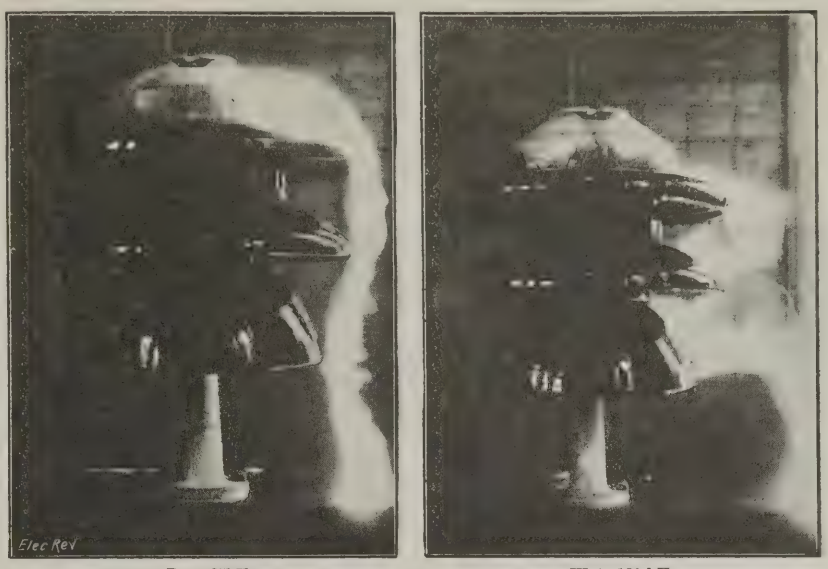


Fig. 4.—Pressure Water Tank.

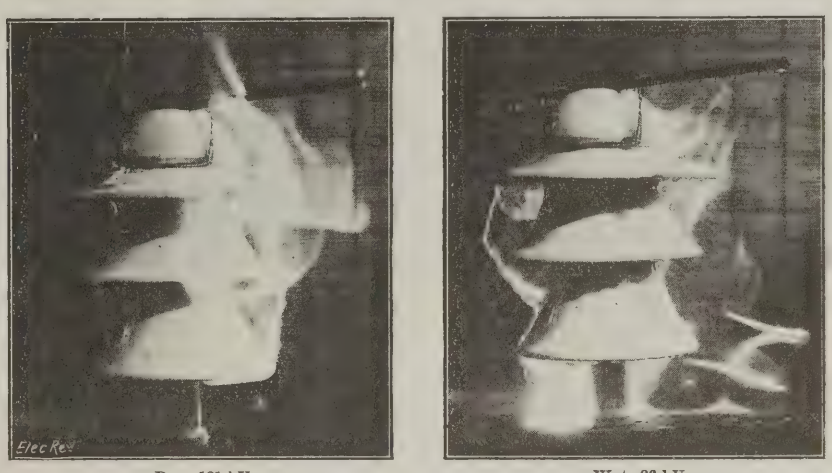
apparatus is kept for the measurement of rate of rainfall and specific resistance of the water. The former is a standard burnished copper rain gauge which does not require any further explanation, and the latter a "Dionic" water tester, fig. 7. This water tester is manufactured by Messrs. Evershed and Vignoles.* This piece of apparatus is eminently suitable for this class of work, as a measurement can be made in a moment, and even a series of readings during one test. Further, it can be used by an unskilled person; the time saved by this method as compared with laborious bridge methods is invaluable.

Tests of the above nature usually group themselves into one or two main classes: duration, and instantaneous spark-over (S.O.) tests. In the former tests, great care has to be taken to maintain a steady rainfall; this operation is greatly facilitated by the pressure control of the rain tank. The method of test is so well known that it does not require any explanation. The following illustrations show spark-overs taking place on various forms of insulators. The photographs reproduced in fig. 5 show a flow-line type of insulator, usually known as a Faradoid insulator; a comparison between the discharge on this insulator and that shown in fig. 6, a delta type, is worthy of notice. The latter insulator when tested dry shows marked corona discharge round the wire band, and also slight brush discharge on the



Dry, 185kV. Wet, 131 kV.

Fig. 5.—Discharge over Faradoid Insulator.



Dry, 121 kV. Wet, 96 kV.

Fig. 6.—Discharge over Delta Insulator.

uppermost shed; this discharge cannot be observed in the flow-line insulator. The relative positions of the metal pins in the two insulators with regard to the top of the porcelain may account to some extent for this difference. In the case of the delta insulator, the pin penetrates in the interior well up into the domed top, whereas in the flow-line type the end of the pin is approximately in line with the bottom of the top shed. The action of the delta type insulator thus makes it

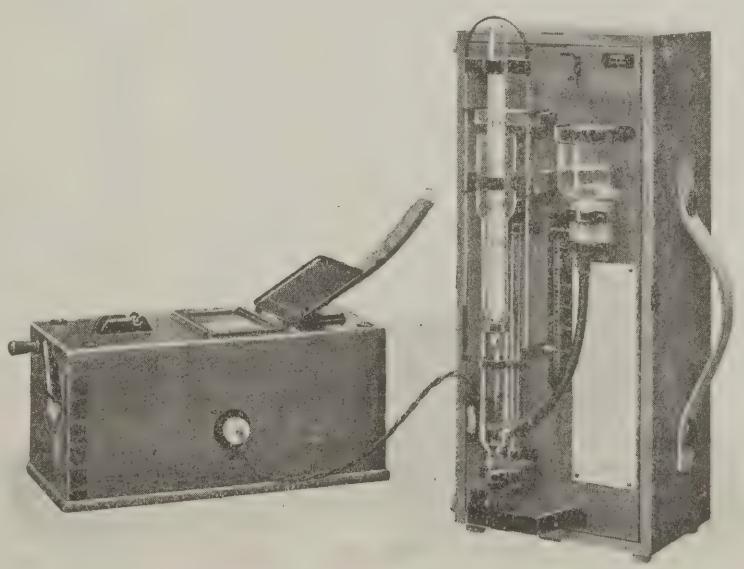


Fig. 7.—Dionic Water Tester.

*See "The Digby & Biggs Dionic Water Tester," by E. Evershed, M.I.E.E.

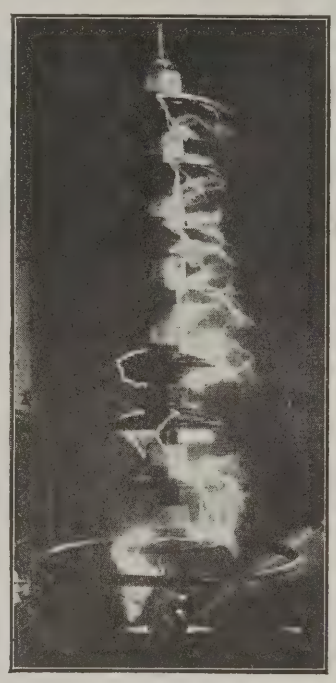
more liable to form creeping sparks and brush discharge. The difference of the path of the arc of the two insulators is also a characteristic feature; in the flow-line insulator the electrostatic field is spread, and there is no tendency to come in between the sheds, whereas in the delta insulator the field around the pin is more concentrated, and tends to draw the arc in. A careful study of the photographs of the delta insulator under rain will show this tendency in as much as the rain drops are being attracted inwards on the middle shed.

Figs. 8, 9 and 10 show three different types of suspension insulators. In fig. 8 the straight line



Dry, 355 kV. Wet, 163 kV.

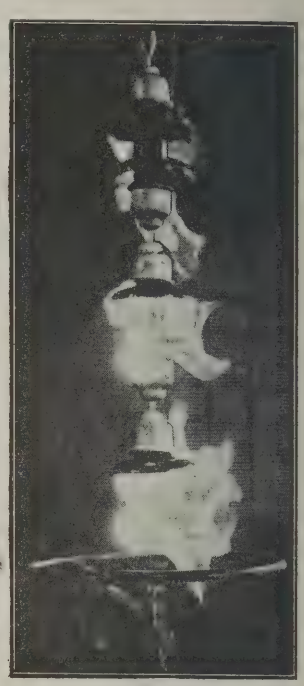
Fig. 8.—Eight Cap and Pin Type Insulators Flashing Over.



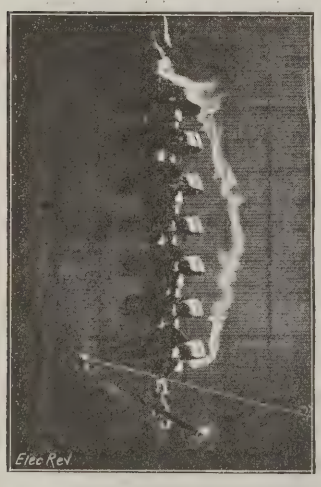


Dry, 370 kV. Wet, 285 kV.

Fig. 9.—Discharge over Double-cap Insulators with Arcing Ring.



slightly to the right of the spark is merely the high-tension lead to the far end of the conductor, and has nothing whatever to do with the spark-over. In looking at the three sets of photographs, the absence of discharge in the dry test on the cap and pin type and interlink types should be compared with the heavy discharge shown on the double-cap insulators. The distance





Dry, 250 kV. Wet, 355 kV.

Fig. 10.—Inter-link Type Insulators Sparking Over.





Dry, 370 kV. Wet, 285 kV.

Fig. 11.—Outdoor Isolating Switch Pedestal Insulators Flashing Over.

between the porcelain pieces in this type and the higher percentage of metal per string of insulators is all conducive to this feature, which is clearly shown in the actual spark-over; where the former types have a clean spark-over, the insulators and the latter form a cascade spark. When tested under rain, this difference is diminished, due to the reduction of the variation in gradient, and all the types give a more or less similar type of spark-over. Fig. 11 shows a rigid pedestal type insulator which is used as a support for various types of equipment such as isolating switches, &c.; the units of this post are the Jeffry Dewitt type.

The variation in different specifications is sometimes confusing; one or other always being employed on various contracts, depending upon the preference of the consulting engineer and client. A few details from them may be of use.

The following notes are extracted from the more important specifications:—

British Standard Specification for Porcelain Insulators for Overhead Power Lines (3,000-150,000 volts). No. 137—1922.

Dry Spark-over Test; Clause 10.—The insulator, complete with metal fittings, shall be tested when dry as follows:—A wire of 0.4 in. diameter shall be fixed to the insulator in a manner similar to that adopted in service. An alternating voltage, of any frequency from 25 to 100 periods per second, approximately of sine wave form, shall be applied between the wire and pin or other support of the insulator. The test voltage shall be measured by means of either a suitable instrument connected to the high voltage side of the transformer, or a suitable instrument connected to the low voltage side of the transformer supplying the test voltage and calibrated by means of the sphere spark gap specified in Appendix II. The test shall be commenced at a voltage of about one-third the full test voltage, and shall be increased at the rate of approximately one kilovolt per second until spark-over occurs. The voltage at which spark-over occurs shall be not less than the appropriate value in Table I.

Rain Test; Clause 11.—The insulator shall be tested in accordance with Clause 10, except that it shall be

subjected to an artificial rain at a temperature of about 15 deg. C., equivalent to one inch in five minutes (5 mm. per minute) directed at an angle of about 45 deg. from the vertical during the test.

The resistance of the water at 15 deg. C. shall not be more than 20,000 ohms per centimetre cube.

TABLE I.

Test Voltage (R.M.S. Values).

	Dry sparkover test.			Rain test.			Puncture test.		
A.C. delivered or declared voltage.	Supporting insulator.		Tensioning insulator.	Supporting insulator.		Tensioning insulator.	Supporting insulator.		Tensioning insulator.
	Pin Type.	Susp. Type.		Pin Type.	Susp. Type.		Pin Type.	Susp. Type.	
3	40	—	30	20	0	10	70	—	52
6	50	—	40	30	—	20	87	—	70
10	62	—	54	39	—	30	108	—	85
* 20	95	90	90	62	57	57	166	158	158
30	125	125	125	84	84	84	220	220	220
* 40	145	150	150	105	105	105	250	260	260
* 50	158	175	175	125	125	125	275	310	310
60	165	200	200	140	142	142	290	350	350
* 80	—	250	250	—	180	180	—	440	440
100	—	300	300	—	220	220	—	525	525
120	—	335	335	—	260	260	—	585	585
150	—	365	365	—	315	315	—	610	610

Kilovolts.

NOTE 1.—The term "delivered voltage" denotes the normal voltage between the conductors at the delivery end. For the purpose of this specification, the working voltage is assumed not to exceed the delivered voltage by more than 10 per cent.

NOTE 2.—Test voltages for special insulators required for intermediate voltages may be ascertained from a curve prepared from the above figures.

* These four voltages are not included in B.S.S. No. 77 Standard Pressures for New Systems and Installations.

The voltage at which sparkover occurs shall not be less than the appropriate value given in Table 1.

(To be concluded.)

The Status of the Professional Engineer.

By FREDERICK MURGATROYD.

ONE has become so accustomed to expect nothing other than technical papers to be printed in the *Journal* of the Institution of Electrical Engineers, that the appearance of the recent paper by Mr. Carter on "The Engineer: His Due and his Duty in Life," must have seemed to many of us remarkable. Our second feeling would be one of pleasure in the thought that things which have been the subject of our meditation are at last being talked of in the halls of the mighty. For giving tongue to our thoughts, Mr. Carter has earned the gratitude of all engineers who love their calling and wish it to take that place in the sun which is its right heritage.

Anyone intimate with the thoughts of modern engineers, and especially those who, for no reason of snobbery, look upon engineering as a major profession, must have become aware of an undercurrent of dissatisfaction, in many ways strange. Strange, because whilst most dissatisfaction springs from purely selfish motives, this new dissatisfaction could not be wholly explained in terms of material gain. It is, therefore, all to the good that the question has now been officially debated, and above all it is essential that the flame lit at the Institution meetings shall not be left to die, but shall be held aloft and retrimmed at every opportunity.

* * * * *

What then is the nature of this dissatisfaction? In the first place, the professional engineer does not feel he is getting a square deal from those who benefit as a result of his work. It is a truism that the engineer blazes the trail of civilization, and that materially the measure of our remoteness from the cave-man is the measure of the contribution of engineering to life. This is really no extravagant claim. Our buildings, our roads, our travel, our means of production and distribution, are all the product of engineering activity. Despite this, the engineering profession is a profession of poor men. The engineer does not ask for a fortune—otherwise he would have been a trader. But he does expect a reasonable financial payment, and in the past he has not had it.

It is this desire for recognition that brings us to the second and far deeper reason for dissatisfaction. The progress of engineering has recently been so rapid, and has embraced the higher realms of scientific work to such an extent, that a new type of entrant has increasingly been drawn into the engineering profession. Especially is this so of electrical engineering. It was not so many years ago that the university graduate was given only benevolent toleration in our ranks. To-day, university training is becoming as essential to success as it is in the sphere of medicine or law. Yet the university graduate in engineering finds that in after life there are no opportunities of leadership or high administrative positions such as seem to fall naturally to his legal or classical brother. Such a state of affairs cannot continue, because engineering is attracting some of the wisest and most enlightened men of our time, men, moreover, who, through their scientific training and inside knowledge of industry, are all the more capable of wise judgment on the many social and national problems to be solved.

That, in brief, explains the nature of the growing dissatisfaction in the profession of engineering. It is the desire of earnest men, who have contributed so much to the public weal, for due recognition from their direct employers and from the nation which benefits.

* * * * *

One or two observations should, however, be made. There is a lot in a name. There is much more in the associations that cling to a name. And, however sweet the word "engineer" may sound to our ears, it conveys nothing more than overalls and oily waste to most laymen. To use the name "professional engineer" is a poor compromise. What is wanted quickly is a *new* name for the well-qualified man, and an authority with legal power to see that only those of specified qualifications shall be allowed to use the name. Moreover, entrance to the profession should be by a suitable ceremony conducted by the authority, just as a priest-elect takes Holy Orders, or a barrister-elect is called to the Bar. All this may seem fantastic to some—there are some people to whom all new ideas are absurd—but, it is only by such a creation of atmosphere that we can win recognition from the world at large.

Finally, in claiming our right to leadership and to administrative posts, we must be sure that we are truly qualified to rule. It is easy to throw gibes at the men who followed classics and law, and have succeeded to places of power. Many of them make good administrators indeed, but no one would put that solely to the credit of their classical or legal training. If they are good administrators, they must have been receptive to many other influences. Thus, no engineer will ever be a good administrator unless he can think clearly, and is able to speak and write his own language correctly and with clarity. He must know something of economics, of history (especially industrial history), and of psychology. Surmounting all, there is the man's personality. No man is a true leader whose main impulse is selfishness. The natural leader is in rhythm with the universal law of service, by which an understanding of life and its problems, approaching the mystical, is attained. He raises himself beyond self, and works in synchronism with nature towards the goal of a more perfect life. The others follow.

It would be one of the highest duties of the authority proposed, to seek among educated men, sharpened in the engineering atmosphere, the few who possess innately the gift of leadership, which is the gift of true service, and to make sure that the qualities of such men are used to the benefit of the nation.

Electric Steel in Mexico.—It is reported from Mexico City that the local firm of Hierrey Acero de Mexico has entered into a contract with representatives of the Siemens and Halske Company of Berlin, for the construction of a modern iron and steel works plant. The smelting furnaces and machinery will be obtained from Germany. It is stated that the question concerns the practical application of the production of steel by means of "electro analysis" on a large scale, such as was shown by the Berlin firm for the first time at the recent Leipzig Fair.

The Electricity (Supply) Bill.

By Sir PHILIP DAWSON, M.P.

The progress of the electricity supply industry in Great Britain has been hindered and retarded by parochial legislation and hampering restrictions. The need for encouraging the industry and its vital importance to the general welfare of the country were clearly and fully brought out in the reports of the Coal Conservation Sub-Committee, of the Committee appointed by the Board of Trade on Electric Power Supply, and of the Archibald Williamson Committee. These Committees comprised representatives of all those interested in the development of electricity supply and distribution and utilisation, and the most exhaustive investigation of the whole subject was made, evidence from all quarters being heard.

The conclusions as to the need for legislation and as to what the requirements were to render available a more abundant, universal, and cheap supply of electricity were clearly laid down, and on the latter point all three Committees were unanimous. The result of these investigations was the 1919 Electricity (Supply) Act, which created the Electricity Commissioners, but gave them no real power.

To some extent this unsatisfactory state of affairs was remedied by the 1922 Act, but the compulsory powers which were essential to enable the fundamental conditions laid down by all three Committees referred to above, to be complied with were still omitted.

Successive Governments have talked about electricity without doing anything to render the use of it more generally possible. The present Government appointed the Weir Committee, whose report has just been published, on which the present Electricity Bill is based.

This Committee had not only the evidence of the investigations of its predecessors before it, but also the results of the exhaustive examination of the conditions obtaining in the supply industry in this country, carried out by the Electricity Commissioners during the last six years. In addition, they took evidence themselves to ascertain how far the present conditions justified the conclusions arrived at by the previous Committees, and obtained outside expert assistance to check the estimates prepared for them by the Electricity Commissioners.

No one who knows the facts can deny that this country, through no fault of its industry or its spirit of enterprise, but in consequence of the hampering restrictions imposed upon it, is behind all other industrial countries of the world as regards the use of electricity for all purposes.

The country realises this, and all political parties have called attention to it; the question is: What is the remedy? It is here that the difficulty arises. Some say "Leave us alone and do nothing." "Wait and see." Others say "Reintroduce the powers given to the Electricity Commissioners in the 1919 Bill, and cut out by the House of Lords."

The present Bill, based as it is on the recommendations of the Weir Report, proposes an alternative which those who framed it believe will bring about the desired result.

The first course is one which can only commend itself to vested interests, and which in a few years' time might make real combination and co-operation practically impossible, conditions which all agree to be essential.

The second is tantamount to nationalisation. The third is wisely conceived, and should achieve its object without nationalising the industry. It must not be lost sight of that the electric supply and distribution industry is a public utility, and that it must of necessity be a monopoly. It is essential, therefore, that the consumers' interests should be reasonably protected, and it is the duty of the State to see to this. So far, in nearly all the discussions which have taken place, the voice of the supply industry has been predominant, and little or nothing has been heard about the consumer.

The Government Bill has received a second reading, and it now remains during the Committee stage to try and amend the clauses, where necessary, so as to provide that:

(1) The Board which is to be set up is composed of the best business talent the country possesses and of men commanding the respect of all, who shall be entirely independent of any political or bureaucratic control, any conflict as regards decisions they may arrive at being settled by an impartial judicial tribunal.

(2) The rights of those who have invested money in the electricity supply industry be not interfered with.

(3) Private enterprise be encouraged by all possible means, and that whilst the consumer is properly protected, there shall be an inducement to the producer to improve the methods of generation and distribution by enabling him to participate in the financial benefits resulting therefrom.

(4) The Board be given any compulsory powers they may need to carry overhead transmission lines across country and to generally facilitate the spread of electrical enterprise.

Some Points in the Bill that need Elucidation.

By "OHM."

The discussions in Parliament and in the Press have helped to clear the air to some extent and define the attitude of those who are interested in the fortunes of the Electricity (Supply) Bill, 1926.

Many of the points raised will shortly be dealt with by a Standing Committee of the House of Commons, and for the present, at any rate, need not be further discussed, but there are certain arguments which have been made in favour of the Bill which do not appear to be well founded and call for consideration.

It is stated that the bankruptcy of the truncated electricity supply legislation of 1919 has been betrayed through statistics alone, because the percentage increase in the output of electricity in the previous year has decreased during the four years ended March 31st, 1926, and will fall to zero in about four years, when the consumption per head of population supplied by authorised undertakers will stand at about 210 units, as compared with the present consumption of 560 units for the United States.

In considering this assertion, the question may be asked why the decrease will not continue with ever-increasing rapidity until there is no output at all? The real answer to the assertion, however, appears to be that the decreasing percentage is due to the slump which followed the war, from which the country has not yet recovered. Happy electrical manufacturers! who have been too busy to notice this and in their haste have been unconsciously led to a wrong conclusion.

Monotony is usually one of the banes of existence, but the chairmen of electricity committees, of power companies, of distribution companies, and even of electrical manufacturing companies, have during these difficult years spoken of the progress which has been made in the supply of electricity, or the manufacture of electrical plant, and expressed their conviction that once trade had recovered there would be unprecedented advances.

It is not the object of this article to discuss the respective merits or demerits of joint electricity authorities formed under compulsion or by consent, but it

may be stated that there is still a good proportion of people in this country who do not believe that the best results are obtained by compulsion or by the brandishing of a big stick. In confirmation of this it is becoming increasingly clear that the opposition to the Bill will centre round those clauses where the provisions are compulsory or where there is no right of independent reference.

The amount of Central Electricity Stock which will ultimately be issued is not very clear. On the one hand it is stated that the £33,500,000 will be reached at a maximum period of development, and according to the Weir Report this should take place about 1940.

There does not appear to be any justification for this statement. It is true that the Bill fixes the sum mentioned as the amount to be issued, but there is no assurance anywhere in the Bill that this amount will not be increased.

On the other hand, it is stated in the Weir Report (paragraph 79) that "The technical scheme will, we think, involve during the next 15 years new money to the extent of upwards of £250,000,000. We estimate that one half of this will be required in connection with the development of distribution schemes, and this capital should be provided by the local authorities, power or distribution companies as now."

This should be read in conjunction with paragraph 81, which states that the other half of the new capital can be divided into two sections, one being "the amount necessary to construct the 'gridiron' for bulk transmission, plus (1) the necessary working capital; (2) sufficient reserve to cover the initial expenses of management; and (3) interest capitalised. . . . We estimate that a sum of £25,000,000 *would be absorbed in the foregoing by the end of five years from the date the scheme is put into operation.*"

If it is correct that the total will be reached at a maximum period of development, does the Weir Report mean that the scheme will not be put into operation until 1935—that is, five years before the 1940 to which reference has so often been made?—inaccurately made, because the Weir Report forecasts the millennium of electricity supply "in 1940 *or when the consumption has reached* 500 *units per head.*"

Those who are familiar with the matter will be aware that the difference between the £33,500,000 and the £25,000,000 above referred to is the estimated cost of the standardisation of frequency. During the debate on the second reading, much doubt was expressed whether this difference was sufficient, but as Kipling says—that is another story.

When will the consumption of 500 units per head of population be reached? Advocates for the Bill point to the output of the United States as the goal towards which this country should strive, but say little of the different conditions which prevail.

To consider the respective advantages of a national or local authority or power company supply, would lead to an article of inordinate length and serve no useful purpose, but it was stated in the House on Tuesday, March 30th, that 97 per cent. of the electricity generated in the United States was generated by private companies and only 3 per cent. by municipal undertakings. Of course, this solution is not contemplated here. It has been stated that "the realisation of a similar co-ordination (that is, as in North Italy or the United States) in Britain, the possibility of establishing a number of power undertakings with centralised control is out of the question, since local authorities account for over 65 per cent. of the total output of electricity."

Nor has this solution been suggested by the power companies. What they have asked for and will continue to ask for is that the Bill shall be so amended that it will not, in the opinion of the many who believe in private enterprise, involve a breach of faith through the cancellation of existing statutory rights, and create such conditions of uncertainty as would prevent the free flow of the capital that is so necessary for efficient electrical development.

Their hope is that such amendments will be made as will give confidence to all engaged in the development of electricity supply, whether it be through the undertaking of a local authority or a company, and so change them from ohms to amperes charged with many volts all working for the common good.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Threatened Tramway Strike at Rochdale.—As we have previously reported, the employés of the Rochdale Corporation Tramways Department decided to cease work on Good Friday on account of the dismissal of two men for misconduct. The strike was postponed, and negotiations were opened between the men and the Tramways Committee. No agreement was reached, however, and the men were to call a meeting to decide upon the action to be taken.

Electrical Contracting Notes.—It is reported that the Gloucester Electricity Department is paying increased attention to the earthing of domestic electrical appliances such as irons, vacuum cleaners, fires, and so on. The local branch of the Electrical Contractors' Association is seeking a definite ruling on this matter. Owing to the approach of the City and Guilds examinations, E.C.A. branches are making arrangements to bring forward promising apprentices to compete for the E.C.A. gold, silver and bronze medals. At the last meeting of the Sheffield branch it was resolved to insert suitable advertisements in the local Press, emphasising the advantages of placing installation work in the hands of competent firms. Members of the Stoke-on-Trent branch have taken space at the electrical exhibition to be held in Burslem Town Hall during "Civic Week." The meetings of this branch are held in the offices of the Electricity Department, and the branch thereby maintains the closest possible touch with Mr. Yeaman, the chief electrical engineer, who is a regular visitor to the branch meetings.

Special Telephones Committee.—Sir Alexander Roger, chairman of the Telephone Development Association, has accepted an invitation to join the Special Committee for Telephones set up by the International Chamber of Commerce. The chairman is Dr. Walter Leaf, and the other representative of Great Britain is Mr. Frank Gill, past president of the Institution of Electrical Engineers.

Baghdad Electrical Concession.—Messrs. John Stone and Co., who hold the Baghdad electrical concession, have asked the Colonial Office for six months' grace to study the fresh proposals put forward by the Iraq Government.—*Exchange Telegraph* (Baghdad).

Local Exhibition.—MANCHESTER.—A Better Housing and Housekeeping Exhibition was opened on April 9th by Mrs. Councillor E. D. Simon, a member of the Council of the new Manchester branch of the Electrical Association for Women. Standard Telephones & Cables, Ltd., have a large display of domestic electrical appliances; Central Cables & Accessories, Ltd., shows its "Central" electric vacuum cleaner; "Delco-Light" and "Frigidaire" products are exhibited by Messrs. Frederick Jones & Co., Manchester; Messrs. E. O. Walker & Co., Manchester, exhibit "Thor" washing machines; and other exhibitors are the Excelsior Electric Cleaner Co., the Gem Labour-Saving Device Co., Ltd., and Hoover, Ltd.

Rubber Industry.—On Monday next, at the Engineers' Club, a meeting of members and friends of the Institution of Rubber Industry will be held to consider a proposal to form a Salesmen's and Advertising Section.

Belgian Customs Regulations.—Owing to the lapse, as from April 1st, of the special duties imposed on certain German goods on importation into Belgium, the list of goods in respect of which certificates of origin are required has been reduced, states the *Board of Trade Journal*. The following classes are, however, still subject to the requirement: Dynamo-electric machines; boiler fittings of various sorts; submarine and subterranean cables for electricity; articles for electrical purposes of faience, porcelain, terra-cotta, stoneware or glass with parts of metals or other materials; and electrical and electrotechnical apparatus and separate parts thereof, for the application of electricity in all forms (not elsewhere specified in the tariff).

City Electricity Charges. — The Special Committee appointed over a year ago by the Corporation of London to consider the cost of electricity in the City has issued a report. Dissatisfaction is expressed at the action of the Ministry of Transport in reducing the legal maximum charge from 8d. to 7d. per kWh, when a reduction of 3d. was anticipated. Mention is made of the Corporation's decision to abandon the right of purchase of the City undertaking of the Charing Cross Electricity Supply Co., Ltd., and that of the City of London Electric Lighting Co., Ltd., and also of the provision of a sliding scale of prices and dividends by the London Electricity Acts. The Committee states that the companies had issued notices setting out a scale of tariff charges to operate as from January 1st, 1926, and it had urged the companies to make the scale take effect from October 1st. The companies gave a number of reasons for their inability to comply with this request, among them being the poor load factor; the conditions in different areas, which made equality of prices impossible; and the fact that their dividends were not unreasonable when compared with those of other companies. It had been suggested to the Committee that the Corporation should either generate electricity for itself or seek an alternative source of supply, but neither of those courses is considered feasible. The Committee concludes its report as follows:—"In view of the very considerable profits which have been distributed by the two companies among their members during the last few years, we are of opinion that there is scope for a further reduction in the price of electricity in the City. Inasmuch, however, as future prices will be based upon a sliding scale in accordance with the recent Act, we do not feel able to make any specific recommendation on the subject until the working of the Act is tested by experience, and in the circumstances beg to recommend that the several references to us be discharged, but that it be referred to us to consider the question of the prices charged in the City when the full effect of the recent legislation is seen."

The Metropolitan-Vickers Carnival.—A carnival and cabaret were held by the staff of the Metropolitan-Vickers Electrical Co., Ltd., on Friday last, at the Free Trade Hall, Manchester. About 2,500 attended in a variety of brilliant costumes, and a number of gorgeous effects were produced by a special scheme of illumination. The cabaret comprised three scenas, Dutch, Parisian and Oriental, the last is depicted in the accompanying illustration. The judges had a very difficult task in awarding prizes for 14 costumes out of a total of over 2,000, but their success was testified to by the general approval. At 11 p.m. the B.B.C. broadcast the proceedings from the Manchester station for the benefit of the public and those employés who were unable to be present. The carnival both from the decorative and catering points of view was a triumph of organisation.



A Tableau at the Metropolitan-Vickers Carnival.

New Businesses.—The following new electrical businesses have been recently registered under the Business Names Act, 1916:—

Smith & Jordan (electrical and wireless engineers), 6, Millbank Terrace, Redcar.

London Radio Supply Co. (manufacturers of and dealers in radio apparatus), 11, Oat Lane, E.C.2.

A. Fraser (cycle and wireless factor), Eltham Market, High Street, Eltham, S.E.9.

Foleshill Wireless Distributing Co., 879, Foleshill Road, Coventry.

Alfred Williams & Son (electrical engineers), 21, Cannon Street, Preston.

Whibro Engineering Co. (electrical and mechanical engineers and contractors), 38, Guildford Park Road, Guildford.

Moorhouse & Co. (electrical, radio, and hardware manufacturers and importers of radio specialities), 101, Bradford Road, Shipley, Yorks.

Rationola Wireless Instrument Co., Hackney Downs Junction Approach, G.E.R., Hackney, E.8.

Telektron Co. (radio components), 14, Lacy Road, Putney, S.W.15.

Rock Electrical Engineering Co., 6, Rock Street, Oldham.

Lead.—Messrs. James Forster & Co. reported on April 10th:—"Though the price of lead may go a little lower yet, we consider that the worst of the fall has already been seen and that forward lead at present prices is well worth picking up by consumers."

Trade with Russia.—In reply to representations upon this subject made by the London Chamber of Commerce, the Foreign Office states that the Government has every sympathy with British investors who have had their properties confiscated under the Soviet law. It is thought that a growing sense of the economic needs of Russia may in time help the Soviet Government to realise that the development of trade depends upon credit and that Soviet credit cannot be established in the markets of the world until existing liabilities legally inherited are recognised and until an honest attempt is made to meet them. With regard to the sale in this country of products of confiscated factories, the Courts have held that where the Soviet Government can prove a good title according to Soviet law such title is valid here. The British Government does not consider that matters would be improved by abrogating the existing Trade Agreement with Russia.

The French Export Trade.—In the course of the report for 1925 of the Union des Syndicats de l'Electricité, it is mentioned that until recent months the exports of electrical manufactures have consistently increased in volume. Thus on the basis of the exports of 10,200 tons in 1913 the export surplus amounted to 2,600 tons; in 1921 the surplus with exports at 12,400 tons was 200 tons; in 1922, when the exports were 13,000 tons, the surplus was 4,600 tons; in 1923 the excess of exports over the imports was 7,800 tons, with exports of 16,700 tons; and in 1924 the exports reached 23,600 tons, giving a surplus of 15,200 tons over the imports. The report states that the share of France in the world's electrical trade has increased from 6 per cent. in 1913 to 11 per cent. in 1924. During the same period the share of Germany has diminished, the shares of England and Switzerland have scarcely increased, while that of the United States has grown by 50 per cent. In view of the present economic situation the French do not know whether the exports of electrical machinery will continue to progress in such a rapid manner, but the hope is expressed that having acquired an important place in foreign markets, French makers will know how to maintain their position.

Manufacturing in Belgium.—The report of the directors of the Compagnie des Constructions Electrique de Belgique, which deals with the period of eight months ended December 31st, 1925, states that during this time the works were idle for seven weeks owing to a strike, which caused a serious loss. Notwithstanding this strike and the industrial and economic crisis and the difficulties resulting from the arrangement of the Liége works, the results for the period show a profit of 109,139 fr. After having placed 5 per cent. to the legal reserve fund, the balance of 103,682 fr. has been carried forward. The capital has been reduced, and at the same time the raw materials have been written down and the machine tools and fixed plant at the works have been re-valued. As the works at Liége has been completed with a view to the production of small motors in bulk, the installation programme has now been finished; large and medium-sized machines are constructed at the Herstal works, while apparatus and small motors are being turned out at the Liége works.

Lift Contracts.—In the reconstruction of Regent Street, W., the Express Lift Co., Ltd. (proprietors, the General Electric Co., Ltd.), has installed over 100 lifts. Amongst other recent installations for which this firm has been responsible are: Bank of England Buildings (12); Midland Bank, Ltd., three branches (18); the new Park Lane Hotel (23); the New Royal Hotel, Southampton Row (15); Service Flats, Ltd. (77); Fullers, Ltd., Regent Street (16); Café Royal, Regent Street (8); New Carmelite House (5); *Daily News* (8); and Lewis's Stores, Birmingham (8).

Electrical Development in Rumania.—A conference was recently held at the Ministry of Industry in Bucharest to discuss the possibilities of electrifying Rumania; Swiss, French, and Italian experts are said to have been present. Foreign financiers manifest great interest in the matter, but it is stated that foreign capital will not be provided for works if the commercialising law and other laws, which greatly hamper foreign enterprise, are applied to electrical undertakings.

Unemployment.—The Employment Exchange returns for March 29th showed a total of 1,013,600 persons wholly unemployed. This represented a reduction of 25,754 during the week and the total was 180,713 less than that of March 30th, 1925.

Trade Announcements.—The address of the ELECTRICAL PUBLICITY BUREAU is now 36, Kingsway, W.C.2.

THE STEEL BAND CONVEYOR & ENGINEERING CO., LTD., has removed to Barker Street Works, Parade, Birmingham. A card illustrating a "record-breaking" "Sandvik" steel band (377 ft. long × 24 in. wide × 0.004 in. thick, and weighing 1,225 lb.) has been received.

MR. A. CLADWELL YOUNG, 120, Wellington Street, Glasgow, has by mutual arrangement severed his connection with Kent Brothers Electric Wire Co. and E. H. Phillips, Ltd. Another representative will be appointed shortly.

THE ALTON BATTERY CO., LTD., has appointed Messrs. Simpson, Baker & Co., 2-5, Nelson Street, Bristol, as its agents for South-West England and South Wales.

THE TELEGRAPH CONDENSER CO., LTD., has opened new works at Wales Farm Road, North Acton, W.3, to which address all communications and goods should be sent.

MESSRS. CLEGG, HIGHCOCK & CO.'s new address is:—8, Drury Lane, Water Street, Liverpool. Telephone: Bank 4000; telegrams: "Praebere."

Catalogues and Lists.—THE ZENITH MANUFACTURING CO., Villiers Road, Willesden Green, N.W.2.—An illustrated catalogue of regulating resistances, resistance units, and small transformers. Priced.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—April price sheet of electrical materials and apparatus. Fully illustrated.

NUCYNES, 35, Waterloo Road, S.E.1.—A booklet advertising the firm's signs.

Mr. W. S. JOHNSON, 42, George Street, Edinburgh.—A priced pamphlet illustrating a wireless electric iron, *i.e.*, one which is placed on an electrically-heated stand.

THE AUTOMATIC TELEPHONE MFG. CO., LTD., Milton Road, Edge Lane, Birmingham.—Booklet No. 71, and a coloured showcard, advertising the company's headphones and loudspeakers.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, nr. Manchester.—A poster measuring 30 in. by 20 in., produced by the photogravure process, showing motor traffic in Whitehall, the purpose being to advertise the company's automobile batteries.

ST. HELENS CABLE & RUBBER CO., LTD., Slough.—A comprehensive catalogue of the company's "C.T.S." cables and wires.

THE TOURTEL MANUFACTURING CO., 48, Uxbridge Road, Ealing, W.5.—A folder advertising the "Diamond" seal padlock.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—April list of motors and dynamos in stock.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—Technical Guide No. 1,510a, containing information regarding small induction motors for driving textile machinery, &c.

Bankruptcy Proceedings.—F. J. TIZZARD and N. TIZZARD (Tizzard Bros.), electrical engineers and contractors, 27, Dalkeith Street, Barrow-in-Furness, and 121, Market Street, Dalton-in-Furness.—First and final dividend of 7¼d. in the £, payable at the Official Receiver's offices, 16, Cornwallis Street, Barrow-in-Furness.

W. C. RHODES (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham.—First and final dividend of 1s. 8d. in the £, payable at the Official Receiver's offices, 191, Corporation Street, Birmingham.

W. R. SQUIRE, electrical engineer, 11, Steward Street, Spring Hill, Birmingham.—First and final dividend of 2s. 1d. in the £, payable at the Official Receiver's offices, 191, Corporation Street, Birmingham.

W. G. BAYMAN, electrical engineer, 86, North Side, Wandsworth Common, S.W. (late of 13, Russell Street, Plymouth).—First and final dividend of 4d. in the £, payable at the Official Receiver's offices, 29, Russell Square, W.C.

REED & BURR, wireless manufacturers' agents, Radio Lodge, Hammersmith Terrace, W., and Red Lion House, Red Lion Court, Fleet Street, E.C.—Receiving order made April 1st on creditor's petition. First meeting April 16th; public examination April 27th, both at Carey Street, W.C.

J. C. HEALEY, electrical engineer, 4, Worsley Terrace, Wigan.—First meeting April 19th, at the offices of the Official Receiver, 11, Dale Street, Liverpool; public examination April 29th, at the Court House, Wigan.

A. F. KINGDOM, 86, Old Town Street, Plymouth, late of Devonport, electrical and radio engineer.—The public examination of this debtor was to be held on April 9th at Plymouth, but he did not appear, and the case was adjourned.

Company Liquidations.—PEERLESS PRODUCTIONS, LTD., Cowthorpe Road, Wandsworth Road, S.W., medical electrical apparatus manufacturers, &c.—A meeting of creditors was held recently at the Institute of Chartered Accountants, E.C., when the chair was occupied by the liquidator of the company and the receiver for the debenture holders, Mr. Sidney Sharpe, C.A. A statement of affairs was presented which showed liabilities of £2,350, and net assets of £800, which left a deficiency as regarded a debenture holder of £1,302. The liquidator said that there would be nothing for the unsecured creditors. The company was incorporated in August, 1925, with a nominal capital of £500. All the shares were issued of which 168 were paid for in cash. On August 20th, 1925, it was resolved to issue debentures and accordingly £1,000 debentures were allotted to Mr. D. J. Phillips (the chairman of the company), and cash for that amount was received. A further £1,000 debentures were issued to the same gentleman in October, 1925. On January 28th, 1926, owing to bad trade, three of the directors resigned and Mr. R. J. Phillips was appointed a director. Since that time the directors had been Mr. D. J. Phillips and Mr. R. J. Phillips, and all the shares were transferred to them. It was apparent from the accounts that the company had not done sufficient trade, and the overhead expenses were far too high. On March 15th, 1926, the company being pressed and a writ having been issued, a resolution was passed for voluntary winding up and on the same date the debenture holder appointed Mr. Sharpe as receiver. A committee of three of the creditors was appointed to act with Mr. Sharpe as liquidator. The following are creditors:—

	£		£
Aston & Mander (1917), Ltd.	25	Telegraph Condenser Co.,Ltd.	33
Erinoid, Ltd.	205	Thornton & Co.	32
Harrison Bros.	31	Vernon, J. G., & Co., Ltd.	52
Hyatt, J., & Co., Ltd.	36	St. Helens Cable & Rubber Co., Ltd.	25
Murphy, F. C., & Co., Ltd.	20	South London Electric Co.	188
Plumtree, J. S.	20	South Metropolitan Gas Co.	72
Smiths Printing Co.	33		
Spicers, Ltd.	54		

R. R. GODING, LTD., radio dealers, &c., 42, Gray's Inn Road, W.C.—A meeting of creditors was held on April 8th, when the chair was occupied by Mr. E. B. Winn, accountant, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented which disclosed liabilities of £1,733, and net assets of £270, leaving a deficiency of £1,463. The liquidator reported that since his appointment he had carried on the business and had retained the services of Mr. Goding and the secretary of the company, Mr. Goding's salary being £4 weekly and that of the secretary £3 10s. per week. Mr. Goding said that the company was formed on December 3rd last, with a nominal capital of £3,000. The company took over stock of £1,600, and goodwill £1,400. The consideration for the purchase of the business taken over was £2,000, and the company assumed liabilities of £1,000, £150 of which was still owing. Mr. Goding stated that he was interested in another wireless business in Cannon Street. He had been supplying that concern with goods up to the date of liquidation, but he had always received cash on delivery. R. R. Goding, Ltd., was formed with the sole object of carrying on a wholesale business, but it was not a success. The company was doing well before and just after Christmas last, but then trade began to decline. It was decided that Mr. E. H. Hawkins, of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C., should be appointed to act as joint liquidator with Mr. Winn. The following are creditors:—

	£		£
Adie & Co., Ltd.	32	General Electric Co., Ltd.	26
Autoveyors, Ltd.	23	Garnett, Whitelev & Co., Ltd.	36
Acton Plating & Enamel Works	23	Graham, A., & Sons	84
Bedford Electric and Radio Co.	28	Hunt, A. H., Ltd.	93
Brentwood Works	64	London Electric Stores	38
Burndept Wireless Co., Ltd.	25	Marconiphone Co., Ltd.	123
British Thomson-Houston Co., Ltd.	31	McMichael, L., Ltd.	24
Brown, S. G., Ltd.	69	Mildner, F.	24
Cable Accessories Co., Ltd.	20	Metro-Vick Supplies, Ltd.	137
Dubilier Condenser Co., Ltd.	132	Marconi's, Ltd.	27
Eastick, P. P., & Sons	36	N.A.R.M.A.T.	21
Fuller's United Electric Works, Ltd.	22	Radio Communication Co., Ltd.	29
Ferranti, Ltd.	39	Radio Instruments, Ltd.	20
		Rothermel & Sons	42
		Wilkinson Wright, Ltd.	37

RADIO EQUIPMENT CO., LTD.—First meeting of creditors and contributories, April 20th, at Carey Street, W.C.

NEUTRON, LTD.—A petition for the winding up of this company was presented to the High Court by Messrs. E. Hunter and Co., Ltd., creditors, and was to be heard in London on April 13th.

BARCLAY RADIO STORES, LTD.—A meeting of members is called for May 10th, at 26, Corporation Street, Birmingham, to hear an account of the winding up from the liquidator, Mr. C. T. Appleby.

Dissolutions of Partnership.—GILBERT & HEARN, automobile and electrical engineers, Central Garage, Holyhead Road, Wednesbury.—Messrs. H. L. Gilbert and W. H. Hearn have dissolved partnership. Mr. Gilbert will attend to debts and continue the business.

HARRIS & MUDDIMAN, electrical engineers, 78, Cox Street, Coventry.—Mr. F. W. Harris and Mr. G. W. Muddiman have dissolved partnership. Mr. Muddiman will attend to debts and continue the business.

HOUCHIN & LAWRIE, electrical engineers, 9, Melbourne Parade, Palmers Green.—Mr. A. O. Houchin and Mr. A. Lawrie have dissolved partnership. Mr. Lawrie will attend to debts and continue the business under the same style.

Private Arrangements.—R. G. CRONYN, trading as Radio Sets and Supplies Co., 3, King Street, Maidenhead.—A meeting of creditors was held on April 7th at the offices of the Society of Incorporated Accountants, E.C., when a statement of affairs was submitted by Messrs. Harper & Broom, which disclosed liabilities of £2,112 and net assets of £1,258, leaving a deficiency of £854. In reply to a question debtor's solicitor said that a few local gentlemen were interested in the business, and they were prepared to offer a composition of 5s. in the £. That offer was not considered adequate, and it was increased

to 6s. 8d. in the £, payable as to 5s. in cash, and 1s. 8d. in three months. Several creditors said that they would not be prepared to accept the offer, as the figures in the statement of affairs showed more than the composition which had been suggested. It was eventually decided that the debtor should be requested to execute a deed of assignment in favour of Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, and Mr. Charles Latham, accountant, 78, New Oxford Street, W.C., as joint trustees, with power to sell for an offer approved by a committee of inspection consisting of Mr. Bryne (London Electric Stores, Ltd.), Mr. Head (Marconiphone Co., Ltd.), Mr. Graham (J. K. Cooper & Sons, Ltd.), a representative of Standard Telephones & Cables, Ltd., and Mr. Smallbones (P. H. Smallbones, Ltd.).

The following are creditors :—

	£		£
London Electric Stores, Ltd. ...	223	Rouse, P.	41
British Thomson-Houston Co., Ltd.	85	Rothermel, R. A., Ltd.	95
Brown, S. G., Ltd.	61	Smallbones, P. H., Ltd.	94
Dew, A. J., & Co., Ltd.	58	Sterling Telephone & Electric Co., Ltd.	27
Edison Swan Electric Co., Ltd....	67	Standard Telephones & Cables, Ltd.	108
Elwell, C. F., Ltd.	38	Darby's Advertising, Ltd. ...	78
General Electric Co., Ltd. ...	51	Heyborn & Co.	44
Houghton-Butcher, Ltd.	32	Cooper, J. K., & Sons, Ltd. ...	121
Marconiphone Co., Ltd.	121		
Radio Communication Co., Ltd.	80		

Book Notices.—"The Slide Rule Simplified." By Donald C. Rogers. Pp. 76. London: Drawing Office Supplies, Ltd. Price 5s. net.—The working of the slide rule is laid down in a clear and concise manner in this book, and numerous examples are given throughout. Apart from the usual arithmetical applications, the solving of money problems by means of the slide rule is dealt with in a separate chapter.

The D. Van Nostrand Co., of New York, has sent us several lists of recently-published works on commercial and technical subjects. These include several works on electrical engineering by British and American authors.

"Official Directory of the British Chemical Plant Manufacturers' Association, 1926."—The directory, issued by the Association, is arranged in two main sections, an alphabetical list of the Association members, and a classified list of their products and manufactures. In addition a complete list of the officers and members of the executive committee is given and an introduction by the chairman outlines the objects of the Association.

"Kempe's Engineers' Year Book for 1926." 33rd Edition. Pp. 3,023. London: Crosby Lockwood & Son. Price 30s. net.

Home Lighting Course for Women.—The Electric Lamp Manufacturers' Association proposes to hold a home lighting course for women at its London Lighting Service Bureau, on April 29th and 30th. From a programme which we have received we gather that the course is designed for lady demonstrators in electrical showrooms and elsewhere. The subjects include a historical review of lighting from the earliest ages, the control of light (including the correct applications of decorative art), modern wiring systems, selling light and other matters of use and interest. The course will conclude with an informal dinner.

Chinese Notes.—The *Chinese Economic Bulletin* states that the capital of the Pootung Electricity Supply Co. is to be increased to a million dollars, and the plant capacity to 5,000 kW. Within the next five years the service is to be extended to a number of neighbouring districts, including Nanwei, Chuansha, and Kingsan.

The Futsing Electric Light Co. has suspended operations owing to the poor business prospects. Futsing merchants are endeavouring to refloat the company with a capital of $30,000, and $15,000 has already been raised.

British Goods in South America.—In the course of a report upon Bolivia (Stationery Office, 6d. net), Mr. A. J. Hill, Chargé d'Affaires at La Paz, states that British goods have the best reputation in South America, but price is the most important factor in sales. Better quality at the same price or the same quality at a lower price appear to be the only effective way of meeting competition. If the price is higher, the argument of better quality does not appeal to countries west of the Andes.

Wages in the Engineering Industry. — In pursuance of their altered policy of negotiating wage increases by districts instead of nationally, representatives of trade unions in the engineering industry met the employers' representatives at York on April 9th. The districts concerned were London, Bedford, Bradford, and Luton. After protracted discussions it was announced that the conference had failed to reach an agreement, and the trade union representatives are reported to have declared that the way was now clear to adopt any action considered necessary to enforce their claim. A meeting of the London Joint Engineering Trades Committee was held on Monday last, when the result of the York conference was reported.

The Committee adopted the following resolution after some discussion :—"That in view of the central conference held at York having registered a failure to agree on the London application for a 20s. a week increase, this joint engineering trades committee recommend to the district committees concerned immediately to obtain permission where necessary of their respective executive councils to issue a uniform ballot paper for strike action. This joint trades committee requests that immediate special meetings of each district committee be called to give effect to the foregoing resolution." The committee will meet again on Monday next to receive the replies from the various districts.

For Sale.—Edinburgh Corporation Electricity Department invites offers for 18 tons of clean scrap high-conductivity copper wire. Slough Trading Co., Ltd., invites offers for several gas-producer plants. By order of the liquidators, Messrs. Toplis & Harding, in conjunction with Messrs. Knight, Frank & Rutley, will sell by auction on April 28th, at the British Empire Exhibition, electric lighting and illuminating equipment, about 900 electric meters, cable, tools and stores, &c. (See our advertisement pages to-day.)

South Shields Tramway Dispute.—It is reported that the threat to cut off the power to South Shields tramways by the Electrical Power Engineers' Association unless one of its members, dismissed on grounds of redundancy, was reinstated has been withdrawn, and the Council has withdrawn the notice to the official concerned. The matter is to be considered in committee.

Diary.—Messrs. Thomas Bolton & Sons, Ltd., have sent us one of their 1926 diaries, which is handsomely bound and contains a great deal of information—general and technical.

Irish Free State Electrical Imports.—The official returns just to hand show that the imports of electrical goods into the Irish Free State during January last amounted to £22,624, as compared with £52,407 in the corresponding month of 1925. Electrical machinery is not included in these figures.

United States Electrical Exports.—The statistics of the January exports of electrical goods from the United States show that the total value was $7,144,842, which was approximately $1,750,000 below the December figure, and $283,000 below the total for January, 1925. The decrease was due to fluctuations in goods affected by seasonal and other conditions; the staple lines, on the whole, showed progress. The exports of generating equipment and transformers declined, particularly large a.c. generators, which were valued at only $73,087, as against $230,593 in January, 1925. Small a.c. generators and d.c. machines of more than 500 kW showed an increase. Switchboard equipment rose considerably in volume and value. Each of the four motor groups gained ground; the over 200-h.p. stationary class rose from $18,747 in January, 1925, to $146,455 in January last. As was anticipated exports of radio apparatus experienced a very marked decline, but an increased volume of batteries was exported. Domestic appliances showed a satisfactory increase.

Lighting and Power Notes.

Australia.—Collie (W.A.).—*Tenders* reports that the recommendation of the Western Australia Electric Advisory Board for the establishment of a South-West power station at Collie has been approved by the ratepayers of Collie. It was also recommended that a trust be formed, and that the proposal be financed under the migration agreement. It was stated that the proposed power station would at the outset supply the requirements of the Collie Collieries, and the towns of Collie and Bunbury.

Barking.—New Electricity Charges.—The Urban District Council has introduced the following new charges for electricity as from April 1st :—Lighting : first 500 kWh per quarter, 5d. per kWh, all additional energy, 4½d.; prepayment meters, 7d. per kWh; exterior lighting, 4d. per kWh. Power : varying from 3d. to kWh for the first 500 kWh per quarter to 1½d. per kWh for all energy in excess of 6,000 kWh, with special rates for large consumers, or 27s. 6d. per kW of maximum demand for quarter, plus ¾d. per kWh for d.c. supplies and ¾d. per kWh for a.c. supplies. Cooking and heating : First 50 kWh per quarter, 2d. per kWh; above this amount, 1½d. per kWh. Domestic rate : 15 per cent. per annum on rateable value, plus 1½d. per kWh for residential premises only. The above charges are subject to a discount of 5 per cent. for prompt payment of accounts, and to a minimum charge of 5s. per quarter.

Barlby.—Street Lighting.—A scheme of public electric lighting for Barlby and New Barlby has been sanctioned. The installation and supply of electricity is to be undertaken by the Olympia Oil and Cake Co., which has a model village at New Barlby.

Barrow.—Inquiry.—The Electricity Commissioners are to hold an inquiry on April 27th into the Town Council's scheme for the erection of a hydro-electric power station at Backbarrow.

Birkenhead.—Loan Sanctioned.—The Electricity Committee has received sanction to a loan of £10,500 in connection with the supply and erection of converting plant at the stations in Bentwick Street and Craven Street.

Blackpool.—Loan Sanctioned.—The Town Council has received sanction to a loan of £8,500 for meters.

Canada.—Hydro-Electric Development.—The Toronto correspondent of *The Times* reports that the House of Commons has approved the granting of permits by the Dominion Government to the Ontario Government and the Ontario Hydro-Electric Commission for the development of electric power on the St. Lawrence River at Morrisburg, and for using the increased flow of water from Niagara River. These permits are not to be issued until the report of the Inter-

national Board of Engineers, acting an behalf of Canada and the United States, and now investigating conditions on the St. Lawrence, makes its report.

Continental.—Belgium.—At the recent annual meeting of the Société Bruxelloise d'Electricité, of Brussels, it was stated that the sales of electricity during the past year showed an advance of 30 per cent., and that in order to meet the increasing demand for supply, the capacity of the plant at the power station is being increased from 23,000 to 30,000 kW.

Germany.—Some further particulars of the new super-power station which is to be established on the Rhine at Niederschworstadt, were given by the president of the Rheinfelden Electric Power Transmission Co., at a recent meeting at Sackingen. The power station will be on the Baden side of the river and the dam and navigable locks on the Swiss side. The concession is to run for 83 years, and it is expected that the power available will amount to a minimum of 100,000 h.p., which is to be equally distributed between the German State of Baden and Switzerland. The plant in the power station will comprise five turbo-alternators, each of 22,000 h.p. The estimated cost of the complete installation is £2,400,000.

Spain.—Work has recently been completed on the construction of a hydro-electric station near Ciñers, province of Leon, for the Sociedad Hidro-Electrica Legionnence. The plant, which utilises the water power of the River Porma, comprises two turbines coupled to 300-kVA alternators running at 730 r.p.m. The electricity is stepped up from 3,000 to 22,000 V for transmission to the town of Leon, a distance of about 30 miles.

Dumfries.—Hydro-Electric Scheme.—A hydro-electric installation is to be erected by the Town Council at a cost of £5,350. The supply will serve as an auxiliary to that provided by the electricity works. The engineer, Mr. Johnston, estimates that there will be a profit on the scheme of from £850 to £1,000 per annum. A new Francis type turbine complete with accessories is proposed.

Edinburgh.—New Plant.—The formal inaugural ceremony in connection with the installation of a new 10,000-kW generating set at Portobello power station was performed by Lady Sleigh, wife of the Lord Provost, on April 13th. The fourth to be installed, the new set was necessary to meet the demand for electricity which has increased rapidly since the station was opened.

Epsom.—Electricity Supply.—The Electricity Commissioners have informed the Urban District Council that it would be desirable to consider the possibility of a bulk supply of electricity as an alternative to the proposed extension of the generating plant, and have asked whether this aspect has been considered by the electrical adviser of the Joint Authority. The Council has decided to ascertain what steps the Joint Electricity Authority is taking in the matter.

Filey.—Electricity Supply.—The Urban District Council has consented to the Scarborough Corporation supplying electricity to the town subject to consumers being supplied upon the same terms and conditions as consumers within the borough.

Halifax.—Inter-Connection Scheme.—The Tramways and Electricity Committee has authorised the borough electrical engineer to confer with the Electricity Commissioners and the electrical engineers of the Bradford, Huddersfield, and Leeds Corporations, and the Yorkshire Electric Power Co., in connection with a proposal to provide an inter-connecting system for the electricity undertakings of the five authorities.

Lancaster.—Bulk Supply Charge.—The Electricity Committee has interview a deputation from the Carnforth Urban District Council as to a supply of electricity to that area and agreed to modify its terms by a reduction from 1d. to .9d. per kWh, in addition to a kW charge.

Loan Sanctioned.—Sanction has been received to a loan of £12,000 for the extension of the distributing system.

Electricity in Bulk.—In connection with the bulk supply to Morecambe, the Electricity Committee has agreed to lay a second h.p. main between Ridge Lane sub-station and the Morecambe boundary at a cost of £5,500.

Maidenhead.—Loans.—The Town Council has applied for sanction to a loan of £11,500 for e.h.p. cables, kiosks, transformers and switchgear, in connection with the extension of the supply to outlying districts, and also for £5,000 for prospective expenditure on l.p. mains and feeders.

Maidstone.—Loan.—The Town Council has applied for sanction to a loan of £10,000 for mains and services for the next three years.

Manchester.—Progress during February.—During the month of February the Corporation electricity undertaking showed an increase in connections of 2,168 kW, bringing the total to 279,488 kW; and the number of applications received for supply, including consumers for additional supplies, was 889, representing a total of 2,143 kW. The number of hired cookers connected increased by 105, bringing the total actually on circuit to 1,412. Applications for the hire of cookers totalled 102.

Loan.—The Corporation is applying for sanction to a loan of £50,000 for mains.

New Zealand.—Hydro-Electric Development.—According to *Tenders*, a further step in the development of the proposed power scheme in the Lake Manapouri district is the formation of a company with a capital of £20,000 to make an immediate commencement with the preparation of data and the submission of these to investors in Great Britain. Electrical energy developed will be utilised for the manufacture of nitrates from the air and other electro-chemical industries. It is expected that ultimately a total of 300,000 h.p. will be developed.

Northern Ireland.—Ardara (Co. Donegal).—The Electricity Committee has decided to proceed at once with the work of erecting the generating station in connection with the scheme for the electric lighting of the town.

Nottingham.—Loans.—The Electricity Committee has recommended to the Corporation that application be made for sanction to the following loans:—£135,000 for underground mains, transformers, switchgear, sub-station buildings and outside services; £15,000 for meters; and £50,000 for transmission lines, l.p. mains, sub-station buildings and transformer plant in the extended area authorised by the Nottingham Corporation Act, 1923.

Padiham.—Power Station Progress.—The generating station of Lancashire Electric Power Co., which is being erected on the banks of the Calder, is approaching completion. Cables have been laid in most of the suburban roads, and installations have been completed at Read and Sabden, but at present these towns are being supplied with electricity from Accrington.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Windsor.—*The Windsor Electrical Installation Co., Ltd.*—Lighting: From 9d. to 8½d. per kWh.

Wimbledon.—Domestic purposes: From 1d. to ¾d. per kWh during the summer quarters only. Power: (Tariff A, flat rate) from 1¾d. to 1½d. per kWh; (Tariff C, flat rate) from 1¼d. to 1d. per kWh.

Watford.—Heating, business premises: Over 1,000 kWh per quarter, 1d. per kWh.

Sandbach.—Opposition to Scheme.—The Urban District Council has decided to place objections before the Electricity Commissioners to the use of overhead lines for the supply of electricity in the town.

South-East Lancashire Electricity Advisory Board.—*Bulk Supply to Bollington.*—The Engineering Advisory Committee has considered the question of a bulk supply of electricity to Bollington, and has decided that the Electricity Company of Macclesfield be requested to intimate to the Bollington Urban District Council the terms upon which it would be prepared to furnish a bulk supply.

New Converter for Heywood.—The Committee has recommended that the proposal of the Heywood Corporation to install a 750-kW converter be approved.

Bulk Supply to Ashton-in-Makerfield.—The question of a bulk supply to Ashton-in-Makerfield Urban District Council has been considered, and the Committee is of opinion that the supply should be furnished from the station of the Wigan Corporation, but as the L. E. P. Co. is a possible alternative source of supply, the Council is recommended to invite offers for its requirements from both undertakers.

Fringe Order.—The Committee has resolved to support the application of Eccles Corporation for a Fringe Order to supply in the Worsley urban district.

Sub-station Plant.—The provision of a 750-kW rotary converter at Hyde sub-station and one of 500 kW at Mossley sub-station of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board has been considered. and the Committee has resolved that application be made for sanction to a loan of £9,500 for the purpose.

Plant Extensions at Buxton.—The Committee has approved plant extensions at Buxton power station at a cost of £7,300.

Special Orders.—The Power Development Co.'s application for an Order to supply in the Chapel-en-le-Frith, Disley, and Macclesfield rural districts and Yeardsley-cum-Whaley urban district has been considered, and the Committee has requested the local authorities concerned to inform it whether they are prepared to apply for Orders for their areas. The Committee has decided to support the application of the Cheadle and Gatley Urban District Council for a Special Order to supply in the parish of Northern Etchells.

Ashton-under-Lyne.—A proposal for a bulk supply to Ashton-under-Lyne as an alternative to power station extensions has come before the Committee, but it has been decided that the extensions should be carried out.

The minutes of the proceedings of the Committee have been adopted by the Board, with the exception of the proposed extensions at Ashton-under-Lyne, which have been referred back, and the application of the Cheadle and Gatley Council for a Special Order, which has been deleted.

South Shields.—Loan.—The Town Council has applied for sanction to the borrowing of £82,000 for electricity purposes, of which £40,000 is required for mains extensions.

Assisted Wiring Scheme.—The electrical engineer has reported to the Council that up to date over 11,730 applications have been received under the assisted wiring scheme. The number of consumers actually connected is 6,170.

Special Orders.—Application has been made to the Electricity Commissioners by the Earby Urban District Council for a Special Order authorising it to supply electricity in the urban district.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Petersfield Electric Light & Power Co., Ltd., to supply electricity in the urban district and part of the rural district of Petersfield; and the East Anglian Electric Supply Co., Ltd., to supply in the borough of Sudbury, the urban district of Glemsford, and the rural district of Melford.

Stockton-on-Tees.—ELECTRICITY SUPPLY.—The Rural District Council has approved an application by the Cleveland and Durham County Electric Power Co. for a Special Order to supply electricity within certain parts of the district. The maximum price in the Order is 10d. per kWh, but the company hopes to supply electricity at from 6½d. to 7d. The Darlington Rural District Council has referred to the Electricity Committee for consideration an application for a similar Order by the same company for powers to supply electricity to nine parishes in the Council's area.

Stoke.—ELECTRICITY IN BULK.—At a recent meeting of the Electricity Committee the question of the correspondence respecting the terms upon which a bulk supply would be given for distribution by the Power Development Co., Ltd., in the Uttoxeter Urban District and the Cheadle Rural District, was considered, and it was agreed that provided that the bulk supply amounts to 300,000 kWh per annum with a maximum demand not exceeding 130 kW, supply shall be given at £4 per kW per annum, with a power factor of not less than 80 per cent. and a consumption charge of ½d. per kWh, with a variation of 0.015d. per kWh, according to the cost of coal.

Tynemouth.—WIRING OF SMALL HOUSES.—The Electricity Committee has set aside an additional £5,000 for the assisted wiring scheme.

MAINS EXTENSIONS.—The Committee has decided to carry out mains extensions at a cost of £3,000.

United States.—ELECTRICAL DEVELOPMENT.—According to *Power*, a new power station is to be erected on the shore of Lake Michigan. It will be owned and operated by the State Line Generating Co. Construction will begin immediately. The first unit, which will have a capacity of 200,000 kW, will represent about 15 per cent. of the estimated combined maximum demand in 1929 of the companies which will take energy from it. The initial expenditure will be about $25,000,000. Four additional units of 200,000 kW each are contemplated—these to be installed from time to time as required—for an ultimate capacity of at least 1,000,000 kW. Development of this station is expected to be accompanied by development in underground transmission at high voltages. An order for six miles of 132,000-V cable for a connection with the 132,000-volt overhead transmission system of the Public Service Co. of Northern Illinois, has already been placed.

Wimbledon.—LOAN.—The Electricity Committee has received sanction to the borrowing of £6,000 for sub-station equipment and £13,000 for mains.

NEW SUB-STATIONS.—The Committee has obtained sites for sub-stations at the Belvedere estate and in Merton Park.

Winchester.—LOANS.—The Town Council has applied for sanction to loans of £1,500 for meters, and £4,000 for mains.

York.—ELECTRICITY IN SMALL HOUSES.—The Corporation Electricity Committee, with the object of inducing occupiers of small houses to use electricity for lighting, has approved a scheme to enable those who are unable to pay immediately for the initial cost of the installation to pay through a slot meter, for which no rent will be charged, instead of under the existing deferred payment scheme of quarterly instalments. The system will be limited to houses having a maximum of eight lighting points.

LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £25,500 for electricity purposes.

Tramway and Railway Notes.

Australia.—PERTH (W.A.).—The work of construction of tramways is progressing, and the State Tramways Advisory Board has recommended the construction of about 11 miles of tramway track in various suburbs, involving an expenditure of £117,846. This amount does not include £38,000 for 14 additional bogie cars and £5,500 for additional feeder cables.

SYDNEY (N.S.W.).—The first electric railway, the line to Illawarra, has been brought into commission. In Melbourne all the suburban lines are electrified, and the scheme has been extended to Lilydale and Fern Tree Gully. In connection with the scheme, each of the three converters already installed at the Prince Alfred sub-station, which is intended to supply power to the other sub-stations in the metropolitan area, will carry a load of about 6,000 h.p. continuously and about 13,000 h.p. for brief periods. There are smaller converters also in the sub-station to carry the tramway load in the district which it serves.—*Reuter's Trade Service* (Melbourne).

Cheadle and Gatley.—TRAMWAY EXTENSION REJECTED.—The Urban District Council has refused to entertain the proposals of the Manchester Corporation for the extension of the tramway along Manchester Road, Cheadle.

Colne.—LIGHT RAILWAY ABANDONMENT.—At the request of the Corporation the Minister of Transport has sanctioned the discontinuance of the Colne and Trawden light railway.

Continental.—SPAIN.—The authorities of the Northern of Spain Railway are reported to have decided to proceed with the electrification of the Manresa, Barcelona, and San Juan de Las Abadesa section of the line.

A concession has recently been granted for the construction of a secondary electric railway between Granda and Santa Fé.

SWITZERLAND.—The decision of the Swiss Federal Railway authorities to postpone for the present any new railway electrification scheme to follow immediately on the programme at present in course of execution, which is expected to be completed by 1928, is giving rise to many objections. The authorities of the Canton of Berne have adopted a resolution opposing any postponement, pointing out that the electrification of the Basle-Delsberg railway, the Brunig line, and the Entlebucher line are urgently needed. At Neuenburg also, objections have been raised against any delays in electrifying the Berne-Neuenburg main line.

ITALY.—As the results of trials on the Rome-Tivoli-Avezzano railway with an electric locomotive using 45-cycle a.c. at 10 kV, the Italian State Railway authorities have placed an order with the Breda Engineering Works, of Milan, for ten engines. They will have a wheelbase of 38 ft. and be fitted with two electric motors, the drive being through gearing and coupling rods to two of the axles. The equipment includes a transformer which steps down the energy to 1,600 V, while the motors can be run either in series or parallel.

Hartlepools.—RAILLESS CARS.—The Corporations of Hartlepool and West Hartlepool have decided to join in the purchase of twelve 36-seater railless cars.

Maidstone.—RAILLESS CARS.—The Town Council has adopted a recommendation to apply to the Ministry of Transport for sanction to run railless cars on the Barming route, and also to borrow £18,662, the estimated cost of the conversion and the provision of eight vehicles.

Middleton.—NEW ROUTE.—The Corporation has arranged with the Manchester Corporation to proceed with the application to the Ministry of Transport for an Order authorising the construction of the proposed Heywood and Middleton tramway.

United States.—RAILWAY ELECTRIFICATION.—The *Electric Railway Journal* reports that preliminary steps have been taken in the programme of the Pennsylvania Railroad for electrification at Philadelphia which entails the expenditure of $10,000,000 in addition to the cost of electrically equipped cars. The railroad's entire programme is scheduled for completion in 1927. The plans contemplate electrification of the lines between Philadelphia and Wilmington and West Chester *via* Media as the initial part of the railroad's general scheme of electrification of all suburban lines in the Philadelphia district. The total number of miles of line electrified will be about 52.

Telegraph and Telephone Notes.

Australia.—WIRELESS IN SMALL SHIPS.—The Seamen's Unions are demanding that wireless apparatus should be installed in all vessels, irrespective of tonnage. In shipping circles the opinion is expressed that if the steamer *Dorrigo*, which recently foundered near Maryborough, Queensland, had possessed a wireless installation, all her crew would have been saved.—*Reuter* (Brisbane).

Bulgaria.—TELEGRAPH CONFERENCE.—Ludwig Mayer, secretary of the International Posts and Telegraphs Association, took part in the eleventh congress of the Association of Bulgarian Posts and Telegraphs, which was opened at Sofia on April 4th.—*Reuter* (Sofia).

Colombia.—RADIO SERVICE REORGANISATION.—The Colombian Government has entered into a contract with the Marconi Co. for the erection and installation of additional wireless stations in various parts of the Republic. An engineer, Herr Carl Clemp, has been engaged for a year to organise the whole of the Republic's wireless services and to supervise the construction of ten new receiving stations which it has been decided to erect at Popayán, Manizales, Cartagona, Tunja, Honda, Bucaramanga, Barrancabermeja, Ibaqué, Ocana and Pasto. The State School of Wireless Telegraphy and Telephony established at Bogotá will also be entirely re-equipped.—*Reuter's Trade Service* (Bogota).

Czecho-Slovakia.—TELEPHONE COMMUNICATION.—The State Administration, which last year began the construction of a long-distance telephone system, is to finish laying during this

year the principal cables which will afford communication with the south-east. The laying of cables to the south and south-west is then to be begun. This year's programme includes the construction of an over-ground telephone cable from Zilina towards the east, in the direction of Kesce and Uzhorod.—*Reuter's Trade Service* (Prague).

Guatemala.—New Radio Service.—Wireless communication has been completed between the Island of Cuba and the Republic of Guatemala and is now in full operation.—*Reuter's Trade Service* (Habana).

India.—Trunk Telephones.—Our correspondent in India reports that the trunk telephone line between Calcutta and Delhi has been completed and is ready for traffic. The section of the line between Patna and Lucknow was completed some time ago, and there is already direct telephone connection between Lucknow and Delhi; the section from Sitarampur (near Asansole) to Patna has been completed. With the completion of the Calcutta-Delhi trunk line, the Department of Posts and Telegraphs will have carried out practically the entire project of long-distance telephony it took in hand about three years ago, and almost all the cities in Northern India will then have thus been linked. The long-distance line between Calcutta and Bombay will then remain to be completed, and work on this project is proceeding. Recently an experiment was carried out in telephone communication between Calcutta and Nagpur, and the result is reported to have been very satisfactory. Messages were sent from Howrah to Nagpur, and messages were received from Nagpur very distinctly. Howrah was selected for the experiment instead of Calcutta in order to avoid the use of the river cable. There is, however, some apprehension as regards the financial results of the Calcutta-Bombay telephone. It is estimated that if the call rate between Delhi and Bombay is Rs. 7-8 per three-minute call, the rate for calls between Calcutta and Bombay is likely to be about Rs. 15, and this high rate is not likely to prove conducive to a great demand for the telephone. What the call rate will be between Calcutta and Delhi is not known definitely, but it is not likely to be less than Rs. 5 for a three-minute conversation.

International Radio Telegraphy.—Conference.—Representatives of the principal wireless telegraph companies interested in international radio communication met last week at Monte Carlo, under the presidency of Mr. T. M. Perkins, American member of the Reparation Commission. The British delegates to the conference were Mr. Frederick Kellaway, managing director of Marconi's Wireless Telegraph Co., Ltd., and Lieut.-Colonel Simpson, deputy managing director. The United States were represented by Mr. Owen D. Young, president of the General Electric Co. and the Radio Corporation, General James C. Harboard, formerly with the American Army in France, and Colonel Roosevelt. M. Emile Girardeau, director of the Compagnie de Telegraphie sans Fil and of the Compagnie Radio France, was the principal French delegate, while the Telefunken Co. and the Italo-Radio Co. were also represented. The International Wireless Telegraphy Committee has held its preceding meetings in New York, London, and Berlin. The chief aim of the present conference is to prepare for the opening up within a short period of wireless communication between Brazil and other countries. The powerful station at Rio de Janeiro is nearing completion, and satisfactory trials have already been made. April 21st has been fixed as the date on which direct wireless services between Brazil and the United States, France, Great Britain, Germany, and Italy will be inaugurated. The Rio de Janeiro station has twelve pylons 200 metres high, and has a power of 500 kW. Transmission on a short wave will be employed as well as on the long wave which has already been tested.—*Reuter* (Paris).

Irish Free State.—Party Line Telephones.—The party line telephone system is being considerably extended in the Free State. Such a line is not as a rule provided for less than three subscribers, in which case the rental is £4 each per year; when there are only two subscribers per line the rental is £4 10s. each per annum.

New Cable Office.—Liverpool.—The Western Union Cable Co. has opened a new office in the Liverpool Produce Exchange to afford direct communication with the produce exchanges in New York and Chicago. As the exchanges in Liverpool and America are "open" simultaneously only during one hour each day, the new premises will only be in use from 3.15 to 4.30 p.m. each day. The new direct cable gives a "three minutes' round trip" service. At the opening ceremony last week a cable of congratulation was sent to the American exchanges, "hoping that the extended facilities for trade provided by the Western Union will result in increased trade to the mutual benefit of both exchanges."

Sweden.—Russian Telegraph Communication.—Telegrams to Russia, which were formerly collected and dispatched by the Store Nordiske Telegrafselskabs station at Goteburg, will in future be sent by the telegraph station at Stockholm, with Helsingfors acting as a relay point for messages between Stockholm and Leningrad. *Commerce Reports* believes that swifter communication between the two countries will result from the change of stations.

Switzerland.—Telephone Boxes.—The firm of Gygax and Limberger, of Alstetten, Zurich, is making a speciality of small telephone call boxes for use in offices. It is claimed that "Phonivor" cabins, as they are termed, are noiseproof and afford greater privacy of conversation than when the 'phone is installed in an open office.

Radio Notes.

Australia.—Demand for Sets.—In an interview regarding wireless in Victoria, the manager of a Melbourne firm said that there continued to be a good demand for sets and parts; there was now a very noticeable increase in the demand for high grade complete sets. At the beginning, he said, the majority of purchasers bought wireless parts which they assembled themselves, and in many cases the cheaper class of goods was purchased; lately, however, the buying of parts had given place, to a large extent, to the buying of complete sets. A recent shipment of high-grade American sets had been quickly disposed of, and several more sets had been ordered for immediate delivery when landed.

A report from Perth, Western Australia, says that if the number of listening licences can be accepted as an indication, wireless is losing a great deal of its popularity. There were 4,055 licences in existence in January, but it is estimated that at the end of March the total will be only 2,500.—*Reuter's Trade Service* (Melbourne).

On the other hand, *The Times* correspondent states that in his recent annual report, the Australian Postmaster-General says that the growing popularity of broadcasting is enabling the companies to contemplate wider activities. The revenue from licence fees is divided amongst the broadcasting companies, a larger proportion being paid to those which operate high-power stations than to those whose transmitters are of medium or small power. The area allotted to each company is divided into zones, and the amount of the licence fee depends upon the zone in which the listener lives. At present, those whose homes are within a radius of 250 miles of a broadcasting station pay 35s. for the first year and 27s. 6d. a year afterwards. Up to the end of last year the total number of licences was in the neighbourhood of 80,000, and the revenue from fees about £130,000. There are numbers of unlicensed receiving sets in use, and proceedings have been taken against certain offenders.

Australia has at present ten broadcasting stations situated in or near large towns. Two of these, the Sydney station and that at Perth, are rated at 5 kilowatts and work on wavelengths of 1,100 and 1,250 metres respectively. The remainder, with the exception of 3LO, the Melbourne station, which is rated at 5 kilowatts, are medium or low-power stations. All of them work on wave-lengths between 300 and 500 metres. One, Brisbane (4QG), which is rated at .75 kilowatt and works on a wave-length of 385 metres, is conducted by the Government; the Post Office has placed telephone lines at the companies' disposal for simultaneous broadcasting.

Chile.—New Station.—A new long-range broadcasting station has been opened at Santiago de Chile, working with a power of 1,000 kW, which is capable of being tripled at any moment. The call letters are CMAC.—*Reuter's Trade Service* (Santiago de Chile).

Dutch East Indies.—New Station.—According to *Commerce Reports*, the Government of the Dutch East Indies has authorised the erection of a large radio broadcasting station and the private use of receiving sets under licence.

El Salvador.—New Station.—A wireless station has been erected on the roof of the National Theatre at San Salvador, capital of the Republic of El Salvador, and will shortly be put into operation.—*Reuter's Trade Service* (San Salvador).

India.—Proposed Station.—The Indian Radio Telegraph Co. is reported to be planning the construction of a 12-kW broadcasting station at Calcutta. Details are not yet available, says *Commerce Reports*, which understands that this is one of two stations to be built in India, the other to be at Bombay.

Poland.—New Station.—On April 18th next, a new broadcasting station will be opened at Warsaw by the Prime Minister, Count Skrzynski, whose speech will be broadcast.—*Reuter* (Warsaw).

Russia.—Radio Interest.—There are six broadcasting stations of 2,000 watts under construction, and one of 50,000 watts, with five stations in Moscow, where the public reading rooms are equipped with receivers and loud-speakers so that people too poor to purchase a set are able to listen, says *T. & T. Age*. It is estimated that over 20,000 Russians in Moscow alone have managed to build and operate their own sets without the knowledge of the authorities. Broadcasting in Russia is under the control of the Commissariat of Posts and Telegraphs.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—Melbourne.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Adwick-le-Street.—May 19th. Urban District Council. H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (See this issue.)

Belfast.—April 22nd. Libraries, Museum and Art Committee. Lifts for the new museum and art gallery. (See this issue.)

Belgium.—April 28th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels, 39,000 metres of cotton-covered wire, 175,000 metres of cord-covered wire, 100,000 metres of compound wire, 250,000 metres of twisted wire, 100,000 metres of bare-lead covered cable, 50,000 metres ditto, and 5,182 metres paper-insulated cable. Particulars (Cahier des Charges Special No. 3-177) for 5 francs.

April 22nd. The municipal authorities of Schaerbeek, Brussels. 8,000 metres of h. and l.p. armoured cable. Particulars from Service de l'Electricité, Hotel Communal, Schaerbeek.

Grimsby.—April 26th. Electricity Department. E.h.p. cell-type switchgear. (See this issue.)

Barking.—April 20th. County of London Electric Supply Co., Ltd. Circulating-water pumps and pump-house equipment, circulating-water screening plant, and boiler-house and coal-handling plant. (March 19th.)

May 10th. Coal-unloading, storing, and reclaiming plant. (April 9th.)

May 11th. Switchgear and accessories, transformers and piping equipment. (March 26th.)

Bentley-with-Arksey.—April 20th. West Riding Education Committee. Electric lighting installation at Bentley Road school. Specifications, Education Department, County Hall, Wakefield.

Bolton-upon-Dearne.—April 22nd. Dearne District Electricity Board. Electric cables and accessories. (April 2nd.)

Chile.—Santiago.—August 20th. Chilean State Railways. Signals, telegraphs and telephones, electrical material for sub-stations, aerial lines, and lighting.*

Dartford.—April 21st. Electricity Department. Coal for 6 or 12 months. (April 9th.)

Dundee.—April 20th. Education Authority. Electric lighting at new central Advanced School at Blackness Road. Schedules from Messrs. Maclaren, Soutar & Salmond, architects, 16, South Tay Street, Dundee.

Exeter.—May 11th. Electricity Department. Boiler-house plant complete:—Two water-tube boilers with economisers, pumps, coal bunkers, conveyor, and accessories. Self-supporting steel chimney, induced-draught fan, and accessories. (April 9th.)

Ferry Fryston (Yorks.).—April 20th. West Riding County Council. Electric lighting installation at Ferry Fryston, Airedale, new school. Specifications from Education Department, County Hall, Wakefield.

Harrogate.—April 25th. Electricity Department. H.p. and l.p. switchgear for sub-stations. (April 9th.)

India.—April 30th. India Store Department. 22,000-V cables. (April 2nd.)

April 30th. Alkaline train-lighting cells. (See this issue.)

May 7th. 15 motor coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

London.—London County Council.—May 4th. Electric wiring and fittings at the Alton Street elementary school, Poplar, E. (See this issue.)

H.M. Office of Works.—April 28th. Fuse boards and switches. (See this issue.)

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*

Wellington.—May 12th. Post and Telegraph Department. 18 switchboards.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (See this issue.)

Southend-on-Sea.—April 19th. Electricity Department. 1,450 current limiters. (April 2nd.)

Spain.—Madrid.—May 9th. Compania de los Caminos de Hierro del Norte. Overhead line, converting sub-stations, locomotives and motor coaches for the electrification of the lines from Barcelona to Manresa and San Juan de las Adebesas in one contract. The constructors are to obtain as much of their supplies from Spanish industries as possible.

Turkey.—May 15th. Direction Générale des Postes et Télégraphes. 111,000 metres of 3, 7, 10 and 12 pair aerial telephone cable, 10,000 metres of 3, 7, 10 and 12 pair underground cable with joint boxes and accessories.*

Warrington.—April 26th. Electricity and Tramways Committee. L.p. paper and lead-covered cables. (April 9th.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines. e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—Melbourne.—Postmaster-General's Department. Accepted:—

Weston electrical instruments (£612).—Warburton Franki (Melb.), Ltd.
Portable three-element oscillograph (£721).—Australian Westinghouse Electric Co., Ltd.
½ mile 10-quad and ½ mile 20-quad lead-covered multiple cable (£625).—Standard Telephones & Cables, Ltd.
Automatic telephone exchange equipment for South Brisbane (£3,772).—Siemens Bros. & Co., Ltd.
Equipment for the South Brisbane and Albion automatic telephone exchanges (£2,364).—Siemens (Aust.) Pty., Ltd.

Victorian Railways. Accepted:—

Battery-charging equipment (£226 and £95).—Australian General Electric Co., Ltd.

Melbourne and Metropolitan Tramways Board. Accepted:—

Four motor equipments (£5,700).—Australian Westinghouse Electric Co., Ltd.
Air brake equipments with spares (£6,744), safety devices for single-truck cars (£1,697).—Australian General Electric Co., Ltd. —*Tenders.*

Bolton.—Electricity Committee. Accepted:—

Renewals to battery, Back-o'-th'-Bank generating station.—Chloride Electrical Storage Co., Ltd.
E.h.p. switchgear, Back-o'-th'-Bank generating station.—Metropolitan-Vickers Electrical Co., Ltd.

Burnley.—Electricity Committee. Accepted:—

Pumps for the 2,000-kW turbine at the generating station (£827).—Hick, Hargreaves & Co., Ltd.

Chester.—Board of Guardians. Accepted:—

Electrical material for the Poor Law Institution.—Commercial Electric Co.

Chesterfield.—Electricity Committee. One 1,000-kW rotary converter equipment, complete with switchgear:—

Mather & Platt, Ltd. (Accepted.)	**£5,002**
Metropolitan-Vickers Electrical Co., Ltd.	5,091
Newton Bros., Ltd.	5,782
General Electric Co., Ltd.	5,819
English Electric Co., Ltd.	5,965

Croydon.—Board of Guardians. Accepted:—

Electrical fittings and appliances for six months.—Commercial Electric Co., Ltd.

Liverpool.—Tramways and Electric Power Committee. Accepted. Materials for 12 months:—

Meters.—Ferranti, Ltd.
Stoneware troughing, insulators, &c.—J. Place & Sons, Ltd.; Callender's Cable & Construction Co., Ltd.; J. Bourne & Sons.
Electrical sundries, switches, fuses, &c.—Sykes & Dyson, Ltd.; Cable Accessories Co., Ltd.; L. Weekes, Ltd.; Simplex Conduits, Ltd.
Cables and accessories for street mains.—Callender's Cable & Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Dussek Bitumen Co., Ltd.
Insulated cables.—Liverpool Electric Cable Co., Ltd.; W. Geipel & Co., Ltd.

City Council. Accepted:—

Switchgear for Lister drive power station (£18,894).—Metropolitan-Vickers Electrical Co., Ltd.
One 1,500-kW (£6,482) and two 1,000-kW (£8,562) rotary converters.—Mather & Platt, Ltd.

Baths Committee. Accepted:—

Installation of electric light at Cornwallis Street Baths (£207).—Lambton and Hobster.

London.—Metropolitan Asylums Board.

Installation of fuel economiser at Southern Hospital:—

E. Green & Son, Ltd. (Recommended.)	**£829**
E. Danks & Co. (Oldbury), Ltd.	829
Clay Cross Co., Ltd.	854
Goodbrand & Co., Ltd.	861
A. Lowcock, Ltd.	872

Installation of steam boilers at Southern Hospital:—

John Thompson (Wolverhampton), Ltd. (Recommended)	**£1,850**
J. & J. Horsfield, Ltd.	1,850
Yates & Thom, Ltd.	1,862
I. & B. Umpleby, Ltd.	1,882
Clayton, Son & Co., Ltd.	1,944
E. Danks & Co. (Oldbury), Ltd.	1,960
Wilson Boilermakers, Ltd.	1,965
Galloways, Ltd.	1,987
Ruston & Hornsby, Ltd.	2,060
T. Beeley & Son, Ltd.	2,093
H. & T. Danks (Netherton), Ltd.	2,120
D. Adamson & Co., Ltd.	2,162
J. Foster & Sons	2,285

Installation of electric lighting at Southern Hospital:—

Alpha Mfg. & Electrical Co., Ltd. (Recommended.)	**£3,010**
T. Clarke & Co., Ltd.	3,700
Read & Partners, Ltd.	3,748
Smethurst & Co. (London), Ltd.	3,912
Brightside Foundry & Engineering Co., Ltd.	3,943
Coley & Swinnerton, Ltd.	4,124
Toy & Winslow	4,150
Kershaws	4,500
Burdette & Co., Ltd.	4,520
S. Dixon & Son, Ltd.	4,548
H. B. Giles	4,637
Taylor & Allen, Ltd.	4,750

Underground cable from hospital to gate lodge, electric lighting installation at the lodge, &c., at Colindale Hospital:—

V. G. Middleton & Co., Ltd. (Recommended.)	**£212**
T. Clarke & Co., Ltd.	226
Toy & Winslow	234
Lund Bros. & Co.	252
Buchanan & Curwen	265
G. E. Taylor & Co.	280

STEPNEY.—Electricity Supply Committee. With further reference to our note on page 586, ELEC. REV., April 9th, the following is the complete list of tenders received :—

Two 150-kVA transformers :—

Hackbridge Electrical Construction Co., Ltd. (Recommended)	**£348**
Ferranti, Ltd.	411
British Electric Transformer Co., Ltd.	422

100 single disconnecting boxes :—

Lucy, W., & Co., Ltd. (Recommended)	**£115**
Universal Electrical Manufacturing Co.	129
British Insulated Cables, Ltd.	162
W. T. Henley's Telegraph Works Co., Ltd.	258

50 TC/C disconnecting boxes :—

Universal Electrical Manufacturing Co. (Recommended) ...	**£107**
W. Lucy & Co., Ltd.	131
British Insulated Cables, Ltd.	134
W. T. Henley's Telegraph Works Co., Ltd.	230

Supply of cables for the year ending March 31st, 1927 :—

W. T. Henley's Telegraph Works Co., Ltd. (Recommended)	**£27,611**
W. T. Glover & Co., Ltd.	28,063
Pirelli-General Cable Works, Ltd.	28,074
Hackbridge Cable Co., Ltd.	28,078
Siemens Bros. & Co., Ltd.	28,158
Standard Telephones & Cables, Ltd.	28,204
British Insulated Cables, Ltd.	28,245
Callender's Cable & Construction Co., Ltd.	28,665

Newcastle (Staffs.).—Town Council. Accepted:—
Laying of electricity mains on the Liverpool Road and Westlands housing sites (£3,038).—Callender's Cable & Construction Co., Ltd.

Plymouth.—Electricity Committee. Accepted:—
Turbo-alternator (£29,020).—Metropolitan-Vickers Electrical Co., Ltd.
Converter (£1,360).—Crompton & Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.
Cables.—British Insulated Cables, Ltd.

Salford.—Electricity Committee. Accepted:—
200 small electric cookers (£2,575).—Hotpoint Electric Appliance Co.

Sheffield.—Electric Supply Committee. Accepted:—
Transformers (£3,416).—British Electric Transformer Co., Ltd.
Chain-grate stokers and accessories for boilers at Neepsend station (£3,144). —E. Bennis & Co., Ltd.
Transformer sub-station at Kilton Hill (£1,299).—G. Longden & Son, Ltd

Stafford.—Electricity Committee. Accepted:—
Transformer and necessary equipment (£656).—English Electric Co., Ltd

Tynemouth.—Electricity Committee. Accepted:—
Cable (£125).—Standard Telephones & Cables, Ltd.

Weymouth.—Electricity Committee. Accepted:—
Mains extensions.—Johnson & Phillips, Ltd.

Forthcoming Events.

Institution of Mechanical Engineers.—Friday, April 16th. At the Institution, Storey's Gate, S.W. At 6 p.m. Paper on "The Modern Development of Paper-mill Plant," by Mr. W. Worby Beaumont and Mr. L. N. Burt.
Friday, April 23rd. Informal meeting. Discussion on "What Our Foreign Competitors are Doing," to be introduced by Mr. F. J. Hookham.

Junior Institution of Engineers.—Friday, April 16th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Automobile Lighting, Starting, and Ignition," by Mr. T. L. Allison.

Salford Technical and Engineering Association.—Saturday, April 17th. At the Royal Technical College. At 7 p.m. Paper on "Switchboard Instruments," by Mr. A. H. Higgs.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, April 17th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 6 p.m. Lecture on "Auto-Synchronous Motors," by Mr. E. E. Tasker.

(London Branch).—Tuesday, April 20th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 6.30 p.m. Paper on "Coal Screening, Crushing, Blending, and Conveying Apparatus," by Mr. F. H. F. Hampton.

British Horological Institute.—Wednesday, April 21st. At 35, Northampton Square, E.C. At 6.30 p.m. Lecture on "Clockwork Gas Controllers and Electric Time Switches," by Mr. E. H. Horstmann.

Edinburgh Electrical Society.—Wednesday, April 21st. At the Royal Scottish Society of Arts, 117, George Street. At 8 p.m. Paper on "Country Distribution," by Mr. J. S. Thomson.

Institution of Electrical Engineers.—Thursday, April 22nd. At the Institution, Victoria Embankment, W.C. At 6 p.m. Seventeenth Kelvin Lecture on "The Mechanics of the Electric Field," by Sir J. J. Thomson, F.R.S.

(Mersey and North Wales (Liverpool) Centre).—Monday, April 19th. At the University, Liverpool. At 7 p.m. Paper on "An All-Electric House," by Prof S. P. Smith.

(Sheffield Sub-Centre).—Wednesday, April 21st. At the Royal Victoria Hotel, Sheffield. Paper on "Electricity in Mines," by Major E. I. David.

(Tees-side Sub-Centre).—Monday, April 19th. At the Cleveland Technical Institute, Middlesbrough. At 7.15 p.m. Ordinary meeting.

(South Midland Students' Section).—Visit to Rugby as guests of the Rugby Engineering Society Students' Section—3-5 p.m., tour of the works of the British Thomson-Houston Co., Ltd. 7 p.m., at Benn Buildings, Rugby, paper on "Induction Motors," by Mr. D. G. Sandeman. 9-11 p.m., smoking concert.

Physical Society of London.—Friday, April 23rd. At the Imperial College of Science, Imperial Institute Road, S.W.7. At 5 p.m. Lecture on "The Absorption of Radiation by the Upper Atmosphere," by Prof. C. Fabry.

Royal Institution.—Friday, April 23rd. At 21, Albemarle Street, W. At 9 p.m. Lecture on "Luminous Discharge Through Rare Gases," by Prof. R. Whiddington

Birmingham Electric Club.—Friday, April 23rd. At the Grand Hotel, Colmore Row, Birmingham. At 7 p.m. Discussion on the "I.E.E. Wiring Rules," to be opened by Mr. C. G. McDonald and Mr. H. Joseph.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

VULCOT insulation (sheets).
ZYROLITE or XYNITE insulation.
Hedge clipping shears (electrical).
ELMO portable drilling machines.

Notes.

An A.C. Link.—An interesting scheme has been adopted for linking up the two d.c. power stations of the Guernsey Electric Light and Power Co., Ltd., at Les Amballes and St. Sampson's Street, St. Peter Port. At each station a 250-kW reversible motor-generator set has been installed, being driven from the normal d.c. supply, 420/480 V, and generating a.c. at 6,600 V, three-phase, 50 cycles. The a.c. system is employed for the transmission link between these stations and a new sub-station which has been erected at St. Peter Port, where a 250-kW rotary converter, with the necessary transformers and switchgear, is installed for supplying d.c. energy. The lighting load is balanced between the outers and neutral by two static balancers, which are suitable for an out-of-balance current up to 80 A. The complete electrical equipment for this contract was supplied by the General Electric Co., Ltd.

London Street Accidents.—An official return of street accidents shows, says the *Evening News*, that in the metropolitan district 2,485 accidents were caused by tramcars in 1925; fatalities due to the same cause numbered 30, as compared with 27 in 1924. Omnibuses were responsible for 3,607 non-fatal and 139 fatal accidents.

Notes From Switzerland.—A scheme is shortly to be commenced to harness the waters of the Dranse of Entremont and of the Ferret below Orsières, and direct them towards Sembrancher (on the Martigny-Orsières railway), where a power station will be erected. The power yield is estimated at about 10,000 h.p. The undertaking will be in the hands of the Société Romande d'Electricité, which already owns the power house of Vouvry.

The Swiss Federal Railways are arranging, together with the Comptoir Suisse de Lausanne, the Union Romande de Tourisme, and the Commission Romande de la Ligne du Simplon, for an exhibition to be held next September in Lausanne, when lectures will be given on the advantages of this international and electrified railway. A very large synoptical map will be used to give a clear idea of the ramifications of this most important line, and other electric and mountain railways of Switzerland connected with the Simplon, as well as those of France and Italy and the Cie. Internationale des Wagons-lits. It is expected that such an exhibition will not only favour the interests of Swiss "tourism," but will also afford an excellent object-lesson in the advantages of electricity to those countries which, as yet, have not adopted railway electrification.

The Superiority of Tramways.—Mr. Henry Mozley, general manager of Burnley Tramways and Motor 'Buses, recently addressed the Burnley Rotary Club on road transport, dealing particularly with local problems. He said that people were becoming impatient of crowded areas, and desired more healthy surroundings. Without transport this could not be obtained. Dealing with the cry of "Scrap the tramways," the speaker said the Burnley Tramways now carried 24 million passengers and 134,000 parcels per annum. With only seven small 'buses on short experimental routes, the number of passengers per annum now numbered two millions. Last year £5,819 was contributed to the funds of the local authorities interested. Imperial funds benefited to the amount of £5,392, and £29,026 was paid for electrical energy. What would their lighting and power cost but for this? The tramways maintained at least one third of the highways on which they ran. For economy, reliability, regularity of service, and adaptability for peak-load periods there was no transport system equal to the tramways, and this was the considered view not only of Government Departments, but by every expert tramway operator. Those who advocated scrapping the tramways and substituting 'buses were sinning against knowledge. They required at least 2½ 'buses to do the work of one tramcar. Pneumatic tires cost £90 and ran only 20 to 30,000 miles. Steel tires on a car cost £20 and ran 70,000 miles. The longest daily mileage of a 'bus (on town service) was 117 miles; of the electric car it was 151 miles. The normal life of a 'bus was eight years, and electric cars were like new after 25 years. If they scrapped the trams they would have to pay probably £100 000 for road reinstatement and the remainder of the debt, which exceeded £100,000. The omnibus depended for its power mainly upon a foreign supply of spirit, which was largely controlled in regard to prices. Among the other disadvantages of the motor-'bus were slow acceleration and limited carrying capacity.

Electric Ignition of Firedamp.—In Paper No. 20, "The Electric Ignition of Firedamp: Alternating and Continuous Currents Compared," by R. V. Wheeler, issued by the Safety in Mines Research Board, price 1s. net, the author compares alternating and direct currents with respect to the ability of their "breakflashes" to ignite firedamp. The comparisons are the result of researches over a number of years and the different forms of apparatus used in the researches are described. The following results were obtained from the ignition of methane-air mixtures when using direct and alternating currents:—

Ignition of mixtures by continuous and alternating currents (50 ∼) at 35 V added inductance, 0.095 henry.

Methane (per cent.).	Igniting current, amperes. D.C.	Igniting current, amperes. Alternating (crest values).
6.15	0.43	0.49
7.10	0.30	0.36
7.60	0.26	0.30
8.00	0.24	0.26
8.50	0.24	0.24
9.00	0.25	0.25
9.60	0.28	0.26
10.20	0.32	0.30
10.90	0.42	0.44

Ignition by d.c. and a.c. at 288 V slow rate of break.

Methane (per cent.).	Added inductance, henries.	Igniting current, amperes. D.C.	Igniting current, amperes. Alternating (crest values).
9.00	0.286	0.37	0.38
9.00	0.007	0.46	0.50
8.05	nil	0.70	0.68
11.05	nil	1.06	0.90

Ignition by d.c. and a.c. at 288 V rapid rate of break.

Methane (per cent.).	Added inductance, henries.	Igniting current, amperes. D.C.	Igniting current, amperes. Alternating (crest values).
6.60	nil	0.26	0.27
8.05	nil	0.26	0.22
10.95	nil	0.40	0.42
11.10	nil	0.46	0.42

Naval Electrical Officers' Pay.—The pay of senior electrical engineers, electrical engineers, and assistant electrical engineers, has formed the subject of a recent award of the Industrial Court. The following basic salaries, *i.e.*, salaries exclusive of cost-of-living bonus, were awarded by the Court. Assistant electrical engineer, £310 a year, rising by annual increments of £15 to £475; electrical engineers, £475, rising by annual increments of £25 to £650; senior electrical engineer, £575, rising by annual increments of £25 to £725. The Government has decided to give effect to the award, as from January 1st, 1926. The officers concerned will enter the new scales at the minimum, or at their existing salary, *plus* the proportion of increment earned on the old scale, whichever is the greater. The new scales will not be applicable to temporary electrical engineers or temporary assistant electrical engineers.—*The Times.*

Appointments Vacant.—Secretary and treasurer to the West Midlands Joint Electricity; switchboard attendants, for the Perth Corporation electricity works. (See our advertisement pages to-day.)

Lubricating and Allied Oils.—The following is a brief abstract of a paper on the above subject delivered before the Institution of Engineering Inspection by Mr. Elliot A. Evans, F.C.S. In considering lubricants there are two aspects to bear in mind, lubricating value and value as a lubricant. The lubricating value is the power of a substance to reduce friction, while the value of a body as a lubricant is much more important, and depends upon a number of factors. Primarily it must be capable of reducing friction, and, secondly, it must have characteristics which permit its use for specific purposes with the minimum of inconvenience. Mineral oils have, in the majority of cases, a better value as lubricants than have fatty oils, but it is generally conceded that fatty oils have better lubricating values. The difficulty in compiling specifications for lubricants is due inherently to their complex nature. Mineral oils are composed of many hydrocarbons, diverse in composition and behaviour, whose chemical properties are such as to bewilder even the most ardent chemist. The natural outcome of these difficulties is to formulate arbitrary tests of a physical or chemical nature to establish definite characteristics, such as specific gravity, viscosity, flashpoint, &c., which, when considered as a whole, together with experience gained in practice, serve a useful purpose. Any one of these tests by itself denotes practically nothing. Specific gravity, if considered alone, is useful to check weight notes of deliveries. Flash point is the temperature at which an oil will take fire when a naked light is applied—a test, in fact, indicative of the fire hazard. Viscosity plays a prominent rôle in all specifications, and must therefore be measured with some degree of accuracy and recorded in a universal way, and at temperatures agreed upon by common consent. The specific gravity of all oils from one and the same source increases with increasing viscosity, and the same is more or less true of the flash point except when the cylinder oil stocks are reached. Low specific gravity oils are frequently associated with low coke and oxidation values; in a measure it is true, but it would be very unsafe to imagine that by virtue of an oil having a low specific gravity it would also have a low oxidation value. On the other hand, high specific gravity oils invariably have a high oxidation value.

Transformer Testing Equipment.—In a recently-issued publication of the United States of America Bureau of Standards, Scientific Papers, Vol. 20, No. 516, December, 1925, price 15 cents, a description is given of the apparatus which has been developed at the Bureau for the testing of standard voltage transformers. The equipment, a shielded resistor, consists of a number of impedances in series which are so shielded as to prevent any capacitance effects due to their relationship to other objects about them. The working circuit has a total resistance of about 520,000 ohms and is made of 27 sections, each being enclosed in a brass box or shield which is connected to the suitable point of a "guard" circuit which is connected in parallel with th e working circuit. The units consist of manganin resistance wire wound on cards of built-up mica, each card being hung vertically in its shield on two suitably placed glass rods. The guard circuit has the same resistance as the working circuit and is made of similar cards which are placed in the open. The equipment is mounted on a rack made up of wooden bars spaced by porcelain supports. It is claimed that with a resistance of 500,000 ohms for both the shielded and unshielded circuits, an accuracy approaching 0.01 per cent. can be obtained on commercial frequencies at pressures up to 30,000 V.

Relieving the Rates.—By a resolution adopted in 1920, the Manchester City Council limited the amounts which could be contributed in relief of the rates from the profits of the municipal trading undertakings. At last week's meeting of the Council, however, Ald. Swales moved that the rescission of this resolution should be considered in so far as it applied to the Tramway Department and that that Department should be instructed to so arrange fares, &c., that after meeting all working expenses, including capital charges, and adequate provision for renewals and reserves, it should contribute an annual sum of £100,000 in aid of the rates, the first allocation being made from the profits of the year 1926-27. In opposing the motion Councillor Binns said that to impose those conditions on the tramways would bear hardly upon the users of the system. If the Department had surplus profits they should be used to eliminate private capital from the undertaking.

The motion was eventually carried and a report upon the matter will be received in due course.

Summer Time.—Attention is drawn to the fact that "Summer time" commences at 2 a.m. on Sunday next, and accordingly all clocks should be advanced one hour during the night April 17-18th. Similar time adjustments will be made in France, Belgium and Spain on the same date, but in Holland the change took place on the 15th.

Electro-magnetic Treatment of Steels.—In a publication, "The Electro-Magnetic Heat Treatment of Alloy Steels," No. 36, April, 1926, issued by Messrs. Automatic & Electric Furnaces, Ltd., the limits of application of the Wild-Barfield magnetic indicators to the alloy steels commercially employed today, are considered. The correct heating point to which nickel steel should be carried is that at which the steel becomes entirely non-magnetic. The addition of manganese to ordinary carbon steel has a similar effect upon the non-magnetic point and the limit for heating is at the magnetic change. In six per cent. tungsten-steel the alloy is not completely absorbed at the non-magnetic point and the consequent superheating of the steel renders the magnetic detector useless. Chrome steel should be allowed to soak in the furnace for a few minutes on an even or falling heat, after the current is switched off, to give the best condition for quenching. The latter treatment also applies to nickel-chrome steel. Other alloy-steels dealt with are vanadium, molybdenum, cobalt, chrome-vanadium, chrome-tungsten, chrome-molybdenum, chrome-manganese, and cobalt-chrome.

Sheffield and the Electricity Bill.—A special committee of the Sheffield City Council appointed to consider the Electricity Bill has presented a long report in which it states that while the Bill may prove helpful to smaller undertakings and areas where industry is not concentrated, it offers no present advantages to Sheffield. It will not assist Sheffield consumers to any degree, but will tend to increase the cost of electricity, the average price to consumers in 1925-26 being practically that which the Bill hopes to achieve in 1940. "For the year 1926-7 the average price in Sheffield will be still lower, and with an increasing sale will continually fall year by year, and by 1940 will, if Sheffield is left alone, be considerably nearer ½d. per unit than the 1d. per unit hoped for by the Bill." Stating its grounds of objection to the measure, the committee says: "The principle of taking at cost price the output of current of authorised undertakers without an obligation to take all their plant could produce, and returning the same to them at enhanced price, is unjust, and will add to the charges necessary to be made to manufacturers for cost of supply, and so increase the cost of producing goods and retard the consumption of electrical energy. No provision is made to expropriate power companies from areas where they are giving little or no supply and enabling local authorities which could give supply on better terms to do so." The committee recommends that it be authorised to take such steps as it thinks desirable to oppose the provisions of the Bill which it considers objectionable.

Electric Cooking in a Match Factory.—One of the latest converts to the electrical idea for cooking is the well-known firm of match manufacturers, Messrs. Bryant & May. Their model and extensive establishment at Bow has just been equipped with a number of standard "Magnet" appliances, the production of the General Electric Co., Ltd., and an excellent idea of the orderly arrangement which has been contrived with these appliances, without in any way impairing their individual efficiency or impeding easy access to them, is given by the photograph reproduced herewith. The adoption of electricity for cooking purposes is an obvious precautionary measure against fire in such a case as this, where materials of a highly inflammable nature are used in various processes of manufacture. Apart from this, there are advantages which have greatly impressed the kitchen staff and have facilitated the work of catering for from seven to eight hundred workers daily. Included in Messrs. Bryant & May's equipment is a large double-oven range, a roasting oven, a large boiling table, and a double-pan fish fryer. The range has open and enclosed boiling plates as well as a griller and toaster fitted into the hob table above the two ovens. A cabinet type roasting oven has been specially installed for roasting joints of meat, baking quantities of fruit tarts, &c. Its internal cooking space is 4 ft. 6 in. high, 2 ft. 9 in. wide, and 2 ft. 6 in. deep. The boiling table carries four 12 in. by 8 in. enclosed pattern plates, and two 12 in. by 8 in. open coil plates. The fish frying is carried out by means of two 18 in. by 18 in. by 6 in. special pattern open-coil fish fryers, mounted side by side on a stand to bring them to a convenient height from the ground for easy working.



"Magnet" Equipment at Bryant & May's.

Standardisation of Agricultural Motors in France.—At a recent meeting of the French Union des Syndicats d'Electricité (Paris) a special committee was appointed to consider the standardisation of electric motors for farm use, or at least to consider whether, with the object of encouraging the use of electricity in connection with agricultural operations, motors for such purposes should be made in standard sizes.

Steam Heating Developments at Winnipeg.—The *Electrical News* recently published an article upon the City of Winnipeg's combined steam stand-by and central steam-heating plant. The plant was originally designed as a stand-by plant for the municipal hydro-electric system, with a capacity of 11,000 kW to take care of the essential service under emergency conditions. It was not until after construction on the plant had commenced that it was decided to use the boiler plant of the stand-by station to supply steam for a central heating system, the decision being arrived at after a complete survey of the situation had been made. This showed that if a steam-heating system, operated on a paying basis, could be co-ordinated with the hydro-electric system and its stand-by plant, certain economies would be effected that would reduce considerably the cost of the plant to the hydro-electric system, and if large electrical steam boilers were installed, about 65,000,000 kWh of off-peak energy could be used annually during the heating season for generating steam for distribution. As the turbo-generators are likely to be called upon only during the summer months when the electrical and wind storms menace the transmission lines, the boiler plant may be used for steam-heating purposes and still be ready in case of emergency for supplying steam for the turbines when occasions necessitate.

The generators of steam for distribution are each of 7,500 kW capacity, 4,800 V, 3 phase, generating at 240 lb. per sq. in. These boilers are of Canadian General Electric design and consist of a vertical shell, composed of two compartments with a diaphragm between. A circulating pump, which regulates the load, pumps water from the lower chamber and discharges it into the upper one, which contains the electrodes. The water flowing back again passes through an opening in the bottom of the upper chamber and discharges towards a sediment pocket at the bottom of the lower chamber. The pump being of constant speed, the flow of water is controlled by a gate valve which regulates the height of water in the electrode chamber and consequently the depth of immersion of the electrodes, thereby determining the resistance which, in turn, governs the electrical input and the steam output. The electrodes are of special cast-iron composition, which resist corrosion and are designed to give a low-current density.

South African Notes.—Considerable progress is being made with the erection of the Witbank hydro-electric generating station, which is expected to be in commission in August next. The station is to be equipped with three 20,000-kW generating sets, and the stator of the first set, which weighs 47 tons, was recently delivered. The transmission lines from Witbank to Brakpan, a distance of 65 miles, are nearing completion. Six cables are being provided, three on each side of the standards; they are mounted on steel towers 100 ft. high and placed at intervals of 1,000 ft. The transmission pressure is to be 132,000 V.

According to the *Rand Daily Mail*, pourparlers are taking place with regard to the taking over of the Colenso power station from the South African Railways by the Electricity Supply Commission and £2,000,000 is mentioned as the sum involved. It is further suggested that the capital so released may be applied to the further electrification of the Durban-Maritzburg line. It is intended that the Colenso station, of 60,000 kW, should work in conjunction with the station at Durban, 40,000 kW, to supply the whole of the uphill railway section from the coast inland and to the municipalities and industries in the area.

Atomic Hydrogen Arc Welding.—Within the last year or two material progress appears to have been made in the laboratories of the General Electric Co., of America, in overcoming some of the difficulties associated with the electric arc-welding process, as a result of which it is now claimed that such welds can be made to withstand the most severe tests. The scientific side of the investigations is, in itself, most instructive and fascinating, being one more example of the inception of many important practical processes by research in pure science. For instance, Dr. Irving Langmuir's work has indicated that when hydrogen gas (ordinarily in the form of HH, or two atoms united to form a molecule) is highly heated, say to about 2,500 deg. C., the molecules are dissociated in a large part into free atoms. Such dissociation, however, demands the expenditure of a large amount of energy and the recombination of the dissociated atoms to form hydrogen again in the molecular state gives back that energy and produces a most intensely hot flame source. A stream of hydrogen directed into an arc between two tungsten electrodes can be made to produce a flame of atomic hydrogen which is of even higher temperature than the oxy-acetylene flame, and in the *General Electric Review* Dr. Langmuir describes in detail the results of his remarkable investigations, which finally led to the conclusion that flames of this gas make possible a new electric welding method of far-reaching importance. Another article, jointly written with Mr. R. A. Weinman, contains a comprehensive statement of the work which has been done in applying the atomic hydrogen arc to the fusing and welding of metals; it is also possible to use this agent of great utility for the reduction of many metallic oxides. The special welding torches and auxiliary apparatus, together with the distinctive character of the results obtained by the application of this principle are described, and the articles will repay careful reading.

Almost simultaneously with the work at Schenectady, Mr. P. Alexander was engaged upon welding research in the Thomson Research Laboratory of the G.E. Co. at West Lynn, which culminated in the establishment of the practical conditions for the production of reliable ductile welds by bathing, or shielding, ordinary electrodes with hydrogen gas, without necessitating any modification of the ordinary apparatus. The author, who worked partly under the direction of Dr. Elihu Thomson, shows that some other gases, or mixtures (which, on reaching the arc, become practically hydrogen and carbon monoxide), or vapours of some liquids, have serviceable properties in this respect. Both this process and that previously referred to produce highly ductile welds, but the equipment and welding technique are so different that each method will doubtless find a field of preferred application.

Petrol-Electric 'Buses in Argentina.—*Reuter's* Buenos Aires correspondent reports that a petrol-electric omnibus service has been instituted between the city and its principal suburbs. Forty Tilling-Stevens vehicles are providing the service and they are said to be well patronised.

High-Pressure Boilers.—In a paper on "High-Pressure Water-Tube Boilers for Marine Purposes," read before the Institution of Naval Architects, Mr. Harold E. Yarrow dealt briefly with some modern developments in high-pressure boilers. He said there should not be any difficulty in making high-pressure steam joints tight. The problem was simplified in marine installations where the valves and pipes were much smaller than was the case with land boilers. The 400-lb. steam pipe from each of the Yarrow boilers at the County of London Electric Supply Co.'s generating station at Barking was of 8 in. diameter and joined up to a 12-in. main line. In a steamship of 24,000 s.h.p., having six boilers of 575 lb. pressure, the diameters of the connecting and main pipes would be 4 in. and 7 in. respectively. The author described and illustrated two h.p., coal-fired boilers which will be installed on a passenger vessel now being built by Messrs. Wm. Denny & Bros. The boilers are being constructed for a working pressure of 575 lb. per sq. in., and the design closely follows that of the Yarrow land-type boiler now in use in several generating stations. A boiler suitable for 1,000-lb. pressure was illustrated, the boiler being of such a size as would produce steam for 4,000 shaft horse-power when worked at a very moderate rating.

E.A.W. Luncheon.—In connection with the first annual general meeting of the Electrical Association for Women, a luncheon is being held at the Criterion Restaurant, Piccadilly, London, W., on May 7th, at which the Rt. Hon. Lt.-Col. Wilfred Ashley, M.P., Minister of Transport, Miss Ellen Wilkinson, M.P., and Sir Hugo Hirst, Bart., have promised to speak. After the luncheon the members will visit the Zoological Gardens to see the new installation of artificial daylight. Application for tickets should be made before May 1st to the Director, Electrical Association for Women, 26, George Street, Hanover Square, London, W.

Textile Mill Drives.—Members of the Blackburn and District Managers' Mutual Association were addressed recently by Mr. P. P. Wheelwright, Blackburn electrical engineer, on the subject of "Electric Power and Driving." Mr. C. Tate (secretary of the Cotton Employers' Association), who presided, emphasised the rapid strides made in the development of electrical energy since the war. Electricity was being used more in connection with the manufacture of textiles than ever before, and actual experience would largely determine its future regarding the cotton industry. The sooner such difficulties as the sudden starting experienced with the electrical drive and the generation of heat to keep the weaving sheds at the right temperature were overcome, the more rapid would be the application of electricity to the industry. The chief consideration, however, was an economical one; at present, electricity rates did not appear to be sufficiently attractive to draw the industrial magnate.

Mr. P. P. Wheelwright said losses due to friction and windage in the mechanical transmission amounted to as much as 40, or even 50 per cent. when operating under full-load conditions, largely traceable to heavy shafting, defective gearing, belts, ropes, and pulleys, and were seldom accurately ascertained. The contrary was true of electrical transmission, provided due attention was paid to the lay-out of the plant at the time of its installation. It was now the exception for new mills to be built without such equipment, which testified that it must possess commercial, economical, and financial advantages. There were cases of electrically-driven mills in which the individual drive had been adopted where the increase in production in 12 months had been from 8 to 10 per cent., compared with a similar mill equipped with the same class of machinery and driven by an up-to-date engine. The cost of upkeep would not amount to more than a few pence per h.p. per annum to cover renewals to bearings, switchgear, &c. Steam would, of course, be required for heating and manufacturing processes, but all that was required was an inexpensive low-pressure boiler capable of withstanding a pressure not exceeding 20 lb. Mr. Wheelwright summed up the advantages of electricity as follows:—Flexibility, lighter building construction, sectional working, smoothness of drive, speed variation, reduction in breakdowns, ease of control and upkeep, increased light due to the reduction in the amount of overhead shafting, belting, &c., and improved welfare of *personnel*. Some of these advantages would substantially decrease the actual cost of driving the mill, whilst other advantages would beneficially influence its general operation, thereby effecting a high standard of production both with regard to quality and quantity.

A Ship's Progress Indicator.—One of the most interesting features of the world's largest motor ship, the *M.V. Asturias*, is the realistic and accurate moving model which gives the ship's location on the ocean at any part of the journey. The indicator was designed and constructed by Messrs. Gent and Co., Ltd., and consists of a large coloured relief map embracing both hemispheres and the sea route of the *Asturias* between Southampton and Buenos Aires. A small model ship, representing the liner, is moved along the route by concealed, electrically-controlled clockwork, the rate of travel of the model being in proportion to the actual speed of the vessel. Coloured lighting effects are provided to illuminate and give life to the map and simulate sunrise and sunset effects on the model. A simple switch control enables the model to be automatically reversed at the commencement of the return journey. The clock is controlled by a "Pul-Syn-Etic" marine transmitter installed in the chart room, and 40 clocks provided throughout the ship are arranged in the same circuit. The clock system and the model-ship mechanism are driven off the ship's lighting supply.

Fatality.—An inquest was held at Lewisham on April 7th into the cause of the death of George Frederick Peter Blackeman, aged 10 years, who received a fatal electric shock on the Southern Railway between Ravensbourne and Beckenham Hill stations on April 5th. It was stated that the boy was looking for flowers, and went over the line, coming into contact with the conductor rail. A verdict of "Accidental Death" was recorded.

Chief Technical Assistants' Association.—The 12th annual dinner of the above Association was held on April 10th at the Holborn Restaurant, Oxford Street, London, when Mr. G. F. Gregory presided, and was supported by a large number of well-known engineers. After the loyal toasts, Mr. J. A. Lee proposed "The Association and Chairman." Mr. Lee said the Association carried out most useful work at its meetings by the interchange of opinions on the various technical subjects of the electricity supply industry.

Mr. Thompson submitted "The Visitors," and was very disappointed because Mr. Lee had not expounded the new Electricity Bill. Like other Government officials Mr. Lee was very guarded in his remarks.

Mr. A. H. Shaw responded, and related several interesting incidents in connection with the industry 35 years ago. He paid a tribute to the chairman, who was his chief assistant at Ilford.

Mr. Cornet proposed "Mr. Wallis," who was leaving Wimbledon to take up an appointment at Bristol, and the latter gentleman responded in a suitable manner.

An excellent musical programme was provided under the direction of Mr. Percy Vaughan, and a vote of thanks to the officials and committee of the Association and the artistes concluded the evening.

Educational.—Faraday House Entrance Scholarships.—On the results of the entrance scholarship examination held at Faraday House Electrical Engineering College on April 7th, 8th and 9th, the following awards have been made by the Governors of the College:—Ernest M. Noble, Holborn Estate Grammar School, the "Faraday" scholarship of 50 guineas per annum, tenable for two years in College and one year in works; Charles B. Forgan, Roan School, Greenwich, the "Maxwell" scholarship of 50 guineas per annum; Ian J. Farmbrough, Stationers' Company's School, Hornsey, an exhibition of 40 guineas per annum; Richard P. E. Tabb, Haberdashers' Aske's Hampstead School, an exhibition of 30 guineas per annum; William R. Crookes, East Anglian School, Bury St. Edmunds, an exhibition of 30 guineas per annum, all tenable for one year in College and one year in works. Entrance prizes of ten guineas each were also awarded to John H. Bayton, The Nautical School, Pangbourne, and John C. McMahon, The King's School, Peterborough.

Extensions at Ilford.—On April 8th, a tour was made by a party of engineers, local and Press representatives of the sub-stations on the distribution system of the Ilford electricity undertaking, when the most recently established one at Gants Hill Cross was formally inaugurated by the Rev. Herbert Dunnico, M.P., J.P., chairman of the Municipal Council. This sub-station is of the fully-automatic type, the equipment having been supplied by the Metropolitan-Vickers Electrical Co., Ltd. It was put into operation in December last, the main object being to improve the pressure on the d.c. network in the neighbourhood. A feature of the "sub" is that, by means of a time-delay relay the converting plant is not disconnected from the distribution system until 20 minutes after the supply pressure rises above the set value, thus allowing for any temporary drop of load. The necessary conversion from the 6,600-V, 3-phase system is effected by means of a 500-kW rotary converter fed from a 550-kVA transformer. The sub-stations at Uphall Road, Grove Road, and Goodmayes were also visited, and an inspection was made of the transformer kiosk which furnishes an a.c. supply to the Tomswood Hill Housing Estate. The kiosk was supplied by Messrs. Callender's Cable & Construction Co., Ltd. It is a steel structure, about 8 ft. square, and houses a 100-kVA Fuller transformer and the necessary switchgear for receiving and distributing the e.h.p. and l.p. supplies. The Uphall Road sub-station receives a bulk supply from West Ham, and is equipped with two 1,000-kW La Cour converters, one by Messrs. Bruce Peebles, Ltd., and the other by Messrs. A.C.E.C., and switchgear by the General Electric Co., Ltd.

The party was entertained to tea in the Ilford Town Hall after the inspection, when Councillor H. G. Odell, chairman of the Ilford Electricity Committee, called upon the Rev. Dunnico to declare the sub-stations open for the benefit of the ratepayers. Councillor Odell outlined the progress made by the undertaking since its commencement 25 years ago. He warned the public not to expect any immediate material reduction in the price of electricity as the result of the Government Electricity (Supply) Bill. Tributes were paid to Mr. A. H. Shaw, M.I.E.E., who had been the engineer and manager of the undertaking during the whole of its 25 years of operation.

Institution Notes.

Royal Institution.—The After-Easter Lectures will include three lectures by Dr. G. W. C. Kaye on the "Acoustics of Public Buildings" (the Tyndall Lectures), on May 11th, 18th and 25th; three by Sir William Bragg on the "Imperfect Crystallisation of Common Things"; and two by Mr. U. R. Evans on the "Corrosion, Tarnishing and Tinting of Metals." On Saturdays, May 15th and 22nd, there will be two lectures by Dr. G. C. Simpson on "Atmospheric Electricity." The Friday evening discourses will include one by Dr. R. Whiddington on "The Luminous Discharge Through Rare Gases" (April 23rd), and one by Dr. W. H. Eccles on "Wireless in the Empire" (April 30th).

Institute of Marine Engineers (Inc.).—The annual meeting of the above Institute was held on April 9th, when the annual report was presented; the Rt. Hon. Lord Inverforth, P.C., president of the Institute, presided. The total membership on January 31st, 1926, was 2,905, representing an increase of 22 on the number for the previous year. The revenue account for the year shows a profit of £796, as compared with £1,021 for the previous year, and the gross revenue was £5,038, representing a decrease of £148 from the corresponding figure for the past year.

Iron and Steel Institute.—The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on May 6th and 7th next. Amongst the papers to be read are: "Specific Resistance and Thermoelectro-motive Potential of Some Steels Differing in Carbon Content," by Messrs. C. D. Campbell and H. W. Mohr; "Magnetic Changes in Iron and Steel Below 400 deg. C.," by Messrs. W. H. Dearden and C. Benedicks; and "The Hardening and Tempering of High-Speed Steel," by Mr. A. R. Page. The autumn meeting of the Institute will be held at Stockholm on August 26th-28th, when, besides the reading and discussion of papers, visits to industrial enterprises in Stockholm will take place.

The Institute of Metals.—Some preliminary details of the annual autumn meeting which is to be held in Liége from September 1st to 4th have been announced. It is provisionally arranged that the party will leave London at 9.15 a.m. on August 31st, arriving at Liége at 7.45 p.m., and return on September 5th. If at least 50 members desire to travel together special arrangements will be made for an inclusive fare, which will not exceed £10, and will provide the necessary travel tickets and hotel accommodation at Liége. This meeting will be the first to be held on the Continent since the very successful Ghent Meeting of 1913.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

MR. W. J. MAXFIELD has resigned his position with Messrs. J. H. Tucker & Co., Ltd., and has joined the Austin Motor Co., Ltd.

MR. L. J. B. FORBES, electrical engineer at the Kirk Sandall Glass Works of Pilkington Bros., Ltd., has been appointed electrical engineer at the firm's head works at St. Helens.

MR. C. BATT, late superintendent of telegraphs at Bournemouth, who has retired, was on April 7th presented with an inlaid mahogany table and a case of pipes by the staff.

MR. J. G. MCLEAN, who for the last 14 years has been agent and superintending engineer in the North Midland and N.E. Coast of England for Messrs. Edward Bennis & Co., Ltd., has severed his connection with the company, and now represents the Crosthwaite Engineering and Furnace Co., Ltd., of Leeds. Mr. McLean was chief engineer and genera manager of the Woking Electric Supply Co., Ltd., 1900-1911

DR. HENRY R. WRIGHT, the newly-appointed managing director of Siemens Bros. & Co., Ltd., who has been a director of Siemens & English Electric Lamp Co., Ltd., since January 1st, 1923, has been appointed managing director of the company, and Mr. S. H. CALLOW, the sales manager, has been appointed a director.

MISS VARA M. BROOKE, elder daughter of Mr. W. A. Brooke, of Framfield, was recently married at Altrincham to Mr. ERNEST THEODORE WRIGHT, principal electrical engineer at the Manchester offices of the Traction Control Euipment, and for some years previously, on the staff of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park.

The Birkenhead electrical engineer, Mr. G. P. SHALLCROSS, was spoken of very highly at a meeting of the Town Council a few days ago, when his impending retirement was discussed. After a long discussion regarding the appointment of a successor, Mr. F. E. SPENCER, A.M.I.E.E., the present assistant engineer, secured the position at a salary of £750 a year for a period of 12 months commencing on the date of the retirement of Mr. Shallcross.

At the Grand Hotel, Manchester, on April 7th, a dinner (followed by a concert) was given by the members of the staff of the Lancashire Dynamo & Motor Co. to welcome Mr. A. P. WOOD, the managing director, on his recent return from India. Mr. H. B. Whitmore, in toasting the honoured guest, spoke of the high esteem in which their chief was held by the staff and employés, also by engineers, clients and others in practically all parts of the world. Mr. A. P. Wood, in reply, referred to the close co-operation that he had always had from his assistants, which had established the company in the sound position and with the high reputation which it enjoyed to-day. He had done extensive business in India, securing some valuable contracts.

Mr. FRANK W. T. BRADLEY, sub-station engineer to the Durban Corporation, upon returning to South Africa, asks us to thank the many engineering friends for the courtesy and kindness shown him during his recent visit to England.

Mr. Z. S. MC. P. JACKSON, representative of the Mullard Wireless Service Co., Ltd., Balham, who has been recalled from the West of England to undertake important business for the company in Australia, left London on March 18th, and will arrive at Sydney on April 22nd.

Indian Engineering understands that Mr. W. F. MARCHINTON, industrial engineer, has been appointed electrical engineer to the Government of Bihar and Orissa.

The Yorkshire Electric Transformer Co., Ltd., have appointed Mr. G. F. STEARN, late of the Metropolitan-Vickers Co., and at present with the English Electric Co., Ltd., as their chief designer.

Obituary.—MR. G. H. COTTAM.—Mr. George Henry Cottam, who passed away on April 1st at Coulsdon, Surrey, was in his 76th year. After some sixteen years in connection with general engineering, he took up, in 1882, the study of electricity; subsequently he worked for the Faure Electric Accumulator Co., the Anglo-Austrian Brush Co. (in Vienna), and superintended the erection of electrical undertakings in Hungary. Electric light and traction work in Spain was followed by duty at the Bankside generating station of the City of London Electric Lighting Co., Ltd., on behalf of the Brush Co., the contractors; and in 1893 Mr. Cottam superintended the erection of the Hanley Corporation electricity works and became electrical engineer to that municipality. Two years later he took up the position of chief electrical engineer to the Hampstead Borough Council. He was a life member of the Institution of Electrical Engineers, which he joined in 1895.

M. A. PEROT.—The death is reported from Paris, at the age of 62 years, of M. Alfred Perot, Professor of Physics at the Ecole Polytechnique. The deceased had read many papers before the French Institution of Electricians, and was well known for his work on relativity and the electro-magnet.

MR. H. OPPENHEIMER.—We regret to learn, at the moment of going to press, that Mr. H. Oppenheimer, of the Phœnix Telephone & Electric Works, Ltd., passed away on Monday last in his 70th year.

New Companies Registered.

T. H. Satchwell, Ltd. (213,046).—Private company. Registered April 8th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of a manufacturer and factor of electrical conduits, fittings, and accessories carried on by T. H. Satchwell at 143, Bridgeman Street, Walsall, as elsewhere, as "T. H. Satchwell." The permanent directors are:—T. H. Satchwell (managing director), 10, Caldmere Road, Walsall; W. S. Glover, 17, Brighton Grove, Monkseaton, Northumberland. Qualification, 100 shares. Solicitor: F. T. Craddock, 15, Bridge Street, Walsall. Registered office: 143, Bridgeman Street, Walsall.

Deansgate Electro Radio (Manchester), Ltd. (212,955).—Private company. Registered April 3rd. Capital, £2,000 in £1 shares. Objects:—To acquire and carry on the business of wireless, electrical and incandescent importers and dealers carried on by K. F. Fritzsche at 14, Hanover Street, Shudehill, Manchester, as "I. L. Radio Supplies." The permanent directors are:—C. Leeming, 10, Merton Road, Cheadle Heath, near Manchester, accountant; K. F. Fritzsche, 52, Seymour Grove, Old Trafford, Manchester, wireless dealer. Qualification, £50.

Rushmer, Ltd. (213,008).—Private company. Registered April 6th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of furnishing and general warehousemen, and manufacturers of and dealers in furniture in all its branches. Power is taken to carry on the business of general, electrical and motor engineers and contractors, suppliers of electricity, carriers of passengers and goods, manufacturers of and dealers in railway and tramway appliances, radio apparatus, electrical signs, heating and cooking appliances, and all kinds of mechanical and electrical machines, &c. The directors are:—W. E. Livingston, 80, Norry Road, Putney, S.W.15, contractor; Mrs. A. A. Livingston, 80, Norry Road, Putney, S.W.15; R. E. B. Trever, address not stated. Qualification, 100 shares. Solicitors: White, Davison and Co., 61-62, Chancery Lane, W.C. Registered office: Rushmer's Warehouse, Ruvigny Gardens, Lower Richmond Road, S.W.15.

Express Radio Co., Ltd. (212,931).—Private company. Registered April 3rd. Capital, £1,000 in £1 shares. Objects:—To carry on the business of radio and electrical engineers and makers, manufacturers of and dealers in all kinds of wireless and electrical apparatus, &c. The life directors are:—H. H. Cowley, 12, Portsdown Road, Maida Vale, W., radio engineer (managing director); J. H. Watkins, 5, Challoner Court, Challoner Street, West Kensington, W.14, journalist. Solicitors: George H. Olley and Co., 11, Queen Victoria Street, E.C.4. Registered office: 66, High Holborn, W.C.1.

Official Returns of Electrical Companies.

Energo Products, Ltd.—S. G. Crimes, of 150, Southampton Row, W.C.1, was appointed receiver and manager on March 30th, under powers contained in debenture dated February 22nd, 1926.

Peerless Productions, Ltd.—S. Sharpe, of Balfour House, Finsbury Pavement, E.C., was appointed receiver and manager on March 15th, under powers contained in debenture dated February 3rd, 1926.

Ross Electric Light and Power Co., Ltd.—Particulars filed on March 30th, 1926, of £1,450 second debentures authorised July 30th, 1925, charged on the company's present and unissued capital, the whole amount being now issued.

China and Japan Telephone and Electric Co., Ltd.—Satisfaction in full on February 27th, 1926, of 7 per cent. first mortgage debentures secured by a floating charge and issued on December 22nd, 1905, January 24th, 1906, and November 1st, 1922, securing £50,000.

McLeod & Sons, Ltd.—G. Miller, I.A., 19, Castle Street, Liverpool, was appointed receiver and manager on March 22nd, 1926, under powers contained in debenture dated December 29th, 1924.

A. and A. Electrical Co., Ltd.—G. E. Sendell, of 36, Walbrook, E.C.4, ceased to act as receiver or manager on March 31st, 1926.

Vio Ray Electric Co., Ltd. (178,937).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925. 377 shares taken up. £377 paid. Mortgages and charges, nil.

Hamilton Bros., Ltd.—H. Lever, F.C.A., of Chiswell House, Finsbury Pavement, E.C.2, ceased to act as receiver or manager on March 31st, 1926.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

A. Reyrolle and Co., Ltd.

This company's report was reviewed in our last issue (p. 591). Mr. William Negus (vice-chairman) presided at the annual meeting at Newcastle-on-Tyne on April 9th, and during the course of his speech mentioned that the share capital had been increased by £60,000, while the creditors had been reduced by £35,000. The employés' deposits were still increasing—a very satisfactory feature, and the general reserve had been substantially increased. The expenditure

upon extensions to stores and additional machine tool equipment amounted to £43,555 during 1925. The work completed during the year was larger than in 1924, and the exports of the company's manufactures continued to increase. During the last few years the company had carried out in a very successful manner a larger proportion of the heavy switchgear installed in this country than any other maker. Recent large extensions, which nearly doubled the area of the shops, had placed the company in a favourable position to meet the greatly increased demand for switchgear which was to be expected in the near future on account of the rapidly growing demand for electricity. The company had an excellent reputation for the reliability and modernity of its appliances. Such a reputation was only obtained by the skill, hard work, and ability of everybody connected with the company, and the shareholders' thanks were due to the staff. The recreation ground for the employés was now completed; the number of shares held by employés continued to increase, showing their interest in the company. Referring to the Government's Electricity Bill, Mr. Negus said that he considered that the intention of the Government to endeavour to co-ordinate the business of electricity supply and convert it from a parochial to a national institution must ultimately lead to beneficial results for the country and industry. The report and accounts were adopted, and the sum of £750 was voted to local charitable and other funds.

Vickers, Ltd.

The report for 1925 shows a profit of £420,973. After paying the preference dividends a balance of £18,275 remains, and this, together with £172,500 from the last accounts, is carried forward. The directors do not recommend a dividend on the ordinary shares. The report records the resignations of five directors. The committee of advisers and shareholders has issued its report, and makes the following recommendations:—That the office of "president" be established, carrying with it membership of the board of directors and each of the management boards, and that Mr. Douglas Vickers should be appointed to the position. That the board should consist of Gen. Sir A. H. Lawrence (chairman), Sir David Yule, Bart., Sir Edmund Wyldbore Smith, Mr. G. R. T. Taylor, Mr. M. W. Jenkinson, Sir Vincent Caillard, Sir A. Trevor Dawson, Bart., Commander C. W. Craven, Sir George Buckham, and Mr. Vincent C. Vickers. The Committee further recommends that the following boards should be constituted:—Industrial Management Board: Mr. M. B. U. Dewar, Mr. B. D. F. Docker, Sir Philip A. M. Nash, Mr. W. F. Sadler, Mr. A. Spencer, and Mr. T. L. Taylor. Armaments and Shipbuilding Management Board: Sir G. Buckham, Commander Craven, Sir A. Trevor Dawson, and Mr. O. H. D. Vickers. Finance Management Board: Sir Vincent Caillard, Mr. V. C. Vickers, and Mr. A. Cartwright. The board has adopted these recommendations, and has appointed as additional members to the management boards Sir E. W. Smith, Sir D. Yule, Bart., and Messrs. M. W. Jenkinson and G. R. T. Taylor. Mr. F. Dudley Docker has agreed for the time being to act as an honorary member of the Industrial Management Board. The whole of the directors were to retire and offer themselves for re-election at the annual meeting at Sheffield yesterday (Thursday).

Automatic Telephone Manufacturing Co., Ltd.

The annual meeting of the company was held on April 7th under the chairmanship of Sir Alexander Roger. The latter, in presenting the report and accounts (*vide* Elec. Rev., April 2nd, p. 550), said that the business done during 1925 was larger than in any previous year, and as a result the profit had greatly increased. They had acquired additional factory premises at which it was proposed to accommodate certain of their non-telephone activities, such as the manufacture of heating and cooking appliances, and signal and telegraph apparatus. Those premises should be in complete operation by June, and should materially help the company's production. The company continued to have available for consultation the resources of the Strowger Automatic Co., of Chicago. The Post Office was proceeding actively with its policy of introducing the Strowger system into London and the provinces. The programme of development which had been adopted by the Post Office, if carried through undisturbed, would provide in reasonable time adequate service at minimum cost. In addition to three main exchanges in London, the company was installing auxiliary call indicator equipment in no fewer than 77 manual exchanges in Greater London. During 1925 A.T.M. (Strowger) exchanges were manufactured and installed at Cwmbran, Risca, Headingley, Stanningley, Chapeltown, Roundhay, Torquay, and Paignton; in addition, the company was engaged on the work for Nottingham and Southport. Their overseas operations were mainly confined to Tokyo, Sydney, and Buenos Aires, and the work on those three great contracts was materially advanced. The company had secured the contract for installing telephones in Canberra, the Federal capital of Australia, and at Elsternwick, Australia. The heating and cooking appliance section of the business was steadily expanding, and further growth was expected. The radio trade was quiescent, and they had regulated their output and stocks accordingly. The technical education of university graduates and electrical engineers undertaken by the company continued to produce good results, and the research department was proving of great value to the company. The welfare of the employés was being studied, and it was hoped that a scheme for a club, sports grounds, &c., would be carried through. Their pension fund provided liberal benefits. The Telephone Development Association, in which the company took an active part, reported definite progress. A large part of the prosperity of the United States was attributed to the telephones, and our Government should bear this in mind and not begrudge money spent on telephone development. The company's prospects were good; its present contracts alone would keep it busy for a year or more.

International Automatic Telephone Co., Ltd.

Sir Alexander Roger presided at the annual meeting on April 8th, and in moving the adoption of the report, reviewed the activities and financial results of the Automatic Telephone Mfg. Co., Ltd., a report of whose meeting appears above. The chairman said that allowing nothing for patent rights and goodwill, the value of the investments at the end of the year showed that the company's capital was intact. The company was engaged mainly in the development of the A.T.M. (Strowger) system in the foreign field and had succeeded in obtaining substantial business in all parts of the world. Many foreign telephone administrations were tending to follow the example of the British Post Office in installing the system and the directors had every faith in the future. Referring to the activities of the Telephone Development Association, Sir Alexander said that for every million pounds expended in telephone work employment was found for 6,000 workpeople, and the technical equipment of the country was improved. In conclusion, he stated that Mr. G. W. Moore, manager of the Automatic Telephone Mfg. Co., Ltd., had joined the board of the company.

United States Companies.

General Electric Co.—Although there was an increase in the value of orders received during 1925, the net sales fell from $299,251,869 to $290,290,165, and the net earnings from $39,235,548 to $38,641,217. The earnings on the average amount of special stock ($28,926,266) were at the rate of 137.07 per cent., as compared with 196.93 per cent. on an average of $19,756,000 of special stock in 1924.

Standard Gas and Electric Co.—It is reported that the company has acquired a controlling interest in the Philadelphia Co. (Pittsburgh) and the Market Street Railway Co. (San Francisco). This brings the company's gross earnings up to over $137 millions per annum, and its combined assets to about $750 millions.

Associated Electric Co.—As a result of the amalgamation of the electrical properties of the Associated Gas and Electric Co. and the properties of the Pennsylvania Electric Corporation, an offer was recently made in New York, and greatly over-subscribed, of $65,000,000 of the company's convertible 5½ per cent. gold bonds, due 1946, at 95½ per cent. These carry the option of conversion into 6 per cent. preferred stock of the Associated Gas and Electric Co.

Babcock and Wilcox, Ltd.

The directors' report for 1925 records a net profit of £785,027, and to this is added £197,395 brought forward, making £982,422. The interim dividends absorbed £222,359, and after paying the final preference shares it is proposed to pay a dividend of 5 per cent. and a bonus of 3 per cent., both free of tax, on the ordinary shares, making a total distribution of 13 per cent., free of tax, for the year. There remains a balance of £408,774, which is to be dealt with as follows:—To reserve fund, £150,000 (making £550,000); to dividend equalisation fund, £50,000 (making £400,000); to staff pension fund, £20,000; carried forward, £188,774. The report states that the works are well supplied with orders, including several for boilers of high pressure, and additional buildings designed to meet this special work have been erected. Judging by the orders received during the first three months of the current year, there are indications of an improvement in trade, and it is hoped that labour troubles will not retard the recovery. It is stated that the additional 1 per cent. on the bonus has been rendered possible by the reduction of taxation. The meeting is to be held on April 20th.

English Electric Co., Ltd.

The report for the past year shows a balance to the credit of profit and loss of £268,870 (including £73,917 brought forward). After deducting debenture interest, preference dividend, &c., there remains a balance of £74,098, which it is recommended shall be carried forward. The directors state that their inability to declare an ordinary dividend is due to the depression of prices by acute competition; the reduction of orders owing to the unsettled conditions of certain foreign markets; and lower royalties and dividends from allied companies. An outstanding feature of the company's business at the present time is the fact that the unexecuted orders on its books exceed the whole output of last year. During the last few months there has been an appreciable stiffening of Continental prices for the types of plant with which the company is most concerned. Mr. Pybus proceeded on sick leave in July last, and Mr. Watlington has joined the board as managing director. The meeting is to be held on April 21st.

Mexborough and Swinton Tramways Co.—The accounts for the past year show a balance to credit of net revenue account of £10,892, and a balance of £772 brought forward makes available £11,634. After providing for depreciation, income tax, and a loss of £452 on the motor omnibuses, it is proposed to pay a dividend of 2 per cent., free of tax, to

transfer £4,000 to reserve and renewals account, and to carry £1,460 forward. The company is promoting a Parliamentary Bill to empower it to connect the railless traction systems in Manvers Main and Conisborough, to extend the system in the latter district, and to authorise the company, if thought fit, to take up the tramway track in Mexborough, over which the new system would be operated. The report records the death of Ald. D. L. Winter, a director. Meeting: April 21st.

Northampton Electric Light and Power Co., Ltd.—An extraordinary general meeting has been called for April 21st to consider a resolution to increase the company's capital to £500,000 by the creation of 150,000 additional "B" shares of £1 each to be issued either as ordinary or preference shares, ranking with the existing preference shares, or with or subject to other rights, privileges, or conditions. The directors propose to issue 70,000 of these to existing holders of "B" ordinary shares in the proportion of one to five at the price of 27s. per share, representing a substantial bonus.

Calcutta Electric Supply Corporation, Ltd.—An issue of 150,000 each of preference and ordinary shares, ranking with the existing shares, is being made. The preference shares have been purchased at par by Messrs. Robert Fleming and Co., while the ordinary are being offered to present holders of ordinary shares at £1 13s. each, in the ratio of one new share to each eight held. The capital is required for the completion of the new power station at the Calcutta docks and for general improvements and extensions.

Peterborough Electric Traction Co., Ltd.—The accounts for 1925 show a revenue of £33,238, an increase of £7,029, and expenses amounting to £29,729 (including £5,500 transferred to renewal fund), leaving a balance of £3,508, to which is added £1,020 brought forward, making £4,528. A dividend of 5 per cent. is recommended, leaving £2,209 to be carried forward.

Reduction of Capital.—Siebe, Gorman & Co., Ltd., and Reduced.—A petition has been presented to the High Court for the confirmation of the reduction of capital of the company from £100,000 to £75,000, and will be heard in London on April 20th. (The grounds of the petition are that the company's paid-up capital is in excess of the wants of the company.)

Wood & Cairns, Ltd.—The directors recommend a dividend of 10 per cent. on both the preference and ordinary shares for the year ended December 31st, 1925. The sum of £818 is placed to reserve, and £487 is carried forward.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

River Plate Electricity Co.—34,701 new ordinary shares of £1 each fully paid, Nos. 347,014 to 381,714, and fractional certificatees (registered).

Anglo-American Telegraph Co., Ltd.—Interim dividends of 15s. per cent. on the ordinary stock and 30s. per cent. on preferred stock, have been declared in respect of the quarter ended March 31st.

Dutch Company.—The accounts of the *Nederlandsche Kabelfabriek* for 1925 are reported to show net profits of 833,000 florins on a paid up capital of 2,500,000 fl. It is proposed to pay a dividend at the rate of 21 per cent.

Greek Company.—The report of the *Société Hellenique d'Electricité*, Athens, for last year, shows a net profit of 3,807,558 drachmae (about £10,290), as compared with 3,563,447 drachmae in 1924.

La Plata Electric Tramways Co., Ltd.—Out of the profits of the past year it is proposed to pay 6 per cent. on the preference shares, to transfer £5,000 to reserve, and to carry forward £3,958.

Brazilian Traction, Light and Power Co., Ltd.—A dividend of 1¼ per cent., payable June 1st, has been declared on the ordinary stock.

Oliver Pell Control, Ltd.—The directors recommend a final dividend of 5 per cent. on the preferred and ordinary shares, making 10 per cent. for the year in each case.

Hadfields, Ltd.—A dividend of 3 per cent. is recommended, as against 2½ per cent. for 1924.

Stocks and Shares.

Monday Morning.

The critical conditions surrounding the coal question constitute the chief factor that controls Stock Exchange business at the present time. That hopefulness is felt in regard to the outlook can be clearly seen from the manner in which prices are maintained. If it were generally supposed that a widespread strike were likely to occur, we should see Stock Exchange markets in a very parlous condition. Whereas, although it cannot be said that anything approaching activity prevails, comparative firmness in prices is noticeable, and this, not only in the general markets, but also in those the companies concerned with which are peculiarly liable to be affected by acute industrial trouble.

Electricity supply shares, as well as the gas companies' stocks, hold their ground with a tenacity which shows the faith reposed in them by proprietors of these investments. In regard to the electricity shares, these are also under the influence of the discussions that surround the Electricity Supply Bill, which enters upon its committee stage immediately. That some hesitation continues to be felt by shareholders is manifest from a further fall in County of London ordinary to 56s., making a drop of 3s. within the last fortnight. County shares are more vulnerable than others in the list, from the fact of their commanding a ready market, and therefore attracting the speculative investor who regards the shares from both points of view. The Bournemouth and Poole Company has declared a final dividend on the ordinary shares of 5½ per cent., less tax, making 10 per cent. for the year, plus a bonus of 4 per cent., free of tax. This is the same rate as was declared for 1924. A fall of 1/16th in Metropolitans lowered the price to 37s. Edmundsons are easier at 23s. In the Provincial list, small declines have taken place in Midland Counties to 19s. 6d., and in Newcastle ordinary to 22s. On the other hand, Yorkshire Electrics at 26s. 6d. are a better market.

The Calcutta Electric Supply Corporation is offering new shares at 33s., and as the existing shares stand in the market at 38s. 9d. ex rights, the privilege is substantial, and there is a premium of 3s. per share on the new. The rights can be sold, if desired, without the necessity of holders taking them up. We have frequently drawn attention to the danger that arises too often in cases such as this when new issues are made at bonus prices. In a company the shareholders of which are mostly of the investment class, people are liable to throw away circulars and other notices if these contain invitations to subscribe more capital. In every case the offers are worth examination with a view to seeing whether the rights can be sold, as in the case of the Calcutta Electric at a profit.

The Canadian General Electric report mentions that the company has been able to redeem five million dollars debentures, thereby fortifying its financial position. The net profits have risen from $578,000 to $934,000. It will be remembered that the General Electric Co. of America holds the bulk of the Canadian company's ordinary capital. The common stock of the Canadian company is quoted at 52½ for the $50 shares. The preferred stock, which is also in $50 shares, stands at about 58½.

No check has yet been imposed upon the buoyancy of the market in Underground Electric Railways of London. The £10 shares are a further 2s. 6d. better, and stand at 3⅜, against £3 before Easter, while the 1s. shares are up to 11s., the Income Bonds remaining at 100. While other Home Railway stocks are weak by reason of the coal affair, Underground Electrics stand out the more conspicuously with strength. Metropolitans are ½ down at 66, and Districts retain their rise at 50.

Anglo-Argentine Tramways have recovered, the first preference to 3, the seconds to 2⅝, upon vague statements to the effect that the Buenos Aires Municipality is on the point of implementing the agreement previously proposed between itself and the company. Brazilian Tractions rose $2 to 93. The quarterly dividend is 1¼ per cent., and, although some people had been expecting an improvement to 1½ per cent.—that is, at the rate of 6 per cent. per annum—the impression prevails that it cannot be long before this latter rate is distributed, provided the company's earnings continue to expand at their present satisfactory rate. The London Traction issues are unchanged, and in Mexicans there is little or nothing doing. British Electric Traction ordinary is 5 points higher at 127½, upon anticipations of an increase in the dividend.

Babcock & Wilcox have issued an exceedingly good report, and the previous dividend of 12 per cent. has been increased by 1 per cent. Some people had been expecting, however, that the company would pay 15 per cent. for the year, and the first effect of the announcement was a slight decline in price to 53s., this being recovered later. The quotation is now 53s. 9d., and in the face of the heaviness apparent amongst iron and steel shares as a whole, the firmness of Babcocks attracts the greater attention.

General Electrics are easier at 30s. Electric Constructions have gone back to 31s. 3d. English Electrics, after their sharp drop from 18s. 9d. to 14s. 6d., rallied to 15s., but could not hold the recovery. There is a good deal doing in the shares. Amongst other manufacturing descriptions, the tone keeps steady without there being any noticeable alteration in prices. The rubber share market has been dull, owing to a further decline in the price of the commodity. Experts talk about a probable shortage in raw rubber that may occur in 1928, but this prospect holds no consolation for those people who bought more shares in 1925 than they now know how to finance.

In the wireless group, Radio Common have recovered to 7¼, the preferred to 9¼, upon a rally in most of the dollar stocks and shares. Marconis are quiescent at 23s. 9d., and Canadians continue at 4s. 3d. Amongst the wireless manufacturing shares a slight demand for Burndept preferred caused the price to strengthen, though apart from this the movements are uninteresting.

The annual report of the Stock Exchange indicates that the House spent, in the year ended March 25th last, £4,729 upon "electric power, working expenses, and maintenance." This goes against £9,259 in the previous year when, however, special expenditure was incurred through the establishment of plant, &c. It will interest cricketers to know that the Surrey County Cricket Club's bill came to no more than £36 0s. 4d. last year for gas and electric light. The club's revenue account shows the charge to be seven shillings less than that debited for the same item in 1924.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	1925.	Price Apr. 13 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	60/9	—	4 13 4
Brompton Ordinary	1	10	10	1⅝xd.	—	*6 3 1
Charing Cross Ordinary	1	14½	15	45/9	—	6 11 2
do. do. 4½ Pref.	1	4	4½	17/-	—	5 5 11
Chelsea	1	12	12	2 1/16xd.	—	5 16 3
City of London	1	15	15	44/6xd.	—	6 14 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/6xd.	—	5 16 5
County of London	1	15	15	56/-xd.	—1/9	5 7 2
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—6d.	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	18⅝xd.	—	5 9 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	37/-	—1/16	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	19/6	—6d.	6 3 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—6d.	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/6	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅞	—	5 13 10
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	19/6	—	4 2 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/9	—	6 17 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/-	—	7 10 0
Yorkshire Elec.	1	8	8	26/6	+1/-	6 0 9

Home Rails.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66	—½	7 11 6
do. District	,,	3½	3½	£0	—	7 0 0
Underground Electric Ordinary	10	Nil	Nil	3⅜	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	11/-	+1/-	Nil
do. do. Income	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	1	3	6	2 7/16	—	4 2 0
Chili Telephone	5	6	5	6¾	—⅛	*3 14 1
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	17¾	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17¾	—	*5 12 8
do. do. Pref.	10	6	6	10¾	—	5 11 7
Great Northern Tel.	10	22	22	32	—	6 17 6
Indo-European	25	7	8½	45⅞	—	*4 13 5
Marconi	1	10	10	1 3/16	—	8 8 6
Marconi Marine	1	10	7½	18/9xd.	—	8 0 0
Oriental Telephone Ord.	1	12	12	2 1/16	—	*5 16 4
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17¼	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8	+1/16	9 3 4
do. do. 2nd Pref.	5	6	6	2⅝	+⅛	11 8 6
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	127½	+5	4 14 0
do. do. 6% Pref.	,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	93	+2	4 6 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	84½	—	5 18 4
do. do. Preferred	,,	96/-	96/-	105½	—	*4 9 4
do. do. Deferred	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb.	,,	4½	4½	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/6	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	62½	—	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—1	Nil
do. Pref.	100	Nil	Nil	62½	—	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	13	53/9	—	‖4 16 4
British Aluminium Ord.	1	5	10	2 7/8xd.	—	4 17 0
British Elec. Transformer Pref.	1	Nil	7	19/6xd.	—	7 3 7
British Insulated Ord.	1	15	15	9⅜xd.	—	4 16 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 1/8	—	4 14 10
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/6	—	4 14 1
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	31/3	—1/16	6 8 0
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	14/6	—	6 13 4
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	30/-	—9d.	5 0 0
Henley	1	15	16	3⅜	—	4 5 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 9 0
Johnson & Phillips	1	10	10	3	—	3 6 8
Met.-Vickers Ord.	1	8	8	24/6xd.	—	6 10 8
do. Pref.	2	8	8	2⅝xd.	—	6 14 9
Siemens Ord.	1	—	7½	1⅜	—	4 12 4
Telegraph Construction	12	20	10	28½xd.	—	*4 4 3

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.	Price April 13th.	Fortnight's Inc. or dec.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... ... per ton.	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net.	£255	£2 dec.
Grade II ... ... ,, ,,	£178	£1 dec.
Grade III... ... ... ,, ,,	£96	£2 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11½d. to 1/-	¼d. dec.
c ,, Wire, basis ... ... ,,	9½d.	¼d. dec.
c Copper Tubes (solid drawn) ... ,,	1/0½	¼d. dec.
c ,, Bars (best selected) ... per ton.	£90	...
c ,, Sheet ... ... ,,	£90	...
c ,, Rod ... ... ,,	£90	...
d ,, (Electrolytic) Bars ... ,,	£64 10s.	15s. dec.
d ,, ,, Sheets ... ,,	£144 10s.	...
d ,, ,, Wire Rods ,,	£74 10s.	15/- dec.
d ,, ,, H.C. Wire per lb.	9⅝d.	1/16d. dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	1/6 inc.
h India-rubber, Para fine ... ... ,,	2/1	2d. dec.
l Iron Pig (Cleveland Warrants) ... per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£30 10s.	25/- dec.
g Mercury ... ... per bot.	£14 5s. to £14 10s.	5/- dec.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2¾	...
p ,, ,, wire... ... ... ,,	1/3¾	...
o Platinum ... ... per oz.	£23 10s.	...
d Silicium Bronze Wire ... ... per lb.	1/-	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
n Tin, Block (English) ... ... per ton.	£282 10s. to £283	£2 to £2 5s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Glasgow and the Electricity Bill.—Mr. Sam Mavor, at Glasgow Chamber of Commerce, reporting for a Committee upon the Electricity Bill, said that they were all agreed that the aims of the Bill were, in principle, sound. Those were the co-ordinating and standardising of electricity supply and distribution and the reducing of costs; but there were divided opinions as to the methods by which these aims were to be achieved. The dominating feature of the Bill appeared to be that the Central Board should have powers not only to control the generation and transmission of electricity, but also to own and operate the generating stations. That amounted to giving power to the Board to nationalise the whole scheme of generating and supplying electricity. The intention of exercising these powers of ownership was disclaimed. If it was not intended that the Board should operate them, it was highly dangerous to confer such powers upon it. The autocratic character of the powers conferred upon the Commissioners was a matter for serious consideration. So far as Glasgow and its neighbourhood were concerned, the Bill—if it were to go through—would have little effect with regard to the reduction of electricity charges; in fact, the result might be on the other side, although they had no reason to contemplate that. The great advantage of the Bill would be to the smaller manufacturing towns, which were at present supplied by inefficient generating stations and were paying prices for electricity very much higher than they would pay under the national scheme. On general grounds, if the scheme was to be of national advantage, it did not seem that corporations such as that of Glasgow, or any large power companies, should put obstacles in the way of measures which reasonably safeguarded their interests.

Electrical Notes from New Zealand.

(From Our Correspondent at Wellington.)

Power Boards Conference.

The second annual conference of New Zealand's Power Boards was held at Dunedin on January 28th and 29th, and was presided over by Mr. J. Nash, M.P., president of the Power Boards Association. Delegates were present from most of the 40 Power Boards already in existence, and matters relating to the retailing of power were discussed. The Power Board system may be considered to be on its trial, and a very heavy responsibility devolves upon it in the handling of the immense developments at present being carried out. Over 70 per cent. of the country is now under Power Board control, and practically three-fifths of the population of 1,340,000 depends upon the Boards for power supplies, and for the general maintenance and safety of the many miles of h.p. lines being erected throughout the country. It is only recently that the Government has passed on to the Power Boards full responsibility in connection with the retail end of the general power scheme and with it the responsibility for accidents, &c., arising through faults, leakages or breaks in the distribution system outside the Government's main transmission scheme between the power plants and the Boards' sub-stations. This matter of responsibility for accidents, &c., was discussed at the recent conference and it was unanimously resolved that the matter be further taken up with the Government which is now framing important regulations covering the point. A resolution passed at the conference proposed that in the event of the Government's demanding periodical inspections of all electrical installations the cost should be borne by the consumers, and that the supply authorities should not be held responsible for any accident which might occur from defects subsequently occurring and over which the supply authorities had no control. Another important point brought up during the conference was the disparity in repair costs in different areas, and the assistance of the engineers employed under the various Boards is to be obtained in drafting a set scale of charges in this connection. The guarantee of revenue to the Boards before carrying out distribution work was discussed. The Public Works Department in its schemes has demanded 20 per cent. of the capital cost as a guarantee, and this policy was generally approved by the conference, and it was further agreed that 12½ per cent. should be accepted as a sufficient sum to warrant the extension of any existing circuit. The great demand for electric ranges and other electric cooking appliances was commented upon, and it was suggested that arrangements would probably have to be made to cope with the ever-increasing demand in a much broader manner than at present. Bulk importation was proposed, and it would seem that some such arrangement will soon have to be inaugurated not only for cooking appliances but for farm machinery as well.

Power for Horowhenua.

The recently constituted Horowhenua Power Board is one of the most favourably situated of the forty Boards in operation being closely situated to the Mangahao power station. The district is traversed by the Main Trunk Railway line, and along the line are some forty definite settlements and a number of enterprising and growing towns. The total population of the Board's area is 12,000. The original supply of power from the Government station at Mangahao commenced in November, 1924, a capital outlay of £117,321 being involved in the Board's distribution network, &c. As against this, revenue to the end of 1925 approximated £5,000 on only a small percentage of consumption. Since these figures were recorded, consumption has increased markedly, and the revenue figures for the next year of working, it is estimated, will result in a substantial profit to the Board. One of the recent developments in connection with the Horowhenua Power Board's operations is the electrification of Foxton Harbour lights, and the change from oil to electricity in the new port light at Manawatu Heads. This latter light will be of material assistance to mariners on the west coast, as it is visible for some 15 miles and is within range of the coastal shipping between Wanganui and Wellington. The various flax-milling industries in the Tokomaru Flax Swamp district have decided to inaugurate a scheme for doing most of their power working at such times as will relieve the peak load on the Board's installation. This will enable the Board to dispose of the greater proportion of its power to greatest advantage. A suggestion is also made that the Horowhenua County Council shall do all its metal crushing work at night time, thus spreading the power service more equitably over the 24-hour period. Already Horowhenua requirements are exceeding the estimated demand; a portion of the increased demand is from the farming community, which is installing milking machines and other electrically-driven devices at a rapid rate.

The Quality of Electrical Goods.

The rapid development of hydro-electric power in New Zealand has brought in its train a certain degree of quackery in connection with the sale of odd lines and special appliances. In addition to this undesirable feature there is also a fairly large volume of "cheap" and unreliable electrical ware finding its way into the local market. The second problem, however, is the more serious, for a large volume of unreliable material is being dumped on the market, and will ultimately place consumers in serious difficulties, and possibly still more serious accidents. The Government has proposed to set up a Board for the examination and testing of all electrical apparatus landed in New Zealand, but unless such a Board is properly constituted and controls actual importations of electrical goods it is difficult to see how it can be effective. Unless it is effective it will more likely become a screen behind which the practice might continue to be carried on with even worse results than at present.

The Electrical Federation, consisting of the electrical traders of the Dominion and others interested in the maintenance of a high standard of electrical goods, has taken the matter up and has made advances to the Government and the Power Boards with a view to securing combined action, and it is stated that some comprehensive scheme will be inaugurated as soon as the present deliberations are completed.

Some concern is felt in certain quarters that so much of the electrical material coming into the country is from other than British sources. Unfortunately this is the case, and it is admitted that this state of affairs will continue so long as the present tariff rules. New Zealand representatives of British electrical firms are notoriously unsuccessful in electrical tendering, and it is calculated that at least ninety per cent. of these tenders are secured by representatives of American firms. Even in Government circles, where it is usually a stipulation that material must be British, the disparity in prices is freely commented upon. It seems therefore that the question of the control of electrical material and the retention of New Zealand as a market for British electrical goods is bound up largely with the export policy of British firms. It would seem that some educational policy to acquaint the Dominion housewives and others with the quality and superiority of British goods is imperative, and that some strong measures are required by British manufacturers to secure sales of their commodities against the foreign article in this country.

Large Power Developments.

The recent announcement of the proposal to start operations on the Nitrate Power Works in the fjiords of the West Coast has resulted in many inquiries as to the exact magnitude of the work, and it is not generally realised that this scheme on Smith Sound will be the largest scheme in that part of the world. The proposal is to develop 300,000 h.p. by utilising the water of Lake Manapouri in a fall of 600 ft. to the sea through a tunnel 30 ft. wide.

The Government scheme for Lake Te Anau involves the utilisation of an available head of 700 ft., developing an available flow of 12,630 cusecs for a power of 1,600,000 h.p., while the Government scheme for Lake Manapouri contemplates utilising a 600-ft. fall and 8,400 cusecs to develop 840,000 h.p. Both these schemes are situated on the seaboard in the Sounds, where the southern coast most nearly approaches Australia.

Another large scheme in the South Island is at Lake Tekapo, where it empties itself into the Fairlie River. Here the Government contemplates installing plant to make use of a fall of 900 ft. and a flow of 5,100 cusecs to develop 400,000 h.p. at a point nearly forty miles from the growing city of Timaru on the Canterbury coast. The Lake Ohau scheme contemplates utilising a 300-ft. fall into the Waitaki River to develop some 125,000 h.p., while another scheme at Lake Hauroto has in view a fall of 514 ft., and a development of 100,000 h.p. on Te Waewae Bay within 50 miles of the capital city of the Southland Province, Invercargill.

Other South Island schemes of some magnitude include Clarence River, 100,000 h.p.; Wataroa River, 80,000 h.p.; Rotorua Lake, 60,000 h.p.; Lake Pukaki, 50,000 h.p.; Lake Hawea, 80,000 h.p.; Lake Hila, 55,000 h.p.; Lake Hall, 48,000 h.p.; Wilberforce River, 44,000 h.p.; and the Waitaki River, 37,000 h.p. There are twelve other schemes of more than 20,000 h.p., and ten others of more than 10,000 h.p. available when the larger schemes on the programme are unable to supply the demand.

The North Island is not so favourably placed with regard to major schemes, the general terrain being much lower and the run-off to the sea more widely distributed and shallower. The main Arapuni scheme to develop 163,000 h.p. is the largest North Island scheme, while a second scheme on the Waikato river is expected to produce 136,000 h.p. The two Lake Waikaremoana schemes will produce 97,000 h.p. and 32,000 h.p., while Rangitikei River at the Makohine Viaduct is calculated to make some 75,000 h.p. available; the Kaituna River, 65,000 h.p.; Aniwhaniwah Falls, 32,000 h.p.; Manganui River, 26,000 h.p.; and the present Mangahao scheme, 24,000 h.p. Other schemes of over 10,000 h.p. number seven, while there are eight of over 5,000 h.p.

Radio Reparations.—According to the *Daily Mail*, the Japanese Treasury has agreed to accept £4,000,000 from Germany in the form of Telefunken radio apparatus to cover reparations which are due.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A Multi-Pole Single-Tank Circuit Breaker.

The Westinghouse Electric & Manufacturing Co., of East Pittsburgh, U.S.A., has recently developed a new type of oil-tight multi-pole oil circuit-breaker, fig. 1. One of the features of the device is the enclosing of the three poles in a single round tank with dome ends, an arrangement for which some material advantages are claimed, including increased interrupting ability, increased terminal clearances for connections, and a minimum of housing-space requirements. The domed frame also permits the use of the space about the contact

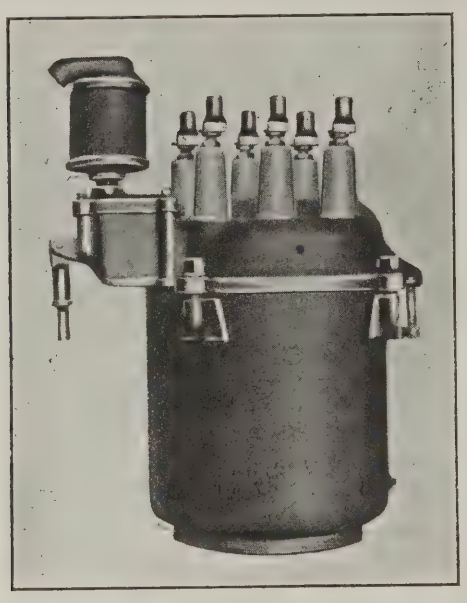


Fig. 1.—Single-Tank Circuit Breaker.

studs for additional air-expansion room above the oil, and also allows the system of operating levers to be enclosed within the breaker chamber, without increasing the overall height. A main shaft brought through the frame with a single operating lever outside, and well away from the live terminal connections and the remainder of the levers within the breaker, results in the removal of earthed moving parts from the vicinity of the bus-bar connections. The breaker is claimed to be particularly well adapted to meet the heavier requirements of modern power house and sub-station operations.

A Low-pressure Dial Gauge.

Special attention has been given to the peculiar requirements of low-reading pressure instruments in a new gauge of the diaphragm type which has been recently introduced by Messrs. Negretti & Zambra, 38, Holborn Viaduct, London, E.C.1. The general arrangement of the movement of this instrument is shown in fig. 2, and reference to this will enable its action to be followed. Pressure is applied to sets of diaphragms C and D enclosed in chambers A and B. The diaphragm sets are built up from a number of non-corrosive, nickel-silver alloy, corrugated disks, and the working range of each diaphragm is such that the elastic limit of the metal is never reached. The full-pressure displacement of the

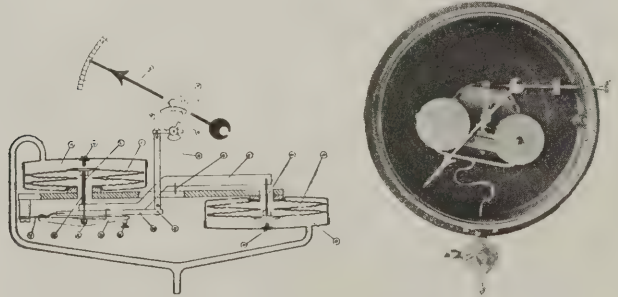


Fig. 2.—A Low-Pressure Dial Gauge.

diaphragm in one direction equals that in the opposite direction when under no pressure. Movement of the two sets of diaphragms is co-ordinated by the lever "F," which has a spring fulcrum G and is operated by the spring struts E and H without friction or backlash. A second spring strut L is attached to one set of diaphragms and operates the lever M through the lever O. Spring V acts as the fulcrum for both M and O, and also permits O to be lifted away from M. An additional spring X is fixed on O and keeps M in contact with the screw W. M magnifies the motion of the diaphragms and is connected at its extremity through the link N to a balanced crank P. F is heavier on that side of the fulcrum on which it is operated by the spring strut H and is of such a weight that it balances its other half with the addition of M and O and link N. The quadrant Q, operated through the balanced crank P, gears with a pinion which carries the pointer. Both the quadrant and pointer are carefully balanced and thus the whole mechanism is unaffected by alteration of position.

The stop T prevents the quadrant from coming out of mesh with the pinion at either end. Stops Y and Z operate on each set of diaphragms should a suction be applied, and a slot at the top of the link N permits the latter to continue its upward motion after the quadrant stop has come into operation.

The gauge is made in two sizes with 8-in. and 16-in. dials, and 20-in. and 40-in. scales.

A Novel Lock Nut.

A specially designed nut, which is claimed to be self-locking, is being placed on the market by Messrs. British Evertite Locknuts, Ltd., 57 and 59, Victoria Street, Westminster, S.W.1. The device is similar in construction to an ordinary nut except that it has a bevelled end and a deep annular V groove cut in the internal face. The nut is used with the bevelled end in contact with the resisting surface. When it is screwed "home" the metal reaction is claimed to cause the groove to yield, resulting in a slight distortion of the metal.

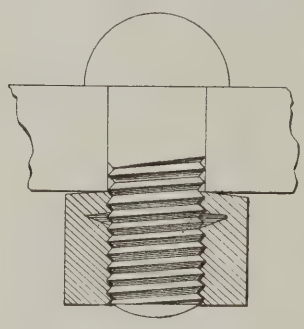


Fig. 3.—Lock Nut "Home."

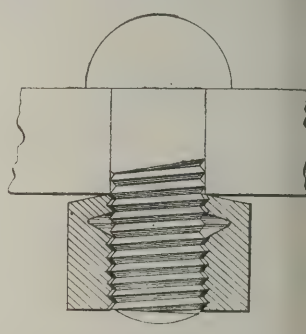


Fig. 4.—Lock Nut Loose.

Figs 3 and 4 illustrate the action of the device; when the nut is tight, the V partly closes and the threads grip on the top sides. It is also claimed that the device can be used repeatedly without injury to the thread of either the nut or the bolt. The nut is made in standard sizes from ⅜ in. to 2 in., and it is constructed of mild steel of 28-32 tons per sq. in. tensile strength.

A Two-Service Adapter.

Messrs. A. P. Lundberg & Sons, 477-489, Liverpool Road, London, N., have sent us a sample of their "Unitem" adapter, which is designed for use as either an ordinary adapter for a B.C. lamp socket, fig. 6, or a two-pin plug, fig. 5. The device is constructed in two portions, one fixed and one reversible. The former is an ordinary 2-pin plug and carries a free screwed socket. The reversible part represents an ordinary lamp-socket adapter on one side and a two-pin plug on the other. Suitable sockets are contained in both the

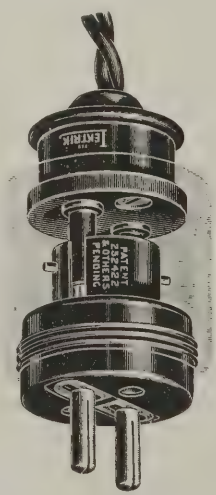


Fig. 5.—Plug Application.

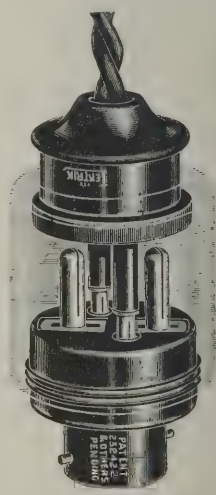


Fig. 6.—B.C. Adapter.

adapter contacts and the plug-pin contacts at the opposite side of the reversible part of the device. These in each case accommodate the plug pins of the fixed portion. The reversible portion is screwed into the free screwed socket in either direction. The two sets of contacts in the reversible portion are quite independent of each other and the plug half of the device is designed for cord-grip fixing. The plug pins of the adapter end are replaceable and two B.E.S.A. standard and three non-standard gauges of two-contact plugs can be accommodated. The body of the device is constructed of a black fireproof compound.

Electricity in Coal Mines.—I.

A Survey of the Present Position in British Mines.

(Abstract of Paper read before the Institution of Electrical Engineers.)

The three papers which were presented at the April 8th meeting of the Institution provided members with a general review of the present position of electricity in mines, the application of machinery at the coal face, and the design of storage-battery locomotives for use therein, and indicated also the directions in which the employment of electric power will be further developed in British coal mines.

One of the papers is abstracted below; the others will be dealt with in a later issue.

A Short Survey.

By R. Nelson, M.I.E.E.—*Abstract.*

There is now more than 1½ million horse-power of electric motors in use in and about the mines of Great Britain, which figure indicates a greatly accelerated rate of growth during recent years, but the total is, in itself, a moderate one having regard to the field for the further use of electricity that still exists on the surface and below ground in mines.

From a safety standpoint the electrical manufacturers of Great Britain have amply proved their willingness and ability to meet the special requirements of coal mining, so that, given the correct choice of apparatus and due care and attention to its maintenance, a high degree of safety is now readily within reach. One good result has followed: The author's own experience is that British-made mining electrical apparatus is at the present moment substantially better than German-made apparatus. In fact, in this connection it may reasonably be claimed that we have established a lead over *all* other countries. The correct solution of safety problems in mining owes a great deal to the skill and perseverance of Prof. W. M. Thornton.

A supply of electricity from an outside source, whether from a public supply or from a neighbouring privately-owned generating plant, has not, everywhere, commended itself to colliery owners. This is one of the points about which there still remains a very common difference of opinion between electrical and mining engineers. In its Memorandum of Evidence before the present Royal Commission on the Coal Industry, it is given as the considered view of the Council of the Institution of Mining Engineers that "unless power companies can supply current at prices very largely below those now in operation, the major proportion of the collieries are correct in continuing to produce their own power, either from exhaust steam or by waste heat from other sources or by generating plant using low cost fuel." It will be observed that the statement is not made in respect of a few examples of large colliery establishments. If it were, something might be said for it. It is made in respect of the "major proportion of the collieries," and implies support of the policy of continuing to use private generating plant for colliery purposes, even where supplies of reasonable efficiency are available from outside sources.

A mining engineer justifying the existence of a private generating plant, such as it seen "at the major proportion of the collieries," has usually the argument of a plant-in-being to support his view, coupled with the utilisation of fuel a sale for which cannot always, or readily, be found. In some cases waste heat from one source or another may be available. On the other hand, to set against these substantial arguments he has very rarely a complete appreciation of the fact that his power plant, as such, regarded from the point of view of efficiency, is a very indifferent performer indeed. Further, it often transpires that the prevailing idea of the cost per unit of current has its justification more firmly founded on tradition than on measurement.

An electrical engineer, subjecting such a plant to friendly scrutiny, concludes at once that he is contemplating an anachronism. He has been taught to believe that the important requirements of a source of power for any industry are reliability, flexibility, and efficiency. He further reflects that power-plant is inherently expensive, and he is amazed that it should be considered economically possible to continue to sink capital, bearing interest and depreciation charges of not less than 15 per cent. per annum, in power equipment when there exists the alternative of carrying the whole (or a large proportion) of the cost of power as a working expense, without involving the expenditure of any large capital sum. How flourishing must be the condition of an industry to which power is a prime necessity that can afford to pay so little attention to its efficient generation? But the electrical engineer may in his turn harbour some hallucinations: He sometimes fails to appreciate that a saving of even 50 per cent. in the cost of power may mean no more than an improvement of 5 or 6 per cent. in the pit-head cost of the coal won. He may also overlook the fact that it is the exception rather than the rule for colliery directorates to build up a reserve for the purpose of meeting the cost of modernising the colliery equipment from time to time, and that lack of funds is therefore sometimes the final and compelling reason for continuing obsolete plant in use for long years after it has served its time and generation.

The following is, in the author's view, the conclusion of this matter: In many cases the point at issue is regarded too narrowly, often determined mainly or solely by a comparison of actual or estimated generating costs with the cost at which power can be purchased, leaving more or less completely out of account the advantages, many of them considerable, which go with the purchase of electricity from an outside source; amongst them are: (1) The ease and quickness with which new machinery can be introduced without the necessity of additional capital outlay on generating plant; (2) the greater reliability, in general, of the supply, because it is the exception rather than the rule to see adequate spare plant provided at a colliery; (3) the convenience of having current "on tap," so that power and light are available at all hours of the day and night, at week-ends and on holidays, without the necessity of employing at these odd times more than the minimum of labour, and (4) the saving of time, money, and worry, arising from the fact that the hitherto constantly recurring power problem has been, once and for all, definitely and finally settled. It is, of course, very difficult to give each of these facilities a cash value, but each of them definitely assists production by enabling the management to reduce idle time, one of the important factors tending towards the present-day diminution of output per employé in British coal mines. The output per employé touches at once upon the most important result which usually follows from an unlimited supply of power, namely, the increased *use* of mechanical power. It is only by this means that the output per employé can be increased and the cost of coal lowered without affecting the daily wages of the workers.

There is one other point: The adoption of electricity for winding purposes without heavy first cost, already possible in two or three of the coal-fields, is gradually being made possible elsewhere by the largely increased size of the units of generating plant now being installed in the stations of public supply authorities. Partial electrification of a colliery, leaving out the winding engines and the larger steam engines, such as the fan engine, involving only partial shutting down of the colliery boiler plant, sometimes gives a somewhat disappointing result. Many schemes which have been only moderately successful as partial electrifications, have been greatly improved by a complete change-over. The winding engines are usually the last item to be converted, and they are, of course, the largest steam users and the most wasteful of all colliery steam engines.*

The author is of opinion that the future will show a growing tendency towards the purchase of power from an outside source. In the newly developed South Yorkshire and Nottinghamshire coalfields the larger collieries are gradually being interconnected by a system of transmission mains, so as to cheapen the cost of power by enabling most of the power plant to be shut down at week-ends and on holidays and by utilising more completely the available reserves of surplus power and spare plant. The collieries are beginning to appreciate that there is, after all, some merit in co-operative working. That is a short step, but a definite step, in the right direction.

The relative importance of the coal-mining and metal-mining industries, and the extent to which electricity is at present being utilised in mines, may be gauged by the information given below, which has been abstracted from the Mines Department records:—

Coal Mines.—The total amount of coal raised in Great Britain in 1924 was 267,061,027 tons, and the number of persons employed 1,213,724. The total number of coal mines at work in 1924 was 2,855, of which 1,629 were wholly or partly electrically equipped. It follows that 1,226 mines, probably most of them small, were still at the end of 1924 without

* In the December (1925) number of *World Power* there is an interesting statement by Mr. J. F. Perry on the subject of the efficiency of power production at collieries. He says: "It is very clear that even if the efficiency of the power plant is substantially increased it will have little, if any, effect on the present crisis, which only a difference of several shillings per ton can affect." Mr. Perry is, of course, quite correct, and what he adds later must be read with the general conclusion just mentioned in mind. He goes on to estimate that if the whole of the collieries were electrified the annual consumption of energy would be 4,430 million units, and the annual coal consumption for colliery purposes 3,950,000 tons. The actual coal consumption in 1924 was approximately 16,000,000 tons. A possible saving of 75 per cent. of the coal used for colliery purposes is indicated, and even though it is quite clear that Mr. Perry has in mind some approach to a counsel of perfection, the result of his calculation is still very striking.

any electrical equipment. The horse-power of motors installed in and about coal mines at the end of 1924 is given below :—

Surface	671,036 h.p.
Underground	810,896 h.p.
Total	1,481,932 h.p.

An analysis of the motive power employed above and below ground shows the following :—

	h.p.
Winding	107,139
Haulage	411,816
Pumping	348,803
Ventilation	102,911
Coal cleaning	112,660
Coal cutting	92,121
Miscellaneous uses	306,482
Total	1,481,932

Taken over the last 10 years the average rate of increase per annum of the horse-power of electric motors installed below-ground has been 6.83 per cent. The actual percentage increase of the total number of motors installed below-ground at the end of 1924 over the total number installed below-ground at the end of 1915 is 73 per cent.

Metalliferous Mines.—The amount of metalliferous ore raised in Great Britain in 1924 was: Iron ore 11,050,589 tons; lead ore 14,294 tons; tin ore 3,546 tons; manganese ore 2,457 tons; zinc ore 2,317 tons. The number of persons employed in metal mining was 19,481.

The total horse-power of motors installed in and about metalliferous mines at the end of 1924 was 23,524; of this total, 11,753 h.p. is installed on the surface and 11,761 h.p. underground. The chief uses are for pumping (9,391 h.p.) and ore-dressing (2,806 h.p.). The Mines Department records show that the horse-power of electric motors installed above and below ground in metal mines has increased by 17 per cent. in five years. Regarding the total amount of power of all kinds installed in and about the mines, there is no definite information available from which an up-to-date estimate can be made, but it is fair to assume that the power utilised in coal mines cannot now be much, if any, less than 3 million h.p. If that total is anywhere near to being correct, it follows from data already given that about one-half the engine capacity in the mines of Great Britain still remains non-electric.

The increase of electrical horse-power in each year is made up of (*a*) conversions from other forms of motive power and (*b*) additional motors. It is probable that the newly installed horse-power due to the former still greatly exceeds the newly installed horse-power due to the latter, and important conversions will continue to be made. The above is the main direction in which electrical engineers may look for further extension in the use of electricity in mines. Other important directions are (1) the greater use of in-bye machinery in place of hand-putting and pit ponies, (2) the extended use of coal-face machinery, and (3) the extended use of electric safety lamps. As to (1), the number of pit ponies is steadily, if slowly, decreasing, but in 1924 there were still more than 65,000 employed below-ground in British mines. With regard to (2), the growth in the use of coal-cutting and coal-conveying machinery in British mines from year to year is disappointingly small. With less than 20 per cent. of the coal output machine-cut, it may reasonably be asked whether an accelerated rate of increase in the number of coal-cutting machines employed, if practicable, would not be one unobjectionable method of increasing the output per employé, the gradual shrinkage of which in most of the coal-fields is one of the present difficulties of the coal-mining industry.

On the subject of (3), progress is best indicated by a short table compiled from the Mines Department records :—

Year.	Number of electric lamps in use.	Number of oil safety lamps in use.
1912 ...	10,727 ...	697,664
1916 ...	126,784 ...	610,821
1920 ...	245,900 ...	635,127
1924 ...	356,817	576,318

Miners' electric lamps as now used give not less than one candle-power at the end of nine hours' use. They are fitted with a 2-volt acid or a 2.5-volt alkaline battery, and weigh about 6 lb. More light can be obtained, but only at the expense of added bulk and weight, and it has always been a debatable point whether the advantage of additional light is worth the handicap of added weight. Larger and heavier lamps giving more light are, however, beginning to come into use for hewers and others able to hang up their lamps while they are at work. It is unlikely that the electric hand-lamp will displace the oil safety-lamp entirely, but it seems clear that the number of electric lamps will soon exceed the number of oil lamps in use.

In conclusion, two further directions in which electrical enterprise and research may hope to be of added assistance are the prospect held out by Prof. W. M. Thornton's experiments of a great improvement in the matter of underground illumination from the ordinary power distribution system, and the fact that storage-battery locomotives for underground use may well prove to be a very important contribution towards the solution of the pit-pony problem. Electrical engineering is, in fact, building up the reputation of an ever-ready help to the mining industry.

Discussion in London.

Mr. J. A. B. Horsley (H.M. Electrical Inspector of Mines) said that Mr. Mavor's paper was a very modest record of 25 years' achievement in a field which Mr. Mavor had made peculiarly his own, namely, the development of coal-face machinery. He said "developing" rather than "perfecting," because the evolutionary process was still very active, and although reliability had been attained by the slow, but sure, method of trial and error, finality was not yet in sight. Lest it should be thought that this reference to further progress was intended to imply depreciation of the excellence and practical utility of present designs, he acknowledged his appreciation of the ingenuity and readiness shown by makers of this class of machinery in altering details where the experience of accidents had shown weakness, having in mind in particular recent or projected improvements in switchgear, in the plug connector, and in the flame-proof enclosure of electrical parts of the machine, and now there was in view promising development towards the application of remote control to coal-face machinery. Mr. Mavor had referred to the priceless advantage possessed by electrically-operated machinery, in that the power could be easily and accurately measured; portable graphic recorders were used in at least one colliery to check the working of electrical coal cutters, critical examination of the charts enabling the management to compare the handling of the machine by different men and to correct errors of operation. The designer of such machinery had to face extraordinary conditions: that nature and man seemed to conspire to destroy the machine could be illustrated by reciting the circumstances of a fatal accident described in his own annual report for 1924. A bar coal-cutting machine had become wedged between roof and floor in a 19-inch seam and in the attempt to free it by using the power of the motor, first the haulage drum was broken, next the haulage prop, and finally the haulage rope. The drum was designed with an adjustable slipping clutch and there were fuses in the circuit at the gate-end box, but those "safety valves" had been attended to and the victim was working under the direction of an under-official of the mine. The difficulty of maintaining flame-proof enclosures intact under such conditions was indeed great. In the Prussian code of mining regulations there was a requirement that for underground use the covers of electrical apparatus should be so fixed that they could only be removed by the use of a special tool, and he had made a similar suggestion to manufacturers in this country because he felt it was a principle well worth adoption in order to make it difficult for unauthorised persons to meddle with such enclosures. He was inclined to agree with Mr. Mavor that the real safeguard in the use of electrical equipment, *i.e.*, the avoidance of risk of explosion, lay rather in the maintenance of adequate ventilation than in design, however excellent it might be, of the electrical enclosure.

Referring to Mr. Millar's paper, he felt that there was undoubtedly a field for storage-battery locomotives in coal mines, but in view of the considerable use made of them in America and in Germany it was unfortunate that Mr. Millar had not been able to support his advocacy by actual operating costs. There were about a dozen collieries and half as many metalliferous mines in Great Britain wherein storage-battery locomotives had been introduced, and in one of the latter cases the battery was also used to furnish the energy for operating rotary drills. Although the service required of battery locomotives was in no way comparable with that required of coal-face machinery, the same problem of proper maintenance must be faced by the management for the battery was not amenable to design which could make it proof against continued misuse. Referring to the competition for a prize offered by Mr. Markham, a coal owner, the report of the Committee would shortly be published by the Stationary Office; some of the provisions of the specification had been criticised on the ground that it would have been more logical to have adapted a mine to suit the characteristics of the storage-battery locomotive, rather than to have called for a freak locomotive to meet the existing mining conditions, but the makers of coal-face machinery did not find that short cut to success, although he willingly agreed that to get the best results it was necessary to modify the mining lay-out to meet the new conditions which the use of such machinery had established. The field trials of the locomotives in the competition proved the superior efficiency of the single-motor drive, if skilfully designed, because the winning locomotive only required one-third of the capacity while running over a test route, which was designed to represent the average work of one shift, whilst the next most efficient vehicle required one-half the energy of the battery. Dynamometer records obtained with the assistance of Mr. George Watson's registering dynamometer showed the rather surprising figure of 57 lb. per ton for the rolling resistance of the road. The actual draw-bar pull recorded ranged from 740 to 775 lb. with a load of 5 tons on a gradient of 1 in 24. As regarded flame-proof enclosure, nothing better than total enclosure with plain machined flanges could be applied to electrical apparatus for which free ventilation was not essential. The use of gauze or of anything approximating the fragility of that medium should be avoided, and intricate devices, however ingenious, were quite unsuitable for colliery conditions as existing to-day. Ventilation might be necessary for the battery, and, if so, it should be obtained by some robust device and even then that device should be subject to daily examination approximating that which the miner's safety lamp underwent.

Regarding Mr. Nelson's paper, the proportion of mines with electrical equipment varied widely in different parts of the coal field: For example, in Scotland 72 per cent. of the mines had electrical equipment, as compared with less than 54 per cent.

for the rest of the country; in South Wales and Monmouth 58 per cent. was equipped; for Northumberland and Durham the figure was 59½ per cent.; and for Nottinghamshire 88 per cent. South and West Yorkshire, taken together, approximated to South Wales, having 57½ per cent. equipped; taking North Staffordshire with the Cannock Chase, the figure was 55½ per cent., falling to 53 per cent. for Lancashire and Cheshire, and to less than 17 per cent. for South Staffordshire and Worcestershire. The h.p. of electric motors installed both above and below ground per mine also varied considerably for different areas, the average for the whole country being 910 h.p. per mine. Reviewing the 25 districts into which the country was divided, mostly separate counties, there were four with about 300 h.p. per mine, nine with about 600 h.p. per mine, and 12 with from 900 to 1,600 h.p. per mine. The proportion of the total h.p. installed for coal cutting and other coal-face machinery for the whole country was 6.22 per cent.; for Scotland alone the proportion was 16.6 per cent., whilst in South Wales it was only two-thirds of 1 per cent. In the Newport and Cardiff division of South Wales 362,000 tons of coal was cut by electrical means and 2,070,000 tons by compressed air, out of a total of nearly 37,000,000 tons. In the Swansea division the position was reversed, 168,500 tons having been cut by the former and 19,500 by the latter out of a total of rather more than 15,000,000 tons. All those figures related to the year 1924. It could be seen therefore that, great as had been the growth of electrical equipment at collieries since 1912, there was still ample scope for development if and when the mining engineer succeeded in controlling the natural conditions —where they were in his opinion at present antagonistic to the introduction of electricity—so as to make it safe to do so. The advantage of electricity in mining lay not so much in the lesser consumption of low-grade fuel for the production of power, but in the greater output that could be obtained by its use and in the ease and flexibility, to use general terms, with which it could be applied.

Mr. ROGER T. SMITH remarked that the contention that conveyors were better than locomotives in thin seams had yet to be proved. They had yet to ascertain how many pit ponies one locomotive would replace. A chain drive had disadvantages in that it was not so easy to clear obstructions and the gearbox would fracture by coming in contact with the road in case of derailment. Mr. Miller was pessimistic with regard to his locomotive speeds. There was a very good reason why the single motor was better than two; the Markham prize winner was of 8 h.p. only and if that were divided the efficiency would fall materially.

Mr. R. ROBINSON (nominated by the Students' Section) referred to the efficiency of turbine-driven air compressors after they had been in use for some time, and was of the opinion that double-acting engines were the cause of much waste of power; there was no need for other than the single-acting type.

Mr. W. B. WOODHOUSE remembered much of the good work done by Mr. Mavor, especially in cultivating the habit of measurement; the fact that it was possible to measure accurately (even air) was beginning to be realised, and thus the miner was acquiring correct data. When the efficiency of air transmission was discussed, the efficiency of use was often neglected. Mr. Nelson had had much to do with the drawing up of the mining regulations; he (the speaker) had had occasion to make observations thereon, on behalf of Yorkshire mine-owners, but experience of those regulations proved them to have been carefully and wisely framed. Private power generation, as against its purchase from a public electricity undertaking, was often favoured because of the absence of measurement; the decision was the result of an opinion, not the facts (he had known of cases where no wattmeters were installed and the figures were estimated). Moreover, interest and depreciation discussions were as a foreign language to miners. However, it was true that in the past few electricity undertakings had been large enough to cope with winders, but that state of affairs had changed and winders could now be connected to the public mains without inconvenience. Therefore, as existing steam winders dropped out of use, more public electricity would be used.

Mr. E. T. WILLIAMS supported the contention that compressed air was inefficient; long pipe lines and many flexible connections could not be maintained without numerous leakages, small in themselves, but when operating for 24 hours per day the loss of power they occasioned was astonishing. It was difficult to make users of compressed air appreciate such facts. It was not easy to make electric cables, especially trailing cables, that would withstand mining conditions; somewhat similar trouble was experienced in the Navy and it might be of interest to note in that connection, that a tough-rubber covered cable having a canvas cord sheath had withstood naval conditions very well and might also have mining applications. In view of the economic importance of the coal industry to the country, the economic crisis through which the country was passing at the moment, and the electrical development which appeared to be imminent, he suggested that the I.E.E. Council should appoint a committee to ascertain how the use of electricity in mines could be furthered.

Mr. F. T. HALL remarked that when electricity could not be applied at the coal face, electrically-driven air compressors located in well-ventilated positions further back might be used to supply air-driven tools at the face and so help to improve the ventilation at the coal face itself.

Dr. W. M. THORNTON was of the opinion that there was a considerable load yet to be obtained by electrical undertakings. If no gas were liberated in mines, electricity would be the ideal method of applying power therein; its use was therefore a question of safety. He thought that where gas was dangerously present electricity should not be used, except at such voltages as would be harmless. The chief reason for employing electric motors for haulage purposes was humanitarian, *i.e.*, eliminating the pony, and with regard to lighting they were 100 years behind. There was a great need to educate the miner so that machinery would be used and maintained in such a condition as would avoid accidents; that point should be taken up, if not by the I.E.E., then by some other responsible body.

Mr. C. E. SAYER pointed out that mechanical means of getting coal gave bigger returns, and though the installation of machinery might reduce the number of men employed in individual mines, the total number of employés in the industry would be increased thereby.

Mr. C. JONES said he had heard it said that the life of a cutter armature was four months, but he knew of d.c. machines that had been in use for 15 years; he did not like the condemnation of d.c. motors. Mr. Mavor had made no reference to the arc-wall cutter; its disadvantage was the use of trailing cables and something better than that was needed. Auxiliary electric air compressors had been used, as suggested by a previous speaker, but there was room for an electric drill as the compressed-air pattern had given trouble. The introduction of locomotives would not only mean the replacement of the pit pony, but also (on account of the extra weight) the replacement of the tram rails; indeed, the whole haulage system would need to be reorganised.

Mr. S. MAVOR, in reply, said that the use of in-bye electrically-driven air compressors for operating drills was not new, but they could not be employed on a large enough scale for coal cutting; moreover, in that case the consumption of electricity would be 20 times larger, and the capital cost would also be greater, than if the cutters were electrically driven. In mines in this country the track conditions were not favourable for the use of locomotives, and conveyors were more useful, but locomotives could be used on level roads that were crooked in contour. There were too many men in the industry who were not miners at all and should never have been there; they could, and should, be eliminated gradually. For every coal getter there were three attendants who were not miners and to whom employment outside was as open as to men of other trades.

Mr. L. MILLER was understood to have said in his reply that he had not much faith in the adoption of electric battery locomotives in mines, except for marshalling purposes and on crooked roads. Worm gearing was expensive, but the chain drive was cheap, and if they were to sell any locomotives at all they would have to be as cheap as possible. The costs given in his paper included everything. The existing track would, of course, need attention if locomotives were introduced.

Mr. R. NELSON, also in reply, drew attention to the remarkable fact that 5 per cent. only of the coal mined in the richest field of the world (South Wales) was machine cut, a fact which would surprise their American friends. He noticed that no one had attempted to contradict the main thesis of his paper, namely, that it was cheaper for the colliery to purchase electricity than to generate it itself.

The Faraday Society.

The Influence of Alternating Current on the Electrolytic Corrosion of Iron.

A PAPER on this subject was read before the February meeting of the Faraday Society by Professor A. J. ALLMAND and Mr. R. H. D. BARKLIE. The corrosive effect of stray earth currents on underground steel structural work has long been recognised and the effect of alternating currents has also been investigated, but no systematic experiments have hitherto been made on the effect of combined d.c. and a.c., although such a case may well occur in practice. In order to simplify the problem and keep the conditions constant and reproducible, the solution used was caustic soda, although the corrosion effects with this electrolyte are quite small, and systematic studies were made under comparable conditions on the corrosion of iron anodes with direct current, alternating current, and the combination of the two. With direct current, unless some "activating" ion be present in solution, oxygen evolution, accompanied by a rise in anodic potential, was observed, the metal remaining completely passive if the current density were not too low, the potential soon becoming constant. When, however, a chloride salt, for example, was added to the solution, activity was conferred on the iron by the Cl' ions and at a certain critical current density there was a fall of anode potential accompanied by a gradual displacement of the oxygen film on the electrode by a layer of green hydroxide.

The experiments with alternating current alone were made with electrodes of electrolytic iron in the form of cylindrical rods introduced through closely-fitting horizontal side tubes sealed into a small cell, to allow of the collection and measurement of any gas produced. Fresh electrode surfaces were exposed in each experiment and it was found necessary to exclude light, as the illumination of an electrode caused it to assume a more positive potential, even to the extent of rendering passive an otherwise active surface. The current densities usually employed were 0.075 and 0.375 amp. per sq. cm. The electrolytes were 2.48 N and 1.03 N and 0.2 N caustic soda, free from carbonate, and the frequencies 6, 40-45, and 380-420. It

was not possible to measure the gas evolved or the quantity of iron dissolved under the conditions of the experiments, and the most striking observations recorded were the colour changes through which the iron rods passed. These either remained bright, or else became successively straw coloured, yellow, golden, bronze coloured, reddish-brown, and temper-coloured. Most marked was the effect of frequency. Thus, whatever the alkali concentration, 10 minutes electrolysis with a current density of 0.375 amps. per sq. cm. produced no visible change in the electrodes if the frequency were 400, but altered them to a yellow light bronze tint at a frequency of 45, and to a dark bronze or reddish brown colour if the frequency were only 6. There was thus a marked increase of corrosion at the lower frequency, such has been observed by other workers in the case of lead electrodes. The explanation is that the discharge of H' ions during the cathodic pulse activates the iron by decreasing the oxygen content in the surface layer, and consequently enables a fraction of the anodic current to pass between metal and electrolyte in accordance with the reaction.

$$Fe + 2\oplus \longrightarrow Fe^{\cdot\cdot}.$$

A certain amount of this dissolved metal will remain in solution (and is probably oxidised to the ferric state). The rest will be thrown down as $Fe(OH)_2$, to be rapidly oxidised to $Fe(OH)_3$ by the oxygen present. The lower the frequency and the longer therefore the cathodic pulse, the more thoroughly will this reduction of the oxygen present in the metal surface take place, and the greater will be the ensuing activity of the metal during the anodic pulse.

In the experiments on the effect of superimposing alternating on direct current, the anode was electrolytic iron and the cathode and the auxiliary electrode for introducing the alternating current to the anode, of soft iron. Air was excluded, and the electrolyte (NaOH of concentration varying between 1.12 N and 3.07 N) was stirred by a stream of pure nitrogen. The direct current circuit contained three accumulators, a regulating resistance and a d.c. ammeter—the alternating current circuit was, as before, tapped off from an inductive resistance put across the a.c. generator, and contained d.c. and hot-wire ammeters.

The effect of superimposition was to produce corrosion in cases where none had occurred with either component separately. It was further shown that a high a.c. : d.c. ratio was favourable to corrosion and that a low frequency also favoured corrosion. The effects are best studied by reference to the anode potential-current density curves given in the paper.

Some experiments were also made using as electrolyte a CO_2-saturated soil liquid such as might represent that which operates on buried conductors and the results were similar to those obtained with caustic soda. The results of two of these experiments are reproduced here :—

D.c.	0.0125 amp./cm.^{2}
A.c.	0.0375 amp./cm.^{2}

	Weight of iron found in solutions in grams.	
	Frequency : 400.	Frequency : 40.
With d.c. only	0.00032	0.00032
With a.c. only	.00015	.00020
With d.c. + a.c.	.00060	.00075
Increase due to superposition ...	.00013	.00023

It is thus established that in electrolytes both more alkaline and more acid than those likely to be met with in actual cases of stray current corrosion, iron behaves in the normal way towards superimposed alternating and direct currents, and the authors see no reason why this should not also be the case for the more neutral electrolytes met with in practice where, even at very low current densities, the increased corrosion should become quite manifest, over long periods of time.

Electrical Progress in Spain.

In the course of an article on "Electrical Developments in Spain during 1925," in a recent issue of *La Energia Electrica*, Senor E. Callego says that progress was greatly hindered as a result of the national economic crisis.

The only new hydro-electric installation of any importance completed during the year was that which utilises the falls of Villalba de la Sierra, work on which was commenced in 1920 by the Sociedad Hidro-Electrica de Castilla, that at the Tambre Falls of the Sociedad General Gallega de Electricidad, and the extension of the installation at the Somiedo Falls of the Sociedad Hidro-Electrica del Cantabrico. The Villalba plant, which is located about 12½ miles from Cuenca, has a capacity of 15,000 h.p., the current being transmitted at 60,000 V a distance of about 40 miles to the Bolarque station of the Sociedad Union Electrica Madrilena of Madrid. The Cantabrico Co. completed during the year a new 7-mile canal to increase by 1,000 litres per second the quantity of water available at the falls; a new pressure supply pipe of 1,200 litres per second was constructed at the power station, where two new sets of 3,500-h.p. turbines and generators were installed, bringing the capacity of the plant up to 14,000 h.p. The company is at present engaged on the erection of two 50,000-V transmission lines, one from the power station at El Puerto to Trubia and one from Oviedo to La Felguera, in the province of Langres.

The Tambre power station of the Gallega Co., which will have a maximum capacity of 16,000 h.p. during nine months of the year, dropping to 7,500 h.p. in the other three months, is expected to be put into operation by about August next. At present work is in hand on the erection of a 70,000-V transmission line between the power station at Santiago, Villagarcia, Pontevedra and Vigo, a distance of about 53 miles.

Although completed in 1924, it was not until early last year that the 2,000-h.p. plant established by the Sociedad Portland Valderrivas to utilise the Estremera Fall on the River Tajo commenced the supply of current; a similar remark applies to the 600-h.p. plant of the Sociedad Electra Canguesa at Cangas and the 300-h.p. plant of the Sociedad Hidro-Electra del Rio Blanco at Los Arcos (Soria province).

Although not officially inaugurated until January, 1925, work was completed during the year and trials were carried out on the Urola electric railway between Zumarraga and Zumaya, a distance of about 23 miles. The line is being worked by 1,500-volt d.c. In February, 1925, the new Sierra Nevada electric tramway, 19 miles in length, was completed. This line runs through very hilly country which necessitated the construction of 14 tunnels and 21 bridges. In the last two months of the year two new sections of the Madrid underground electric railway were completed, increasing the length of the system to a little over nine miles.

During the year the Compania Telefonica Nacional de Espana laid a new submarine cable between Algeciras and Ceata, a distance of 18 miles, as well as erecting over 600 miles of new lines and opening over 30 additional exchanges. In preparation for the adoption of automatic operation, work was also commenced on the substitution of underground for overhead telephone lines in Madrid and Barcelona. Finally, it may be mentioned that the Government Centro Electrico y de Comunicaciones completed the erection of a high-power wireless telegraphy station at Prado del Rey, Madrid, which is able to communicate with New York and Buenos Aires on wave-lengths between 8,000 and 14,000 metres.

In addition to the foregoing, various extensions and improvements have been effected at several of the old-established electricity supply undertakings. Thus, the Sociedad Riegos y Fuerza del Ebro, in conjunction with the Sociedad Energia Electrica de Cataluna, has erected a high-pressure transmission line to connect the Tremps and Pobla de Segur hydro-electric stations in Catalonia. The line is about 6½ miles in length and works at a pressure of 110,000 V; it consists of three aluminium cables of a section of 107 sq. mm. with a steel core. The current is stepped down at Pobla de Segur to 90 kV. The Riegos y Fuerza del Ebro Co. has also added to the Camarasa power station a new Voith 22,300-h.p. turbine and a 15,000-kVA generator built by the American General Electric Co.

The Cataluna Co. has increased its water storage capacity and is increasing its installations at Saburo, Mar and Colominas, which, when completed, will effect an annual saving of 45,000 tons of coal. The Sociedad Electrica del Viesgo is erecting a 95,000-V transmission line between its power station at Usdon and Camarmena. The Sociedad Hidro-Electrica Iberica is further extending its plant at its Cinca power station, while the Sociedad Hidro-Electrica Espanola is engaged in substituting a 130,000-V transmission line for the existing lines between the Dos Aguas and El Molinar stations and Madrid. This company is also installing a 18,600-h.p. turbine and generator at its Villora station at Cuenca, which will bring its capacity up to 47,400 h.p. and the total capacity of the company's plants to 114,000 h.p., which represents an approximate annual output of 300 million kWh.

The Compania Mengemor added a third 500-h.p. turbine and generator at its El Vado station and at the Escuderos station replaced an old 300-h.p. set with a new one of 500 h.p. A new 2,000-kVA, 70,000/25,000-V transformer was also installed at La Carolina sub-station. In July, the Sociedad Motrices del Valle de Lecrin inaugurated a 60-mile transmission line at 60,000 V between the Durcat power station (Granada province) and Santa Fé, Almeria.

It is hoped that electrical progress will be more rapid during 1926 than it was in 1925, especially as the Spanish Cabinet has approved the general lines of the new scheme of the Minister of Public Works for the better utilisation of the country's hydro-electric resources by lumping together the annual State subsidies for the next 25 years towards such undertakings.

Electric Smelting of Iron Ore.—It is reported from Oslo that last September the A.S. Norsk Staal concluded, with favourable results, its experiments at the Trondhjem installation in the direction of the electrical production of iron according to the "electric gas reduction process" devised by Mr. Edwin, there having been produced for a long time previously 1.5 tons per 24 hours of high-quality iron in the form of iron sponge. Since then the company has been working so as to be able to carry on the process on an industrial scale, and for this purpose an application was recently made to the Norwegian Government with a view to obtaining a supply of 6,000 h.p. from the State hydro-electric works at Glomfjord, but the authorities are said to have not shown an accommodating attitude towards the company in the matter. Under these circumstances, Messrs. Edwin and Major Johanssen, the inventors and principal in the company, respectively, have approached Swedish interests and have entered into an agreement under which the new smelting works will be established in that country for the reduction of Swedish ore.

Swiss Electricity Supply Notes.

(From our Correspondent in Switzerland.)

The Power Station at Lago Tremorgio.

This station is situated south-west of the village of Rodi (in the Tessin) and near the Lugasca river and the main road of Airolo-Faido. Built as it is on the rocky flanks of the mountains, it is necessarily very simple, and the back of the building has been treated as a barrage wall, provided with pillared vaults, to protect the building from avalanches, so frequent in that region, but which so far have, fortunately, never reached the station.

It utilises the water of the Lugasca, one of the tributaries of the Tessin, which has a drop of about 880 metres. The Lake of Tremorgio provides a storage area of about 11,000,000 square metres. The task of utilising this water was not easy, and a collector under the lake was necessary. The rocks, too, were terribly fissured and bad, and the Swiss engineers had a trying time with geological disappointments, percolation of water, stoppage of suspicious chinks with cement, and so on.

The greatest care had to be taken to place the pipe-line in a part of the mountain free from avalanches, and some idea of the difficulty may be gathered when one considers that the grade in places is as much as 230 per cent., and as a rule 68 per cent. The total length of the line is 1,157 metres, of which 1,040 metres is buried in stone and earth, with special shelters above this arrangement at points where avalanches may fall. The weight of the pipe-line, including the cement and stone protection, is 520 tons. It speaks well for the engineers that no serious accident took place during the very difficult placing of this pipe-line.

The power station, which can be enlarged later on if necessary, is equipped with a Pelton turbine of 15,000 h.p., 750 r.p.m., coupled to a 10,000-kVA, 8,400-V, 50-cycle, 3-phase alternator. The supply pressure for transmission is raised to 50,000 volts. The escape-room under the turbine is tiled with granite slabs as a protection against wear and tear caused by the excessive speed of the water.

The lower part of the power-house contains the alternator ventilation equipment. At about 13 metres below the opening of the turbines are gratings which reduce the force of the water, which is carried off in a canal from 1½ to 3½ metres wide; a water-gauge is placed where the canal joins the Lagasca.

The Supply at Chancy-Pougny.

The Chancy-Pougny generating station is situated at the mouth of the Couchefatte, a little stream that flows into the Rhône, about two kilometres from the bridge that joins Chancy on the Swiss bank of the Rhône to Pougny to the French side of the river. As the Rhône forms the frontier between France and the Swiss canton of Geneva, there were lengthy negotiations between the two countries before the present establishment was definitely decided on. It was finally settled that all the power should be in the keeping of the "Société l'Energie Electrique Rhône et Jura," with the result that energy is transmitted at 120,000 volts into districts a considerable distance away.

The erosion at the mouth of the Couchefatte facilitated building operations, which were commenced in 1920. The dam, perpendicular to the course of the Rhône, is principally on the French side of the river, and is 85 metres long; it has five openings, each 12 metres wide, and the fifth is a lock for navigation. The barrage is 92 metres long, and the building contains five vertical single-wheel turbines, 510 to 570 r.p.m. At the time of their construction these turbines (Atelier des Charmilles and Ateliers Escher, Wyss et Cie.) ranked amongst the largest in either Europe or America, the outer diameter of the motor-wheel being about 5½ metres. The power divided between these five groups, when the fall is 8.16 m., is 7,600 h.p. At low water, with a fall of 9 m. the output is 8,700 h.p., 92 cu. m. of water passing per second. The ordinary output of water during 90 to 150 days yearly is 450 cu. m. per sec., falling sometimes to 310 cu. m. per sec., and even to 96 in the height of summer. The station can furnish annually more than 150,000,000 kWh.

Above the turbine building is a filtering pond, of over 4,000 sq. m. surface, separated from the level of the river by a reinforced concrete screen, supported on stays. The openings between these stays (7 to 16 metres wide) are closed by a coarse grating, and the upper end of the screen is situated on the right of the first vent in the dam, so that all detritus can thus be carried off. The filtering pond is separated from the sluices at the entrance to the machine rooms by extremely fine gratings, and each turbine has two of these stop-vents, worked electrically by independent levers from a frame above the service gangway.

The electrical equipment is housed in a building on the French side of the river. The alternators (Schneider of Champagne-sur-Seine) generate at 11,000 V, 50 periods. The connecting cables to the transformers and switchgear pass under the upper bridge of the dam in a special channel; this was lowered to the level of the alternators by means of a tower on the right of the turbine rooms.

The Chancy-Pougny power-house is worth a visit from British engineers staying at Geneva, whence it can be reached by tramway or train in a very short space of time.

The Bodio Undertaking.

If the suggested tax on electrical energy imported into Italy materialises, one of the first power stations to be affected will be that of Bodio, a station that has had the most chequered existence during the 20 years that have passed since it came into being. In 1905 the Société Motor of Baden obtained permission to use the waters of the Tessin and Biaschina. A canal 9 km. long, containing 16 galleries, brought 15,000 litres a second to the Centrale Electrique, and the fall, 260 metres, gave a summer force of 45,000 h.p. The cost of the power-station amounted to eight million fr., and the installation was considered as very satisfactory.

In 1917 the plant was sold to the Officine Elettriche Ticinesi, for munition work; more land was acquired near the power-station, and a whole suburb of workmen's cottages came into being, to say nothing of electro-thermal establishments and chemical works, which did a great trade during 1917-1918, when the number of hands employed was over fifteen hundred.

Following the trade slump after the war a terrible explosion occurred which literally wiped out of existence the great chemical factories of the Société Nitrum and the Société des Carbures du Day.

At present there are two factories using the electrical energy of Bodio, one a chemical factory and the other manufacturing artificial precious stones.

Recently the Conseil Fédéral made a grant to the Bodio undertaking to enable it to export a large quantity of energy into Lombardy, and at the same time it was arranged that both Lugano and Locarno should benefit by Bodio's water power. As both of these towns are placed inconveniently in the winter as regards an electricity supply, this is a most satisfactory plan, and the city of the Security Pact will no longer be faced with the previous risks of supply failure, while the surplus energy sent over the frontier will be of great value to the towns in Lombardy, which are not as lucky as their Swiss neighbours, who have endless supplies of "white coal."

Swiss Federal Railways.

Once again the Swiss Federal Railways have had to take into account the fact that birds can do damage to electric railways. In the canton of Valais the hawks have discovered that the top of a high insulator forms a capital observatory for surveying the land below, and having perceived their prey dash down upon it from the insulator. The result is that their wings touch the live wires and cause a short circuit, at the same time electrocuting the unlucky hawk.

To try to avoid recurrences of these troubles, special poles were placed here and there along the line, and for a time the birds used the new observatories; but after a time they returned to their old perches. The C.F.F. has now adopted a method of protecting the insulators by means of specially fitted wires, and this seems to have had the desired effect.

The first step towards the electrification of the C.F.F. between Lausanne and Berne was taken recently, when the Lausanne-Palézieux section was connected to the supply. It was hoped that the scheme would be completed by March 1st, but the line itself offers certain technical difficulties. Some of the bridges will have to be entirely reconstructed, notably that over the Singine between Flamatt and Thoerishausen, as well as the one at Mionnaz between Palézieux and Oron. The viaduct of Macconnons, near Romont, has just been finished, while the engineers are busy on that of Grand-Fey, near Fribourg.

On the Lausanne-Palézieux section, instead of taking forty minutes, as formerly, the run is now accomplished in twenty or twenty-five at the outside, at an even speed that ignores the pull-up of 222 metres. Furthermore, for the present, Palézieux jumps into the limelight as a sort of quasi-terminus. For until the sections to Berne and Lyss are electrified, trains to and from these places must change engines at Palézieux (as they had to do in bygone days at Sion, for instance), and this means a halt of six minutes, the shortest time in which the change can be made.

No doubt the good people at Palézieux will regret the further electrification of the line, which will put an end to those precious six minutes giving time for thirsty souls to "prendre un verre" in their society!

National Association of Supervising Electricians.—The fourth annual competition for the W. E. Highfield Shield is announced by the above Association and, in addition to the shield, three prizes will be offered to full members, and associates will have a special prize to compete for. The full member winning the first prize will be the holder of the Shield for one year. The prizes are offered to the authors of six selected papers which will be read at the Association meeting on May 4th. April 27th is the closing date for the papers to be sent in.

Modern Electric Textile Practice.

Some Details of Two Recent Mill Installations.

The flexibility of electric driving in textile mills is now generally recognised, and the two recent installations which we cite below support the claims of electric drive for quick starting and housing in quite out of the way places without impairing

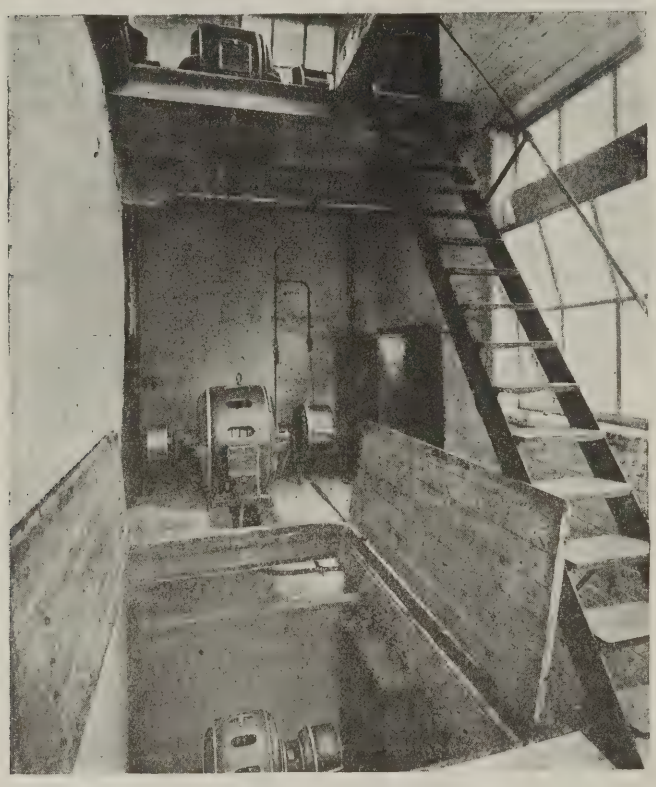


Fig. 1.—Three 200-h.p. Motors in Tower.

in any way the efficiency of the working. Electrical plant has recently been installed at the Osborne Mill, Oldham, one of the oldest cotton-spinning mills in the district, supplanting an old steam-driven plant, and it is recognised that the new installation is superior in efficiency and ease of erection to the steam plant. A new sub-station has been erected at the mill, and is supplied with three-phase energy at 6,600 volts, 50 cycles, which it transforms down to 400 volts. A main switchboard is installed in the sub-station, controlling the power supply from the transformer to the various motors in the mills, the motors being arranged for automatic starting up.

In order to render the motors in the spinning and carding rooms quite inaccessible to any except authorised persons, they are accommodated in a tower adjacent to the sections. The positions of the motors in the tower will readily be understood from the illustration, fig. 1, which shows three 200-h.p. slip-ring motors, each mounted on a separate floor and driving machinery in one of the spinning rooms. Each motor is provided with a contactor-type rotor starting panel, which contains contactors for both the stator and rotor circuits for switching on to the main, cutting out the rotor-circuit resistances when speeding up. In addition to the 200-h.p motor driving the machinery in the spinning room, there is also a similar machine for driving line-shafting in the carding room by means of a rope drive, leaving the ground space beneath available for any heavy machinery which may be installed at a later date. Two 75-h.p. slip-ring motors in the blowing and cardrooms are coupled to the main line-shafting through reduction gears. These motors are equipped with ventilation pipes, a provision necessary owing to the amount of cotton waste in the atmosphere.

Another interesting example of textile mill electrification may be seen at the Rydalmere Street Thread Works of the York Street Flax Spinning Co., Belfast. The installation consists of a Fraser & Chalmers 1,250-kVA, 500-V, 3-phase, 50-cycle, 3,000-r.pm. turbo-alternator, fig. 2, a 500-volts, iron-clad switchboard, and several textile motors driving the thread-drawing machinery. The turbine is designed for a steam pressure of 200 lb. per sq. inch, and exhausts into a jet condenser with a vacuum of 28½ in. The alternator, which is provided with a dry-air filter, has a maximum load of 750 kW under present operating conditions, the mill being only partially equipped. A particularly interesting feature of this installation is the method employed for starting the plant. When the mill is shut down none of the switches or starters is opened, the whole electrical installation being left directly connected to the turbo-alternator. The turbine is started with the exhaust open to the atmosphere, and the motors run up to speed with the turbine, full speed being reached in about 1¼ min. The set continues to run on atmosphere for another two minutes, by which time the condenser pump motors have run up to speed and a vacuum is created in the condenser, into which the exhaust is then directed by means of a change-over hand valve. This arrangement results in the whole mill running efficiently at full speed in 3½ minutes from starting. The drive is effected by 15-h.p. squirrel-cage motors, each coupled through a single-reduction gear and chains to the 100-ft. line shafts, each of the latter carrying 36 or 72 pulleys and belts, loose pulleys being employed for starting the thread-twisting machines. The motors, therefore, have to accelerate the whole of these lines of shafting, which means starting against approximately a ¾-load torque. The electrification of both of the above mentioned mills was entrusted to the textile department of the General Electric Co., Ltd.

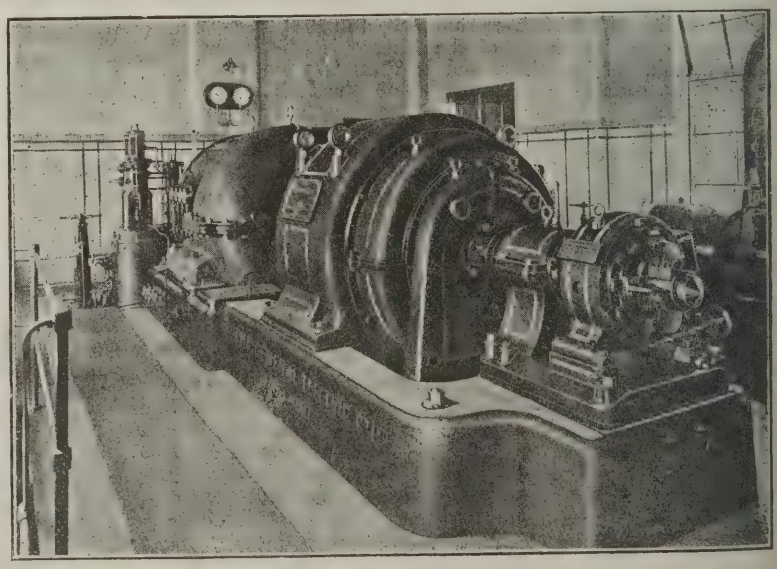


Fig. 2.—1,250-kVA Turbo-Alternator.

Electric Welding in Gas Plant.—In a paper on "Electric Welding in the Construction of Gasholders and Other Gasworks Plant," by Mr. J. N. Reeson, before the Institution of Civil Engineers, abstracted in the *Gas World*, the author discusses the influence of electric welding in the design of structures, and suggests that its employment without special consideration of design is likely to prejudice its application. Doubts have been expressed as to its strength in actual practice, the effect of corrosion on the weld and on the welding deposit, and its cost in comparison with riveting. As a result of tests carried out to determine the requirements of welded joints, the size of the electrode, number of runs, and lineal length of the electrode to be deposited per unit length of weld are specified on drawings. In order to ensure efficiency elaborate log sheets were evolved to check these important items, and as covered electrodes solely are used, it is essential that this valuable material should be carefully accounted for. The shop foreman and the foreman welder each have copies of the drawings, and the foreman welder's whole duty is to see that the most efficient joint is produced. The shop foreman is not relieved of responsibility because of the supervision of the foreman welder. The causes which led to the adoption of welding by the author's company date from 1916, when an extensive programme of gasholder construction became necessary in Melbourne. The serious collapse of a large gasholder in 1920 caused the author great anxiety. Investigation showed that the fracture was invariably at the lap of the sheets and not through the rivets. The author decided to substitute welding for riveting for joints of thin sheets which showed signs of serious corrosion. This was the first occasion, it is believed, for a large structure to be so treated, and it was necessary to alter the design and modify the methods of construction, as well as to equip the shops and site with the necessary welding plant and to train a staff of welders. The author suggests that the advantages of electric welding over riveting are, first, far greater security; and, second, simplification of design in the office and great economy in the workshop and field.

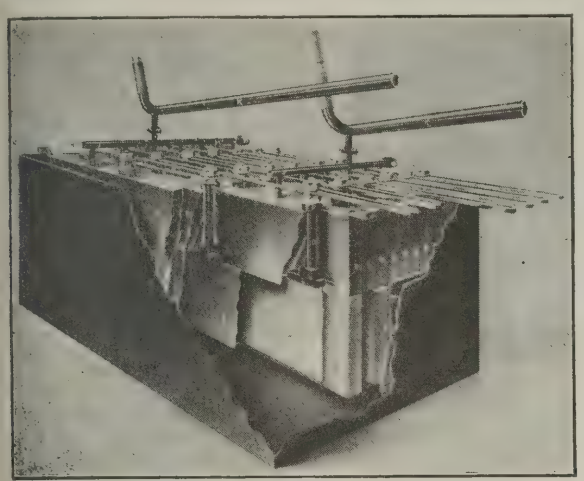
Electrolytic Hydrogen.

The Production of Gas for the Hydrogenation of Oils.

By A. EDGAR KNOWLES.

(*Abstract of a Paper read before the* Chemical Engineering Group *of the* Society of Chemical Industry.)

Many processes for the manufacture of hydrogen for the hydrogenation of oils have been suggested and tried out, but to-day there remains only one process which has stood the test of time, namely, the electrolytic decomposition of water. Probably the most important reason for this is that in the practical running of hydrogenation plant there must always occur disconcerting irregularities in the process due to the impossibility of obtaining absolute uniformity in the oil for



AA Electrodes.
BB Gas-collecting bells.
CC Electrode leads.
DD Sealing and safety tubes.
EE Insulating tubes.
FF Top insulators.
GG, HH } Copper connections.
JJ Gas-collecting pipes.
KK Gas-offtake pipes.
LL Asbestos diaphragms.
MM Skirting.

Fig. 1.—Sectional View of Knowles Cell.

treatment, and if electrolytic hydrogen is used the quality is so high and uniform that it need never be considered when irregularity occurs in the hydrogenation process.

Given cheap, suitable fuel, the Haber-Bosch process, used by the Badische Anilin und Soda-Fabrik in the manufacture of synthetic ammonia, is the cheapest method of producing hydrogen on a large scale, but the hydrogen, on account of the large percentage of nitrogen it always contains, is quite unsuited for hydrogenating oils.

In considering the cost of electrolytic hydrogen one of the most important factors is that the by-product oxygen is usually a valuable asset. Generally, the quantity of oxygen is sufficiently large to be worth compressing and selling, and seldom is it so large that there is difficulty in disposing of the whole output.

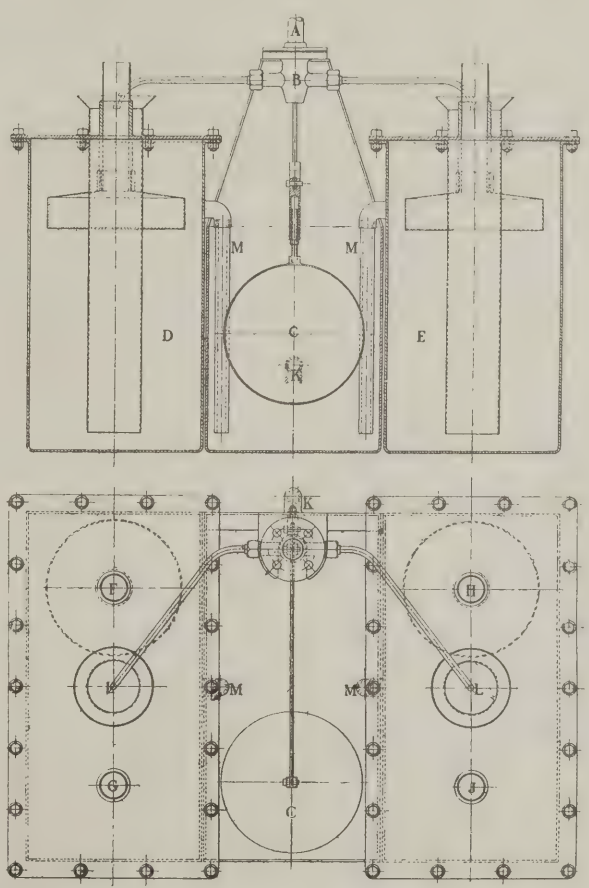
Another factor is that the main item of cost—electricity—is the same for all capacities of plant, the production always being in the proportion of 1 cubic metre of dry hydrogen at 0 deg. C. and 760 mm. pressure for 2403.0126 Ah. A well-constructed modern type of cell has no measurable internal leakage of current and no gas leakage, and can be relied upon to give this figure. The ampere-hour capacity and therefore the output of gases at constant temperature is approximately 1 at 2 volts per cell, 2 at 2.25 V and 3 at 2.5 V. With cells running at 2 volts 4.806 kWh will be required per cubic metre of dry hydrogen at N.T.P.; at 2.25 volts 5.407 kWh, and at 2.5 volts 6.008 kWh. The capacity of a multipolar cell is in direct proportion to the number of electrodes less one (only the inside surfaces of the outside electrodes are effective). It follows, therefore, that the cost of cells at any particular voltage is practically in direct proportion to the output. The two main items of cost, electricity and interest and depreciation on outlay, will therefore be almost the same for small outputs as for large outputs for any particular voltage per cell and with the same charge for electricity.

In the latest types of plants the gases are washed by the fresh distilled water going to the cells and the feed is automatically controlled, requiring no labour. The total labour required is therefore very small and the caustic soda or potash used for the electrolyte is negligible; the practical consumption of distilled water averages about 10 per cent. above the theoretical. The final product is practically 100 per cent. hydrogen direct from the cells, and cannot contain any catalyst poison.

The first improvement to be introduced to electrolytic plant was in the purification of the gases. Siemens-Schuckert used a silver tube containing palladium pumice heated in an electrical furnace. This was fairly effective with low-quality products, but it consumed a considerable amount of energy and the tubes frequently burnt out and were expensive to replace. It was ineffective with high-quality gases.

In the next improvement the incoming gas was preheated by the outgoing gas and the palladium pumice was spread over a large area through which the gas was bound to pass. This apparatus proved completely satisfactory. Electricity for heating was only required when starting cold, after which it maintained sufficient temperature to completely remove the impurity.

In present practice woven asbestos diaphragms are used to separate the gases. This material is so effective that no subsequent purification is necessary. Curiously, it lowers the resistance of the cell, but, most important of all, it avoids completely a danger always present when metallic diaphragms are used—the possibility of the diaphragm becoming polarised and thus generating mixed gases on one side of this separator. This danger is a very serious one with batteries running at high pressures on cheap electricity. Fig. 1 shows the separation arrangements of the Knowles cell. Fig. 2 is a diagrammatic drawing of the automatic feed, showing how the gases are washed, with the distilled water going to the cells, removing the caustic spray from the gases and returning it to the cells, so that the loss of caustic is negligible when running. The first plant built (1910-11) at Bromboro' for supplying the oil-hardening plant of Lever Bros., consisted of 200 cells in series on a 440-V circuit and with 2,000 to 3,000 A passing through each cell. To-day 200 cells are running at Bussi in Italy at up to 7,200 A through each, and 600 cells are being built at Pierrefitte in the French Pyrenees to pass continuously 7,500 A



A. Distilled-water inlet.
B. Piston valve.
C. Ball float.
D. Oxygen-washing tank.
E. Hydrogen-washing tank.
F. Oxygen inlet.
G. Oxygen outlet.
H. Hydrogen inlet.
J. Hydrogen outlet.
K. Distilled-water outlet to cells.
L. Water-inlet to washing tank.
M. Overflow-pipe to centre tank.

Fig. 2.—Automatic-Feed and Gas-Washing Arrangements.

each. These are for synthetic ammonia, as such large plants have never been called for in connection with the hardening of oils.

Fig. 3 is a view of the first of the improved type, erected at Erith three years ago—the first to be fitted with the automatic feed and gas-washing tanks.

The present demand for electrolytic hydrogen is so great, particularly for synthetic ammonia, that at several plants immense quantities of oxygen are being wasted. Ammonia works are generally in isolated places where cheap hydro-electric energy can be obtained, hence away from an industrial area where there is a demand for oxygen. The cost of compression and transport in cylinders is prohibitive. It might

be and probably will be conveyed by pipe lines under pressure, but the ideal is some large use for it at the source. Many minds are working on the problem at present, as with it is bound up the further extension of the use of pure electrolytic hydrogen in other synthetic processes such as the manufacture of alcohol, petrol, &c., which now appear to be getting near the practical stage.

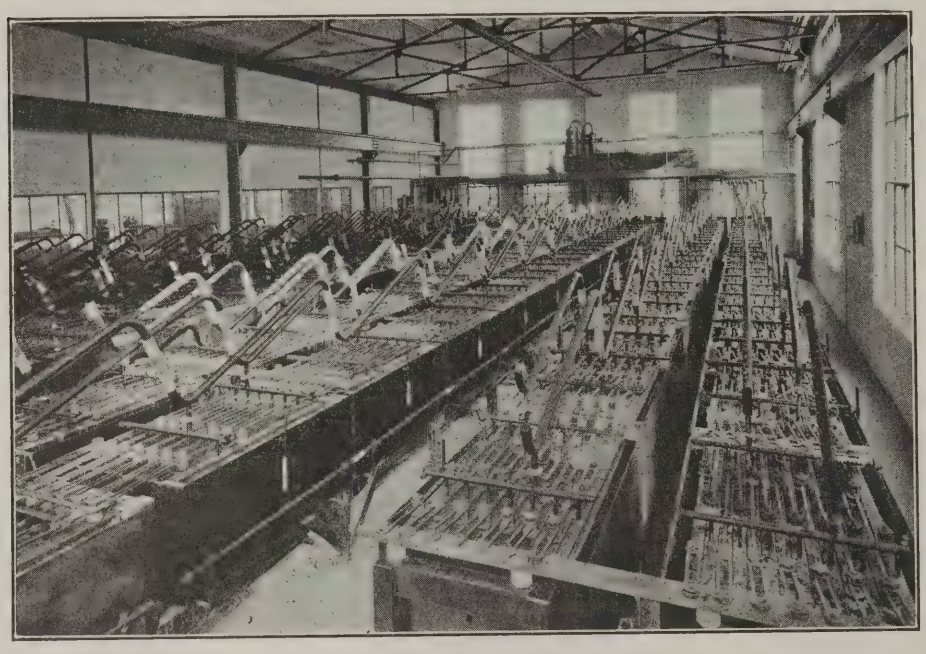


Fig. 3.—Electrolytic Hydrogen Installation at Erith.

Unlike most electro-chemical processes, the electrolysis of water does not require constant voltage or constant amperage, and these can be varied within wide limits. Further, the plant can be shut down or started up instantly by means of the switch.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Fine Regulation of Resistance.

I have read with much interest Mr. Amberton's letter describing his multi-step rheostat.

I think he exaggerates the necessity for a very large number of steps, except for such purposes as theatre-light dimming; 120 to 150 contacts is amply sufficient.

The very gradual stepping which he obtains with his 600 steps is obtained at a cost of considerable mechanical and electrical complications.

He has six rubbing contacts, three insulated brushes, a star-wheel, rack and pinion, and 85 electrical connections, whereas with a plain rheostat with 150 contacts there is one insulated brush, two rubbing contacts, and 151 electrical connections. These connections, of course, should not be "bunched," but should be kept clear of each other.

The ordinary screw-operated, straight-line regulator is the most simple and straightforward type, and makes it possible to keep all the connections quite clear of each other.

Rheostat.

London, *April 10th*, 1926.

Electricity Supply in Rural Districts.

An Interesting Installation at Titchwell, Norfolk.

In the small village of Titchwell, Norfolk, about seven miles from Hunstanton on the sea coast, an electrical installation has been put down for Mr. W. Ringer to supply the village with lighting and his farm with power. An old barn has been remodelled to serve for the engine and battery rooms, special ventilating outlets being provided to allow the acid fumes to escape through louvres in the ends of the building above the ceilings.

The generating plant consists of an 18-21-h.p. Petter cold-starting, single-cylinder, crude-oil engine directly-coupled to a 200-280-V, 9-kW shunt-wound generator made by the Lancashire Dynamo & Motor Co., Ltd. In addition to the usual charging and discharging switchboard, suitably equipped lighting and power panels are provided on a neat angle-iron frame; change-over switches are arranged so that the heating circuits of the Manor House (the owner's residence) may be run from the power board when required.

The battery room houses a Fuller, open-type, 360-Ah battery, the cells being arranged on the single-tier principle with the top of the bearers 2 in. from the ground. The usual copper connectors are carried by wooden brackets from the ceiling; this arrangement was necessary because the walls of the barn, being made of chalk, prevented insulators being fixed satisfactorily. Ample lighting and ventilation has been provided by additional windows, both in the engine and battery rooms. The building is situated close to a main road, and a storage tank has been erected so that the fuel may be purchased in bulk from tank lorries.

For aesthetic reasons the owner of the property would not allow overhead lines, therefore paper-insulated, lead-covered, steel tape-armoured cables, to the B.E.S.A. specifications, were laid direct in the ground, and in most cases just inside the fields adjoining the road, and where it was necessary to cross the road, the cables were drawn through cast-iron pipes laid at a depth of 2 ft.

For the Manor House and farm buildings special cables were run for heating and power, as it is intended to drive the following machines by electricity:—A grinding mill, a cake breaker, two shaft cutters, two root cutters, a small pump, and a separator. The majority of these machines are at present run by a paraffin oil engine through a long length of shafting, but this method of drive has proved costly, varying from £20 to £30 per month, and the change to electrical driving is estimated to provide a saving, considering the cost of generating is now approximately ½d. per kWh. A .03 sq. in. feeder has been run to a feeder pillar in the centre of the village, from which four .01 sq. in. distributors supply various buildings, including the village inn, church, post office, and 36 cottages. In most of these premises prepayment meters have been provided. The tenants generally are delighted with the change, and much appreciate the convenience of being able to "switch on" instead of lighting up oil lamps on dark mornings when most of them have to be up by 5 a.m. to work on the farm. It is particularly interesting to learn that the opinion of the consumers is that the electrical service is less costly than paraffin.

Messrs. Francis Polden & Co., London, were the contractors for the cable work and wiring, and Messrs. Powell & Co., Brancaster, carried out the alterations to the buildings. The work was generally supervised by Mr. E. A. Uttley, of Messrs. A. Hugh Seabrook & Partners, consulting engineers, who were responsible for the scheme.

Reviews.

An Introduction to Industrial Administration. By Mr. J. Lee, M.A., C.B.E. Pp. vii + 194. London: Sir Isaac Pitman & Sons, Ltd. Price, 5s. net.

One is sometimes surprised at the lack of appreciation of the changes that have taken place in industrial problems that is occasionally shown by men holding appointments appertaining to the administration of industrial concerns. It is often difficult, therefore, to convince these gentlemen, in argument, that it is necessary that certain steps must be taken in the light of present-day knowledge and experience to enable industry in this country to maintain the position it has held in the world's affairs. It is a national duty for all of us to keep ourselves advised of the requirements of our time and the probable requirements of at least, the immediate future; and to assist those interested in the fulfilment of this task we would recommend the above book. Its great value lies in the fact that it is in no way dogmatical. It draws attention to general principles that have been followed and it enlarges on the reasons of success or failure, leaving it in many cases for the reader to draw his own conclusion as to what would appear to be the correct procedure to follow. Knowing something of the mentality of energetic business men we have one small fear, that is, that some readers may become impatient with the book in places and therefore fail to read it through, for it needs rather close reading to arrive at certain cardinal points, and further, the arguments in connection with these points are often repeated in various chapters.

Under the heading of "Capital" the author gives some broad views on the part played by capital in industry and suggests that the State should make laws and further the protection of the small investor, and comments that shareholders are too often kept outside the confidence of the directors, knowing

little of the aims or intentions of the company of which they form a part. Mr. Lee also emphasises a point that the Communist is particularly apt to forget, that railways, for instance, which are the backbone of our industrial operations, were built when England was not a rich country, by men long since dead and forgotten, and that these men, therefore, are still contributing to the satisfaction of our daily wants. With regard to the chapter on the expansion of industry, in the light of present-day tendencies this is full of interest. It particularly deals with questions of the combining of interests with a view to efficiency. This, of course, has been the procedure in the newer industrial nation, the United States, for some years; in this country attempts have been made to follow the same procedure but very often the financial results have not always been as good as anticipated, not because the principle of "pooling" is wrong, but because of the difficulty of getting the maximum of efficiency on account of the strength of vested interests in old older firms, baulking the steps that should be taken to obtain best results. These difficulties are very clearly summarised on page 35. Under the heading of "Organisation of Industry" the author says "that the tradition of English industry is to overwork the management," and this is the outstanding difference between English and American methods." The author also deprecates the old type of management which was carried on largely through its autocratic, unsympathetic and often bullying methods, and points out that these cannot possibly produce the best results, particularly with a generation which now has the advantage of better education.

The real heart of the book is in the chapter on "Research, Costing and Planning." His reference to the fact that the Taylor system in full will not produce its best results in the long run in this country is certainly a timely warning and is well worth most careful reading and thought. The author's particular warning to those employed on the research side of our industrial organisations should be carefully noted. He says this body must "beware of the greatest of all dangers, *viz.*, the sense of self-importance, whereby suggestions from the actual industry are undervalued." On page 80, the author, referring to "Planning and Costing," says that the management which has a policy of constantly estimating and making actual costs, constantly bringing them to light, and is progressively determined to discover wastes and weak spots in organisation, will have time for thought and policy. It will not be the overworked management to which we have become so accustomed in England."

All who are associated with the problem of obtaining maximum results for a given wage will realise the truth of his statement that, "the reason for the prejudice against piecework is that the cutting of rates has seemed to be unjustified, and this is because there is insufficient interchange of opinion and enlightenment as between management and workers." This is a very sound statement because, as we all know, it is often necessary to change piecework prices, which may have been too low or too high. If too low, the initiative comes from the workmen and is completed by the management, and the workmen are satisfied. Under the heading of "Salesmanship," the author weighs the "pros and cons" of advertising. The advantages from advertising apply, of course, much more to some industries than others and, therefore, may not be so generally interesting as many of the other chapters. The chapter headed "The Purpose of Industry," seems to be a misnomer; nevertheless, it contains interesting matter and deals with such things as rules and regulations and psychological problems.

With regard to "the future of industry," the author opens with an interesting reference to the electrical industry, *viz.*, "Naturally enough, the greatest hopes in respect of the future of industry are centred at the moment in the distribution of electric power."

Kempe's Engineer's Year Book, 1926; 33rd Edition. Edited by H. R. Kempe and W. Hanneford Smith. Pp. 3,023 + 83; illustrated. London: Crosby Lockwood & Son. Price 30s. net.

Concerning this invaluable work of reference it is as impossible as it is unnecessary to attempt a detailed review. The list of contents, the names of its contributors and associate-editors, and the long-established reputation of the work, are sufficient recommendation. "Kempe's Year Book" is known throughout the world as a "compendium of the modern practice of civil, mechanical, electrical, marine, gas, aero, mine, and metallurgical engineering," and the contributors to its pages include acknowledged authorities in each of these branches of engineering. First issued by Mr. H. R. Kempe in 1894 with the expressed hope that it would take its place as the standard book of reference for engineers, the Year Book has continued to fulfil that aim in a manner and to a degree alike unique. For more years than we care to confess we have turned to the successive issues of this volume and have almost invariably derived valuable assistance from its pages.

Two features to which the Year Book doubtless owes a large measure of its perennial popularity are the careful revision to which each issue is subjected, and the fact that commercial information is included as well as matters of theory and general practice. The world's best sources of information are sifted with remarkable thoroughness—how this is done in the time available must remain a mystery—references to authorities and further sources of information are given throughout, and the whole work is arranged and indexed in a manner which enables the reader to find just what he wants in its 3½ million or so words. The inclusion of well illustrated and sufficiently detailed descriptions of particular makes of equipment of all kinds adds enormously to the value of the work; the maker's name is mentioned in every instance, and there is no difficulty in distinguishing between what may be termed "makers' data" and the matter compiled by the authors of the sections.

Naturally the specialist in any particular branch of engineering will not find in this work such detailed treatment of some problems as in the so-called "pocket" books devoted specifically to his own subject. For example, the electrical engineer will not find that this book can meet his needs to the same extent as Pender's Handbook or such another treatise, but Kempe gives a special section of over 100 pages to electrical engineering in addition to innumerable references to electrical equipment in other sections of the book. The special section on electrical engineering and that on electric traction have again been revised in detail by Prof. S. Parker Smith.

As an all-round work of reference for engineers of all classes, Kempe's Year Book continues to occupy more than creditably the place which it has made its own.

Alternating Current Circuits. By J. M. Bryant, M.S., and J. A. Correll, M.S. Pp. xii + 412; figs. 289. London: McGraw-Hill Publishing Company, Ltd. Price 20s. net.

According to the preface this volume is intended as an introductory course in the study of a.c. circuits and transmission lines, and the matter included has been used as a course for junior students in electrical engineering at the University of Texas, U.S.A., for the past eleven years, though now brought up to date for this publication. The work is divided into two major parts, the first one, consisting of Chapters I to VI, dealing with the theory and equations of a.c. circuits, and the second one, comprising the remaining chapters, dealing with applications of the foregoing theories to polyphase circuits and transmission lines.

Chapter I treats of the general relations of e.m.f. current and flux in a.c. circuits, embodying considerations of the generation of e.m.f., wave forms in simple electric circuits, power equations, and, very briefly, measuring instruments.

Chapter II deals with the characteristics of series circuits under the influence of sine-wave a.c. excitation, the different inherent characteristics of resistance, inductance and capacitance being defined and calculated. Resonance and the energy relations of compound series circuits are also considered.

In Chapter III the vectorial representation of sine waves and equations is studied, commencing with the generation of a sine wave by a vector and passing on to the vector illustration of different compound circuits. Addition, subtraction, multiplication and division of vectors are dealt with finally.

Chapter IV deals with parallel circuits on lines similar to those already indicated for series circuits.

The important subjects, power, power factor and apparent power are investigated in Chapter V.

Chapter VI makes a short though interesting study of complex a.c. circuits, and illustrations are given of such a circuit containing series and parallel arrangements of resistance and inductance; we feel that it is a pity that similar circuits containing capacitance also were not included.

Chapter VII, which opens the second part of the volume, deals with the current and e.m.f. equations of three-wire, single-phase and two-phase circuits, and of circuits with e.m.f.'s 120 deg. apart. Balanced and unbalanced loads are considered, as also are loads of different characteristics.

Chapter VIII deals with currents and pressures in polyphase circuits and embraces studies of two-phase systems supplying star- and mesh-connected loads and three-phase star- and mesh-connected circuits, under balanced and unbalanced loading conditions. The power consumed in the different kinds of circuits is indicated.

Chapter IX deals with the measurements of power in polyphase circuits, and similar circuits are studied to those covered by the previous chapter. The different well-known methods of power measurements are illustrated diagrammatically and vectorially, while the mathematical synthesis of each is given. Balanced and unbalanced loads are considered. The determination of the power factor of a three-wire, three-phase circuit supplying a balanced load from two wattmeter readings is given, and this treatment might advantageously have been extended to cover unbalanced loading conditions, as, of course, an accurate determination of the power factor cannot be obtained from two wattmeters under such circuit conditions.

Chapter X deals with the analysis of the amounts of conductor materials required for different systems of transmission and distribution, the circuits studied being single-phase two-wire, two-phase four-wire, two-phase three-wire, three-phase three-wire, and three-phase four-wire. The results of the investigation are summarised in clear tabular form. The constants of transmission lines are dealt with in Chapter XI, these covering d.c. resistance, a.c. resistance, skin effect, inductance and capacitance. Inductance and capacitance equations are given for single- and three-phase lines and for different arrangements of conductors. The chapter concludes with short notes on corona phenomena, the calculation of the disruptive critical voltage, the visual critical voltage, spark-over voltage, corona loss and calculations and exciting conductance.

Chapter XII gives the calculation, illustrated by vector diagrams, of short low-voltage transmission lines and distribution

circuits. These embrace single-phase and three-phase lines supplying non-inductive, inductive and capacitive loads. Useful circle diagrams, notably the Mershon, are included for determining receiving and sending end voltages at different load power factors. Vector diagrams are given to illustrate the effects of variations of one of the circuit characteristics upon the others.

Chapter XIII is a study of medium length transmission lines having appreciable capacitance and Chapter XIV discusses the solution of very long transmission lines by means of the differential equation.

The preceding chapters have all been based upon the assumption of sinusoidal wave forms, and the effects of non-sinusoidal shaped waves are dealt with in Chapter XV. Some of the causes of the production of non-sinusoidal waves are given, and even and odd harmonics are discussed. Equations are given for the R.M.S. values of complex waves and for the power consumed by a circuit having e.m.f. and current waves of any shape. Wave analysis by Fourier's series and the Fischer-Hinnen method are given. We commend to the author's attention the methods of wave form analysis evolved by Kemp and Clinker, for inclusion in a future edition of their book. Equations are given for the e.m.f.'s in the series circuit containing resistance, conductance and capacitance when a distorted current wave flows through the circuit, while complementary to this, equations are given for the current wave produced by a distorted e.m.f. wave impressed on the circuit containing resistance, inductance and capacitance in series. Finally, current and e.m.f. relations are investigated in parallel connected circuits when a distorted e.m.f. is impressed across them.

Examples, following some of the chapters, are worked through in detail and these are useful accessories. The volume is profusely illustrated by circuit and vector diagrams, which add considerably to its value. We think that every vector diagram should bear an arrow indicating the assumed direction of vector rotation, although in most cases the direction is immediately apparent. We can unhesitatingly recommend this book to those desirous of obtaining a thorough grounding in the essentials of a.c. circuit theories, but we think it would have enjoyed a wider circulation at a price not exceeding, say, twelve shillings and sixpence.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 7th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Krone (lettering and design). No. 461,946. Class 4. Electric and galvanic carbons.—The firm of C. Conradty, 9, Spittlertorgrabe, Nuremburg. (S. Sokal, 1, Great James Street, Bedford Row, W.C.1.)

Ceag (lettering and design). No. 453,216. Class 8. Electric accumulators, resistances, switchboards, cables, meters, and similar electrical goods for use in connection with miners' electric safety lamps.—Ceag (lettering only). No. 453,219. Class 8. Electric accumulators, resistances, switchboards, cables, meters, &c. No. 453,220. Class 15. Electric lamp bulbs, glass trays for charging standards, for use in connection with miners' electric safety lamps.—"Ceag" Miners' Supply Co., Ltd.

Unitron. No. 465,382. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy.—A. J. Garrod, White Horse Place, Mark Street, Wellingborough.

Capitol (lettering and design). No. 466,307. Class 8. Light projecting appliances.—Capitol Machine Co., 100, East 42nd Street, New York. (Herbert Haddan & Co., 31-32, Bedford Street, Strand, W.C.2.)

Helenite. No. 467,422. Class 8. Electric cables.—St. Helens Cable and Rubber Co., Ltd.

ES (lettering and design). No. 465,388. Class 13. Switchboards and parts thereof, fuses and switch fuses.—The Edison Swan Electric Co., Ltd.

A.C.C., Ltd. (lettering and design). No. 466,827. Class 13. Ordinary electric lamps, and miners' electric safety lamps.—A. C. Cossor, Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

18,993. "Electric resistance welding-machines." W. C. Priestley. June 11th, 1925. (248,803.)

22,252. "Switch for automatic telephone system." P. C. Rushen (Lorenz Akt. Ges., C.). September 20th, 1924. (248,819.)

26,970. "Interrupter or switch electrically controlled at a distance for starting internal-combustion engines." Fabbrica Italiana Magneti Marelli. February 13th, 1924. (229,261.)

27,371. "Selecting mechanism for type-printing telegraphy and other purposes." T. J. Berryman. November 17th, 1924. (249,177.)

27,442. "Methods of and means for eliminating capacitive coupling between electric circuits." Hazeltine Corporation. September 22nd, 1924. (240,114.)

30,026. "Polarised relays." K. E. Edgeworth. December 13th, 1924. (249,189.)

30,162. "Electric ringing mechanism for the bells of churches." E. Gubler. December 15th, 1924. (249,192.)

30,227. "Electric conductors and associated fittings." R. J. Sutton. December 16th, 1924. (249,194.)

30,499. "Electric motors." J. F. Monnot. December 18th, 1924. (249,213.)

30,598. "Moving electric signs." A. B. Penney. December 19th, 1924. (249,216.)

30,684. "Electrically-heated steam or water radiators." Benham & Sons, Ltd., and C. R. Allensby. December 20th, 1924. (249,220.)

30,698. "Illuminated sign for lighting shop windows." W. G. Reeves. December 20th, 1924 (249,222.)

30,803. "Loud-speaking telephonic receivers." E. A. Graham. December 22nd, 1924. (Addition to 243,396.) (249,225.)

30,877. "Arrangement of selectors and contact sets in automatically-operated telephone exchanges." F. Merk. December 24th, 1923. (226,820.)

31,078. "Electric switchgear." F. B. Cox. December 29th, 1924. (249,232.)

31,099. "Intervalve couplings for use in radio circuits." M.-L. Magneto Syndicate, Ltd., and D. K. Morris. December 29th, 1924. (249,234.)

31,147. "Hand-operated mechanism for operating electric controllers and for other devices." A. West & Co., Ltd., and A. West. December 29th, 1924. (249,235.)

31,260. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. December 30th, 1924. (249,237.)

31,310. "Tubular electric vacuum signs and methods of mounting same." E. V. Hayes-Gratze. December 31st, 1924. (249,244.)

1925.

423. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. January 6th, 1925. (249,248.)

523. "Electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. January 7th, 1925. (249,249.)

530. "Electric switches." Callender's Cable & Construction Co., Ltd., and C. W. Kay. January 7th, 1925. (249,250.)

1,496. "Sparking plugs." A. C. Sphinx Sparking Plug Co., Ltd., W. A. Clark and D. H. Corbin. January 17th, 1925. (249,257.)

2,061. "Electrically-heated boilers controlled by thermostats." E. Rothwell. January 23rd, 1925. (249,263.)

2,512. "Ignition-controlling apparatus for internal-combustion engines." A. Howard. January 28th, 1925. (249,267.)

3,525. "Apparatus for the regulation of electric currents." C. D. Farmer. February 9th, 1925. (249,278.)

3,699. "Wireless coil-holders." T. McClelland. February 10th, 1925. (249,280.)

3,816. "Apparatus for testing electromagnetic sound-reproducing devices." Brandes, Ltd. November 26th, 1924. (243,664.)

3,874. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). February 11th, 1925. (249,284.)

4,181. "Method of and means for frequency multiplication in electrical phenomena." C. Lorenz Akt. Ges. February 15th, 1924. (229,337.)

4,190. "Sound-transmitting apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). February 14th, 1925. (249,287.)

5,263. "Variable inductances." W. A. Appleton and J. Joseph. February 25th. 1925. (249,292.)

5,783. "Crystal detectors or rectifiers for wireless reception." G. C. Simmonds and N. B. Simmonds. March 3rd, 1925. (249,302.)

6,559. "Variable electric condensers." Lissen, Ltd., and R. P. Richardson. March 10th, 1925. (249,310.)

6,747. "Variometers and the like." A. S. Jones. March 12th, 1925 (249,315.)

7,194. "Telephone systems." Siemens Bros. & Co., Ltd., and J. Berry. March 17th, 1925. (249,316.)

7,476. "Thermo-electric cells." Metropolitan-Vickers Electrical Co., Ltd. ((Westinghouse Electric & Manufacturing Co.). March 19th, 1925. (249,318.)

8,029. "Electrical connecting devices." C. A. Silfversparre. April 8th, 1924. (232,197.)

10,062. "Electric switches." C. L. Arnold and M.K. Electric, Ltd. April 17th, 1925. (249,339.)

10,632. "Fittings for electric lamps." Wardle Engineering Co., Ltd., and E. E. Hopwood. April 24th, 1925. (249,343.)

11,453. "Methods of and means for compensating temperature changes in magnets." British Thomson-Houston Co., Ltd. May 5th, 1924. (233,358.)

12,513. "Holders for thermionic valves." L. F. Braun. May 14th, 1925 (249,357.)

12,950. "Radio loud-speaking horn." W. Boenicke. May 18th, 1925 (249,363.)

13,625. "Electric motor control systems." A. H. Jackson. May 25th, 1925 (249,366.)

13,768. "Thermionic valves." W. R. Bullimore. December 19th, 1924 (Divided application on 234,916.) (249,367.)

18,365. "Holders for thermionic valves." Excelsior Motor Co., Ltd., and C. B. Hemphill. July 18th, 1925. (249,386.)

19,238. "Dynamo-electric machines." International General Electric Co. Inc. July 29th, 1924. (237,911.)

20,360. "Thermionic-valve holders." C. Pressland. August 13th, 1925 (249,397.)

21,374. "Electric ovens, particularly for dental purposes." W. Hoberg. August 30th, 1924. (239,213.)

21,596. "Fire-alarm devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), S. T. Buer, and E. M. S. McWhirter. August 28th, 1925. (249,401.)

22,030. "Electrodes for thermionic valves and the like." A. Emerson, jun. September 3rd, 1925. (249,403.)

22,041. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. September 3rd, 1924. (239,524.)

22,043. "Adjustable electrical condensers." Dubilier Condenser Co. (1925), Ltd. September 3rd, 1924. (239,526.)

22,075. "Ribbon cables." Siemens & Halske Akt. Ges. and F. Doring. September 3rd, 1925. (249,404.)

22,354. "Antennæ systems." Soc. Francaise Radio-Electrique. September 10th, 1924. (239,854.)

23,994. "Dry galvanic cells." Elektrotechnische Fabrik Schmidt & Co. October 3rd, 1924. (240,827.)

24,057. "Electrical heaters." Benham & Sons, Ltd., N. C. Barrett, and T. W. Davis. September 26th, 1925. (249,414.)

24,727. "Worm and segment gearing for wireless apparatus." J. G. Newey and C. B. Jerred. October 5th, 1925. (249,419.)

27,025. "Protective devices for use in polyphase current installations." Akt. Ges. Brown, Boveri et Cie. November 17th, 1924. (242,968.)

28,769. "Insulated high-tension electric cables." Maxsieverts Fabrik Aktiebolag. December 6th, 1924. (244,071.)

29,277. "Headlights." G. L. Neave. November 20th, 1925. (249,442.)

29,426. "Contact-breakers for the ignition apparatus of internal-combustion engines." International General Electric Co., Inc. November 21st 1924. (243,382.)

32,367. "Uniformly-loaded conductors for signalling purposes." Felten and Guilleaume Carlswerk Akt. Ges. December 27th, 1924. (245,137.)

1926.

2,127. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. January 24th, 1925. (246,516.)

British Science Guild.—The annual meeting of the British Science Guild will be held in the Mansion House London, on Thursday, April 29th, at 4.30 p.m. The Rt. Hon. Lord Askwith, K.C.B., K.C., President of the Guild, will be in the chair, and the programme will include speeches on "The Future of the Coal Mining Industry," by Sir Richard Redmayne, K.C.B.; "Dyestuffs," by Dr. E. F. Armstrong, F.R.S. managing director, British Dyestuffs Corporation, Ltd.; and "Broadcasting and the Electrical Industry," by Capt. P. P. Eckersley, M.I.E.E., chief engineer, The British Broadcasting Company, Ltd. Cards of invitation to the meeting may be obtained from the Secretary, British Science Guild, 6, John Street, Adelphi, London, W.C.2.

The

Electrical Review

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THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

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Co-operative Research in the United States.

A RECENTLY issued Circular of the Bureau of Standards (No. 296), gives a full account of an interesting scheme of co-operative research which has been developed at the National Bureau. That institution, like our own National Physical Laboratory, has experienced the effect of the demand for trained research workers emanating from manufacturing industries, in the shape of a constant drain upon the personnel of the establishment. That the unquestionable advantages of research are thus gaining appreciation in the commercial world is very gratifying, and there can be no doubt that our industries are benefiting materially by the enlistment of research workers of proved ability and resourcefulness in their service, whilst the financial position of those workers is undoubtedly improved by the change of employer; but the loss of valued members of the staff, who cannot be speedily replaced, no less certainly constitutes a serious problem for the management of the laboratories.

The plan adopted by the Bureau of Standards is admirably conceived to benefit all parties, by providing a steady stream of trained research workers, familiar with the methods and resources of the Bureau, and capable of supplying the needs both of the Bureau and of industry. The fact that the scheme has recently "grown notably both in magnitude and variety of fields" indicates that it has proved its utility, and there appears to be no good reason why it should not be equally successful in this country, where the extension of research is so greatly needed.

Simultaneously with the foundation of the Bureau of Standards in 1901, the use of the scientific and technical research facilities of the Government by investigators and students was sanctioned by Congress, and there are to-day 61 research associates in the Bureau, maintained by 36 organisations. The plan is intended to permit qualified workers to utilise the Bureau's facilities and staff in conducting researches of mutual interest; to provide for training and experience in research in an institution specially concerned with that class of work, to promote close co-operation between the industries and the Bureau, to encourage the appli-

cation of science to industry, and to lend the prestige of the Government to the results of research. The "research associate" is appointed by the Director of the Bureau, but is employed by an industrial association or group, which desires the solution of some outstanding problem; he is usually a graduate, and to all intents and purposes becomes for the time a member of the staff. Each proposed research is approved by the Director, and monthly progress reports are made to the supporting association through him; the results are made available to the industry concerned by publication, but, apparently, may be treated as confidential, at the discretion of the Director. Inventions arising out of the research must be placed freely at the disposal of the public. Needless to say, the splendid resources of the Bureau—in respect of equipment, staff, and literature—together with those of the other Government institutions in Washington, immensely facilitate the specialised work of the researcher, whilst exceptional opportunities for private study are provided.

The circular to which we have referred gives examples of enormous savings effected by the work of the Bureau, such as 20 millions a year from motor-fuel researches; incidental economies are also realised, such as an estimated saving of £100,000 a year in insurance premiums by owners of lifts, the outcome of the Bureau's researches on interlocks. Examples of the work done by research associates are cited; for instance, the American Electric Railways Association instituted a research into the cause of breakage of welded rail joints, which were apt to fail in a year or two, whilst the rails lasted 15 or 20 years; it was found that butt-welded joints withstood many times as many impacts as seam-welded joints. "It is not unusual that a research pays dividends a hundred times its cost". . . if only our political and industrial leaders could be brought to a full appreciation of that fact! Amongst the many associations maintaining research associates at the Bureau is the American Society of Mechanical Engineers, which has two experts engaged in determining with precision the numerical constants and the properties of steam, as a basis for its more effective use.

From the particulars given in the Circular we are led to the conclusion that the system described is well worth the consideration of the Department of Scientific and Industrial Research, in conjunction with the Director of the National Physical Laboratory and the Research Associations assisted by the Department. It does not appear to compete with the work of the Universities, as the research associates employed are not novices, but graduates qualified to initiate and conduct research; the scheme, therefore, provides remunerative employment for university-trained men and a convenient avenue of access for them to the fields of applied science in industry.

It is interesting to note, in the Report of the Executive Committee of the National Physical Laboratory which has recently been issued, that the Laboratory does its best to place the knowledge which it has acquired at the disposal of industrial firms, whose representatives frequently visit the N.P.L. in search of information; but the numerous claims on the time of the staff render it difficult to provide adequately for this service. Many visitors from dominion, colonial, and foreign institutions are received at the Laboratory, and in some cases the technical officers of oversea Government departments are allowed to work for a period at the Laboratory in order to acquire familiarity with the methods employed in particular branches of work. Thus the Laboratory has already gone some distance along the path followed by the Bureau of Standards, and we trust that it will be found possible for it to go the whole way.

The Balfour Committee Still Sitting.

It were base ingratitude not to express sympathy with the members of the Balfour Committee on Industry and Trade in the enormous mass of information that it is falling to their lot to listen to and inwardly digest in the hope that they may ultimately guide the nation of the future to right conclusions. We are not surprised that members fall out by the way, though it says much for the public spirit of business men and women to find others ready to step into their places and carry on the good work.

Some of the subjects lately brought forward seem to suggest that the taking of evidence is nearing its end—or ought to be. Not that we desire to under-estimate the importance of these recent subjects, though they do seem to be of the "general" rather than the special class. For example, the Trade Exhibition Organisers' Association is reported as giving evidence regarding the inimical effects of the British Industries Fair upon the interests of its members. We are afraid that its efforts to excite sympathy for private exhibition organisers because of the increased patronage which our trades are giving to the Fair will meet with little success. So far as the electrical industry is concerned, it has shown plainly for many years that it can look after itself in respect of exhibitions. Indeed, we recall the early discussions out of which the present electrical exhibition policy developed; the industry then saw, as it sees now, that it was quite capable of running its own affairs and keeping the profits within the family circle. In co-operation with the Government it can run a thoroughly businesslike electrical section at the British Industries Fair. It is claimed that private organisers can bring to their exhibitions more overseas buyers than have so far been lured to the British Industries Fair. Here we should require to examine the evidence of both sides, but whatever has been in the past we hope that the 1927 Fair at Birmingham will be well patronised by overseas visitors because specialised action is to be taken in time to invite them.

Another point brought before the Balfour Committee is the position of the commercial traveller. The evidence did not relate to the electrical trade, but no doubt it interests this indispensable section of staffs connected with our trade. Exactly where the grievances of commercial travellers fit into the Balfour mosaic may not be immediately obvious, yet the fact that commercial travellers are making lower average earnings now than before the war, owing to the cost of living, is a tendency to be noted, though it may be partly due to bad trade and partly to the class of occupation becoming less attractive to the most suitable men. The evidence was advanced by the National Union of Commercial Travellers, and it included reference to the fact that employers in some trades were pledged not to take into their service any traveller who had left a competing firm. We have heard, on the other hand, of firms which have done their utmost to entice away other firms' travellers for the sake of their connections, afterwards dispensing with their services at the earliest convenient opportunity.

Yet a further point. Travellers sometimes in a moment of eagerness or of desperation, sign an unfair and harsh agreement in order to secure an appointment, and they regret it afterwards. We have often touched upon this point, but commercial traveller readers will know how, acting alone, they are likely to fall into such traps. Their Association asks the Balfour Committee to say that such agreements should by legislation be declared invalid.

All these are very interesting points, and they will find a place in the complete, many-volumed work of the Balfour investigators, but it requires all the optimism at our command, and more, to believe that we shall live to see much legislation as the direct outcome of its work.

Flaming June.

The change to "Summer-time" came upon us to the accompaniment of a hailstorm in London, but to compensate somewhat the post-bag brought us particulars of further events that are to be expected when June arrives. The programme of the Conference of the Electrical Contractors' Association and allied organisations which is to be held in June at Brighton completes, we hope, the list of engagements for that month. In the Electrical Review for April 2nd (p. 545) we published the advance

programmes for the I.E.E. Summer meeting, which takes place at Newcastle-on-Tyne from June 7th to 12th, and for the I.M.E.A. Convention at Glasgow which opens on the following Monday (June 14th) and continues until the following Saturday. Very considerately the organisers of the Electrical Contractors' Convention have allowed the technical Press representatives and any other electrical gentlemen who may desire, or be compelled, to be present at all three engagements, a long week-end respite, for Wednesday (June 23rd) will be occupied with preliminaries, the really serious work of the first annual E.C.A. Conference only beginning on Thursday and continuing throughout Friday. Altogether there will be between two and three weeks full of professional and business interest, interspersed with a round of social events which will make June a record month in 1926. But how much trouble might have been spared by all pulling together in the organisation of one big convention, and how much more effective would have been its electrical advertising effect upon the public mind in this year of Parliamentary and Press discussion of electricity supply!

The Optical Convention.

The Optical Convention is now over, and no doubt on the whole it has answered the hopes of its supporters. The display of apparatus was imposing, and the grafting on to the serious part of the programme of the series of "scientific marvels" and "optical illusions" was an ingenious step. Certainly, even allowing for the advantage of securing the Prime Minister to open the Convention, the publicity arrangements appear to have been well managed. It is rarely that a scientific exhibition gains so much attention in the daily Press. The electrical industry might with advantage study the methods employed—for electricity could surely present an equally imposing record of work accomplished and future possibilities. The series of papers read at the Convention was a comprehensive one and served to show the many-sided aspects of optics. We were glad to see included in the programme a paper by Mr. L. Gaster, emphasising the close relation between optics and illuminating engineering. Certainly a very large part of the work illustrated and described is of interest to all concerned with lighting problems. It is a misfortune that modern science is divided into such watertight compartments; many optical inventions for a specific purpose would find other applications if they were more widely known. The Convention, therefore, has done something towards bringing scientists together. Has it been equally successful in impressing the public with the value of optics? One wonders. We suspect that a large proportion of the non-technical public visited the entertainments but did not make much progress in the exhibition proper. We are inclined to suggest that on another occasion more attempt might be made to explain how the illusions were worked; by this means the public would be instructed besides being entertained.

Electric Cranes in Foundries.

In a foundry in the North of England an overhead carrying system was installed recently, and it is estimated that a saving of nearly 30 per cent. of the handling costs has been effected. In many foundries, especially of the jobbing kind, hand-operated cranes are still used, but in repetition foundries power cranes and runways have been chiefly used for a number of years. It is rather surprising that automatic electric runway systems, or telphers, have not come into more general use for conveying materials about foundries. There is certainly great scope for them in repetition foundries in delivering castings from the moulding shop to the dressing shop, and thence to the forwarding department—where there is a special forwarding department. The telpher, operated from the floor by a switch, is not a novelty, and it requires little skill to operate it. Perhaps it is because its excellent qualities have not been sufficiently made known that it has not come into more general use.

In America, electrical lifting and conveying plant is common in both ferrous and non-ferrous foundries and, in a certain technical journal, an instance was given recently of a foundry where a daily production of over 22,000 pounds of castings was maintained with only one moulding machine; two electric hoists, of three tons capacity each, handle all materials and do their work with an efficiency that makes this high production possible. In turning out this tonnage nearly 330 tons of moulding boxes, moulds, ladles, castings, &c., must be lifted, moved, and lowered. The simple electrical equipment takes the place of a complicated system of jib cranes, wheel-barrows, and other manual labour.

There are other advantages of electric cranes besides reducing operating costs, because, as already indicated, they have a big bearing on production. In a repetition foundry the work is kept moving in an unbroken flow, and the most efficient use is made of floor space. It is sometimes contended that hand-operated cranes are all that is required in small jobbing foundries, but, in the smallest non-ferrous foundry, modern equipment is well worth while, and in the large foundry which specialises in heavy machine-tool and engine castings a very considerable saving in labour charges can be effected.

Copper.

The market for this metal has been languishing for a considerable time now, and values touched a very low level. Indeed, the standard market declined to about the lowest point reached since the war. The remarkable feature is that this has all occurred in face of practically a record consumption. Of course, it has to be remembered that production is also at a record rate, and it is therefore necessary for consumption to keep at top notch if the situation is not to deteriorate statistically and values to be affected adversely. The principal cause of the unsatisfactory appearance of the market for some time past has, of course, been the poor economic and industrial position in Germany, where consumption fell off to a marked degree. This was a matter of considerable importance to the copper industry, as that country is normally such an important outlet for American copper. Meanwhile, consumption in the United States has been very well maintained, and although there are some doubts as to whether it is keeping up to its highest level, it certainly does not appear to have fallen away much just yet, but this in itself was insufficient to support the market in face of the diminution in Europe's takings. Latterly, however, the market has attracted more interest, and has assumed a rather better appearance. One of the reasons for this was the report that the stocks of refined copper in America had decreased during March to the extent of fully 11,000 tons, bringing the total stocks of refined metal there down to about 75,000 tons. This is no doubt all to the good, but there were other features in last month's statistics which were not quite so satisfactory, one being that refined output had increased and another that the deliveries showed such a large expansion compared with the previous month as to suggest that it was due to some accidental circumstance. However, even leaving these figures aside, the position does seem to have a slightly better aspect for the reason that there are certain indications which suggest that conditions in Germany have turned the corner, and although this has not yet translated itself into any very large buying of copper, a certain amount of business has already been done in connection with electrical schemes there, and it seems reasonable to believe that more is likely to follow. The importance of the electrical industry to the copper trade can be realised when it is mentioned that well over 60 per cent. of the American deliveries of refined copper are in the form of wire bars, the shape used for drawing into wire. In this country, of course, the outlook is somewhat obscured by the various clouds hanging over the labour position, but a factor which should not be lost sight of is that copper is at a very reasonable price.

The Manufacture of Radio Valves.

Some Impressions of a Visit to the Mullard Co.'s Thermionic Valve Factory.

One of the most noteworthy, and it may be also far-reaching, steps ever taken in the history of the British "wireless" industry was accomplished recently by the agreement for collaboration of the Mullard Radio Valve Co., Ltd., with Philips Glowlamp Works, Ltd., of Eindhoven, Holland.



Fig. 1.—A View of an Assembling Unit.

Prior to this arrangement, Messrs. Philips were the largest exporters of radio valves to this country, but since the conclusion of the above-mentioned agreement they have ceased to send their valves here. The cessation of this supply implies increased British production to meet the demand of the home market, thus creating more employment for British labour. Further, the arrangement means that all Mullard valves will henceforth be manufactured in Great Britain under the combined valuable patents of the two firms concerned, for it has conferred upon the Mullard Co. the right to the exclusive use of all Philips patents and improved processes relating to the specialised manufacture of thermionic valves. Messrs. Philips have corresponding similar rights under the Mullard patents with respect to the Continental markets, and a separate concern, known as the Mullard Wireless Service Co., Ltd., has lately been formed to take over the sale of the products manufactured by the Mullard Radio Valve Co., Ltd. Both the British Companies are under the able managing directorship of Mr. S. R. Mullard, M.B.E., M.I.E.E., who is also chairman of the Service Co.

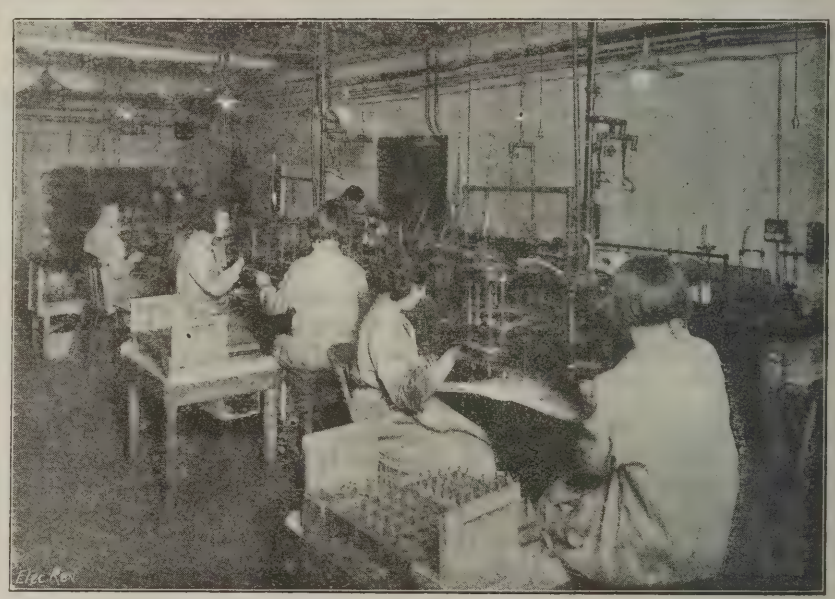


Fig. 2.—A Sealing-in Unit.



Fig. 3.—High-power Silica Valve Bay.

Established in a small way at Hammersmith, the Company's manufacturing organisation has grown steadily until to-day its factory in South-West London, at Balham, is claimed to be one of the largest in Europe devoted solely to the production of radio valves. Considerable improvements have recently been carried out, and present indications are that an extension of the premises cannot be long deferred. The organisation affords employment for some 400 people at present; the factory is equipped on modern lines and the plant and machinery is of up-to-date design, much of the latter being of the automatic or semi-automatic pattern; electricity is used extensively for lighting, power, heating, and testing purposes, and the switchgear and mains have recently been modernised to deal with a maximum load current of 2,500 amperes at 200 volts, while the overhead air ducts visible in the accompanying illustrations show that the efficient ventilation of the premises has received

attention. The factory is so organised that the various manufacturing operations which the component parts pass through follow one another consecutively in order to reduce transportation to the minimum. Commencing in the Components Departments, where the initial processes in the manufacture of connecting wires, supports, and electrodes are carried out, and the glass tubing necessary for making the "feet" is cut into the desired lengths, the parts pass to the Assembling Department (a section of which is illustrated in fig. 1), where the electrodes are mounted and prepared for sealing them into the glass bulbs, which operation is performed by machines such as those shown in fig. 2. The valves are then sent to the pump benches (fig. 4), where they are exhausted and sealed off, at which stage they are ready to undergo preliminary tests. It is understood that at every stage of their manufacture the valves are subjected to close inspection and metal parts gauged; such repeated precautions may be considered expensive, but it is economical to check a faulty article at an early stage in its production, and thus afford a chance of rectification rather than reject it on completion, which would involve wastage of material.



Fig. 4.—A Portion of the Pump Room.



Fig. 5.—Final Test and Inspection Department.

Following the "getter" process (when necessary), heat treatment, and ageing, the valves are "capped" (fitted with bases) and then finally tested (fig. 5); the glass bulbs are next acid-etched with distinctive marks and painted with coloured rings according to type, cleaned externally, and then packed ready for dispatch. In this connection it is to be regretted that the various manufacturers distinguish valves of similar rating differently, for it would be much more convenient and satisfactory to the user if all makes of similar characteristics were designated in a uniform manner. Electric welding machines are employed freely in making the

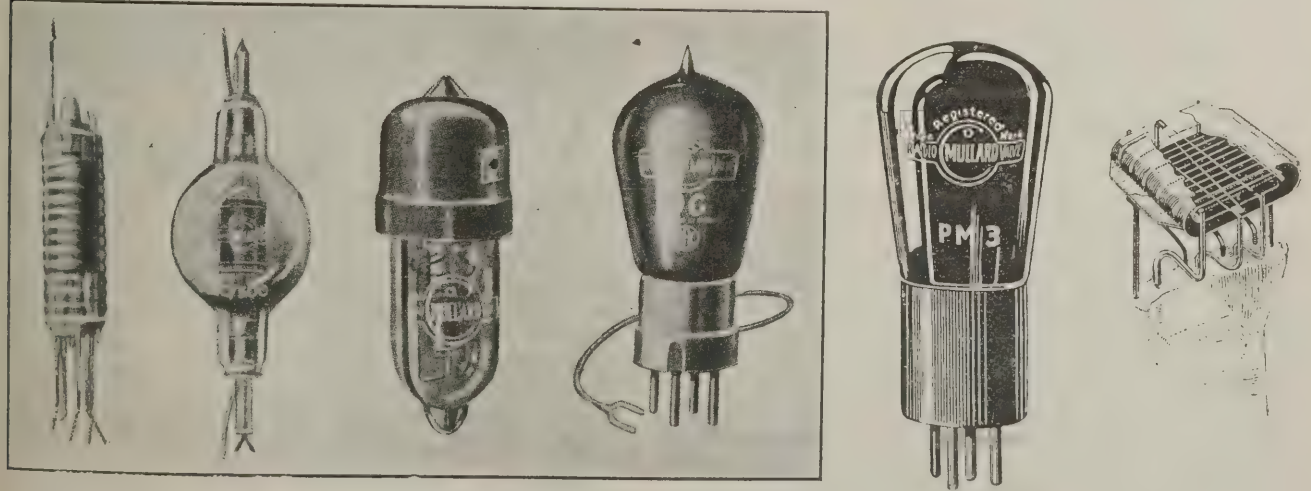


Fig. 6. Fig. 7. Fig 8. Fig 9. Fig 10. Fig. 11.

A Selection of the Types of Thermionic Valve made by the Mullard Company.

electrodes, which are carried on stiff nickel supports that are joined to fine platinum (or a substitute which enables a good airtight seal to be made) wires, which are embedded in the glass "pinch," and they in turn are connected to copper wires soldered to the 4 valve pins. Usually the grids and plates of the smaller valves are circular, those of power valves being oval or rectangular: grids of the former type are made by winding nickel wire over a metal former threaded to the correct pitch, suitable lengths being cut and placed in jigs with pieces of stiff nickel wire laid along them and to which each coil is welded at the points of contact; the latter type are wound direct on the supporting wire, which has been previously bent to the required shape and similarly welded. Thus each coil is securely attached to the supporting wire, and the precise diameter, spacing, and number of turns are fixed by the setting of the machines. Anodes are cut out of sheet nickel, rolled or stamped to the requisite shapes, and their edges welded together.

A somewhat intricate pattern of machine is used for sealing the supporting wires in the glass "feet" of the valves; the machines are similar to those used for making the corresponding portion of electric lamps, the operations being timed exactly so that the glasswork is rotated and heated by successive gas jets to the right degree at each stage. When the "pinch" has been made, the glass part is annealed and the foot is placed in a jig, which cuts and bends the supporting wires to the requisite lengths and shapes. Next, the filament (after undergoing a cleansing process) is inserted and welded to its supports, as are also the grid and anode, the machines used for assembling the electrodes being arranged to automatically locate and fix the elements in position. The filament of the 60-milliampere class of valve is so fine as to be only just visible to the naked eye; to enable it to be handled with facility the wire has attached to it small nickel clips which are so spaced as to give filaments of the correct length. The wire is laid in position and one clip welded to each filament support, the surplus being cut off.

Shaped bulbs purchased from the glass manufacturer are each fitted with a small glass tube, which acts as the exhaust pipe; in the case of the "pipless" pattern, exhaustion takes place through the "foot" of the valve. After internal cleansing it is placed over a "foot" carrying the electrodes, which is mounted in a machine and rotated through successive gas jets so that the glass base gradually softens, and finally the bulb and "foot" unite. On cooling, a tap removes the surplus glass, and after being annealed, the bulb is ready for the pumps. It is interesting to note that the liquid air needed for the pumps is produced on the premises.

Exhaustion is one of the most critical and costly operations of the whole manufacturing process. A "dull emitter" can only be satisfactory if it is considerably "harder" than a bright valve; that is, strict precautions are necessary to produce and maintain a good vacuum by exhaustion to a high degree, and during evacuation the valve is heated in order that occluded gases contained in the glass as well as the metal electrodes and their supports may be removed and thus minimise the harmful quantity that is liberated during the life of the valve.

The valve may be heated in two ways: either by electron bombardment (*i.e.*, raising the filament to a high temperature and at the same time applying a high voltage to the grid and plate), or the induction or eddy-current method (*i.e.*, placing a coil carrying high-frequency current over the valve); the former method involves filament wastage, and is therefore not applied to valves containing very fine filaments. During the heating a small piece of metallic magnesium (previously affixed to the anode during its formation) is volatilised, thus "getting" the last trace of gas and incidentally resulting in a silvery deposit inside the glass bulb. To enable a "dull" filament to emit electrons at its normal operating temperature, it has to be activated by heat treatment, which produces a chemical action between the thoria and tungsten of which it is composed. It is accordingly "flashed" at about 2,900 deg. K. for one minute, its temperature is then reduced to about 2,250 deg. K. for three or four minutes, and finally lowered to the normal working value of about 1,700 deg. K. The filament alone is heated (the grid and anode being inactive meanwhile), the voltage applied (approximately three times the normal) depending on the composition of the wire; the result is a diffusion of the thorium outwards, forming a coating on the surface of the filament, the free emission thereafter at low temperature being characteristic of thorium instead of tungsten. Either before or after the valves are completed by having their bases fitted, they are hung on "ageing" racks and run for a time under normal conditions before undergoing their final tests.

The Company's products are too numerous to mention individually: fig. 5 illustrates a part of the bay wherein high-power silica valves are made, and such a valve, capable of 10 kW continuous anode dissipation at 12,000 volts, is shown in fig. 6; its filament consumes 47 amps. at 28 volts. Fig. 7 indicates a glass transmitter of 300 watts at from 2,500 to 5,000 anode voltage, the filament needing 8 amps. at 18.5 volts; this type is assembled in such a way that the filament is easily renewable. Very similar in appearance are the rectifying valves, which are made to deliver d.c. up to 30,000 volts. The Philips-Mullard 30-kW valve is of the water-cooled metal-glass pattern. Two types of low-temperature thoriated-tungsten transmitters are made, the larger having an impedance of 4,500 ohms at 200 anode volts, and being suitable for an input of 20 watts.

Turning to receiving valves, fig. 8 shows an "ORA" type B, and a 4-electrode (or double-grid) valve is illustrated in fig. 9, which may be connected so as to neutralise the space charge and give good reception at anode voltages of from zero upwards; it may also be used to obtain dual amplification in the anode circuit by coupling the latter through a transformer back to the second grid. As an example of "dull emitters," the D.06 type is well known, but the latest pattern made by the Mullard Co. is the "PM" group, which is composed of the PM2, PM3, PM4, PM5, and PM6. They are all pipless (fig. 10), and the PM3 and PM4 possess an "N"-shaped filament (fig. 11), whilst the PM5 and PM6 have an "M" filament. The four valves take a filament current of only 0.1 amp. which can be supplied by dry cells. Other products are valve holders, fixed tubular condensers, the Holweck molecular pump, and carbonised cellulose resistances; it is claimed that the method of manufacturing wire-wound anode resistances enables the desired value to be attained with a 3 per cent. accuracy. In conclusion, it may be remarked that special classes of valves are produced for the Royal Air Force and the Admiralty.

The "Lux" Fire Extinguisher.—With further reference to Messrs. Walter Kidde & Co.'s "Lux" system of extinguishing fire by the use of carbon dioxide as recently described in our pages, a test was recently carried out at the works of Messrs. Brown, Boveri, of Milan, Italy, to determine what effect a discharge of carbon dioxide at the low temperature obtained with this system would have upon the insulating qualities of a standard 70,000-volt porcelain insulator. The report on the demonstration states that the insulator suffered in no way whatever; in fact, its insulating properties appear to have been materially improved when the insulator was enveloped in the CO_2 gas. Furthermore, it was shown that the stream of CO_2 "snow" produced by the "Lux" system is a non-conductor of electricity even when the distance between the live high-voltage lead and the nozzle of the gas cylinder was only 40 cm., which indicates that the system may be safely used to protect high-pressure apparatus. Another test conducted in America at the station of the United Electric Light & Power Co., New York City, seems to have been equally successful in demonstrating the efficiency of the "Lux" method of extinguishing fires in transformer vaults with the chamber doors either opened or closed.

Edinburgh Electrical Society.—A lecture was given on April 7th by Mr. G. Peers before the above Society on "The Electrical Equipment of a Battleship," when many interesting points, such as fighting efficiency, watertight installations, general lighting, and searchlights, were explained. Mr. J. G. Burchell, president of the Society, was in the chair.

Testing Porcelain Insulators under Artificial Rain.

By R. T. FLEMING, A.M.I.E.E.

(*Concluded from page* 615.)

A.I.E.E. Standards (No. 41, July, 1925) Insulator Test Specifications.

Clause 41-6.—Wet Flashover Voltage.—Wet flashover voltage is the voltage at which the air surrounding a clean, wet insulator or shell breaks down between electrodes with the formation of a sustained arc, the test being made as described under "Wet Flashover Test."

Clause 41-101.—(This clause is in particular reference to pin-type insulators, but the details referring to rain are common to all classes of insulators.)

Wet Flashover Test.—The testing arrangement shall be the same as in the dry flashover test, with the addition of equipment to provide a finely-divided and reasonably uniform spray at an angle of 45 deg. from the vertical and at a rate of 0.2 in. (5.07 mm.) per minute. The water shall have a resistance of from 6,000 to 8,000 ohms per inch cube (15,200 to 20,300 ohms per cm. cube), and shall be delivered to the spray nozzle at a pressure of not less than 35 and not more than 50 lb. per sq. inch (2.46 to 3.51 kg./sq. cm.) measured at the nozzle. The vertical and horizontal dimensions of the vertical area sprayed shall be measured in a plane through the vertical axis of the insulator, and shall be at least 1.75 times the corresponding overall projected dimensions of the insulator. The precipitation shall be determined by measurements taken, with the insulator removed, at the location of the top, centre, and bottom of the vertical axis of the insulator when in its test position.

The water shall be collected in a vessel having a top diameter of 6 inches. Individual measurements shall show a variation of not more than 25 per cent. from the mean of the three measurements.

V.D.E. Regulations. 12th Edition, 1925.

Instructions for the testing of suspension insulators valid from October 17th, 1922.* The spark-over voltage of strain and suspension chains shall be at least twice the supply voltage† when tested under rain falling vertically and at 45 deg. to the horizontal. The specific resistance of the rain should not exceed that of natural rainwater, about 50,000 ohms per cm. cube‡, and the rate of fall should be 3 mm. per min. The test must be carried out as far as possible under practical conditions as regards the position and the suspension of the insulators. The duration of the test shall be 5 min.

For apparatus to be used in the open air, the test voltage should be at least twice the nominal voltage, for 5 min. with the rain falling at the rate of 5 mm. per min. at an angle of 45 deg. C.

L'Union des Syndicats de l'Electricité, December, 1921.

A. Porcelain Insulators. Clause 12.—*Electrical Tests Under Rain.*—Artificial rain shall be produced having a precipitation of 5 mm. per minute. The water shall be taken from convenient mains and shall be at a temperature of 15 deg. C.; the jet shall be directed at 45 deg. to the axis of the insulator as set up in service. The voltage shall be gradually raised until sparkover takes place; this value should not be less than 90 per cent. of that stated by the manufacturer.

The preceding extracts of various testing specifications indicate the points wherein there is variation, and show the necessity of having at present a flexible equipment which is capable of adhering to any limits which may be laid down.

A *résumé* is given in the following table:—

Table II.

Comparison of Several National Specifications.

Nationality.	Authority.	Temp.	Precipitation.	Angle of precipitation.	Water resistivity.
British	B.E.S.A.	15°C.	1" in 5 mins. (0.2"/min.)	45°	Not greater than 20,000 ohms/cm.cube.
American	A.I.E.E.	—	0.2"/min.	45°	From 15,200 to 20,300 ohms/cm.cube.
French	L'Union des Sydicats d'Electricite.	15°C.	5mm./min. (0.2"/min.)	45°	Not stated.
German	V.D.E.	—	3 mm./min. ((0.12"/min.)	45° and 90°	Not greater than 50,000 ohms/cm.cube.

Some Special Tests Carried Out in the M-V Laboratory.

The Variation of Sparkover with Water Resistivity.

The effect of the resistance of the water used in sparkover tests is very marked; this point is mentioned in a recent paper* wherein the author states that one firm is "obliged to reserve the right to deviate from the above figures (presumably quoted in catalogue) at least 10 per cent. up or down," due entirely to the fact that in different tests the water resistivity varies.

In view of the number of contrary results reported for wet sparkover, some tests were carried out on standard 10-in. disk cap-and-pin type insulators to note this effect. The insulators were arranged in a string and the water was adjusted to a certain resistivity at a precipitation of 1 in. in 5 minutes at an angle of 45 deg.; the wet sparkover was then measured. After each flash the length of the string was reduced by one unit and the operation repeated. The results are shown in Table III, and graphically in fig. 12, p. 652.

Table III.

No. of Units.	Sparkover in kilovolts. Water resistivity in ohms/cm. cube.		
	21,200	6,800	1,750
1	47	44	40
2	84	85	73
3	123	115	95
4	164	148	106
5	210	180	145
6	242	212	175
7	282	246	212
8	320	285	242
9	357	310	283
10	396	350	320

Very similar curves to the ones shown have been obtained by the Compagnie Générale d'Electro-Céramique.† The unifying effect on the voltage distribution under rain is worthy of note and can be seen to advantage in the following table, giving string efficiencies based on Peek's empirical formula‡:—

$$\text{String efficiency} = \frac{\text{S.O. on } n \text{ insulators.}}{n \times \text{S.O. on 1 insulator.}}$$

* Adopted at the annual meeting, 1922, published in the *E.T.Z.*, 1922, p. 134.

† If the standard for suspension insulators is adhered to, the words "supply voltage" are to be replaced by "nominal voltage."

‡ A specific conductivity of 20 corresponds to this value.

* "Developments in Porcelain Line Insulators," by J. L. Langton, read before the International Conference of Large Electric Systems. Paris, 1925.

† Essais à très haute tension à sec et sous pluie sur Chaines d'Isolateurs, p. 17.

‡ Peek, "Electrical Characteristics of the Suspension Insulator. *Proceedings*, A.I.E.E. May, 1912.

Table IV.

No. of Units.	S.O. Dry.	Efficiency.	S.O. Wet. Water, 21,300.	Efficiency.
1	80	1·0	47	1·0
2	145	0·855	84	0·89
3	195	0·813	125	0·87
4	245	0·768	164	0·87
5	290	0·726	210	0·89
6	340	0·707	242	0·86
7	380	0·679	282	0·86
8	420	0·657	320	0·85
9	460	0·639	357	0·845
10	495	0·62	396	0·84

It will be noted that in the case of a dry string there is a steady decline of string efficiency to 62 per cent. at the eighth insulator, whereas in the case of the wet string the figure becomes 89 per cent. at the second insulator, and shows only a very slight decrease throughout the whole string; this feature is noted in the cases of wet tests whatever the resistivity of the water may be, the actual value of course altering. In general, the lower the water resistivity the lower the constant value for string efficiency. As a result of a number of tests at varying resistivities, it has been attempted to plot a series of curves (fig. 13) showing the variation of the sparkover voltage of strings of insulators consisting of one up to *ten* insulators. The particular use of these curves is to enable one at a glance to estimate the wet sparkover voltage for a given set of conditions. The curves cover tests at a rainfall of 0.2 sq. in. per min. inclined at an angle of 45 deg. It is impossible to maintain that the curves are perfectly accurate; they should only be regarded as an approximate check. The following Table V shows the percentage decrease in sparkover value as a function of the water resistivity. A resistivity of 20,000 ohms/cm. cube is taken as a 100 per cent. basis, it being the most usual figure aimed at in English practice.

Table V.

No. of units.	Water resistance in ohms/cm. cube. 20,000 %	16,000 %	12,000 %	8,000 %	6,000 %	4,000 %	2,000 %
2	100	93·5	98	92	88	85	79
4	100	99	97.5	92	86	82.5	67
6	100	97.5	95	90	86	80	74
8	100	98.5	95	91	88	84	78
10	100	97·5	96	90	87	85	82

The tests indicate the necessity of specifying the water resistance when carrying out S.O. tests under rain, and the advisability of having equipment with which these measurements can be made quickly and accurately.

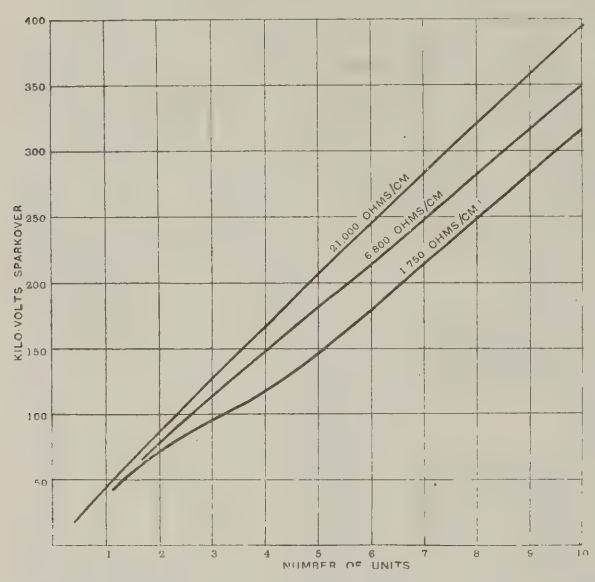


Fig. 12.

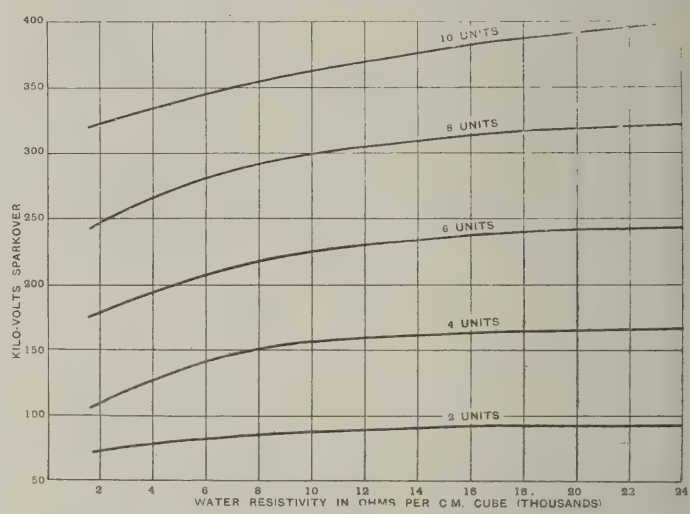


Fig. 13.

Figs. 12 and 13.—Variation of Sparkover with Water Resistivity and Number of Units.

Variation of Rate of Rainfall.

The tests on the insulators under varying water resistivity have shown the necessity of knowledge of factors when carrying out S.O. tests; to complete this a further number of values were obtained with alteration of the rate of precipitation, all other conditions being kept as standard as possible (*i.e.*, rain at 45 deg., resistivity 20,000 ohms per cm. cube).

Tests were carried out in a similar manner to those

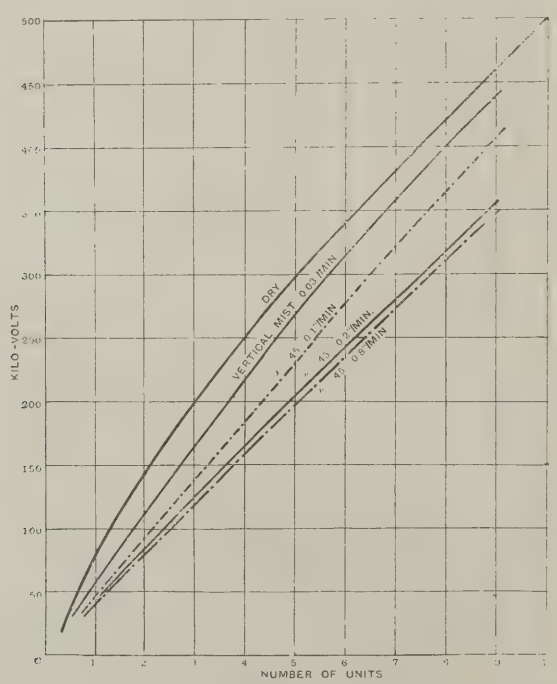


Fig. 14.

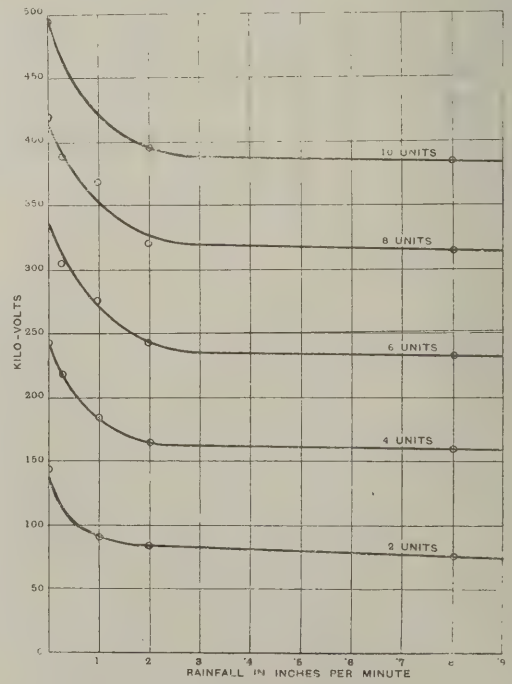


Fig. 15.

Figs. 14 and 15.—Variation of Sparkover with Rate of Rainfall.

previously reported; the results are given in Table VI and shown graphically in figs. 14 and 15.

Table VI.

No. of units.	Fine spray falling approx. vertically. 0.03"/min.	Rain falling at an angle of 45° to the vertical. Pressure 20 lb./sq.in.		
		0.1"/min.	0.2"/min.	0.9"/min.
1	·8	50	47	45
2	1·0	87	84	72
3	166	137	123	1·6
4	216	185	164	160
5	270	224	210	194
6	306	277	242	233
7	392	312	282	272
8	—	370	320	315
9	—	405	357	350
10	—	—	396	386

The results show quite a marked increase in S.O. values with precipitations lower than 0.2 in./min.; this is specially so in the case of a vertical mist where the values almost reach the magnitude of dry S.O. Any rainfall greater than 0.2 in./min. does not lower the values to any marked extent, as is shown in the comparatively small discrepancy between 0.2 in./min. and 0.8 in./min. The results indicate the necessity of obtaining at least 0.2 in./min. rainfall, which is the specified B.E.S.A. figure. The following Table VII shows the percentage decrease in sparkover value as a function of the rate of rain precipitation; the dry sparkover value is taken as 100 per cent.

Table VII.

No. of units.	Dry S.O.	Rate of rain precipitation at 45° in ins./min.			
		0.05"	0.1"	0.2"	0.8"
	%	%	%	%	%
2	100	89	62	57	52
4	,,	84	74	67	65
6	,,	87	80	72	68
8	,,	90	87	78	76
10	,,	93	85	80	77

The author wishes to thank the Metropolitan-Vickers Electrical Co., Ltd., for permission to publish the tests; Messrs. Bullers, Ltd., Evershed & Vignoles, Ltd., and Drake & Fletcher, for leave to publish photographs of their products; and Mr. J. B. Mitford, of the M.V.E. Laboratory, for valuable assistance in the experimental work and general preparation.

[Correction.—In the first part of this article (April 16th issue, page 614) under fig. 8, for "Dry, 355 kV" read "Dry, 422 kV," and for "Wet, 163 kV" read "Wet, 320 kV."

Under fig. 9, for "Dry, 370 kV" read "Dry, 355 kV," and for "Wet, 285 kV" read "Wet, 163 kV."

Under fig. 10 the values should also be reversed.]

The Future Price of Electricity.

An Estimate of the Limits Attainable.

By "INVICTUS."

Whilst we eagerly await details of the Government scheme for dealing with electricity supply in this country,* it is interesting to probe future possibilities as to price: to work from practical experience through the fluxing present to a future which, without being Utopian, is yet not inconceivable. What may we take to be the economic limit in the light of present experience, plus a little optimism?

According to the latest figures published by the Electricity Commissioners, the average cost of generation throughout the country for 1923 was 0.54d. per unit, and the average price paid by all consumers was 2.07d. per unit—roughly a ratio of 1 : 3, *viz.*, generation ½d., other costs 1½d. A view of practical merit is that this ratio should be "fifty-fifty." Before examining this, it is well to consider the question of reliability of supply. High efficiency in generation, though important, is not so supreme a consideration for this country as reliability. If reliability is now given the degree of importance it demands, a period will be put to experiments in the siting of so-called super-stations. Even interconnection has its limits narrowed down by the two factors of price and reliability.

The present cost of a capital steam station may be put at £18-£20 per kilowatt of plant capacity. As a substitute for some spare plant, £20 per kilowatt of cable capacity represents equality. This is reached with a 5,000-kW cable 40 miles long, but its full duty would entail a loss of 10 per cent. in transmission. Such a cable might save the cost of a certain amount of stand-by plant, but yet there must be a margin at both ends to enable assistance to be given in emergencies. Also, such a cable might usefully give and receive energy along its route, and it is this consideration chiefly which favours comparatively short cable interconnectors for use in this country.

It may be said that the cost of an equivalent overhead line would be only half that of a cable. But is it not probable that overhead construction for high voltages in this country is foredoomed to early scrapping? For low and medium pressures, for distribution purposes in rural areas, it is necessary, but for other purposes it is a timid expedient—a makeshift upon the pretext of economy. Reliability should not be sacrificed lightly, and it will not be economy to spend much money upon vulnerable, arterial, overhead lines in this country. They are liable to grave interference by lightning, birds, and atmospheric deposits over the insulators, which lead to failure. The insulators also invite potshies from the exuberant youth of the districts which such lines would traverse, whilst maliciously-fired rifle or even catapult shots would play havoc at any moment. Further, overhead lines require constant patrol, whilst their life cannot be expected to equal that of a modern cable laid underground.

The soundest course for development appears to be to install modern generating plant, including ample margins of spare, at or near the load centres, and to interconnect with cables when they will improve the degree of reliability or are obviously desirable from other practical points of view. There are many situations where advantage can be taken of the efficiency of large generating units, but much smaller plant can give very efficient results—and better reliability.

There is a national point of view about this matter which is not, perhaps, at once apparent. Generating plant produced in this country very largely utilises our own natural products, such as steel and iron. Our works are equipped for its manufacture, and our artisans and labourers have generations of inborn mechanical skill as their heritage for its making. By employing all this and producing plant for our own use, we shall be able to produce for export at prices which, together with the goodwill which goes with our international reputation for similar products, will further develop our oversea markets and so enrich our home conditions of life.

In the production of cables or overhead lines, most of the materials have to be imported by us, and the proportion of labour cost for manufacture is small, with no bulk of skill.

There is a better case for the development of our electricity supply industry by installing modern plant than by the wholesale scrapping of existing stations, merely because they are not large. Let them be made efficient with modern plant, where such plant would enable reasonably low generating costs to be obtained.

* This article was received on February 27th, 1926.—Eds.

Without question, there are many existing stations which should be shut down, and a bulk supply is the obvious need, especially where a more important station is not far away. Bulk supply should always imply a dual supply. When taken, it should be distributed as alternating current, or at least only partially converted whilst the change-over from direct current is effected. In most cases the change-over is but a puny giant if it is fully examined.

This digression upon the theme of reliability and method was necessary for the satisfactory study of future price.

We may expect to achieve average generating costs of 0.3d. per kWh with coal at present prices. If, as seems possible, the price of coal should advance, our average will exceed 0.3d.

With a present consumption of, say, 100 kWh per head of population per annum, the "other costs" amount to 1.5d. per unit. A consumption of 500 units per head suggests the figure of 0.3d. per unit for the "other costs," or the ratio of fifty-fifty previously mentioned. There is no fundamental verity about this particular ratio, but it does appear to bear a certain significance.

Five hundred units per head and a load factor of between 50 and 60 per cent. are not extravagant anticipations, but for a population of fifty millions it gives an output of 25,000 million units per annum, with a top load of five million kilowatts. Allowing reasonable margins for spare, with some interconnection, the total installed plant capacity will be, say, 6 million kilowatts. At £18 per kilowatt installed, the capital sum will amount to 108 million pounds sterling. Interest and depreciation upon this, taken at 10 per cent., amounts to nearly 11 million pounds per annum—about 0.1d. per unit for the output estimated.

For transmission and distribution a similar amount of capital expenditure will be called for, so that this also indicates the figure of 0.1d. per unit.

A further similar item will be required for repairs and maintenance in connection with transmission and distribution, together with management, rates, taxes, accounts, publicity, and reserve.

All charges may therefore be considered as follows:—

	Pence per unit sold.
(*a*) Generation	0.3
(*b*) Capital charges (generation) ...	0.1
(*c*) Capital charges (transmission and distribution)	0.1
(*d*) Recurring expenses	0.1
Total	0.6

Of the above items, (*a*) and (*b*) are common to every load, but (*c*) and (*d*) are subject to apportionment between producing and retailing organisations.

At two-part tariff rates the total revenue requirements are met by a charge of £6 per annum per kilowatt of installed generating plant, plus 0.3d. per unit; or (allowing a diversity of 1.5, including spare plant provision) £4 per kilowatt of the purchaser's maximum demand, plus 0.3d. per unit. The kilowatt charge is capable of further easing by an appropriate division of the items (*c*) and (*d*) as between producer and bulk purchaser.

In the light of these considerations it seems that present-day prices are not so very far removed from the visible limits, at least so far as the bulk of the present output is concerned. It is unfortunate that insufficiently-informed speakers should talk at large about supplies at 1d. per unit. This leads quite satisfied consumers, who are at present paying reasonable prices for lighting and certain other purposes, to expect the impossible. Even popular price cutting is liable to bring an unwelcome reaction in the course of a year or two. We should not forget the advent of the metal-filament lamp, the regrettable audacity of the "point fives," and the possible prices of copper and lead.

The foregoing computations refer, of course, to average figures for the whole country; they imply a range of prices to consumers between about 0.5d. per unit for steady industrial loads of long-hour duration and the present rates for short, overlapping loads of little inherent diversity, such as shop lighting. Domestic requirements, other than lighting, will probably be met, eventually, at an average figure of about 0.6d. per unit. Upon a calorific value basis this figure compares most favourably with coal gas distributed at 9d. per therm.

None of these figures include the enormous volume of business that they predict in house wiring and the installation of motors and other consuming apparatus. Supply authorities must cater for this in its entirety. It will call for large capital expenditure, but since all expenditure can be made profitable from the first through sales, hire-purchase, and simple hire, it can always sustain its own sinking fund, and is not an item of cost in electricity supply.

In conclusion, let it be said that the best-informed supply engineers throughout the country have confidence in the Electricity Commissioners and wish to see them vested with the greater authority which it was originally intended they should have. It is to be hoped that they will remodel the present constitution of joint electricity authorities by establishing smaller councils, with a local Commissioner. The present solemn, but inept, meetings, mainly attended by numbers of delegates from borough and urban councils and some other remarkable bodies, who advise without knowledge, and know as much about electricity supply as they do of gunnery ballistics, are a pitiful travesty of what should be a brisk and efficient zonal organisation. Surely chartered electrical engineers, to whom alone all the credit is due for the flourishing state of our industry to-day, should be the delegates—not the haberdasher or squire who happens to be upon a local council or some other vaguely interested body.

The Law of Contract.

By HERBERT G. CLAYTON, A.I.S.A.

Electrical contractors, especially those in a small way of business, frequently appear to be in some doubt regarding the legal rights and duties imposed on them by various contracts.

One of the first essentials to remember when two parties meet for contractual purposes is that they shall be *consensus ad idem;* that is to say, they must be of one mind regarding their intentions and the subject-matter of the agreement. Otherwise, mistake of purpose will arise, which may result in the contract being invalidated.

A contract has been defined as an agreement, enforceable at law, between two or more parties for the provision of goods or services, in exchange for money or other goods or services. There are three classes of contracts:—

(*a*) Specialty contracts (under seal).
(*b*) Simple (or parol) contracts.
(*c*) Contracts of record.

There are certain cases where it is absolutely necessary to have the contract made under seal, but in modern business this is not usually necessary, and this type of contract has been largely superseded by the simple contract, which, however, must conform to certain requirements to make it legally enforceable. One of the chief distinctions between these two classes of contracts is that the simple contract requires what is technically known as "consideration" to make it binding; whereas in a specialty contract this is unnecessary.

Furthermore, although contracts under seal must be written, witnessed, sealed, and delivered, simple contracts may be written, verbal, or implied. There are a few exceptions to this rule, and the one which is most likely to affect electrical contractors generally is the provision under the Sale of Goods Act, 1893 (Section 4), which enacts that goods to the value of £10 and upwards must be evidenced in writing and signed by the party placing the order, or, alternatively, that there must have been part performance of the contract.

It will be found that whenever a contract has been made there has been an offer to do a certain thing on the one part, and the acceptance has taken place on the other part. It is important to note that the acceptance of the offer must be unconditional, otherwise no contract has been effected, but simply a counter-proposal. The acceptance must also take place before the offer is withdrawn or revoked. As soon as acceptance of the offer takes place in the manner provided, it is conclusive; the contract is complete and cannot be revoked without cause for an action for damages arising.

An important point for electrical contractors is the legal position of offers (*e.g.*, estimates) sent by post. In these cases, the Post Office is deemed to be the agent for the party first using it. Consequently, when an offer is posted by a contractor, the Post Office is deemed to be his agent, and as soon as the customer receives the letter and accepts the terms, the mere act of posting his acceptance completes the contract. It is not necessary to wait until the communication is actually delivered. Conversely, if an offer is withdrawn by post, the revocation does not become effective until the letter has been delivered.

In making a simple contract, it should be noted that there must be valuable consideration to make the agreement enforceable at law. Consideration may be briefly defined as "some interest or profit accruing," which is required to show that it was not a gratuitous promise, as such a promise must be made under seal. For instance, if a promise is made to keep an offer open, this requires consideration, or, alternatively, it must be made in the form of a specialty contract. In addition, a promise to pay a smaller amount in discharge of a larger debt, necessitates consideration (however small) passing; otherwise, even if the smaller amount is accepted, there is nothing to prevent the creditor sueing for the balance at some future date.

The mater of contractual capacity is of importance to the contractor, and it should be noted that all contracts made with minors, except for necessaries, are void (Infants Relief Act, 1874). The exception to this statement is in the case of apprenticeship contracts, which are binding on all parties. The Court, however, if appealed to, will always review such contracts if harsh and unconscionable conditions are alleged, and if and when necessary will grant relief.

In the case of companies, any contract made outside the capacity of the powers conferred in the Memorandum of Association is *ultra vires* the company, and cannot be enforced or ratified. Any contract, however, made *ultra vires* the directors, but within the powers of the company itself, will be effective if ratified by the members of the company.

If there is breach of contract, the usual remedy is an action for damages. When, however, damages would not give the desired result, "*specific performance*" may be ordered by the Court; this sometimes applies to the sale of special goods which cannot be obtained elsewhere.

Damages may be liquidated (assessed in contract) or unliquidated (loss incurred through breach of contract). If a cause for action at law arises, the Court will scrutinise the liquidated damages clause very closely, and if it is apparent that it is really a penalty clause, in spite of its name, the Court will grant relief, the reason being that the Court holds that it alone has the power to inflict penalties.

The London Electrical Engineers.—27th (London) Anti-Aircraft Battalion, R.E. (T.A.).—Officer Commanding, Lieut.-Col. C. H. S. Evans, O.B.E.—The following orders have been issued for May, 1926: 304th Company, Major P. F. Foulger. 305th Company, Major A. W. M. Mawby, O.B.E., Tuesdays 7 p.m. to 9-30 p.m. 306th Company, Major F. C. Clarke. Monday, 7 p.m. to 9-30 p.m. The Easter Camp at Biggin Hill was well attended. On Friday and Saturday night an aeroplane was engaged by four searchlights; the standard of work done was uniformly good and special mention should be made of one light manned by recruits. All ranks were exercised with sound locators and were fortunate enough to be given a lecture and demonstration on three different types of aeroplanes, by their respective pilots.

Modern Electric Furnace Practice.

A Review of Some of the Methods of Installation and Operation.

By "LAPIS LAZULI."

In fixing the connections for an electric furnace the electrical engineer usually encounters numerous obstacles although, as a rule, none of them is particularly complicated. It may be helpful, however, to outline the process necessary to ensure the correct electrical conditions being maintained. At the outset it will be realised that "arcing" with a current like one employed in a steel-refining furnace is a matter of no small importance, and it largely falls to the duty of an experienced man to see that connections are properly made, and the clutch which carries the current to the electrode must exert an exceptionally firm grip on the carbon. Any slackness in screwing up the clutch, bolting and tinning the bus-bars, and other similar points would lead to disastrous results when the heat developed, as the arc at any slight space obtaining would melt away copper and carbon alike in a few moments. Similar results would be brought about if the arrangement which keeps the electrodes in proper alignment were allowed to move or even vibrate; also if the carbons came into contact with the side of one of the metal holders.

The bus-bars carrying the current from the transformer to the furnace are usually arranged overhead with the phases kept well apart; this is done with a view to preventing accidents when the furnacemen are carrying long pinches, rabbles, and other furnace tools.

The bus-bars are usually connected to the furnace by means of cables; in the arc furnace cables alone are used, but with the arc-resistance type it is customary to extend or divert the bus-bars close to the bottom connections, where a short length of cable is employed to permit the tilting of the furnace. A "box" lug is used for the bus-bar connection. The bus-bars are supported by iron bars, suitably insulated, and wooden spacers are employed. As a rule the transformers are housed in a small chamber adjoining the foundry, with a hole in the wall allowing the bus-bars to be connected directly to the transformer. This space, which is often left open, should be filled in with asbestos or any other suitable insulating material as soon as the installation is completed, as it prevents foundry dust finding its way into the transformer.

Most of the furnaces in this country are employed on a two-phase supply, the h.p. 3-phase supply from the generating station being dealt with by Scott-connected static transformers. The voltage is tapped off as required, with the aid of a selector switch controlled by an oil switch. Current and potential transformers are used in connection with the measuring instruments, and the supply is metered after each "heat," the consumption per ton of steel cast being recorded. Various controlling arrangements are employed on different furnaces, and the switches and other equipment are usually installed on a panel fitted into the wall of the furnace. To bring the current on to the metal in the hearth in the ordinary arc and arc-resistance types of furnace, the electrodes are carefully lowered until the arc is struck.

When the metal is cold the current is liable to surge violently, due largely to the irregular shapes of the pieces of scrap. This is apt to throw out the trip switch, which is brought in again after the electrodes have been raised. As the metal becomes melted the surging decreases, and at the final stages it ceases altogether. A small switch in circuit with the transformer switch coils is used to open the switch immediately in the case of emergency. This is only used in exigencies such as the furnace roof falling in, and arcing at the terminal boxes. The tilting mechanism of the furnace is provided with trip switches, so that the shell cannot be damaged by over-tilting. When the charge is ready for tapping, the electrodes are first raised, the ladle is then brought into position and the furnace tilted.

Arrangements are made to see that the electrodes are firmly fixed, although raised from the actual hearth, as in the tilting there is some risk of their being broken. In the older types of furnace the electrodes were continually being fractured by intermittent exposure, when hot, to the cold atmosphere. In the modern furnaces economisers are used which reduce these losses to a minimum. Current losses are one of the most important points in furnace efficiency, and the proper method of insulation at the leading in and out places of the shell is essential to success in this direction.

Although the Scott-connected transformers are provided complete with switches, it is the usual practice to transport them with the parts dissembled, the reassembling being effected at the steel works. From this it will be observed that such work necessitates a sound knowledge of the process, from the introduction of the high-pressure energy to the final stages of the melting. It should be added that the employment of current regulators has made electric furnaces more acceptable to the supply undertakings, as violent surging is eliminated.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity Bill.—We understand that the Electricity Bill will be considered by a Committee of the House of Commons during next week.

Electrical Energy Generated.—On April 15th Mr. H. Williams asked the Minister of Transport if he could state for the year 1925 the amount of electrical energy generated by all authorised undertakers and by railway and tramway companies; and the estimated quantity generated privately.

Colonel Ashley said that the returns submitted by authorised undertakers for the year 1925 had not yet been completely verified. The unchecked returns showed that approximately 6,685,700,000 kWh was generated during the year ended December 31st, 1925. With regard to railway and tramway companies, complete figures were not yet available for the calendar year 1925. Complete data in respect of private generation were not available. A rough estimate, however, from which he saw no reason to differ, was given in the Weir Report that the total national consumption from all sources in 1923 was about 200 kWh per head. During that period the energy generated by authorised undertakers amounted to 4,016,000,000 kWh.

[The last figure is that given in the Weir Report for "Units Sold." The energy generated was 4,572 million kWh.—Eds. Elec. Rev.]

Legal.

Alleged Theft of Electricity.

At the Newcastle (Staffs.) Police Court, on April 15th, John Stanley Cook, electrician, was summoned by the Corporation for the fraudulent abstraction and use of electricity. The Town Clerk, prosecuting, said that the defendant had employed for lighting purposes energy which had passed through a power meter, thereby securing it at a much lower rate. Evidence was given by employés of the Electricity Department to this effect, and one of them admitted that as the lamp in question was fitted it acted as a resistance for the charging of accumulators. Counsel for the defendant maintained that his client had no intention of defrauding the local authority; for twelve months he had openly charged accumulators in his shop, using a 200-W lamp as a resistance. Others in the district also charged batteries in that way. The lamp was only used for illumination purposes incidentally. The magistrates considered that a *prima facie* case had been made out, and committed the defendant for trial at the Borough Quarter Sessions.

Claim for an Electrical Installation.

At Southport County Court recently, Mr. G. H. Turner, electrical engineer, sued a Mrs. Howarth for £18 6s. 10d., balance of account for installing electric lighting to her order. The total bill was stated to be £48 6s. 10d., and his Honour Judge Dowdall said that he had had an electrical installation put in his house, with 27 lights and 30 points, at a cost of £35; it was lead-covered work.

P. Morley, electrical engineer, said that screwed tubing was very expensive. He would not estimate at under £2 a point.

For the defence, G. Littler, electrician, said that he estimated the job at £33 10s. He and an assistant could do the work in a fortnight at the outside; two hundred hours were unreasonable.

His Honour said that he thought the work might have been done more quickly. At the same time, he did not doubt that the time was put in. That would have been a suitable case for arbitration by an expert. He gave judgment for the plaintiff for £15 10s., with costs.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Fine Regulation of Resistance.

I am afraid I cannot see eye to eye with your correspondent who signs himself "Rheostat." His suggestion that a straight line type of rheostat with 150 contacts will meet all requirements for fine regulation scarcely needs refutation as more steps than this are frequently called for and supplied.

The Multistep Rheostat was designed to meet these requirements, and the fact that it gives 600 uniform steps when the designers of alternators and converters would be content with less, is surely no disadvantage.

During the introduction of railways there were doubtless gentlemen writing to the papers under appropriate pseudonyms pointing out the efficiency of the horse as compared with a steam engine, and whilst the difference between 150 and 600 steps is not so great, it nevertheless represents a small step in advance and one for which there has been a demand for some years past.

R. Amberton.

London, S.W., *April 16th*, 1926.

I read with interest Mr. Amberton's article on the Multistep Rheostat which appeared in your issue of the 9th, and have since had the advantage of seeing the apparatus.

But for the fact that a letter signed "Rheostat" and containing disparaging remarks was published in your issue of the 16th, I would not have encroached upon your space, as the article on the Multistep sets out its characteristics so clearly that I should have thought its utility would have been evident to all technical readers.

It solves an old problem—and in my opinion solves it remarkably well. Moreover, an inspection of an actual Multistep Rheostat shows it to be a simple, well-thought-out piece of apparatus, the only complication being in the inception of the idea, and not in its mechanical or electrical features.

One point occurs to me which Mr. Amberton did not emphasise in his article. With a limited number of steps of the order of, say, 100-150, it is not possible to specify the resistance and stepping of the Rheostat until after the alternator has been built and excitation curves have been plotted. The provision of 600 steps on the Multistep Rheostat will make it possible for the designer of an alternator to allow an ample margin of resistance and not to trouble himself about stepping. He will also have the advantage of having the Rheostat on hand and available as soon as the alternator is ready for test.

C. A. Ablett.

Manchester, *April 17th*, 1926.

I think that "Rheostat" has rather missed the point in his criticism of Mr. Amberton's apparatus.

The plain rheostat of 150 steps is hardly comparable in smoothness of working with one of 600 steps, and the 151 electrical connections needed are very many more than the 85 which Mr. Amberton requires. I do not suppose this gentleman ties himself to 600 steps, but presumably if a 150-step resistance is required it could be made on his principle with a similar large reduction in the number of electrical connections. The fewer these connections are, the easier it will be to keep them clear of one another.

F. A. Greene.

London, *April 17th*, 1926.

Three-phase, 4-Wire Distribution.

I should be glad if any readers would kindly inform me whether the variation of pressure is very marked on a 3-phase, 4-wire supply with unbalanced loads on the phases, using three 3-phase core-type transformers, connected star/star; also whether they would recommend the star/star connection in preference to the delta/star, having regard to the fact that the former permits of single-phase transformation in the event of one of the transformers becoming inoperative.

Inquirer.

April 15th, 1926.

Country-house Fires.

My attention has been directed to a letter in your issue of the 2nd inst., signed J. Price. I think that the statement that insurance companies do not "cause very careful tests to be made" needs some modification, as a perusal of the reports called for by the tariff companies specialising in engineering insurance will show that a definite report is required from the surveyor as to earthing and tests and examination of the earth wire. There are, of course, non-tariff companies which run engineering insurance as a branch and do not insist even on inspections, and it is at these companies that the brickbats should be thrown, as they will generally accept risks which an engineering insurance company has refused for some reason. The greatest stumbling block the surveyor meets with is very often the clients themselves, who object and sometimes refuse to allow the surveyor into those parts, labelled, on the dis. board "Principal Floor—1st Floor

Principal Rooms," &c., to take out lamps or test sub-circuits, so that an insulation test to earth from the main switch over the whole circuit is all that is possible; should the insurance company insist on a full series of tests, the only intimation is that the clients have changed their insurance to another company, generally one which does not insist on inspections. As regards insurance companies and qualified engineers, a little investigation would show that engineering insurance companies require quite as good qualifications of their surveyors as any manufacturer requires of his technical engineers. While it is generally agreed that installation inspections should be compulsory, something is also required to compel occupiers to allow proper tests to be made irrespective of the company with which they are insured.

Engineer Surveyor.

April 15th, 1926.

The Qualifications of a Salesman.

"Qui Pense" raises an important point in the qualifications of an engineer. Box numbers 9739 and 9709 in this issue of the REVIEW both mean:—"We require men who have paper qualifications and have done the same work. At some period of the future we will pay them the sum they have the wit to obtain from us, provided they fit in with our existing staff." Quite legitimate requirements and quite fair, but points to be remembered by men who hope that if they work hard and show keenness their salaries will follow the story books' rule.

I have applied for 100 situations, for 10 of which I held *almost complete* qualifications. Of these ten, three were advertisements "by law compelled" (this form of torture I hope will soon cease) and I was placed on the short list for five.

In the course of these interviews and thinking over them afterwards the following home truths were thrust on me: "Don't accept a temporary or junior job; you might be smythed for a better job or promotion. Don't be a new broom. Don't show too much enterprise or keenness for the job or take your coat off afterwards; this is taboo. See that the sport you take up is the correct sport. Don't like any other."

Nildes.

April 12th, 1926.

Overhead Transmission Lines.

I recently had the opportunity of inspecting an overhead transmission line erected in 1915 and, considering the time it was erected in what may be called open country, was astonished to find the condition of the galvanised ironwork. The channel arms, insulator pins, arm bolts, connecting earth wires, &c., were deeply encrusted with rust, not any galvanising remaining. I can personally vouch for the fact that the galvanising, when the line was erected, was good, and can only attribute the deterioration to the fact that, with the wind in a certain direction, the smoke from an adjacent railway service was carried across the line. Those who have control of overhead lines know, only too well, the difficulties of shutting down for sufficient length of time to allow any extensive repairs to be carried out.

It has occurred to me that, now that rustless steel and iron can be purchased at a more reasonable figure, it would be an eventual saving if all ironwork in the vicinity of the line conductors were made of this material.

If any of your readers have had any experience in this direction I should appreciate a statement of their views, as it seems to be a matter worth looking into, especially when one considers the projected developments.

James Nelson, M.I.E.E., M.I.R.E.

Bristol, *April 15th*, 1926.

Electric Vacuum Cleaners.

Mr. H. Harrison Dent's most interesting article on "Electric Vacuum Cleaners" in the ELECTRICAL REVIEW, contains much that is instructive and helpful to the trader and the user, and, to say the least, some food for thought for the manufacturer.

One must, however, realise that the average user, unless he be of an enquiring disposition, or engaged in engineering himself, has very often neither the time nor the inclination to conduct even the most simple tests when purchasing this appliance.

In fact, there are probably two reasons which make it somewhat difficult in these times to conduct tests as set forth in Mr. Harrison Dent's article, the first being the growing custom for the manufacturer to go direct to the purchaser, ignoring the contractor altogether, and secondly, the practice now, I think, fairly common, for the manufacturer to provide the demonstrator and to give the demonstration for the contractor, at the private residence of the customer.

The result is that the salesman, who is naturally enthusiastic about his machine, allows his enthusiasm to run away with his better judgment, hence wild and extravagant claims are not infrequently put forward by the salesman who desires to bring off the sale.

It is indeed a pleasure to come across cases where, as in the article in question, due recognition and generous tribute are paid to the advantages and merits of each type of machine. Those who have spent many years in the vacuum cleaner industry know only too well the difficulties that beset them and how hard it is to please the housewife. We realise that the salesmen of competitive firms are, not infrequently, anything but guarded in their condemnation of all machines except their own, forgetting that each machine as a rule has its good points, and, I have no doubt, its faulty ones.

It is constructive criticism, such as Mr. Dent's, that manufacturers can turn to in order to find food for thought. He is, however, treading on thorny ground when he speaks about the advantages or the disadvantages of the rotating brush; it is a point around which a sharp controversy always rages, and one which, I readily admit, is as far from being settled as ever.

It is an acknowledged fact that a vacuum which is too powerful does injure the fabric of the carpet if used frequently; at the same time the revolving brush has much to be said against it. I quite agree with Mr. Dent that the impact given to the carpet by the brush is not violent, but it is, nevertheless, an impact which will in time flick the nap of the carpet and take it into the bag. This constant flicking bruises, if I may be permitted to use this phrase, the nap, and it takes some little while before it becomes apparent; a careful examination of the dust in the bag will show this to be the case.

I trust Mr. Dent will pardon me when I take him up for saying that there is no evidence to prove that the revolving brush is injurious to the carpet. I would point out that the evidence is there all the same, without going to America to find it. The evidence is to be found in the constant complaints of users, who frankly say that they do find the nap of the carpet in the bag. Again, I myself have both seen and handled the evidence.

I gladly grant that a brush is a valuable asset; failure to do so would be unjust to the writer and unfair to the vacuum cleaner itself, but I very much doubt if the policy of the rotating brush is to be desired. I will go further, and will admit that, on a thick carpet, cotton is extremely difficult to pick up unless the end of the thread is standing up; a brush, however, is just as effective if fastened on to the front of the orifice of the machine, as in the case of the old type Croydon "Premier," and this practice is, I think, still carried out in the new model.

This brush is only put on when cleaning a room where sewing has been done; it can easily be removed and cleaned, and does not clog the orifice with hair and so forth, thus preventing the suction falling away.

If vacuum cleaners were used by highly instructed maids all would be well, but my experience is that the faults which arise are not so much faults in design as a complete lack of understanding on the part of the operator; she will look after her sewing machine like a young mother looks after her child, while the vacuum cleaner, because it is a vacuum cleaner, and therefore used for dirt and dust, can look after itself.

I do not think Mr. Harrison Dent's test with flour is quite a fair one, when testing a vacuum cleaner, but I will not complain about it. I am certain that he will find that flour retains moisture longer than sand, and is as a rule when dry, not so susceptible to crumbling as ordinary dirt the molecules of which more easily disintegrate as the machine or nozzle passes over it. The difference is very marked indeed.

The whole question of design is one which to my mind—and I speak from having many years' manufacturing experience in this branch of the electrical industry—calls for serious thought on the part of those who, in this country at any rate, are manufacturing cleaners with what I call an open bag. I am convinced more than ever by past experience that the external bag is neither sound nor healthy. It is astonishing what dirt gets through the bag back again into the room; every bag should be placed in the cylinder of the machine as in the case of the Electrolux and the Regina, and proper provision should be made to disinfect the air after it has passed through the dust chamber, and therefore, the bag, before it passes through the motor housing into the room. It means, I know, the scrapping of much material. If only the users could see the dust that is left on the disinfecting pad they would insist on its being adopted. As far as the provision of adjustments for lowering or raising the nozzle of the machine is concerned, I think that Mr. Dent will agree with me when I say that, speaking generally, they are satisfactory. The real trouble is that they are frequently ignored and, if not, are adjusted so carelessly that I do not think I am stretching the point when I say that in the majority of cases the machine is not given a fair chance. I am convinced that in many cases the orifice is as a rule either quarter or in some cases half open, most of the time the machine is in use. I only wish that more users would test machines before buying, then the machine worthy of merit would hold its own, but unfortunately, the public have, it appears, yet to learn that The Good House-keeping Institute is for the purpose of counselling those who want advice about purchasing domestic articles.

Before closing I should like to ask Mr. Harrison Dent what he considers is an adequate suction. I contend that nothing below 16 to 20 inches as measured with a manometer is really effective.

Alec. Sacré.

Sydenham, S.E.26, *April 16th*, 1926.

The Belgian Electricity Supply Industry.—Of six Belgian electricity supply concerns which have recently issued their report for last year, two are paying dividends of 7 per cent. for 1925, while the other four are paying, respectively, 9½, 10, 11 and 12 per cent.

The Properties and Engineering Uses of Stainless Steel.

By T. R. WILTON, M.A.

(*Abstract of a Paper read before the* Liverpool Engineering Society.)

Two of the causes of corrosion are direct solution of the material, resulting in a gradual wasting away, and galvanic action, causing selective local attack. In the case of wrought iron the first cause alone operates and in the case of steel both causes operate together. An addition of upwards of 9 per cent. of chromium to mild steel suffices to make the material insoluble in water, and therefore should suppress the type of corrosion which occurs with wrought iron. The problem of the dissimilar crystals in steel is overcome by hardening the material by heat treatment, causing the dissimilar crystals to dissolve one in the other and produce a homogeneous agglomerate. In the production of stainless non-corrosive material, we have to guard not only against solubility in water and dissimilarity of the crystalline bodies forming the structure of the material, but also against selective distortion. Stainless steel finished with heavy cuts will rust on the surface, and the same piece will be found immune from rust if this rough machined surface be removed by fine cuts and finished by grinding. The virtue of the polished surface is that only fine machining and careful grinding can produce it, and the distortion of the surface material is therefore avoided or eliminated. The verdict of experiments has been that contact corrosion diminishes steadily as the amount of chromium present in the steel rises, and that when a figure of 16 or 17 per cent. of chromium is reached, most forms of contact corrosion are eliminated.

It was found that stainless steels containing 16 or 18 per cent. of chromium, without other alloy, had a comparatively coarse crystalline structure, which could not be effectively refined by heat-treatment, and were consequently rather brittle. To overcome this difficulty small percentages of nickel were added, and the result is what is know as Twoscore stainless steel, in which general immunity from contact corrosion is obtained by the use of 17 or 18 per cent. of chromium and where a fine structure and good physical properties are restored to this high-chromium steel by the addition of 2 or 3 per cent. of nickel. Such a material may have in the heat-treated condition a hardness of between 50 and 100 tons per sq. in., according to the composition and the treatment, which makes it serviceable for the great majority of engineering applications. Chromium and Twoscore steels have similar characteristics to high carbon steels, in that they can be hardened, if reheated to suitable temperatures, and then either cooled in air or quenched in oil, or even, in extreme cases, water.

The presence of a high percentage of chromium in steel, in addition to making it non-corrosive at atmospheric temperatures, renders it also practically immune from oxidation at high temperatures. Straight chromium steels may resist oxidation or scaling up to temperatures between 800 deg. and 1,000 deg. C., or even higher, depending on their chromium content, and high-chromium-nickel alloys may resist oxidation up to temperatures of 1,100 deg. C. This property is extremely valuable in such applications as inlet and exhaust valves for internal combustion engines. Further, straight chromium steels are stronger at high temperatures than ordinary carbon steels, and the high-chromium-high-nickel steels, are stronger still at high temperatures. This property is extremely valuable in exhaust valves for internal combustion engines, enabling them to resist deformation under repeated impact when working red hot, and the possibility of constructing gas turbines in the near future probably turns upon the use of such alloy steels. In hydraulic machinery at a steel works the author has found the life of packings with stainless rams to be from 3 to 10 times that with ordinary steel or bronze rams.

For some reason that we cannot yet explain, stainless steel will not slide on stainless steel under pressure without seizing. The best slide-valve combination, known by the author, uses stainless steel for one of the sliding faces and a nickel-copper alloy for the other.

The blading of both impulse- and reaction-type turbines is another field which has been strongly invaded by stainless materials. The original machines were all bladed with bronze, which had many characteristics. It was readily produced in blading profiles, either by extrusion or by cold-drawing; it was easy to solder or braze in ways of shrouding bands; and it was soft and easy to machine. But with the advent of higher steam pressures and considerable superheats, bronze blading could no longer stand up to the work, and trials were made with steel. The most popular steel up till recently was mild nickel steel, generally 5 per cent. of nickel being used. Very high nickel steels (25 per cent.) have been used, but prolonged exposure to high steam temperatures induces extreme brittleness in this material. Cases of disastrous blade-stripping have occurred from this cause. But the low nickel steels, while physically stronger than bronze, suffered from corrosion, and in impulse turbines, from erosion and pitting. Within the past three or four years many of the largest turbine builders have adopted stainless-steel blades either exclusively or very extensively

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Wages in the Contracting Industry.—The National Federated Electrical Association, while unable to agree to the Electrical Trades Union's request for the restoration of the 5 per cent. "cut" made in 1923, has decided to revert to the National Sliding Scale Agreement of September, 1921, by which wages rise and fall in accordance with the cost-of-living index. The hourly rates to be adopted, as from the week covered by the pay-day April 30th or May 1st, are as follows:—Grade A, 1s. 10½d.; Grade B, 1s. 8¼d.; Grade C, 1s. 6¾d.; and Grade D, 1s. 5¼d. We are informed that this implies a general increase of ½d. per hour.

"Buy British Goods."—At a luncheon of the London Commercial Club last week, Sir Philip Cunliffe-Lister, President of the Board of Trade, said that the placing of orders at home not only meant more employment but increased the volume of trade and enabled prices to be reduced, giving British manufacturers a better position in foreign markets. The Government was practising what it preached. The G.P.O., one of the biggest buying departments, only purchased ½ per cent. of its requirements abroad, and the foreign purchases of the Stationery Office were only 1½ per cent. On behalf of the Government he appealed to local authorities to adopt the same policy; some were not buying British goods. Another matter in which these authorities could be helpful was in standardisation of requirements.

City Electricity Charges.—The report of the special committee on electricity charges, which was reviewed in our last issue, was presented to the City of London Corporation on April 15th. Mr. Deputy Sandle said that although the protests of the Corporation and the London Chamber of Commerce had borne some fruit, the prices were still too high. During the past seven years the companies had been able to put to reserves a sum equal to the whole of their ordinary capital, in addition to paying dividends totalling 101 per cent. in the case of the City of London Electric Lighting Co. and 82½ per cent. in the case of the Charing Cross Co. Mr. Sandle quoted figures showing that large firms in the City paid the companies twice as much for electricity as they would have had to pay Stepney Borough Council if that body had been able to supply them. The Corporation adopted the report which, it will be remembered, recommended that further action should be deferred until the results of the working of the London Electricity Acts were seen.

A "Stay-In" Engineering Strike.—The employés of Messrs. R. Hoe & Co., who were recently involved in the strike which threatened to lead to a national lock-out, suspended work without leaving the shops on April 14th. The reason for their action was stated to be the transfer of a foreman from one shop to another. The A.E.U. discountenanced the strike. The men resumed work on the following day, an agreement having been reached.

Unemployment.—The Employment Exchange registers for April 5th showed an increase—the first for some weeks. At that date the number of wholly unemployed persons was 1,049,800, as compared with 1,013,609 on March 29th and 1,166,353 on April 6th, 1925. The increase is said to be due to temporary stoppages at Easter.

The Canadian Budget.—Mr. Robb, the Dominion Finance Minister, introduced his Budget in the Canadian House of Commons last week. Among the points in his speech were announcements that the two-cents post would be restored on July 1st; that the British preferential tariff, after January 1st next, would only apply to goods conveyed directly to Canadian ports; that the income taxes would be substantially reduced; and that the duty on equipment for generating electricity for farm purposes was to be reduced to 5 per cent. under the British preferential tariff, and to 10 per cent. under the intermediate and general tariffs.

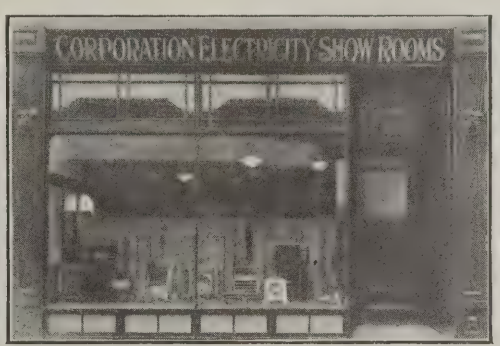
Registered Contractors.—The following contractors were approved for registration at a meeting of the Executive Committee of the National Register of Electrical Installation Contractors at its meeting on April 9th :—

Dodd, W. G., Ltd., Ayr.
Gilliver & Crouch, S.W.1.
Truman Electrical Co., Walsall
Henderson, T., Durham
Stearn, R. J., & Co., Luton
Brewster, G. M., Manchester
Gilkes, G., & Co., Ltd., Kendal
Milsted, C., & Sons, Tenterden
Sandon Motor & Engineering Co., Ltd., Liverpool.
Bannister, J. D., Padiham
Harvey, E .A., Nottingham
Hynds & Co., Belfast
Napier & Wheeldon. Hull
Glover, E. & H., Darlington
Elphick, C , Tunbridge Wells
Read & Partners, Ltd., S.W.1
Hardy, G. A., Leek.
Williamson, W. M., S.E.22
Beckett & Wheatley, Aston, Birmingham
Long, T. J., & Sons, Hexham-on-Tyne
Ajax Co., Ilford
Giffen, R. A., St. Albans
Andrews, H. A., Dublin
Laws, H., Ashington
Walsall Electric Supply Department
Cunningham, J., Pollokshields, Glasgow
Parkin, E., & Son, Newport, Mon.
Dalbeattie Electric Light & Power Co., Ltd.
Watson, A., & Dundas, Partick, Glasgow
Alden, F. G., Oxford
Bonham, J., & Co., Willington Quay-on-Tyne

New Municipal Showrooms.—On April 8th, the Mayor of Birkenhead opened the Electricity Supply Department's new showrooms in Grange Road West. The popular Jacobean style has been adopted in the decoration of the new premises and a very comprehensive collection of appliances has been gathered together. As will be seen from the accompanying illustrations the showrooms have an attractive exterior. A large number of lighting fittings are displayed, and each is separately switched to enable it to be demonstrated. In the same apartment vacuum cleaners, fires, fans, and many other appliances are shown. In accordance with the invariable practice a part of the showrooms has been set aside as an electric kitchen for the exhibition and demonstration of electric cooking, water heating, &c., while another section is devoted to laundry appliances—washing machines, a wash boiler, and an ironer.



Fittings Showroom.



Exterior.



Kitchen.

New Showrooms at Birkenhead.

PAISLEY.—The Electricity Department is acquiring extensive premises at 4, Abercorn Street, which are near the centre of the town, and these are to be altered and fitted up as meter workshops, cooker and repair stores and workshops, and they will also be used as temporary showrooms. It is hoped that when the widening of the principal street is completed, premises will be allotted to the Electricity Department for showrooms and offices.

ILKLEY.—As an alternative to spending £5,500 on a new showroom and offices for the Electricity Department, the Ilkley Town Council is considering a proposal to utilise the existing public library for the purpose.

Engineering Employés' Wages.—Last week the Engineering and Allied Employers' Federation offered to increase the "war bonus" paid to engineering employés by 2s. 6d. per week, but at the same time stipulated that the rates for overtime and night work should be reduced. The trade unions concerned stated that the offer was unacceptable, as many men would actually suffer a reduction of wages. They intimated that an offer of an increase of 2s. 6d. unhampered by conditions would be considered worthy of putting to the vote of their members.

At a meeting of representatives of trade unions in the London District, sanction was given to a ballot of members to decide upon strike action to enforce the men's claim for an increase of 20s. per week. The papers will be returnable by May 31st.

Brazilian Railway Electrification Contract.—It is reported from Rio de Janeiro that the Metropolitan-Vickers Electrical Export Co. has been awarded a contract for the electrification of one of the lines of the Western of Minas Railway.

For Sale.—Liverpool Corporation Electric Supply Department has for disposal six Willans engines, direct coupled to Siemens 550-V d.c. generators, seven Lancashire boilers, one 350-tube economiser, draught fan, feed pumps, &c. The Electrical and Mechanical Officer, Catterick Camp, invites offers for two 150-kVA, 440-V generating sets. Mr. H. J. Shaw will sell by auction on May 4th, at 3, 5 and 7, Southville, Wandsworth Road, S.W., wireless and electrical material, machinery, plant, &c., and on May 6th and following day, at 13, High Holborn, various stocks of wireless material, valve and crystal sets, &c. (See our advertisement pages today.)

The Swedish Industries Fair.—The Swedish Industries Fair will be held at Gothenburg from May 6th to 13th next, in the magnificent exhibition building of 30,000 sq. metres floor area, which was originally erected for the engineering section of the Gothenburg Exhibition a few years ago. It is said to be the largest timber structure in the world. The Fair this year will be particularly comprehensive, and certain sections, such as leather and rubber goods, radio, travelling requisites, arts and crafts, and a separate department of inventions should be especially attractive and interesting.

"British" Electrical Goods in New Zealand.—According to the *Daily Mail* Christchurch (N.Z.) correspondent, the Wellington Chamber of Commerce is investigating the action of certain English firms in shipping goods, notably electrical fittings, to New Zealand at prices greatly below those of other British makers. It is alleged that these goods are of German manufacture, are imported to England, and re-shipped to New Zealand as articles of British manufacture, thus paying lower rates under the preferential Customs tariff.

Electric Cookers for Employés.—At the Wakefield City Council meeting last week, objections were raised to a proposal that three members of the Electricity Department staff should be allowed the use of electric cookers in their homes for purposes of demonstration to prospective purchasers. Ald. Emmett said that the loan of the cookers would cost not more than £2 per year, and they were intended not for the men themselves but for their wives to demonstrate electric cooking to people who were interested and could thereby see practical daily use which was impossible in a showroom. The employés concerned paid for the energy used and it was a very cheap advertisement for the department. The recommendation was approved.

Book Notices.—"Chemical Engineering and Chemical Catalogue" (pp. 366). London: Leonard Hill. Price 15s. This is the second edition of a very complete guide to the chemical industry and its products, and electrical manufacturers are well represented. A foreword and an article on "Corrosion" are contributed by Sir Robert Hadfield, Bart., and a large amount of data and tables is given. The volume has been edited by Mr. D. M. Newitt, Ph.D., D.I.C., &c.

"The English Electric Journal," March, 1926. London: The English Electric Co., Ltd.—This issue of the journal is of particular interest for its contents consist mainly of pictures of plant supplied to all parts of the world by the company. Railway electrification is given special prominence.

"An Introduction to Refrigeration." Published by the Technical Section, Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's Square, London, S.W.1. Price 2s.

"Relay Handbook, 1926." Pp. 13 + 1,001; figs. 749. Published by the National Electric Light Association, New York. Price to members, $4.00; non-members, $6.00.

"Telephone Repeater Stations."—This 32-page, fully illustrated handsome souvenir publication from the Peel-Conner telephone works of the General Electric Co., Ltd., is a reprint of a description of the repeater stations on the London to Bristol trunk telephone cable. They were the first two of the new series of permanent stations to be completed in connection with the underground trunk telephone cable system, and were put in service in June, 1924, since when they have been in constant commercial use without developing any kind of fault whatsoever. The whole of the repeater equipment was manufactured at the Peel-Conner telephone works at Coventry, and the power plant at the Witton works of the G.E.C.

"Les Moteurs à Explosion," by E. Marcotte. Pp. 216; 61 figs. Paris: Librairie Armand Colin. Price 8 fr. 50.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIV, No. 4. April, 1926. New York: The Institute. Price $1.

Recent Contracts.—MESSRS. FERRANTI, LTD., inform us that they have recently secured two important contracts from the Southern Hemisphere. The first is for six 10,000-kVA, 3-phase, 33,000-V transformers for the Sydney City Council; the other comprises seven 5,000-kVA, single-phase transformers for use as 15,000-kVA, 110,000-V groups, for the New Zealand Public Works Department. The total value of the two orders is approximately £40,000.

New Metro-Vick Showrooms.—On Monday last a party of the Press was conducted over the new showrooms, offices, &c., which the Metropolitan-Vickers Electrical Co., Ltd., and Metro-Vick Supplies, Ltd., have opened in Charing Cross Road, W.C.2. The company was afterwards entertained to luncheon at Frascati's Restaurant. Sir Philip Nash, K.C.M.G., presided, and in a short speech welcomed the visitors, stating that this country had three great things in its favour, electrically speaking:—We had a great deal of headway to make up; we had the ability and the finance to undertake any task; and there existed a most able Press. The company realised that the domestic appliance business had only just started growing, and it had become essential for manufacturers of heavy plant to produce smaller current-consuming devices which brought in a steady income. Sir Philip said that the company was erecting similar premises in Glasgow to cover the important Scottish area.

Local Exhibitions.—KEIGHLEY.—We reproduce herewith a view of the recent exhibition organised by the Corporation Electricity Committee in the Keighley Municipal Hall. The



Electrical Exhibition at Keighley.

show was well supported by both national and local concerns, as will be inferred from the picture.

BRADFORD.—The Corporation Electricity Committee has been awarded a silver medal (second prize) for its stand at the recent Bradford Ideal Homes Exhibition. It is reported that good results were secured from participation in the show.

EVESHAM.—We recently made mention of the electrical exhibition at Evesham, organised by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. One of the



The B.T.-H. Stand at the Evesham Exhibition.

exhibitors at this show was the British Thomson-Houston Co., Ltd., which displayed lighting fittings and domestic appliances upon the stand depicted in the accompanying illustration. The company also supplied the lighting fittings for a model shop window arranged by the organisers.

MORECAMBE.—In connection with the Morecambe Trade Revival Fashion Exhibition being held at the Winter Gardens from April 21st to 28th, the Morecambe Corporation Electricity Department has 10 stands displaying electricity in the home. Demonstrations are being given of cookers, vacuum cleaners, washing machines, boilers, irons, &c., and in addition there are special films and illustrated lectures. Mr. W. H. Wilkinson, A.M.I.E.E., is also exhibiting a variety of labour-saving devices, including ventilating fans, cookers, geysers, &c., and Mr. W. B. Duckworth, radio and electrical engineer, also has an exhibit.

Lead.—Messrs. James Forster & Co. reported on April 17th that there was little change in the general position. It was hoped that present values for lead would bring out more buying from consumers but there was no evidence of this, the demand from cable makers in particular being distinctly disappointing. It seemed likely that until definite signs of an upward movement appeared consumers would continue their policy of buying from hand to mouth. The Board of Trade returns for March showed:—Imports, 19,148 tons; exports, 1,897 tons, leaving for home consumption, 17,251 tons.

Birmingham National Trades Exhibition.—The exhibit of the City of Birmingham Electric Supply Department at this show, which is open from March 15th to May 8th, takes the form of three model rooms of an "all electric" house, *viz.*, dining room, bedroom and kitchen. In the dining room the furniture is dark oak with fittings of oxydised copper. A three-light lantern fitting is placed in the centre of the room for general lighting, and two drop lights fixed near the overmantel are a unique feature. A reading lamp and floor standard are also provided. The heating is supplied by a "Magicoal" fire, supplemented by a 2-kW "Premier" fire. Other appliances shown are a hot plate, small urn, kettle, fan and vacuum cleaner. A bowl fitting is fixed for lighting the bedroom with a cord adjustable pendant over the dressing table, and a table standard near the bed. A tray containing a coffee percolator, toaster, &c, is placed by the bedside. On the dressing-table are an electric hair dryer and a pair of curling tongs. Two fires are shown, a 3-kW "Arora" and a 1-kW



The Birmingham Electric Supply Department's Stand.

"Sturge-Baker." In the kitchen there is an interesting display of domestic apparatus consisting of a "Heatrae" geyser, a "Frigidaire" automatic electric refrigerator, a cooker as supplied on hire, a "Creda" wash boiler, a "Giljay" battery-charging set, &c. A totally-enclosed lighting unit is installed, provided with an adaptor for use with small appliances, kettle, iron, &c. This "room" is illustrated in the accompanying picture.

New Businesses Registered.—The following businesses have recently been registered under the Business Names Act:—

Rotherham Wireless Co. (radio factors), 151, Fitzwilliam Road, Rotherham.

R. Egerton & Co. (electrical engineers and contractors), 26, Pear Tree Street, Derby.

F. H. Barrett & Co. (electrical, radio, and general engineers), 2a and 2b, Church Street, Staines.

Canning Electro-Plating and Engineering Works (electro-plating and scientific instrument makers), 1a, Canning Crescent, Wood Green, N.22.

The Regent Radio Co. (radio distributors), 50-51, High Holborn, W.C.

The London Radio Store (wireless sets and components), 107a, High Street, Uckfield, Sussex.

J. W. Markland (electrician), 89, Old Street, Ashton-under-Lyne.

Gillitt & Co. (sports and wireless outfitters), 22, Lowther Street, Whitehaven.

Central Electric Co. (Watford) (electrical engineers and contractors and wireless dealers), Water Lane, High Street, Watford.

Volume Crystal Manufacturing Co. (wireless and sports goods), 234, Green Street, Bethnal Green, E.2.

Trade Announcements.—The LONDON ELECTRIC WIRE CO. AND SMITHS, LTD., have opened branch offices as follows: Newcastle, 93, Pilgrim Street; Manchester, 19a, Brazennose Street; Liverpool, 63, Moorfields; Leeds, 2, Cabinet Chambers, Basinghall Street. An agency arrangement has been made with Mr. A. Tracy Cross, Circus Street Chambers, East Circus Street, Nottingham. Stocks of cotton, silk and enamelled wire, resistance wires, "Glazite" and "Lewcos" inductance coils are now held in Glasgow, Newcastle, Manchester, Liverpool, Leeds, Nottingham, Birmingham, Coventry, Cardiff, and London.

MESSRS. KENT BROS. ELECTRIC WIRE CO. & E. H. PHILLIPS, LTD., have appointed Messrs. John Grogan & Co., 95, Waterloo Street, Glasgow, as their representatives for Scotland.

THE MAIDENHEAD RADIO CO has taken premises at 40, Queen Street as showrooms for wireless apparatus and electrical supplies.

MR. W. S. JACKSON, electrical contractor and wireless expert, has opened premises at 8, Walton Road, Stockton Heath, Warrington.

MESSRS. JOHN RICHARDS & CO. (ELECTRICAL ENGINEERS), LTD., having opened branch offices and showrooms at 22, Bore Street, Lichfield, ask for catalogues, &c.

MR. H. A. GREENFIELD, electrical engineer, &c., Norwich, has removed to 48, Bethel Street.

MR. J. E. FOWLER, electrical engineer and contractor, has opened new showrooms and offices at Corn Exchange Buildings, Market Street, Wakefield.

Communications for MESSRS. FESCOL, LTD., should be sent to their new works: 101, Grosvenor Road, Westminster, London, S.W.1. Telephone Nos.: "Victoria 2622 and 2623."

THE UNIVERSAL ELECTRIC LAMP CO., LTD., is removing on 26th inst. to larger offices at 35, Hatton Garden, London, E.C.1.

On the retirement of Mr. Donald Murray from business, the agency for the Morkrum-Kleinschmidt Corporation, of Chicago, has been taken over by STANDARD TELEPHONES & CABLES, LTD. (formerly Western Electric Co., Ltd.), of Connaught House, Aldwych, W.C.2. The Standard Company has already had considerable experience in printing telegraph apparatus, principally in connection with the Western Electric Multiplex system, and the addition of the Morkrum-Kleinschmidt apparatus, including the "Teletype," will materially increase the activities of this company in the telegraph field. It is contemplated that, with the development of its factories which is now taking place, the Standard Company will commence manufacturing "Teletype" apparatus in England.

Catalogues and Lists.—MESSRS. GEORGE ELLISON, Perry Barr, Birmingham.—List No. 327, containing illustrated details of totally-enclosed brake solenoids or power magnets for d.c. circuits up to 300 A and 660 V.

BATTERIES, LTD., Crabbs Cross, Redditch.—List No. 2, describing the company's "Nife" accumulators (nickel-iron type). Priced.

MESSRS. L. WEEKES (LUTON), LTD., Luton, Beds.—A priced and illustrated catalogue of switch- and fuse-gear, including mining-type apparatus.

MESSRS. BERRY, WIGGINS & CO., LTD., Stratford Market, E.15.—A list of electrical compounds for joint boxes, cable troughs, accumulator sealing, &c.

THE D.P. BATTERY CO., LTD., Bakewell, Derbyshire.—An illustrated booklet describing electric locomotives for military purposes.

MESSRS. LACY-HULBERT & CO., LTD., 91, Victoria Street, S.W.1.—List E.O.3, dealing with the "Boreas" electrically-driven tire inflator.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlets Wa. 401, 402, and 403, describing the "Ferranti" l.f. radio transformer. The last pamphlet is a set of instructions as to the proper use of the instrument. Also Pamphlet Ta 156, dealing with high-voltage d.c. testing equipments.

THE WEINBAU INCANDESCENT & ELECTRICAL CO., 327-335, Commercial Road, E.1.—A net price list of electrical materials and accessories.

SWITCHGEAR & COWANS, LTD., Elsinore Road, Trafford Park, Manchester.—Descriptive Section No. 3-2, advertising remote controlled safety gate-end starters with special protection for use in mines.

BRITISH BROWN-BOVERI, LTD., Trafalgar House, Waterloo Place, S.W.1.—Pamphlet 893E, containing an illustrated description of electric locomotives supplied to the Paris-Orleans Railway.

ELECTRICAL APPLIANCES (BLACKPOOL), LTD., 5, Bloomfield Road, Blackpool.—A priced and illustrated folder advertising switch-plugs and sockets.

VENTEX ELECTRICAL CO., 220, Cooksey Road, Small Heath, Birmingham.—A price list of "Ventex" ironclad cut-outs, distribution boards, &c., and a pamphlet dealing with the "Ventex" time switch.

STELLA LAMP CO., LTD., Winchelsea Road, Harlesden, N.W.10.—An illustrated and priced catalogue of vacuum and gasfilled lamps, including special types.

THE IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publications Nos. 6 215, 6,218, and 6.220, dealing, respectively, with "Xilos" inductance coils; the "Indigraph" vernier knob and dial; and the "Igranic" super-heterodyne receiver outfit. Illustrated and priced.

MESSRS. MARRYAT & SCOTT, LTD., 57, Hatton Garden, E.C.1.—A well-produced catalogue of electric lifts (91 pp.). The publication is profusely illustrated and contains several pictures symbolising the main characteristics of the company's lifts.

KODA (LONDON), LTD., Koda Works, Byfleet, Surrey.—A pamphlet advertising primary cells and batteries.

MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.1.—List LM.1/26, containing details and illustrations of "Leach" motors, dynamos, motor-generators and converters.

Bankruptcy Proceedings.—JOSEPHINE R. HEREFORD-LAVEY and VIOLET DE FRECE (carrying on business as the Radio Cash Stores), 371, Upper Street, Islington, Leeds, and Nottingham.—The debtors attended before Mr. Registrar Mellor at the London Bankruptcy Court on April 13th for public examination upon a joint statement of affairs showing liabilities of £1,111 and assets "nil." The Official Receiver reported that, in addition to the above liabilities, there were claims amounting to £361 which had not been scheduled by the debtors, and the accounts would consequently have to be amended. According to the debtors' statements, in June, 1924, in partnership with another person, they began business as radio accessories dealers at Leeds, the debtor De Frece providing in all £800 capital. The business was successful, and in August, 1924, the third partner retired, receiving £150. The debtors subsequently removed it to other premises in Leeds, and later opened similar businesses at Islington, Swansea, and Nottingham, all of which were placed under management. The trading resulted in a loss of £300. In February, 1925, execution was levied at all the business premises at the instance of a judgment creditor, and the whole of the stock was seized and sold and the business ceased. The debtors attributed their failure to a slump in the wireless trade, to the heavy increase in the overhead expenditure in connection with branches, and to bad management and irregularities on the part of certain employés. The examination was adjourned for a month, and the debtors were directed to lodge the amended accounts within a fortnight.

JOHN RUSS, electrical goods dealer, 22-23, Verulam Street, Gray's Inn Road, W.C.—This debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court on April 13th for public examination upon accounts showing total liabilities of £8,641 (unsecured £8,630) and net assets valued at £7,446. In reply to Mr. Armstrong, Official Receiver, the debtor stated that he was born in Schleswig-Holstein; he came to this country in 1899, and was naturalised in 1910. He served in the Army in England from August, 1918, till February, 1919. In October, 1920, he entered into an agreement with a German company under which he carried on business in partnership with them in the sale of electrical goods, first from his private address at Highams Park and afterwards at Verulam Street, the arrangement being that the company should finance the business, which he managed without supervision. The agreement was cancelled in 1924, and he continued the business on his own account from the same address until, realising his hopeless financial position, he filed his petition in August, 1925. He attributed his insolvency to the failure of the before-mentioned German company, as his partners in the business, to finance it to the extent to which they had promised; to liability for the payment of partnership debts since the date of the cancellation agreement, &c. The assets included a sum of £5,914, which he alleged to be owing to him from the German company. The examination was concluded.

A. E. BURR (trading as Read & Burr), wireless manufacturers' agent, late of Hammersmith Terrace, W., and Red Lion Court, Fleet Street, E.C.—The first meeting of creditors was held on April 16th at the London Bankruptcy Court. The receiving order was made on April 1st upon the petition of the Rexo Engineering Co. According to the debtor's statement, in April, 1925, he rented a stand at the British Empire Exhibition, and the venture proved a failure, and subsequently, having come to the end of his capital, he ceased business. The liabilities were roughly estimated at £400, and no assets of any description were disclosed. The debtor attributed his failure to the small turnover and heavy expenses at Wembley, depression in wireless trade in 1925, and insufficient capital. The case was left with the Official Receiver to be wound up in bankruptcy.

E. H. NEWMAN and DORIS E. NEWMAN (trading as Newman and Co.), radio and electrical engineers, Shepherd's Bush Green, W.—These debtors attended on April 16th before Mr. Registrar Francke at the London Bankruptcy Court for public examination upon accounts showing liabilities of £793, against assets valued at £45. They commenced business in partnership in January, 1925,. The failure was attributed to lack of capital, heavy overhead expenses, and trade depression. Upon the application of the Official Receiver, the debtors were ordered to furnish cash and goods accounts, and their further examination was adjourned until June. The following are creditors:—

	£		£
Birnard's Press	33	Morton, Burt & Co., Ltd. ...	28
Goswell Engineering Co. ...	111	Radions, Ltd.	67
S. T. Hill	65	Sparks Radio Supplies, Ltd. ...	27
J. Hollingsworth	125	Stella Products	31
Listron	32	Sylvex, Ltd.	35
Linno Radio Valve Co. ...	28	Wireless Electric Wholesale Co.	30

W. J. KIDD, electrical engineer, Townhall Street, Enniskillen.—This debtor appeared before Mr. Justice Brown, in the Ulster Bankruptcy Court, Belfast, on April 16th, for examination. Kidd said that he started business in August, 1924,

with a capital of £30, and was adjudicated bankrupt in February last with liabilities amounting to £1,500. He said there were debts due of £85. He had not kept any books. The examination was adjourned.

C. Hubbard, 13, Magdalen Street, Norwich, electrician and wireless dealer.—The receiving order in this matter was made on March 19th on debtor's own petition. The statement of affairs shows liabilities of £472, while the assets are estimated at £709, from which preferential claims of £32 have to be deducted, leaving net assets of £677, or an estimated surplus of £205. In October, 1923, debtor started trading on his own account at Magdalen Street, Norwich, having saved about £300, which was his available capital apart from stock which he had created in his spare time. The Official Receiver states that debtor seems to have allowed too much credit and has not had sufficient capital at his disposal to carry on business on these lines. First meeting, April 23rd, at the Official Receiver's office, 9, Queen Street Chambers, Norwich; public examination, May 11th, at the Shirehall, Norwich.

W. C. Rhodes, trading as L. J. Palmer & Co., Corporation Street, Birmingham, electrical engineer and contractor.—The application for discharge of this debtor was heard on April 15th at the Court House, Birmingham. The proceedings took place in 1925. The liabilities totalled £749 and the assets realised £80, a dividend of 1s. 8d. in the £ being paid. An immediate discharge was granted, subject to debtor's consenting to judgment for £50.

A. North and F. North (A. & F. North), wireless and electrical engineers, 38, Bradford Road and Market Place, Dewsbury.—Receiving order made April 9th, on debtors' own petition. First meeting April 20th, public examination May 6th, both at the County Court House, Dewsbury.

J. McFadden, electrician, 177, Higher Hillgate, Stockport.—Receiving order made April 9th on debtor's own petition.

M. Kelly, radio apparatus dealer, 12, Jackson's Row, Manchester.—Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester, appointed April 9th.

Company Liquidations.—Bucks. Electric Wire and Engineering Co., Ltd., North Street, New Bradwell.—A meeting of creditors was held on April 15th at the office of Messrs. Corfield & Cripwell, E.C., when the chair was occupied by Mr. W A. J. Osborne, who had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented which disclosed liabilities of £2,879, and net assets of £290, leaving a deficiency of £2,589. Mr. Osborne stated that the company was formed in March, 1924, with a nominal capital of £500. The turnover from January, 1925, to February, 1926, was £4,822, and there was a gross profit of £644, and a net loss of between £500 and £600. When the company was formed, it took over liabilities of £1,183, and the whole of them had been discharged. In August, 1924, £300 was raised on debentures, and in the following month a further £200. In March, 1925, a further £800 was raised on debentures in favour of Mr. Bullard. At a later date a Mr. Kibble advanced £1,000 on the security of the freehold premises, and the debenture holder was paid out. It was decided that the voluntary liquidation of the company should be continued with Mr. Osborne as the liquidator. The following are creditors :—

	£		£
Bowen Davies, E.	22	Kaye, E. E., Ltd.	275
Coquantin, M.	100	Midland Auto & Engineering Co.	22
Derricott, ...	60	Musk, Beattie H.	43
Gibert, J., & Sons	168	Patman, H.	255
Gurney, A. W.	43	Powell Bros.	194
Hyde, A. H.	381	Townsend, W. H.	369
Hill, Vellacott & Co.	52	Townsend, A. H.	20
Hyde, J. B., & Co.	60	L.M. & S. Rly. Co.	54
Kibble, A. J.	82		

Wireless Installations, Ltd.—Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C., released April 13th.

British Electric Vehicles, Ltd.—A petition for the winding up of this company has been presented to the High Court by Batteries, Ltd., of Crabbs Cross, Redditch, creditors, and will be heard in London on April 27th.

Union Electric Welding Co., Ltd.—A meeting of members is called for May 18th at 81, Cannon Street, E.C., to hear an account of the winding up from the liquidator, Mr. L. O. Huggins.

Tele-Dis Services (Founders Co.), Ltd.—Last day for proofs for dividend April 28th. Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C.

Dissolutions of Partnership.—Egerton, Jobey & Co., electrical engineers and contractors, 26, Pear Tree Road, Derby.—Mr. H. W. Jobey and Mr. R. E. Worsley have dissolved partnership. Debts will be attended to by Mr. Worsley.

Thornton & Evans, electrical and motor engineers, 37, Regent Street, and The Garage, Lambpit Street, Wrexham.—Mr. S. Thornton and Mr. A. Evans have dissolved partnership.

Private Arrangements.—P. R. Masheder, wireless engineer, trading as "Radio Services," 63a, Stanley Road, Bootle, Liverpool.—A meeting of creditors was held recently, at the offices of Mr. Parkin S. Booth, Liverpool, when a statement of affairs was submitted which showed liabilities of £501, and net assets of £114, leaving a deficiency of £387. It was reported that the debtor commenced business at his present address in December, 1924, with a borrowed capital of £200. He was able to trade successfully until the end of 1925, when the takings fell off considerably, mainly owing to the fact that a fire broke out on the premises and destroyed a large number of batteries which he used in his battery service. A resolution was passed confirming the deed of assignment already executed with Mr. Booth as trustee, whilst a committee was appointed consisting of the representatives of the General Electric Co., Ltd., Messrs. Baxendale Bros., Ltd., and Messrs. Wm. Allan & Co. The following are creditors :—

	£		£
Allan, Wm., & Co.	63	Baxendale Bros.	61
Anderson, Thomas & Co. ...	201	General Electric Co., Ltd. ...	43
Blake, J., & Co., Ltd.	33	Pulford Bros., Ltd.	33

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, April 20th: Copper (electrolytic) bars, £65 5s., 15s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £75 5s., 15s. inc.; ditto ditto h.c. wire, 9 7/16d., 1/16d. inc.

Messrs. James & Shakespeare report, April 20th: No change in the prices for copper bars (best selected), sheet and rod; English pig lead, £29 10s., £1 dec.

Messrs. Edward Till & Co. report, April 20th: India-rubber, Para fine, 1s. 11d., 2d. dec.

Our Foreign Trade.—March Figures.—The following were the values of imports and exports of electrical goods and machinery during March, 1926 :—

	March, 1926.	Inc. or dec.	3 months, 1926.
Imports—			
Electrical goods and apparatus	287,955	− 44,790	−217,324
Machinery	1,264,400	+188,941	+251,683
(Electrical machinery)	117,155	− 10,854	− 10,384
Exports—			
Electrical goods and apparatus	994,854	+ 80,562	−161,530
Machinery	4,317,449	− 35,136	− 89,500
(Electrical machinery)	484,413	− 490	+ 8,322
Re-exports—			
Electrical goods and apparatus	20,560	+ 5,627	− 16,135
Machinery	121,078	− 2,212	+ 749
(Electrical machinery)	11,758	+ 6,616	+ 7,030

Lighting and Power Notes.

Ayrshire.—Electricity Supply.—The Electricity Board is considering the question of a supply of electricity to Maybole and Turnberry.

Bath.—Loans.—The Town Council has received sanction to a loan of £8,500 in respect of excess expenditure on mains and services, and £15,000 for new works. A further loan of £5,000 for expenditure on sub-stations for the next two years has been applied for.

Bolton.—Loan Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £75,000 for mains in connection with the Corporation's electricity undertaking.

Brookwood (Surrey).—Electricity Supply.—A supply of electricity will shortly be available in Brookwood and Pirbright from the power station of the Woking Electric Supply Co., Ltd. The charges will be as follows :—Lighting, 7d. per kWh. Heating: Winter quarters, 3d. per kWh; summer quarters, 1½d. per kWh. Cooking: Winter quarters, 2½d. per kWh; summer quarters, 1½d. per kWh.

Burton-on-Trent.—New Plant.—At a recent meeting of the Town Council, the chairman of the Electricity Committee said the Committee had had under consideration the best method to adopt to make its generating station safe for the next two or three years, having regard to the Electricity Bill at present before Parliament. After careful consideration it was decided to increase the capacity of the plant by from 4,000 to 5,000 kW. When this extension was complete, the Corporation would have a stand-by in the old machine in case of a breakdown of one of the bigger machines. The cost would be approximately £30,000. A further extension of the system in South Derbyshire, which had been already sanctioned by the Council, would cost approximately £20,707. It was decided that application be made for permission to borrow the necessary money.

Carlisle.—Electricity Extensions.—The Town Council has decided to carry out mains extensions at a cost of £5,641. The electrical engineer is to prepare a definite scheme with a view to an application being made for an Order authorising the Council to extend its area of supply.

Cleobury Mortimer.—Electricity Supply.—The Rural District Council has given its consent to the erection of overhead wires by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for the supply of electricity to the town. The company will supply at from 7d. to 8d. per kWh for lighting, and at about 1½d. per kWh for power, heating, and cooking.

Continental.—France.—The Société de Transport d'Energie Electrique du Nord, in conjunction with the Société Electricité et Gas du Nord, is engaged in a considerable extension of the electricity supply service in the war-devastated area of the country. At Jeumont a new 7,500-kVA, 10,000/45,000-V transformer is being installed; three similar sets are being added to the sub-station of Fourmies, two of which will replace 2 500-kVA sets that are to be transferred to Cambrai and Bavay; two similar sets are being added to the trans-

former station at Hirson, while at Bavay a new sub-station is being erected which will be equipped with two 15,000/45,000-V transformers—one of 2,500 kVA from the Fourmies station, and one of 1,400 kVA from the Cambrai station.

The Société des Forces Motrices de la Selune, of Avranches, has recently secured a concession to establish a 30,000-V transmission line between Pontaubault (Manches) and Sainte-Brice-en Coglis (Ile-et-Vilaine) with the object of affording a supply of electricity to a large number of rural communes in that area.

East Ham.—ELECTRICITY SUPPLY.—The Electricity Committee has decided to lay a cable in connection with a supply of electricity to Manor Park, at an estimated cost of £2,000.

Edinburgh.—INQUIRY.—The Commissioners under the Private Legislation (Scotland) Act recently held an inquiry into a draft provisional Order promoted by the Corporation for general powers. The chairman asked that the clause to enable the Corporation to carry forward surpluses and deficiencies on the electricity undertaking should be specially considered. The Minister of Transport did not agree that deficiencies should be allowed to be carried forward. The Corporation thought that in certain cases it might be desirable to carry forward a deficiency, particularly when by so doing charges for electricity might be kept uniform. The Commissioners having considered the point, intimated that they desired to give effect to the suggestions of the Minister of Transport. In view of this decision, it was stated that the clause would be withdrawn by the Corporation.

Fowey.—ELECTRICITY SCHEME.—It was reported at a recent meeting of the Town Council that the St. Austell and District Electric Light & Power Co., Ltd., is shortly to commence laying an underground cable through the town in connection with the electricity scheme.

Fylde.—ELECTRICITY SUPPLY.—At a recent meeting of the Rural District Council it was decided that at the next meeting of the Council a resolution should be passed agreeing to Blackpool Corporation giving a supply of electricity to the townships of Marton and Carleton.

Glasgow.—ELECTRICITY IN SMALL HOUSES.—In connection with the scheme for laying mains to Possil housing estate, the electrical engineer recommends acceptance of similar charges to those made by the Gas Department for gas mains, namely, £5 15s. 8d. per house.

Hamilton.—HYDRO-ELECTRIC SCHEME POSTPONED.—In connection with the proposed hydro-electric installation at Clyde Bridge, the Corporation Electric Lighting Committee reports that it has considered the offers received for the scheme, the lowest being £38,949. The view of the Committee and of the resident engineer (Mr. Cooper) is that the project is sound from an engineering point of view, but meanwhile, owing to the large increase in the capital costs, it is not economical. The Town Council has agreed to wait until the effect of the Government's scheme for the supply and regulation of electricity has been ascertained.

Haworth.—INAUGURATION OF SUPPLY.—The electricity supply for the district was formally inaugurated by the chairman of the Urban District Council on April 10th. Electricity is obtained from Keighley in bulk at a pressure of 6,600 V, and is reduced at the sub-station for distribution. The cost of the scheme was approximately £6,000. Mr. Maxwell Webber is electrical engineer to the Council.

Hitchin.—INQUIRY.—The Ministry of Transport, on April 7th, held an inquiry into the application of the North Metropolitan Electric Power Supply Co. to erect an overhead line in the urban area for the transmission of electricity. The Urban District Council had refused its consent. For the company it was stated that it was desired to have a trunk line from Stevenage to Hitchin, and the Hitchin Rural District Council had given its consent. It was pointed out that the cost of an overhead line was £1,700 per mile, compared with £3,200 for underground mains.

Irish Free State.—THE SHANNON SCHEME.—The Free State Government hopes to have the Shannon hydro-electric scheme completed in 1929. The estimates for the current year show that the cost of the scheme, as originally calculated, will be £5,250,000, and that, with the new advance in the 1926-7 figures, £2,282,200 will have been provided, leaving nearly £3,000,000 to be found in 1927-8.

Japan.—ELECTRICAL DEVELOPMENT.—The I.G.R. is erecting a large steam power station near Teurumi, at a cost of 17,000,000 yen, and it will be completed by the fiscal year 1928-1929. The plant will include three 20,000-kW turbo-generators.

KOBE.—The city of Kobé has a plan to extend its electrical plant at a cost of more than ten million yen. The fund will be raised by loans issued subject to the authorisation of the Tokio Government. The plant will include a 35,000-kW set.

London.—ST. PANCRAS.—The Electricity Committee has had under consideration the revision of the charges under its scheme for electricity supply to small dwellings, and has recommended to the Borough Council that the fixed weekly charge be withdrawn and meters installed, electricity being charged at 7d. per kWh for a minimum consumption, according to the number of points per house, after which the present flat rate for lighting would apply.

ISLINGTON.—The Electricity Committee has voted capital expenditure as follows:—Cables, £9,000; services, £6,000; transformers, £3,500; meters, £3,000.

Loughborough.—ELECTRICITY EXTENSION.—The electrical engineer has recommended to the Electricity Committee that the cables be extended to the Outwoods Drive district and a sub-station erected at an estimated cost of £3,450.

Motherwell.—ELECTRICITY SUPPLY.—The Electricity Committee has accepted the offer of the Motherwell Machinery and Scrap Co., Ltd., to purchase and remove plant at the electricity works for £4,180. The Electricity Commissioners have written the Town Council requesting further information regarding the Council's application for consent to borrow £32,608 for a bulk supply.

Newcastle-on-Tyne.—PROPOSED CHANGE-OVER.—The Newcastle and District Electric Lighting Co., Ltd., has applied to the Corporation Transport and Electricity Committee for approval to change its system of supply to consumers in the city who are now being supplied from its single-phase, 80-cycle system at 100 and 240 V, and to substitute either its a.c. 250-V and 480-V, 3-phase, 40-cycle supply or d.c. at 240-V and 480-V. The Committee has recommended to the Town Council that the change-over be approved.

Northern Ireland.—LURGAN (Co. ARMAGH).—The Urban District Council is applying to the Electricity Commissioners of Northern Ireland for sanction to a loan of £11,350 in connection with its electricity scheme.

Nuneaton.—SCHEME APPROVED.—The Rural District Council has given approval to the proposals of the Leicestershire and Warwickshire Electric Power Co. to erect overhead cables between Long Lawford and the power station at Hinckley, passing through the parishes of Wolvey and Burton Hastings.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

SLEAFORD.—Lighting, heating, and power: A reduction of 1d. per kWh.

BOURNEMOUTH.—*Bournemouth and Poole Electricity Supply Co., Ltd.*—Lighting: First 5,000 kWh, per annum, 7d. per kWh; next 15,000 kWh, 6d.; beyond, 3½d. per kWh. Power: Varying from 3d. for the first 2,000 kWh per quarter to 1¾d. for over 10,000 kWh. Heating and cooking: First 5,000 kWh per quarter, 2d. per kWh; beyond, 1¾d. per kWh.

BLACKPOOL.—Heating: From 1½d. to 1¼d. per kWh; "all in" tariff, secondary charge, from 1d. to ¾d. per kWh; and an industrial heating tariff of 1¼d. during peak load hours and ¾d. off peak load hours, subject to a minimum consumption of 2,000 kWh per quarter, with a meter rental of 10s. per quarter for two-rate meters.

SALFORD.—Power (within the borough): Varying from 2½d. per kWh for the first 250 kWh per quarter, to .8d. per kWh for all energy in excess of 25,000 kWh, with an alternative charge on the maximum demand system. Power (in the urban district of Prestwich): Varying from 2¾d. per kWh for the first 250 kWh per quarter to .9d. for all energy consumed in excess of 25,000 kWh.

SOUTH SHIELDS.—Power, heating, and traction: From 1½d. to 1¾d. per kWh.

CARMARTHEN.—*Carmarthen Electric Supply Co., Ltd.*—Lighting: 8d. per kWh. Heating and cooking: Summer quarters, first 100 kWh, 2d. per kWh; above this amount, 1½d. per kWh; winter quarters, first 100 kWh, 2½d. per kWh; above 100 kWh, 2d. Power: Sliding scale, from 4d. to 1¾d. per kWh.

HAMILTON.—Lighting: From 8d. to 6½d. per kWh. Heating: From 2d. to 1¾d. per kWh, with reductions for public lighting and power.

RATHMINES AND RATHGAR (Co. DUBLIN).—Lighting: 6d. per kWh. Outside lighting: 4d. per kWh. Heating, cooking, and other domestic purposes: 2d. per kWh. Lighting (through slot meter, including meter rent): 7d. per kWh. Power: Unrestricted supply, 2d. per kWh; restricted hour supply, 1¾d. per kWh.

PEMBROKE (DUBLIN).—Lighting: From 6d. to 5½d. per kWh. Heating and cooking: From 2½d. to 1½d. per kWh.

SALE.—Maximum demand system: 7d. per kWh up to 100 hours' use per quarter and 2d. per kWh beyond. Domestic heating: First 100 kWh per quarter, 2d. per kWh; next 100 kWh, 1¾d.; beyond, 1½d. Private house domestic rate: A fixed charge of 20 per cent., of the rateable value, plus 1½d. per kWh during the summer quarters, and ¾d. per kWh during the winter quarters.

Rothesay.—NEW POWER STATION.—Application has been made for consent to the establishment of a generating station at a cost of £10,200. Meanwhile the town is taking a supply of energy in bulk from the Rothesay Tramways Co., Ltd.

Sandwich.—ELECTRICITY SUPPLY.—The Town Council has appointed a committee to approach Messrs. Pearson and Dorman Long, Ltd., with a view to obtaining a supply of electricity for the borough.

Sheffield.—LOANS SANCTIONED.—The Corporation has received sanction to the borrowing of £300,000 for mains and £60,000 for equipment of sub-stations on consumers' premises.

Shrewsbury.—Loan Sanctioned.—The Electricity Committee has received sanction to the borrowing of £8,000 for plant.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The National Electric Construction Co., Ltd., for the supply of electricity in the urban district of Holbeach; the Derbyshire and Nottinghamshire Electric Power Co., to supply in the urban districts of Bakewell, Baslow and Bubnell, and South Darley, and the rural district of Bakewell; and the Truro Electricity Supply Co., Ltd., in the city of Truro.

Stourport.—New Power Station.—The new power station erected by the Shropshire, Worcestershire, and Staffordshire Electric Power Co. will, it is expected, be inaugurated in May by the Prime Minister. The plant may ultimately reach 200,000 h.p., and the area to be supplied will include the northern and central parts of Worcestershire and parts of Staffordshire and Shropshire. There will be sub-stations at Kidderminster, Halesowen, and Redditch, and a linking-up with the system in Smethwick, Dudley, and Oldbury.

Thornton-de-Fylde. — Loan Sanctioned. — Sanction has been received by the Urban District Council to the borrowing of £29,750 in connection with the electricity scheme for the district.

Torquay.—Loans Sanctioned.—The Town Council has received sanction to a loan of £10,000 for mains and services.

Extension of Supply.—Application has been made for a Special Order to extend the present area of supply so as to include a number of additional parishes. The total estimated capital cost of the extension is £21,800.

Wirral.—Electricity Scheme.—The Rural District Council, acting upon the advice of the Electricity Commissioners, has decided to negotiate with the Corporations of Birkenhead and Wallasey, and the Mersey Power Co., Ellesmere Port, with a view to obtaining bulk supplies of electricity, to carry into effect the Council's electricity scheme for which it obtained a draft Order in August, 1925. The Commissioners, following a recent inquiry into an application for sanction to borrow £110,000 to carry out the first part of the Wirral Council's scheme, expressed the view that a modified scheme should be brought forward.

Worcester.—Loan.—The Electricity Committee has recommended the City Council to apply for sanction to borrow £30,000 for the following purposes:—Mains, £15,000; services, £6,500; and sub-station equipment, £7,500.

Tramway and Railway Notes.

Canada.—New Electric Railway.—The Ontario Hydro-Electric Commission is conferring with the municipalities concerned in connection with a proposal to construct a high-speed radial railway from Toronto to Hamilton at a cost of $11,000,000.

Continental.—Germany.—It is reported that the German State Railway authorities have decided to establish a new power station near Berlin to supply electricity for the Berlin Metropolitan Railway. A feature of the new plant which is to be located near the Berlin municipal power station at Rummelsberg, is that the boilers will be adapted to use as fuel lignite drawn from the mines near Frankfürt-am-Oder, about 62 miles away.

The Baden State Railway Council is urging the German State Railway authorities to take in hand without further delay the electrification of the railway between Frankfürt-am-Main and Basle.

East Ham.—Track Renewals.—The Tramways Committee has decided to reconstruct the tramway track in Rowland Road West at an estimated cost of £15,500.

London.—A New Ticket Machine.—A new type of ticket-issuing machine is shortly to appear on the Underground Railways, which will fully print, number, and date the ticket at the time of issue at the rate of five per second.

Trafalgar Square Tube Improvements.—The new escalators at Trafalgar Square Station (Bakerloo) were put into service on April 13th. The new escalators are of comb type. The area now occupied by the lifts will be devoted to a new and more spacious booking hall. The station, now catering for four million passengers a year, will be able to handle eight millions with ease. A new subway, giving a connection between the Underground station and Cockspur Street, is to be constructed. This will be completed by about midsummer.

Royton.—Scheme Rejected.—In connection with a request from the Oldham Corporation for the consent of the Urban District Council to the reconstruction of the tramway track in Oldham Road between the boundary at Longsight and Royton Town Hall, the Council has decided that it cannot reconsider its decision not to proceed with the proposed work.

Worcester.—Purchase of Undertaking.—At a recent meeting of the City Council it was decided to purchase the tramway undertaking for £58,000. The necessary Bill will come before the House of Lords on April 27th.

Telegraph and Telephone Notes.

Argentina. — Telephone Repeaters. — An amplification station is about to be erected by the Argentine Telephone Co. in Buenos Aires to link up subscribers in the towns of Bahía Blanca and Córdoba, a total distance of 1,952 kilometres. Santa Fe, Villa María and Rio Cuarto will also be brought within the radius.—*Reuter's Trade Service* (Buenos Aires).

Guernsey.—Inter-Island Telephony.—In response to a petition from the tradespeople of Guernsey and Alderney to the State Telephone Council, experiments in telephony between the two islands have been successfully carried out. It has been found possible to use the single telegraph wire which already unites the two islands for carrying on a telephone conversation, and at the same time to send a telegraph message, which will obviate the necessity of laying a new cable.

South Africa.—Long-distance Telephony.—Direct telephone communication was inaugurated on April 12th between Johannesburg and Cape Town, a distance of 908 miles, five repeaters being used.

The Telephone Service.—Suggested Separation.—At its annual meeting this week the London Chamber of Commerce is to urge the Government to appoint at an early date a Commission for the purpose of introducing a new system of Post Office Administration, including the separation of the postal service from the telegraph and telephone services and possibly the vesting of the latter services in a semi-independent body, which should include non-official representation.

Continental Service.—All-day telephone communication between England and Germany will be established when the last portion of the cable connecting Domburg (Holland) with Aldeburgh (England) has been linked with the German telephone system. The German steamer *Neptune* went to Holland from Cologne last week to carry out this work, which is expected to be completed by the end of April. The cable is 165 kilometres long and weighs 1,700 tons.—*Reuter* (Berlin).

New Exchanges.—To meet the immediate requirements of the "Hop" district a new 800-line exchange was opened on April 19th and will be known as "Waterloo." During the summer two others, to be called "Rodney" and "Reliance," will be opened to serve the Walworth and Oval areas respectively; they will have a capacity of 3,500 lines each. A new Bermondsey exchange is also in hand.

Police Telephone Boxes.—It is estimated that £13,000 a year will be saved to the rates of Newcastle by the decision of the Watch Committee to introduce the police telephone box system. The nine police stations at present in use will be reduced to three, and in the place of the six stations to be closed, fifty-one telephone boxes will be erected.

Northern Trunk Extension.—The trunk telephone extension from Inverness and Tain, northwards to Wick and Thurso, was formally opened last week. The extension covers a distance of 118 miles, and Mr. John McAllan, chief inspector of telegraphs, Inverness, was responsible for the carrying out of the work.

The Yap Cable.—Dutch Assignment.—According to German reports, the Allied Governments contemplate the assignment of the Yap-Menado cable, which belonged to the German-Netherlands Telegraph Co. and was seized during the time of the war, to the Dutch Government. When the negotiations on the matter have been concluded it will be possible for the financial situation of the Company to be cleared up in connection with the claims made by the Company on the German Government for compensation.

Radio Notes.

Licences.—Prosecutions.—It was announced on April 16th that proceedings had been taken in 135 cases against people for installing broadcast radio receiving sets without licences, and that 134 convictions had been secured.

Korea.—Broadcasting Service.—The Seoul Radio Broadcasting Station Establishment Committee hopes to open a station in July and establish a service with a capital of y. 200,000; 48 of the promoters of the scheme are in Seoul and 51 in the provinces. Monthly reception charges are estimated at y. 2, the number of possible subscribers being expected to reach 5,000. The undertaking is to be a corporate juridical body, and *Eastern Engineering* expects the projected station to be powerful enough to serve the whole of Korea. Broadcasting will be in both Korean and Japanese.

United States.—"Radio Slander."—The first conviction in America for "slander" by wireless has been recorded. *The Times* explains that recently a wireless news "bulletin" was broadcast from Chicago's "Moulin Rouge" cabaret, which contained a statement regarding the State Attorney, Mr. Crowe. The Attorney issued a writ for libel, but this was later reduced to a slander charge, and the proprietor of the establishment has been ordered by the courts to pay a fine of £5 and costs for "disorderly conduct."

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Adwick-le-Street.—May 19th. Urban District Council. H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (April 16th.)

Barking.—May 10th. County of London Electric Supply Co., Ltd. Coal-unloading, storing, and reclaiming plant. (April 9th.)
May 11th. Switchgear and accessories, transformers, and piping equipment. (March 26th.)

Chile.—SANTIAGO.—August 20th. Chilean State Railways. Signals, telegraphs and telephones, electrical material for sub-stations, aerial lines, and lighting.*

Croydon.—April 28th. Electricity Department. Water-softening plant. (See this issue.)

Doncaster.—May 4th. Electricity Department. One 1,000-kW motor converter and l.p. switchgear. (See this issue.)

Dublin.—May 4th. Electricity and Public Lighting Department. E.h.p. and l.p. cables, cast-iron pillars, and stoneware troughing, section pillars, compound and other materials and accessories for one or two years. (See this issue.)

Dundee.—Education Authority. Installation of electric lighting at four schools. Specifications, &c., from Mr. John E. Williams, executive officer.

Edinburgh.—April 26th. Electricity Supply Committee. Installation of electric lighting and wiring for motors at the public wash-house, Portobello. Specifications from the Engineer's office, Dewar Place.

Exeter.—May 11th. Electricity Department. Boiler-house plant complete:—Two water-tube boilers with economisers, pumps, coal bunkers, conveyor, and accessories. Self-supporting steel chimney, induced-draught fan, and accessories. (April 9th.)

Glasgow.—May 6th. Electricity Department. L.p. cables, small i.r. insulated cables and flexibles, meters and carbons for 12 months. (See this issue.)

Grimsby.—April 26th. Electricity Department. E.h.p. cell-type switchgear. (April 16th.)

Halifax.—Wiring for about 70 points in house. Electricians desirous of tendering to send names to Henry Thompson, architect, Elland.

Harrogate.—April 25th. Electricity Department. H.p. and l.p. switchgear for sub-stations. (April 9th.)

India.—April 30th. India Store Department. 22,000-V cables. (April 2nd.)
April 30th. Alkaline train-lighting cells. (April 16th.)
May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)
May 11th. One 200-kW La Cour-type motor converter. (See this issue.)
May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*
May 15th. Madras and Southern Mahratta Railway Co., Ltd. Telephone line material (comprising porcelain insulators, galvanised terminal irons, &c.), copper line wire (1,302 miles), copper binders, tapes, &c. (See this issue.)

London.—LONDON COUNTY COUNCIL.—May 4th. Electric wiring and fittings at the Alton Street elementary school, Poplar, E. (April 16th.)
H.M. OFFICE OF WORKS.—April 28th. Fuse boards and switches. (April 16th.)
May 7th. Steel conduits and fittings for electric wiring. (See this issue.)
ST. MARYLEBONE.—May 5th. Electricity Department. L.p. and e.h.p. underground cables for 12 months. (See this issue.)

Manchester.—May 11th. Tramways Committee. Electric tramcar bodies, trucks, motors, and controllers. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.
April 30th. Central Purchasing Committee. Twelve months' supply of incandescent lamps. Forms of tender from Mr. H. C. Lamb, manager, Electricity Department, Manchester.

Meltham.—April 27th. Electricians' work at extension of Liberal Club. Quantities from Stocks, Sykes & Hickson, architects, 4, St. Peter's Street, Huddersfield.

New Zealand.—June 21st. Auckland Electric Power Board. L.p. insulators, &c.*
WELLINGTON.—May 12th. Post and Telegraph Department. 18 switchboards.*
DUNEDIN.—May 28th. Otago Harbour Board. One portable electrically-driven cargo stacker.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

Seaham Harbour.—May 5th.—Urban District Council. Overhead l.p. pole line, h.p. cables, sub-station equipment, h.p. switchgear. Specifications (£2 2s.) from Mr. J. E. Favell, consulting engineer, 22, Oxford Street, Newcastle-on-Tyne.

South Africa.—JOHANNESBURG.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (See this issue.)

Spain.—MADRID.—May 9th. Compania de los Caminos de Hierro del Norte. Overhead line, converting sub-stations, locomotives and motor coaches for the electrification of the lines from Barcelona to Manresa and San Juan de las Abadesas in one contract. The constructors are to obtain as much as possible of their supplies from Spanish industries.

Switzerland.—Tenders have been invited for the erection of the overhead lines necessary for the electrification of the railway between Brugg and Pratteln.

Turkey.—May 15th. Direction Générale des Postes et Télégraphes. 111,000 metres of 3, 7, 10 and 12 pair aerial telephone cable; 10,000 metres of 3, 7, 10 and 12 pair underground cable with joint boxes and accessories.*

Walthamstow.—May 12th. Electricity Department. One 1,500-kW motor converter. (See this issue.)

Warrington.—April 26th. Electricity and Tramways Committee. L.p. paper and lead-covered cables. (April 9th.)
May 10th. Electricity Department. E.h.p. sub-station truck-type switchgear. (See this issue.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Lighting Committee. Accepted:—
Feeder pillars.—W. Lucy & Co., Ltd.

Bath.—Town Council. Accepted:—
7,000-kW Brush-Ljungström turbo-alternator, complete with condensing plant and accessories (£23,020).—Brush Electrical Engineering Co., Ltd.

Bradford.—Tramways Committee. Accepted:—
24 tramcar gear wheels (£164).—Alfred Wiseman, Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Switchgear for Park Street sub-station (£599).—Ferguson, Pailin & Co., Ltd.

Carlisle.—Electricity Committee. Accepted:—
Overhead line to Cocklakes (schedule prices).—British Insulated Cables, Ltd.

Croydon.—Electricity Committee. Recommended:—
Steam receiver and pipe work in connection with erection of alternator set (£1,365).—Babcock & Wilcox, Ltd.

Dublin. — City Administrative Commissioners. Accepted:—
Wiring 230 houses in connection with the Croydon Park housing scheme (£2,714), and 218 houses at Kehoe Square (£2,601).—Dublin City Electricity Department.

East Ham.—Electricity Committee. Recommended:—
Cable (£6,147).—Bergmann Electric Co., Ltd.
Conduit tiles (£11 9s. 6d. per 1,000).—J. Baldwin.
Three switchboard panels (£210).—Bertram Thomas.
Two feeder pillars (£117).—W. T. Henley's Telegraph Works Co., Ltd.
High-pressure cylinder (£1,230).—Murgrave & Co., Ltd.

The Council has since decided to refer to the Government the question of the contract for the supply of a new feeder cable for Manor Park. The lowest tender was that of the Bergmann Electric Co., Ltd., at £6,147, but there was considerable opposition to the acceptance of a tender from a Continental firm.

Grange-over-Sands (Lancashire).—District Council. Accepted:—
Underground electric cables and connections for the new electricity area (£2,740).—Johnson & Phillips, Ltd.

Gravesend.—Electricity Committee. Recommended:—
Steam pipes (£218 15s.).—Foster Bros.

Heywood.—Electricity and Tramways Committee. Accepted:—
Overhauling the e.h.p. overhead line between the electricity works and Bury.—British Insulated Cables, Ltd.

Leyton.—Education Committee. Accepted:—
Installing electric light at Sybourn Street Infant School (£205).—Burdette and Co.

London. — ISLINGTON. — Cleansing Committee. Recommended:—
Two 3¼-ton electric vehicles (£1,892).—Electricars, Ltd.

Lamp Contracts.—Metro-Vick Supplies, Ltd., has received contracts from the London, Midland & Scottish Railway Co. for "Cosmos" vacuum train lamps, and from the Admiralty for "Cosmos" gasfilled ordinary lamps for H.M. ships.

Lynn.—According to the *Daily Telegraph*, the Town Council last week accepted a German tender for six miles of electrical cable, the price being £2,480, which was nearly £900 less than the lowest British tender.

Maxwelltown.—Town Council. Accepted:—
Wiring houses at Troqueerholm for electric light (A type, £47 10s.; B type, £25 16s.; C type, £25 10s.; D type, £25 10s.).—Mr. Moodycliffe.

New Zealand.—AUCKLAND.—Auckland Power Board. Accepted:—
Cable (£17,000 approx.).—Concordia Electric Wire Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Ventilating frames and covers.—John Hall (Oldham), Ltd.
Cable.—Union Cable Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.

Perth.—Corporation. Accepted:—
Electric lighting installation at Corporation housing schemes at Pitheavlis.—W. Borthwick.

Portsmouth.—Electricity Committee. Recommended:—
Two test panels (£376).—Johnson & Phillips, Ltd.
1,500-kVA transformer (£890), three transformers (£267).—Hackbridge Electric Construction Co., Ltd.

Ramsgate.—Town Council. Accepted:—
Installing electric light at the Westcliff Concert Hall (£216).—E. A. Pinto.

Rotherham.—Corporation.
Straker-Clough omnibus chassis.—Clough, Smith & Co., Ltd.

Sheffield.—Tramways Committee. Recommended:—
500 steel tramcar tires (£2,644).—John Brown & Co., Ltd.

Stirlingshire.—Education Committee. Accepted:—
Installing electric lighting at new schools at Riverside, Stirling.—Lockhart & M'Nab.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Dismantling interior of cooling tanks at central power house (£542).—Davenport Engineering Co., Ltd.
L.p. d.c. feeder panel at Burslem sub-works (£137).—Park Royal Engineering Co., Ltd.

Wakefield.—Housing Committee. Accepted:—
Wiring 50 houses on the Lupset estate.—Mr. H. Smith.

Forthcoming Events.

Birmingham Electric Club.—Friday, April 23rd. At the Grand Hotel, Colmore Row. At 7 p.m. Discussion of the I.E.E. Wiring Rules, to be opened by Mr. C. G. McDonald and Mr. H. Joseph.

Junior Institution of Engineers.—Tuesday, April 27th. At the Monico Restaurant, Piccadilly Circus, W. At 6.30 for 7 p.m. Annual dinner.

Institution of Electrical Engineers.—Thursday, April 29th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Frequency Characteristics of Telephone Systems and Audio-Frequency Apparatus and their Measurement," by Messrs. B S. Cohen, A. J. Aldridge, and W. West.

(North-Eastern Centre).—Monday, April 26th. At Armstrong College, Newcastle-on-Tyne. At 7 p.m. Annual general meeting. Lecture on "Modern Methods of Measurement," by Mr. B. A. Robinson.

(Scottish Centre and Dundee Sub-Centre).—Friday, April 30th. At the Y.M.C.A. Hall, Constitution Road, Dundee. At 7.30. p.m. Lecture on "The Past, Present, and Future of Wireless Telephony," by Capt. P. P. Eckersley.
Saturday, May 1st. Excursion to St. Andrews.

(South-Midland Centre).—Monday, April 26th. At the University, Birmingham. At 7 p.m. Ordinary meeting.

(London Students' Section).—Wednesday, April 28th. At the E.L.M.A. Lighting Bureau, 15, Savoy Street, W.C. At 7 p.m. Lecture and demonstration on "The Art of Illumination."

Illuminating Engineering Society.—Thursday, April 29th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7 p.m. Discussion on "School Lighting (Modern Requirements and Recent Progress)," to be opened by Dr. J. Kerr.

Royal Institution.—Thursday, April 29th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Imperfect Crystallisation of Common Things." by Sir W. Bragg.
Friday, April 30th. At 9 p.m. Lecture on "Wireless in the Empire," by Dr. W. H. Eccles.

Notes.

Local Societies.—Under the auspices of the Hastings and St. Leonards Radio Society, Mr. Wilfrid Schofield, of the Hart Accumulator Co., Ltd., delivered to an appreciative audience at Hastings on April 12th a lecture on "The Theory and Practice of Electric Accumulators."

NOTTINGHAM SOCIETY OF ENGINEERS.—A joint meeting with the Nottingham section of the Society of Chemical Industry was to be held on Wednesday last at the University College, when a paper on "Stream-line Filtration" was to be given by Professor J. W. Hinchley, A.R.C.S., F.I.C., accompanied by a demonstration of the stream-line filter.

A Large Hydro-Electric Project.—In a recent issue of *Power* some details are given of a scheme which has been submitted to the Chicago Chapter of the Izaak Walton League of America by Mr. C. Campbell, as a solution to the problem of maintaining and increasing the present low levels of the Great Lakes. The plan provides a new supply of water from the north into Lake Superior by diverting the waters of the watershed of the Albany River and its main tributary, the Ogoki, by the construction of two great dams, one on each side of the two rivers, and bringing these stored waters southward, through a canal cut through the high land on the southern side of this watershed, to flow from there south into Lake Nipigon and on through Nipigon River into Lake Superior. Mr. Campbell also suggests, as an after consideration, the creation of a new Great Lake, 15,000 sq. miles in area, should a great storage reservoir become desirable. The estimated cost of the scheme is $150,000,000, and the additional power which would be rendered available along the Great Lakes and the St. Lawrence River is estimated to be 1,000,000 h.p. A committee has been appointed to consider the merits of the schemes.

Iron Bauxite Smelting in Norway.—It is announced from Oslo that a large new works is to be established at Kinsarvik in Hardanger for the production of iron direct from the ore and the incidental output of alumina according to the process devised by Professor Pedersen, which is claimed to have been fully worked out. The scheme is being promoted by the A.S. Kinsarvik, in which the Aluminium Company of America has acquired or has applied to acquire the bulk of the capital. The process consists in the smelting of iron ore, but instead of limestone bauxite is used as a flux. The result is said to be the production of fine pure iron, equal to the best Swedish malleable iron, and of the semi-product alumina, which can be subsequently smelted in the electric furnace into aluminium. It is estimated that from 800 to 1,000 men will be permanently employed at the works and that from 500,000 to 600,000 tons of iron ore and bauxite will be required per annum.

Tramway and Light Railway Return.—A return has been issued by the Ministry of Transport of the accounts and statistical returns of the tramway and light-railway undertakings in Great Britain for the year ended December 31st, 1924, in the case of companies, and March 31st, 1925, for local authorities. It has been prepared and revised in accordance with the recommendations of a committee consisting of representatives of the Institute of Municipal Treasurers and Accountants, the Municipal Tramways Association, the Tramways and Light Railways Association, the Ministry of Health and the Ministry of Transport. The total route mileage open for traffic at the end of the period was 2,605 miles, of which 1,859 miles was worked by local authorities and 746 miles by companies. The total capital expenditure up to the same date amounted to £94,552,372. The total gross receipts for 1924-25 were £28,737,639, and the total working expenditure £22,733,155, leaving net receipts amounting to £6,004,484. The number of passenger journeys made during the year was 4,620,501,521, an increase of approximately 177 million over 1923-24. The car-miles run amounted to 378,239,229, of which 99.59 per cent. were by electric cars. The return, which is obtainable from H.M. Stationery Office, price 15s., also gives particulars of the trackless-trolley undertakings in Great Britain.

Telephotography.—Capt. R. H. Ranger, of the Radio Corporation of America, has brought a complete set of telephotography, or "photo-radio," apparatus to this country, and hopes, in co-operation with Marconi's Wireless Telegraphy Co., Ltd., to demonstrate during his visit to London the practicability of inaugurating a commercial service on his system. The route would be by land line to the Carnarvon radio station, thence across the Atlantic ocean to River Head, Long Island, and so by an 80-mile land line to New York. Three transmitters and two receivers are in use at New York City, and regular tests are being made with San Francisco; a limited service has also been opened between San Francisco and Honolulu. It is claimed that the detail in such pictures is comparable with that on an 80-line screen.

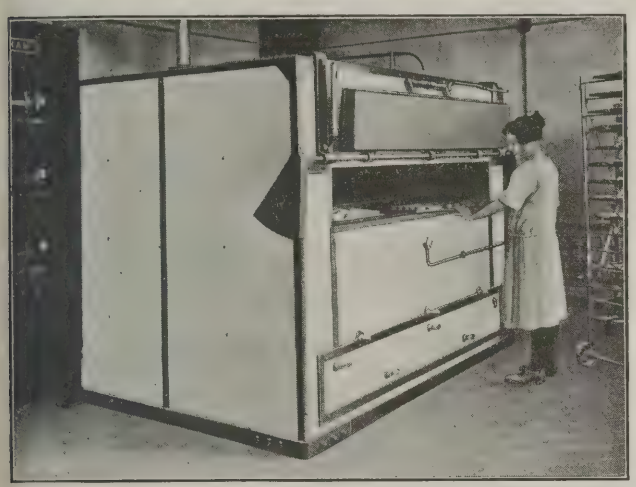
Telephone Battery-charging Set.—The Post Office Telephone Department has just taken delivery of a generating set, made by Messrs. Stuart Turner, Ltd., for battery-charging, which has an output of 1,200 watts. The telephone service does not require many sets of plant of as large a capacity as this, as a supply of electricity is generally available from the public mains. The plant is of the standard FS type made by the firm for country-house lighting, but the dynamo has been made capable of the special output necessary for telephone batteries.

Stage Lighting at the Plaza Theatre.—The electrical installation at London's latest kinema theatre, the Plaza, includes a bank of G.E.C. Schwabe horizon flood lamps, cloud apparatus, and panorama projectors for use in conjunction with an artificial horizon or cyclorama. This is probably the first installation of apparatus of this nature incorporating stage lighting in the general scheme which has been made in a kinema in the United Kingdom, and is of interest as a new departure in kinema equipment. Three G.E.C. magazine battens fitted with 150-watt "Osram" gasfilled lamps, wired on four-colour circuits, are also installed; these battens are of an entirely fresh design, and embody a new type of highly-efficient metallic reflector, rustless and non-tarnishing.

Explosive Reactions in Gaseous Media.—A general discussion on this subject is being organised by the Faraday Society, to take place on Thursday, May 13th, at the Institution of Mechanical Engineers, Westminster. The proceedings will be divided into two sessions. The first, from 2.30 to 6.30 p.m., will deal with the subject generally, and Professor H. B. Dixon, F.R.S., will preside. An introductory survey will be given by Dr. W. E. Garner, and papers initiating discussion will be presented by Professor Dixon, Professor W. T. David, Dr. S. W. Saunders, Dr. R. V. Wheeler, Professor W. A. Bone, and Dr. C. Campbell. The second session, 7.45 to 10 p.m., will deal with "Explosive Reactions Considered in Reference to Internal Combustion Engines." Sir Dugald Clerk, F.R.S., will preside and he will give an introductory survey, being followed by Professor David and Mr. H. T. Tizard. A dinner will be held between the sessions at the St. Ermin's Hotel. A full programme can be obtained on application to Mr. F. S. Spiers, 90, Great Russell Street, London, W.C.1.

Meter Engineers' Technical Association. — The first general meeting of the Association was held on April 15th at Anderton's Hotel, Fleet Street, London, E.C.4, when 37 members and visitors met to receive the Council's report on the progress made to date and to discuss proposed future activities. It was decided to hold the general meetings monthly during the winter months.

The Conveyor-type Electric Oven.—The use of the conveyor principle for electric ovens is proving of great assistance to progress towards the general adoption of electricity for baking. The outstanding advantages of this construction are greater convenience of operation and absolute uniformity of baking. Cumbersome drawplates and unwieldy peels are entirely dispensed with, since the oven brings its shelves right to the oven door for loading and unloading. Labour costs are thereby reduced and a valuable saving of space in front of the oven is effected. A one-sack conveyor oven, it is claimed, can easily be operated by a young girl. The accompanying illustration shows an oven of this type in operation in a bakery of Messrs. H. Cookson & Sons, Preston, manufactured by the



An Electric Bakery Oven at Preston.

Metropolitan-Vickers Electrical Co. The conveyor oven is equally suitable for the mass production of one class of goods and for the mixed trade of the ordinary baker and confectioner. Provided that whatever goods are to be baked require the same temperature, they can be baked together and each portion removed when it is ready. It is interesting to note that ovens of this type have recently been installed for such well-known firms as Cadbury Brothers, the Indo-China Tea Company ("Kardomah" Cafés), and the Welwyn Garden City Bakery. Probably the deciding factor in connection with electric ovens is the question of the cost of operation and on this point there appears to be a good deal of misapprehension. The experience of those who have adopted electrical baking is that with electricity at 1d. per kWh, the cost is about 3d. per £1 worth of goods baked or 1¼ per cent. of the goods value.

Radium in Czecho-Slovakia.—During 1925, one and a half grammes of radium were produced at the Jáchymov mines, which raises the quantity of radium extracted since 1902 to about 12 grammes. A quantity (1.6 grammes) was lent some years ago to a British company, but this company having "disappeared," the radium was deposited at the Czecho-Slovak Legation in London. The rest, apart from quantities sold or placed at the disposal of clinics against an interest of 10 per cent. payable to the Ministry of Public Instruction, is deposited with the Office Bancaire against an interest of 10 per cent. The interest represents an important part of the revenue of the Jáchymov State mines. In 1922 the international price of radium was 10,000,000 crowns; now it is 3,000,000 crowns. The Jáchymov mines employ a staff of 300 workers, out of which thirty are miners; apart from the extraction of pitchblende and the production of radium, they are also engaged in the extraction of uranium compounds from which dyes are obtained for use in the glass and porcelain industries; the dyes are exported principally to Germany and Great Britain.—*Reuter's Trade Service* (Prague).

Electrically-operated Swing Bridges.—The Great Western Railway is installing electric power for the operation of the swing bridge over the River Neath at Court Sart on the Rhondda-Swansea Bay Railway, to take the place of the existing hydraulic machinery.

The Sarsfield swing bridge, spanning the Shannon at Limerick, which was erected some two years ago by the Limerick Harbour Board, has recently been equipped for electrical operation by the Metropolitan-Vickers Electrical Co., Ltd. The bridge was formerly operated by manual labour.

American Electric Lamp Developments.—An estimate of the incandescent electric lamp business in the United States for 1925 indicates the sale of 280,000,000 lamps for home, office and factory lighting, representing an increase of 7¼ per cent. on the sales of the previous year. About 195,000,000 "Miniature" flashlight lamps were also sold during that period, a 3½ per cent. increase. A practical method of chemically frosting the inside surface of electric lamp bulbs is said to have been developed, which, it is claimed, results in a reduction of the absorption of light to less than 2 per cent. The production of the double-filament Mazda headlight lamp, with two 21-c.p. filaments, was the foremost achievement in the small lamp field. One filament, it is stated, throws a powerful beam far down the road and the other filament gives a beam depressed about 2½ degrees.

Notable Performance of a Starter Battery.—Miss Violette Cordery's Invicta motor-car, on which she recently set up four new world's records and four international class records on the Monza track, Milan, is fitted with Exide batteries. The average speed maintained for 15,000 miles was no less than 56 m.p.h.

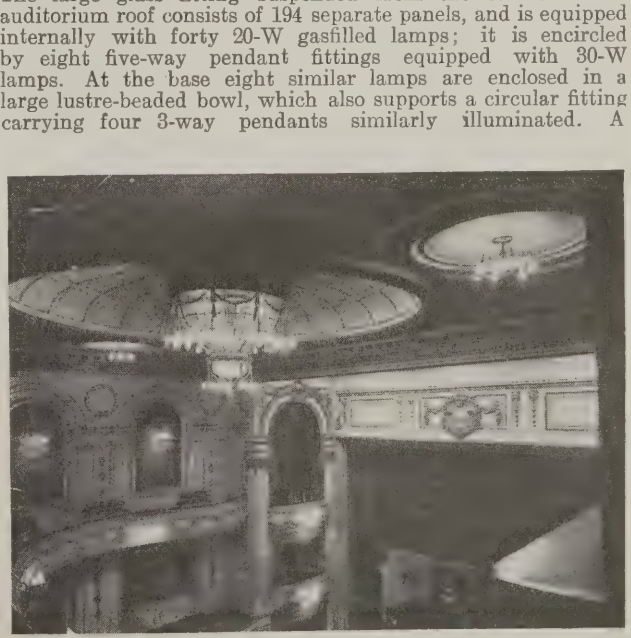
According to the rules governing these records, if for any reason the car stops on any part of the track, the driver may not have any assistance in bringing it round to the replenishing depôt. Consequently, as it is not too easy for one person to push the car for perhaps two miles, the Invicta Co. decided, before making the above record-breaking attempt, to discover how far the starter battery would drive the car on top gear with the engine switched off and against compression—admittedly a rather brutal test. The Invicta Co. reports the result of this test as follows:—"A standard Invicta car was taken at random, and on a level road the engine was stopped and the car driven solely by the Exide starter batteries for one mile at a speed of about 3 m.p.h. At the end of a mile the voltmeter still showed over 12 volts, and it was estimated that the car could have been driven about two miles in all. The following morning the same Exide batteries, with no recharging, started the engine at once from cold.

Scientific Organisation in Belgium.—Following the International Congress on Scientific Organisation held in Brussels in September last, a movement has been started in that city to organise a Belgian National Committee of Scientific Organisation.

All-Electric Public Baths.—On April 17th, the new all-electric public baths at North Woolwich were officially opened by the Mayor of Woolwich, Councillor W. Baresoot, J.P. The water is heated on the Bastian electric water-heating system, the apparatus being supplied by Messrs. Bastian & Allen.

Electrically-Welded Railway Apparatus.—Some interesting particulars are given in the *Railway Review* of a locomotive tender tank which, with the exception of the safety appliances (grab handles) has been constructed throughout by arc welding. The tank was put into service in 1921 and since that time it has covered a distance of 201,563 miles and no defects have developed in the welding. The tank is made of ¼-in. plate and is 26 ft. long, 10 ft. wide and 5 ft. 2 in. high. It has a capacity for 8,000 gallons of water and 12 tons of coal. In the average tank of this capacity there are approximately 7,000 rivets of a total weight of 800 lb., and the number of holes punched in sheets, angles and T-braces would total approximately 15,800. A total of 39½ lb. of welding rod was used in the new tank. In order to eliminate the water scoring and rusting prevalent in the riveted type of tank, the welding of the T-braces to the bottom and top of the tank was continuous in its entire width.

A Theatre Lighting Installation.—The accompanying illustration shows the effects of the lighting installation with which the Aldwych Theatre, London, has been equipped. The large glass fitting suspended from the centre of the auditorium roof consists of 194 separate panels, and is equipped internally with forty 20-W gasfilled lamps; it is encircled by eight five-way pendant fittings equipped with 30-W lamps. At the base eight similar lamps are enclosed in a large lustre-beaded bowl, which also supports a circular fitting carrying four 3-way pendants similarly illuminated. A



Electric Lighting at the Aldwych Theatre.

smaller circular fitting is installed on either side of the central unit carrying six lighting units, which are equipped with "White Osrams." Three tastefully-grouped 18-lamp circles illuminate the proscenium, and triple wall brackets with shades are used to illuminate the tier fronts and boxes. The stage lighting is effected by 40-W vacuum lamps. A ten-light fitting and two-light brackets are installed in the outer hall, six multiple-light brackets in the vestibule, eight similar brackets and two handsome standards in the grand saloon, and a 21-light fitting in the rotunda well. The whole of the lamps installed are of the Osram type.

Appointments Vacant. — Transmission-line engineer (£800), electrical machinery and transformer engineer (£500), structural engineer (£600), hydraulic engineer (£600), and five junior assistant engineers (£200), for the River Shannon hydro-electric development scheme; electrical engineer (£650 +) for the Burgh of Hamilton; general assistant engineer (£270) for the Basingstoke Corporation Electricity Department; scientific officer for research work (£250+) for the Royal Aircraft Establishment, South Farnborough; district assistant to the mains engineer (£421), for the City of Birmingham Electric Supply Department; charge engineer, for the Lancashire Electric Power Co.; assistant shift charge engineer, for St. Marylebone Borough Council Electricity Department. (See our advertisement pages to-day.)

The Association of Mining Electrical Engineers.—The annual general meeting of the South Wales Branch and the Western Sub-Branch of the above Association will be held at the Wellington Hotel, Brecon, on May 8th, when a visit will be paid to the constructional works of the Taf Fechan Water Board at Pontsticill. Members and friends will meet at the tramway depôt of the Merthyr Electric Traction and Light Co., Ltd., and proceed by motor coach to Pontsticill, thence to Brecon for tea and the meeting, returning to Merthyr.

Institution Notes.

Institution of Electrical Engineers.—Informal Meeting.—At the informal meeting on April 12th Mr. J. Coxon was in the chair when Captain P. P. Eckersley opened a discussion on "The Linking together of Wireless and Wire Communication Systems."

The Chairman announced that this was the last meeting of the Session, and stated that while the standard of the discussions had been fully maintained and the numbers attending had exceeded those of previous years, the Committee was anxious to see even larger attendances; and as the programme for next Session would be under consideration shortly, he invited members to write to the Secretary proposing subjects to be discussed, and to suggest improvements that would increase the popularity of the informal meetings.

Captain Eckersley, in his own truly informal way, then reviewed some of the applications of linked wire and wireless systems. Explaining the difficulties of the intermittent methods by simplex working and the first attempts at duplex transmission made by Captain Round, he said great difficulties arose from having large transmitting apparatus near the receiver. He described the handicaps in using land lines that had been designed for other purposes. He drew diagrams of the unique semi-automatic board at 2LO, which insured a continuous broadcast programme by rapid transfer to other lines, in the event of failure of a transmitting station. His conclusions were that the linking of wire and wireless systems was unavoidable, but however indispensable the wireless system must inevitably be, in its present stage of development he would never use wireless where a wire would serve.

Scottish Centre.—At the sixth annual meeting of the Scottish Centre of the Institution at Glasgow, the following officials were elected for the year:—Chairman, Mr. W. L. Winning; vice-chairmen, Mr. A. S. McWhirter and Mr. W. F. Mitchell; hon. secretary, Mr. Joseph Taylor; Edinburgh assistant hon. secretary, Mr. H. V. Henniker.

Gas and Electricity Undertakings.—With the concurrence of the Council of the Institution and of the National Gas Council, a joint committee has been set up with the following reference:—"To consider whether in the national interest an inquiry might advantageously be held into the possibility of closer co-operation between gas and electricity undertakings in promoting capital and fuel economy in the supply to the public of energy derived from coal," with the understanding that no reports or discussions of the committee are to be published without the consent of both Councils. The committee is constituted as follows:—Messrs. R. A. Chattock, J. S. Highfield, G. W. Partridge, C. B. Sparks, C.B.E., W. B. Woodhouse, nominated by the Council, I.E.E.; Messrs. D. Milne Watson, D.L., and W. Cash, F.C.A., Sir A. Duckham, K.C.B., Messrs. A. W. Smith and C. Wood, O.B.E., F.C.S., nominated by the National Gas Council.

Association of Mining Electrical Engineers.—The annual general meeting of the London Branch of the Association was to be held on Tuesday last at the Junior Institution of Engineers. After the formal business there was to be a lecture in the form of a kinematograph demonstration on the subject of coal screening, blending and crushing, with special reference to the belt conveyor, by Mr. F. H. F. Hampton.

Royal Society of Arts.—At the meeting to be held on Wednesday, May 5th, at 8 p.m., Mr. C. F. Elwell, B.A., will lecture on "Radio: Its Past, Present, and Future." Prof. W. H. Eccles, D.Sc., F.R.S., will preside. On the following Wednesday, May 12th, at 8 p.m., Mr. Warre S. Bradley will deal with "Industrial Welfare in Practice." Sir Robert A. Hadfield will preside.

Institute of Transport.—Congress.—The sixth Congress of the Institute will be held at Birmingham from May 13th to 15th, and the proceedings will comprise the reading and discussion of papers and various visits and inspections. The latter will include the works of Messrs. Cadbury Bros., Ltd., at Bournville, the Kyotts Lake Depôt of the Birmingham Corporation Tramways, the Curzon Street goods station, L.M. and S.R., the carriage and wagon shops of the L.M. & S.R. at Derby, and the works of the Austin Motor Co., Ltd., at Longbridge.

Among the papers to be read are "Road Passenger Transport," by Mr. Alfred Baker, General Manager, Birmingham Corporation Tramways, and "Transport in England: a brief historical survey," by Mr. C. Grant Robertson, M.A., LL.D., C.V.O., Principal of the Birmingham University.

The Faraday Society.—The *Transactions* of this Society, which have hitherto appeared three times a year, will in future be published bi-monthly in order to expedite the publication of papers presented to the Society. In addition to the six bi-monthly parts, reports of two general discussions will be published annually, one in the spring and one in the autumn. The new arrangement begins with Volume XXII, 1926.

Institute of Wireless Technology.—Dinner.—Dr. Ralph Bown, vice-president of the American Institute of Radio Engineers, is at present visiting London in connection with developments in transoceanic radio telephony. A meeting of members of all classes of the Institute of Radio Engineers resident in Great Britain and the Irish Free State has been arranged to welcome Dr. Bown, who is the director of the Department of Development and Research of the American Telegraph and Telephone Co., of New York. His address will convey information regarding developments. The date of the meeting has been fixed for April 27th, and will take the form of a dinner at the Engineers' Club. Tickets (price 8s. 6d., exclusive of wine) should be applied for at once, addressing the hon. secretary, Institute of Wireless Technology, 71, Kingsway, London, W.C.2.

Junior Institution of Engineers.—In a paper on "Automobile Lighting, Starting and Ignition," read before the Institution, Mr. T. L. Allison described the operation of the trembler coil, magneto, and battery and coil systems of ignition, and mentioned the advantages of the battery and coil system in respect of cheapness, simplicity of moving parts, and adaptability and uniformity of spark at all speeds. He also described and illustrated several types of dynamos, starters, switchboards and wiring. Mr. Allison said that the public was very quick to condemn a car because of a known defect in its electrical equipment.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

At the last meeting of the Council of the E.C.A. Allied Associations, held at 15, Savoy Street, on April 13th and 14th, Mr. H. J. Miles, M.I.E.E. (Messrs. Page & Miles, Ltd., Brighton) was unanimously nominated as president for the year 1926-1927; and Mr. W. H. Walton (Messrs. Pinching and Walton) was also unanimously nominated as vice-president for the same period. At the same Council meeting Mr. L. C. Penwill was unanimously appointed as secretary of the E.C.A. Allied Associations. Mr. Penwill acted as assistant and deputy to the late Mr. Leonard G. Tate, M.I.E.E., for six years (from 1920), during which time he acquired an intimate knowledge of all the Association's affairs and activities.

The marriage took place at Fleetwood on April 3rd of Mr. Lawrence F. Rowntree, who is in charge of the local branch of the Humber Electrical Engineering Co., Ltd., and Miss Margaret E. Fish.

Mr. G. Weeks, of G. Weeks & Son, electrical engineers, Bromley, Kent, was on April 9th presented with a Gladstone bag, a cheque for 100 guineas, which he will devote to educational purposes, and an album containing an illuminated address, a portrait of himself, and a list of the subscribers, in recognition of his long and valued public services to the town. Mr. Weeks served on the Town Council from 1903 until his recent retirement, and filled the office of Mayor from 1911 to 1913.

Mr. W. J. Cooper, acting electrical engineer at Hamilton Electricity Works, has been appointed electrical engineer for the burgh of Hamilton.

The *Financial Times* states that Mr. F. Stacey Hooker, who in 1924 joined the board of C. A. Vandervell & Co., and also acted as general manager, has now resigned his executive position, but remains a director of the company. He is joining the board of several other companies.

The *Financial Times* says that Mr. Bruce has offered Mr. Howard Gepp, general manager of the Electrolytic Zinc Company, the chairmanship of the Migration Developmental Commission at a salary of £5,000 a year, and that Mr. Gepp has accepted the position.

Mr. L. Hermes, of the Marconiphone Co., Ltd., Tottenham Court Road, W.1, has resigned his post as sales manager of the company as from April 13th.

Aylesbury Town Council has increased the salary of the electrical engineer, Mr. W. A. Turnbull, from £650 to £750.

The Dover Town Council has increased the salary of Mr. Osborn, mains superintendent, from £409 per annum to £455.

Alderman J. W. Longley, consulting engineer and chairman of the Bradford Corporation Electricity Committee, is the newly-elected president of the Bradford Engineering Society.

On April 16th Mr. Joseph Taylor, foreman of the finishing department of English Electric Co., Ltd., at Preston, who is retiring after 27 years service, was presented with a cigarette cabinet, a silver cigarette case, and a silver matchbox. Mr. Barwick, works superintendent, made the presentation.

At a social gathering held on April 15th Mr. E. Evans, who, after 30 years' service in the Electricity Department of the Southport Corporation, recently relinquished his position as works superintendent, was presented by the borough engineer, Mr. E. Moxon, on behalf of the members of the Welfare Club, with an easy chair and a framed photograph of the staff. Mr. Moxon, Mr. W. T. Gann, chief assistant engineer, and Mr. J. J. Young, works superintendent, each paid tribute to Mr. Evans's abilities.

Mr. W. A. MacKenzie, of the Charing Cross Electricity Supply Co., was entertained to dinner at Gatti's Restaurant, Strand, on April 16th, and was presented with a token of esteem from his personal staff on the occasion of his appointment to the London Power Company.

M. Maurice Le Las, the president of the Société des Téléphones Le Las and a director of the Compagnie Française Amplion, of Paris, has recently been appointed a Chevalier of the French Legion of Honour. The Le Las Co. is well known as suppliers of telephone and signalling apparatus for the French Navy, and it is in connection with this work that the honour has been conferred on its president.

The Stoke Newington Electricity Committee has recommended that the sick leave of Mr. C. S. Hann, the borough electrical engineer, be extended until May 13th, as his medical adviser reports that there is every prospect of a permanent cure being effected.

Mr. Edward Perugini recently resigned from the post of general manager of the Electrical Federation (Victoria) and, according to the *Australian Electrical Times*, Mr. W. Richards, who has had an extensive experience in the Department of Trade and Customs, the Tariff Board, and in private business, has been appointed to succeed him.

We learn that a new air record for a flight from London to the Continent was set up this week, when Mr. P. F. Berk, chairman of Messrs. F. W. Berk & Co., Ltd., chemical manufacturers and makers of the B.A.A. accumulator acid, flew 1,200 miles in 15½ hours.

Obituary.—Mr. H. Oppenheimer.—Mr. Hermann Oppenheimer, whose death, in his seventieth year, was briefly mentioned in our last issue, was for many years one of the most



The Late Mr. H. Oppenheimer.

familiar personalities in electrical trade circles in London. His connection with the industry had extended over 40 years, for in the early days of the General Electric Co., Ltd., he was associated therein with Sir Hugo Hirst and the late Mr. Byng. After that relationship he became manager of the International Telephone Co., Ltd., first at Aldermanbury and later at Red Cross Street, London. Mr. Oppenheimer was always a man of spirit, energy and enterprise, and under his direction the International Co.'s business grew until it became necessary to move to more commodious quarters; it was then that he opened a new factory at Kilburn. During this period the telephone industry was undergoing rapid development and the company's work comprised telephonic installations in the Island of Guernsey and at Glasgow. Mr. Oppenheimer's principal achievement was the foundation in 1911 of the Phœnix Telephone & Electric Works, Ltd., of which he became chairman and managing director. At a dinner held to celebrate the removal of the company into the Hendon premises, marked testimony was borne to Mr. Oppenheimer's popularity. The group of well-known electrical men who used to meet at the Hotel Cecil and other places in the old days when the National Electrical Manufacturers' Association was beginning the discussion of problems confronting the electrical trader and manufacturer, will well recall the interest that Mr. Oppenheimer imparted to its proceedings, and they will also remember the important part that he played in bringing into being the Electrical Trades Benevolent Institution. In the Electrical Review for June 2nd, 1905—nearly twenty-one years ago—the first annual meeting of the National Electrical Manufacturers' Association was reported, and it will perhaps be interesting to reproduce now the list of those who at that meeting were appointed as the committee, for they revive the surroundings in which Mr. Oppenheimer was formerly a very familiar figure:—Messrs. Bevis, Grainger, Lundberg, Nalder, Northcote, Oppenheimer, Patersen, Clarke, and H. H. Berry. Those who knew him in these and other connections will agree that he was a lovable man, always optimistic, very good company, and interested in the electrical industry as a whole, and the employés of his company will bear testimony to the personal interest that he took in their well-being. Indeed, one of the schemes which he brought into existence shortly before his death was a pensions scheme, to which the company contributed handsomely.

Mr. A. A. Brown.—The death took place, on April 7th, at the age of 48 years, of Mr. Alfred Alexander Brown, who had for many years been in business as an electrician in Church Street, Barnsley.

Mr. A. F. Lovey.—We regret to record that the death took place, on April 10th, of Mr. Arthur Feri Lovey, of Blackheath, S.E., who had for 47 years been on the electrical staff of the Telegraph Construction and Maintenance Co., of East Greenwich. Since 1880 he had assisted in laying cables in many parts of the globe.

Mr. H. A. Olive.—The death took place, on April 14th, in hospital in London, after an operation, of Mr. Henry Andrew Olive, who was in business as an electrical engineer at Sittingbourne. He was 40 years of age.

New Companies Registered.

Gravesend Welding & Electrical Engineering Works, Ltd. (213,118).—Private company. Registered April 12th. Capital, £1,500 in £1 shares. Objects:— To acquire the business of welders and electrical and general engineers now carried on by S. Levett and E. J. S. Wheatcroft at Gravesend and Northfleet, Kent. The permanent directors are:—S. Lovett, 28, College Road, Northfleet; E. J. S. Wheatcroft, 4, Park Place, Milton Road, Gravesend; E. W. Whiteman, 2, Ivanhurst, Overcliffe, Gravesend. Qualification, 400 shares. Remuneration, £30 per annum, divided between them. Solicitors: Edward Lovell & Son, Gravesend.

County Electrical Co. (Pendleton), Ltd. (213,097).—Private company. Registered April 12th. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrician carried on by T. H. Blood as the "County Electrical Company," and to carry on the same and the business of electrical engineers and contractors, dealers in electrical and wireless goods, &c. The directors are:—H. T. Blood and Mrs. E. Blood, both of Ravensfleet, Linney Lane, Bramall, Cheshire. Qualification, 1 share. Remuneration as fixed by the company. Registered office: Town Hall Chambers, Broad Street, Pendleton, Manchester.

Dri-Ac, Ltd. (213,055).—Private company. Registered April 9th. Capital, £1,500 in £1 shares (1,200 ordinary and 300 deferred). Objects: To acquire from C. G. Smith the benefit of certain existing inventions relating to secondary cells or batteries for electricity storage, and the trade mark or name of "Dri-Ac" used in connection with the sale of apparatus, &c., and to carry on the business of electric or wireless apparatus engineers, &c. The subscribers (each with one ordinary share) are:—C. G. Smith, "Woodville," Oakland Avenue, Cheltenham, Glos., electrical engineer; J. E. Mindfino (?), Avening Court, Glos., gentleman. The directors are not named. Qualification: 10 shares. Solicitor: J. G. Fishwick, 5, Cook Street, Liverpool.

The Standard Sealing-Chamber Co., Ltd. (213,144).—Registered on April 13th as a company limited by guarantee and not having a capital divided into shares, with 20 members each liable for £10 in the event of winding up. The objects are:—To acquire, develop and turn to account patent No. 200,895, of 1923, for an invention relating to improvements in and relating to the connection of electric cables to electrical apparatus, and to carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical, magnetic, galvanic and other apparatus, &c. The management is vested in an executive committee of not less than three or more than 11 members. The first members are:—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2; English Electric Co., Ltd., Queen's House, Kingsway, W.C.2; General Electric Co., Ltd., Magnet House, Kingsway, W.C.2; Edward Holme & Co., Ltd., Broadheath, Altrincham; Johnson and Phillips, Ltd., Charlton, S.E.7; Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow; Metropolitan-Vickers Electrical Co., Ltd., 4, Central Buildings, Westminster, S.W.; Bruce Peebles & Co., Ltd., Edinburgh; Allen West & Co., Ltd., Lewes Road, Brighton, all electrical engineers. Secretary: J. Bilsland. Solicitor: T. Trimnell, 1, Lincoln's Inn Fields, W.C. Registered office: 57-58, Chancery Lane, W.C.2.

Crow, Davies & Co., Ltd. (213,086).—Private company. Registered April 10th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical and mechanical engineers, &c. The directors are:—F. G. Crow, 14, Upper Hornsey Rise, N.19, engineer; E. W. Davies, 4, Martlett Chambers, Crown Court, Covent Garden, W.C. Qualification, 100 shares. Remuneration as fixed by the company. Secretary: I. M. Chapman. Solicitors: Bernard Shaffer & Co., 57, Conduit Street, W.1. Registered office: Buchanan Buildings, Holborn, W.C.

Globe's Auto Electrical Co., Ltd. (213,163).—Private company. Registered April 14th. Capital, £3,600 in £1 shares. Objects: To acquire the business of a magneto and general electrical engineer formerly carried on by Anna Globe at Broad Lane, Sheffield. The directors are:—H. Heath, 649-651, Attercliffe Road, Sheffield, motor car proprietor; F. Simpson, address not stated; Mrs. A. Globe, 37, Alexandra Road, Chesterfield. Solicitors: Chambers & Sons, 26, Bank Street, Sheffield.

Official Returns of Electrical Companies.

Lewes and District Electric Supply Co., Ltd.—Satisfaction in full on March 22nd, 1926, of debentures dated December 30th, 1910, securing £8,800.

Debenture dated March 23rd, 1926, to secure £20,000 and bonus, if any, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Prudential Assurance Co., Ltd.

Aldeburgh Electric Supply Co., Ltd.—Satisfaction in full on March 26th, 1926, of debenture dated February 9th, 1918, securing £2,500.

Shoreham and District Electric Lighting and Power Co., Ltd.—First mortgage debenture dated March 19th, 1926, to secure £10,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Solicitor to H.M. Treasury.

Lighting Trades, Ltd.—Two charges dated March 19th, 1926, to secure £55,000 and £95,000, respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Nobel Industries, Ltd., and Curtis's & Harvey, Ltd., Nobel House, Buckingham Gate, S.W.1.

J. P. Hall & Co., Ltd.—Particulars filed of £46,666 13s. 4d. debentures authorised March 30th, 1926, constituting a specific charge on the company's freehold and leasehold property at Oldham, and a floating charge on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

"M.K." Electric, Ltd.—Particulars filed of £10,000 debentures authorised March 12th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, if any, the amount of the present issue being £4,600.

Cooke & Whitfield Wireless, Ltd.—E. P. Q. Carter, of 35, Waterloo Street, Birmingham, C.A., was appointed receiver and manager by order of Court dated March 30th, until April 13th, 1926, or until a further order.

Hayden, Ltd.—W. Reynolds, accountant, of 9, Heather Gardens, Golders Green, N.W.11, was appointed receiver and manager on March 22nd, 1926, under powers contained in debenture dated December 3rd, 1926.

G. W. M. Electrical Co., Ltd.—A. C. J. Jackson, of 43, Grafton Street, Tottenham Court Road, W.1, was appointed receiver and manager on April 7th, 1926, under powers contained in debentures dated December 24th, 1925

Maywood Engineering and Electrical Manufacturing Co., Ltd.—Mortgage or charge on the company's undertaking and property, present and future, including uncalled capital, dated March 25th, 1926, to secure £750. Holder: Lady Mills, Wentworth, Virginia Water.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £3,700, on March 31st, 1926, of 4 per cent. perpetual first mortgage debenture stock secured by trust deed dated December 16th, 1897, securing £200,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Vickers, Ltd.

Mr. Douglas Vickers (president) occupied the chair at the annual meeting on April 15th and presented the report, which was dealt with in our last issue (p. 630). He said that the profits of the past year were sufficient to pay preference dividends and leave a margin of £18,275 to be carried forward. In the opinion of the directors it was not necessary to make any further reduction last year of the low value of assets recently taken as a basis upon the recommendation of the advisers, but considerable sums had been written off for depreciation in the accounts of the subsidiary companies. The board would probably decide to reorganise some of the other subsidiary companies to bring their capital down to a figure more in accordance with the value of their assets. Reviewing the activities of the subsidiaries during 1925, Mr. Vickers said that on the purely electrical side W. T. Glover and Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., had done well. The latter company had cultivated foreign business very carefully, with the result that considerably over half its orders came from abroad. Those foreign orders included some of the heaviest and most important pieces of machinery made in the country. After dealing with the prospects of the shipbuilding and armament departments, the president made reference to the Electricity Bill and said that the proposals had caused a setback in the demand for heavy generating plant. There would, however, soon be urgent necessity for new plant to meet the growing demand and to supersede the small inefficient stations which had stood so long in the way of development. He deprecated attempts to wreck the Bill and hoped that the Government would insist upon the provision of a "grid-iron" of mains for the interchange of energy between systems, and the construction of new stations to feed it. Apart from that there should be as little interference as possible with the generators and distributors of electricity. Mr. R. McKenna seconded the adoption of the report, which was carried. The whole of the directors were re-elected with the exception of Lord Invernairn, who had expressed a wish to retire.

Electric Supply Corporation, Ltd.

Mr. K. A. Scott-Moncrieff (chairman) presided at the annual meeting on April 15th, and in presenting the report (*vide* Elec. Rev., April 9th, p. 591), he said that although the energy supplied in Dumbarton and Hitchin had decreased, in all the other towns served by the company there had been progress. The result was an increase of £1,969 in the amount carried to net revenue account. The company had increased its interest in the Hendon Electric Supply Co., Ltd. The Dawlish and North Berwick Companies had not yet issued their reports. The undertaking of the latter company had been acquired by the North Berwick Town Council on March 31st last, and the distribution of its assets would give the company a considerable premium on its holding in the North Berwick undertaking. The Dumbarton Burgh & County Tramways Co. was suffering from severe outside omnibus competition. The E.S. Corporation had increased its holding of short-term notes in the company; these were secured upon the shares of the Dumbarton General Omnibus Co., which had been formed to meet the competition. Referring to the Government's Electricity Bill, the chairman said that although there were points in the measure which would affect the company adversely, it would be all to the good if the company could take bulk supplies instead of running small generating stations. In connection with such supplies, however, a difficulty arose where the undertaking was purchasable by a local authority within a comparatively short period which would not give the company time to write off the capital cost of the plant which had to be discarded. The Bill made provision for that in general terms. The Dalkeith undertaking was being purchased by the Town Council, but the Chelmsford Council had not exercised its option at the end of last year. The next purchase period would be in 1936. The company had thought it advisable to extend its operations into new fields. Accordingly, the Orders in respect of Alton, Hants., and Wellington, Somerset, were being acquired, and also that for Seaford and Newhaven when it was granted. The company had also obtained Orders in its own name for the supply in Hitchin and Exmouth, as the existing arrangements were unsatisfactory.

Oliver Pell, Control, Ltd.

Speaking at the annual meeting on April 8th, the chairman (Mr. C. Oliver) said that the profit enabled them to maintain the dividend of 10 per cent. upon both the ordinary and preference shares. The position of the company had also been strengthened by substantial allocations to depreciation and by increasing the amount carried forward. The company had been engaged on street-lighting contracts during the year employing the "Oliver" lamp. In the directors' opinion the arc lamp was superior to the gasfilled lamp for street lighting, and was sure to come into its own again. Their subsidiary, the Varley Magnet Co., had been busy during the year, as had their switch department, whose products were sold to the trade by Iok Switches, Ltd., in which company they held a controlling interest. They anticipated a great expansion in the sale of their switches, which were replacing American patterns, and to provide for this growth they were reorganising their works in all departments and providing further accommodation and facilities. They considered that the Government should extend a certain measure of protection to the industry, and were willing to fall in with Sir Field Beale's recent proposal that manufacturers should agree, in return for protection, not to advance their prices to the public.

The report and accounts were adopted.

Lanarkshire Tramways Co.

Owing to unrestricted motor-omnibus competition, the company sustained a loss of £9,848 during 1925, and to this has to be added interest charges amounting to £858. After crediting £3,183 brought forward and £5,663 from investments, a debit balance of £1,859 remains to be carried forward. In view of the heavy loss, it was necessary to reduce the wages of the staff, and this resulted in two strikes. Expenses have been reduced in all directions, but until some control is exercised over the motor-'bus services in the area, the financial results will continue to be unsatisfactory. A statement circulated with the report shows that the receipts per car mile fell from 16.86d. in 1924 to 9.57d. in 1925. In the last eleven years a total of £388,383 has been expended virtually in relief of the ratepayers, including £238,469 for road maintenance. The report records the death of two directors, Sir Bache Cunard, Bart., and Lord Carmichael, whose places have been taken by Mr. G. F. Pollock and Mr. A. Clements. Meeting: April 30th.

Bournemouth and Poole Electricity Supply Co., Ltd.

The annual meeting was held on April 15th. Mr. J. A. Hosker (chairman), who presided, said that the report showed continued progress. The expenses had been increased by heavier rates and taxes, but the increase in revenue more than balanced that. The total reserves were now £446,271, while the ordinary capital was £360,000. Mr. Hosker was of opinion that unless the Government's Electricity Bill were considerably amended it would fail to secure the development of the industry and lower generating and distributing costs. If the company could obtain a bulk supply at a lower rate than that at which it generated electricity, the opportunity would be seized. Conversely, the company would be glad to afford a bulk supply to other undertakers. He feared that there was a danger of bureaucratic control impeding progress. So far as the company's area was concerned it would appear that it was unlikely to be affected for many years.

Canadian Companies.

Canadian General Electric Co., Ltd.—The gross profits for the past year were $1,617,092 and the net profits $933,751, as compared with $578,473 in 1924. The same amount was allocated to depreciation ($600,000), but the interest charges were lower, owing to the redemption of outstanding debentures and notes; these charges have now been

entirely eliminated. The payment of dividends absorbed $553,541, leaving a surplus of $380,209, as against $66,246 in 1924. This surplus has been employed to write off the premium paid on the redemption of the debentures. The cash balance at the close of the year was $1,092,119, as compared with $816,420 at the end of 1924, and the value of investments has risen from $325,152 to $849,012.

Canadian Light and Power Co.—By an extraordinary resolution passed recently, 40 per cent. of the principal indebtedness, represented by 5 per cent. 40-year first mortgage sinking fund bonds, is to be converted into fully-paid, non-assessable shares of the common stock of the company at par.

West Kootenay Power and Light Co.—The gross earnings for 1925 were $1,041,125, as against $683,416 in 1924. After providing for interest, depreciation, renewals and dividends, a surplus of $5,238 remains, which is added to $11,374 brought forward. Last year's surplus was only $67.

Belgian Companies.

The *Compagnie de Tramways et Electricité* states that the net profits realised in 1925 amounted to 718,000 fr., allowing of the distribution of a rate of 15 fr. net per share.

The *Compagnie Générale de Railways et Electricité* reports an increase in net profits from 7,252,000 fr. in 1924 to 7,945,000 fr. last year. It is proposed to pay a dividend at the rate of 31.20 fr. net per ordinary share, as compared with 31.87 fr. in 1924.

The *Société Générale Belge d'Entreprises Electriques* reports that the net profits increased from 3,502,000 fr. in 1924 to 4,783,000 fr. last year, permitting of the payment of a dividend at the rate of 42.90 fr. net per share, as compared with 46.75 fr. in the previous year.

The *Ateliers de Constructions Electriques de Charleroi* records net profits of 7,159,000 fr. for 1925, as compared with 5,295,000 fr. in the preceding year. The rate of dividend is 15.60 fr. net per share, as contrasted with 12.75 fr. in the previous year.

German Companies.

The *Welter Electricity and Lifting Appliances Company*, Cologne, reports a total loss of 61,000 marks for the years 1924 and 1925, which is covered by an appropriation from the special reserve fund.

The *Concordia Electricity Company*, Dusseldorf, has declared a dividend at the rate of 5 per cent. for 1925.

The *Transradio Wireless Company*, of Berlin, recommends the payment of a dividend at the rate of 8 per cent. for 1925.

South Wales Power Co., Ltd.—Speaking at the annual meeting last week, Mr. W. Forster Brown, who presided in the absence through illness of the chairman (Mr. W. North Lewis), said that in spite of industrial depression in the district the company had continued to progress. The first stage of the large developments in hand was completed recently, and two 15,000-kW turbo-alternators were running on high-pressure steam. The power station at Treforest now supplied energy for 73,000 h.p. of motors in South Wales and Monmouthshire, and the demand upon it was steadily increasing. Mr. Brown said that, in common with many others, he viewed the Government's Electricity Bill with grave misgivings, and all necessary steps were being taken to safeguard the shareholders' interests.

Cork Electric Tramways and Lighting Co., Ltd.—Mr. A. R. Monks, presiding at the annual meeting on April 15th, said that the tramway results had been unsatisfactory, and there was a small loss on operating to which had to be added renewal and depreciation charges. Under pressure from the Ministry, they had reduced their fares in the autumn of 1924, and the financial results on the basis of the present fares would always be unsatisfactory. The reduction in the lighting and power revenue was partly due to the small falling off in the power demands and partly to the reduced power and heating tariffs.

Low Temperature Carbonisation, Ltd.—Steps are being taken to reduce the capital of the company from £1,275,000 to £162,150 10s. by cancelling 2s. 6d. per share on the "A" preference shares, 17s. 6d. on each of the participating preference shares, and 18s. on each of the ordinary shares. The capital will then be reinstated to £1,275,000 all in ordinary shares of 2s. each, and it is proposed to issue £284,841 of 8 per cent. cumulative income debentures. The debenture holders are asked to accept new stock and ordinary shares in exchange for their holdings.

Great Northern Telegraph Co., Ltd.—The directors propose to distribute a total dividend and bonus of 20 per cent., including the 5 per cent. already paid, for the year 1925, and to transfer £19,444 to the reserve and renewal fund, and £37,500 to the pension fund. It is also proposed to carry forward £244,438. The annual meeting will be held at Copenhagen on May 28th.

Indo-European Telegraph Co., Ltd.—The directors recommend a final dividend of £1 2s. 6d. per share and a bonus of 15s. per share, both free of tax, making a total distribution of 10 per cent., tax free, for 1925. The dividend for 1924 was the same but the bonus was only 7s. 6d. The annual meeting is to be held on April 29th.

Northern General Transport Co., Ltd.—The report for the past year shows a net revenue of £101,630. After meeting loan and debenture interest, &c., and adding £8,305 brought forward, a sum of £53,664 remains. It is proposed to pay a dividend of 10 per cent. (2½ per cent. already paid), to place £3,000 to reserve and £2,053 to debenture sinking fund, leaving £7,111 to be carried forward. The meeting was to be held yesterday (Thursday), when a resolution was to be submitted empowering the directors to increase the capital to £700,000 by the creation of 50,000 six per cent. preference and 150,000 ordinary shares of £1 each. The directors have decided to offer 118,750 ordinary shares at par to present holders in the ratio of one to four.

Wycombe (Borough) Electric Light and Power Co., Ltd.—The balance available from 1925, after meeting debenture interest, preference dividends, &c., and adding the amount brought forward, was £11,782. An interim dividend of 4 per cent., free of tax, on the ordinary shares absorbed £2,500, and at the annual meeting on April 13th it was decided to allocate the balance as follows:—Final dividend of 6 per cent., free of tax; £4,000 to general reserve; £500 to superannuation account; leaving £1,032 to be carried forward. The directors issued £25,000 in ordinary shares during the year and additional plant and cables have been ordered to meet the growing demand.

Simms Motor Units (1920), Ltd.—In his speech at the annual meeting on April 14th, the chairman (Mr. F. R. Simms) said that the trading results for the past year had been very satisfactory, enabling the directors again to declare a dividend of 10 per cent., and to increase the carry forward from £19,742 to £33,171. A branch had been opened in New Zealand and two British branches and one in Canada would be opened during the current year. The directors intended to extend their branch policy over India and the British Dominions, so as to be able to give "Simms Electric Empire Service," coupled with a proved sales policy.

Carmarthen Electric Supply Co., Ltd.—The accounts for 1925 showed a profit of £2,571 and to this was added £584 brought forward, making £3,155. The interim dividends absorbed £410 (including one at the rate of 7½ per cent. on the ordinary), £600 is transferred to depreciation fund, and £500 to capital reserve account. The final dividend on the ordinary shares is at the rate of 3¾ per cent. for the half-year and a bonus of 2½ per cent. is also paid. A balance of £902 is carried forward. Prices to consumers have been reduced.

Kalgoorlie Electric Power Corporation, Ltd.—The Perth (W.A.) correspondent of the *Financial Times* reports that the Western Australian Government has offered to render financial assistance to the company to enable it to extend its plant. It is anticipated that this would result in a reduction of ore-treatment costs and would prolong the lives of the mines by enabling low-grade ore to be worked profitably.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Calcutta Electric Supply Corporation, Ltd.—150,000 new 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 2,375,001 to 2,525,000 150,000 new ordinary shares of £1 each, issued at £1 13s. per share, partly paid and fully paid, Nos. 1,216,711 to 1,366,710.

Montevideo Telephone Co., Ltd.—An interim dividend at the rate of 6 per cent. per annum has been declared on the ordinary shares in respect of the year ending July 31st. Last year's interim dividend was at the rate of 4 per cent.

Joseph Lucas, Ltd.—Interim dividends of 5 per cent. on the ordinary shares (against 2½ per cent.) and of 2½ per cent. on the 1926 ordinary have been declared in respect of the year ending August 31st.

English Electric Co., Ltd.—The annual meeting was held on Wednesday last. A report of the proceedings will appear in our next issue.

Stocks and Shares.

MONDAY EVENING.

ACCORDING to the various phases of the coal situation, so do Stock Exchange markets ebb and flow in the matter of their price-fluctuations. These movements are brought about, as a rule, as much by sentiment as by actual orders, for trade is exceedingly slack, and in no market can it be said that there is anything that approaches liveliness. The fate of the Electricity Supply Bill is expected to be settled one way or the other in the present session of Parliament, but, as a market factor, it is completely over-shadowed by more pressing industrial problems.

The feature of the week, so far as our markets are concerned, is another sharp rise in the issues of the Underground Electric Railways of London, where optimism has again become pronounced over the expectation of a dividend announcement, joined to the anticipation of some form of capital reorganisation—so often canvassed during the past ten years. The £10 shares gained 7/6 at 3¾ and the "A" shares are up to 12/-. The 4½ per cent. bonds have risen to 101. Even the Contingent Certificates have increased their value by about 50 per cent., standing now at the lordly price of 6d. each. Districts strengthened to 51, but no changes occurred in Central Londons or Metropolitans. There is a good deal of speculation afoot in Underground Electrics, mostly of that kind, how-

ever, in which the buyers pay for what they purchase, content to wait upon the future for a profit rather than to look for an immediate gain.

Sir Douglas Hogg, K.C., is in charge of the Electricity Bill in its passage through Committee. The Industrial Group held a meeting last week, in the House of Commons, with the intention of considering the Bill, and of deciding what assistance should be offered to secure its safe conduct through the Committee stage. It was agreed to propose a series of amendments for the purpose of fortifying the Bill, and, although this was unofficial, hints were given that the Government would look favourably upon the group's movements. With regard to the price movements in the market, the tendency is dull, owing to the coal outlook. Bournemouths have gone back to 58/3 and Chelseas have come on offer, shares changing hands down to 38/6. A fall of 5/- in Kensingtons lowered the price to 13½, Westminsters fell 1/9 to 42/-, Metropolitans to 35/9. Midland Counties remain heavy, upon the apprehensions of shareholders who are timid in regard to the effect which the Government Bill may have upon companies such as this.

The only improvement in this week's list is secured by Urban Ordinary, the price of which has risen to 20/6. City Lights are unchanged at 44/6. Protests are again being made by the City Corporation against the price of electricity, and a speaker at one of the meetings the other day maintained that prices are still much too high, and that citizens must not rest content until the rates approximate more nearly to those paid by neighbouring boroughs. The chairman at the Bournemouth and Poole meeting declared that his company is willing to become a centre of supply, or to obtain cheaper bulk supply elsewhere.

Amongst the cable stocks and shares, Indo-European have risen 2 to 47½, on declaration of a final dividend of £1 2s. 6d. and a bonus of 15s., both free of tax, making 10 per cent. tax-free for the year. This is an increase of 1½ per cent., and the market is very well satisfied. On the other hand, Great Northerns are £2 down at 30, there having been a little selling from Copenhagen. The Montevideo Telephone Company has declared an interim dividend at the rate of 6 per cent. on the ordinary shares, as against 4 per cent. this time last year. The price is better at 23/9. It may be recalled that the final dividend paid last November was 5 per cent., and it is assumed that the final for the current twelve months will show an increase upon this rate. Chili Telephones are ⅛ up at 6⅞ and Orientals are firmer at 42/-. The Marconi group is placid. Radios have steadied after their violent slump and recovery. Automatic Telephones keep about 48/9 and Internationals have been changing hands on the basis of 43/9.

Electric Supply Corporations remain at 32/6, and at the meeting last week it was stated that potential cheaper supply will be worth while, even at the cost of shutting down small generating stations. The speaker, Mr. K. A. Scott-Moncrieff, said that he hoped the Electricity Bill would be strengthened in the Committee stage, so that its purpose might be achieved on equitable lines. English Electric shares rallied a trifle to 15/-. The report states that an outstanding feature of the company's business at the present moment is the fact that the unexecuted orders on its books already exceed the whole output for last year. This suggests that the progress in the present financial year will be such as to wipe out the memory of the unfortunate 1925, with its absence of dividend for ordinary shareholders.

Manufacturing shares are dull as a whole. Edisons have gone back to 7/9, General Electrics to 28/3, Electric Constructions to 30/- and Brush to 25/9. The same story has to be repeated in regard to the cable construction shares, where declines have occurred in Callenders, Siemens, Johnson and Phillips and India Rubber. Babcock & Wilcox hold their price at 53/9, the comparatively small return which the shares offer at the present time being taken as no more than an earnest of what the company will be able to achieve when trade settles into more prosperous lines.

British Electric Traction ordinary retains its gain of 5 points, and it is taken for granted that the company will declare an increased dividend. Attention has been drawn to the company's preference, the price of which stands at 107. The stock carries participating rights, and optimism looks for a possible 8 per cent. dividend on this stock in the course of time. The company is managed on cautious and safe lines. As a sound investment of the lock-up type, the stock is reasonably priced at the present quotation. Brazilian Tractions are lower, Canada having come in a seller, and Anglo-Argentines have made no further addition to their improvements of last week. Mexicans are a little better. A few of the Indian Industrials have been disposed to weaken, in consequence of the recent rioting in Calcutta. In Calcutta Electric Supply Shares, however, no particular change has occurred, and the price of the new ordinary is better at 3/3 premium. Lancashire new shares are 23/6.

The rubber share market has been depressed by a further fall in the price of the commodity to 1s. 10½d. per lb. Many of the best-class companies are now declaring dividends that afford, at the current quotations of the shares, about 12½ per cent. on the money. With the price of rubber so dull, it is natural enough that the public should feel indisposed to take any particular hand in the market at a time when industrial conditions do not encourage capital to seek speculative investments. The American buyer controls the situation in regard to the demand for raw rubber. "Dollar" stocks have fallen: Montreal Light and Power at 228 and Shawinigan Water at 184½ both show losses of 5 points.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	1925.	Price Apr. 19 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	58/3	—	4 16 0
Brompton Ordinary	1	10	10	18⅝	—	*6 3 1
Charing Cross Ordinary	1	15	15	45/9	—	6 11 2
do. do. 4½ Pref. ...	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	38/6	—	5 16 3
City of London	1	15	15	44/6	—	6 14 10
do. do. 6% Pref. ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/6	—	5 16 5
County of London	1	15	15	56/-	—	5 7
do. do. 6 % Pref.... ...	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	18½	—¼	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	35/9	—⅛	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	19/6	—	6 3 1
Newcastle-on-Tyne Ordinary ...	1	7	7	22/-	—	6 7 3
do. 5% Pref. ...	1	5	5	18/-	—	5 11 1
do. 7% Pref. ...	1	7	7	24/6	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	15⅝	—	5 13 10
South London...	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	20/6	+1/-	3 18 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	42/-	—1/9	7 2 10
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	20/-	—	7 10 0
Yorkshire Elec.	1	8	8	26/6	—	6 0 9

Home Rails.

Central London Ord. Assented ...	Stock	4	4	68	—	5 17
Metropolitan	,,	5	5	66	—	7 11 6
do. District	,,	8½	8½	51	+1	6 17 3
Underground Electric Ordinary ...	10	Nil	Nil	3⅜	+⅜	Nil
do. do. "A" ...	1/-	Nil	Nil	12/-	+1/-	Nil
do. do. Income ...	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	102	—	5 17 8
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	1	3	6	2⅞	—	4 2 0
Chili Telephone	5	6	5	6⅞	+⅛	*3 12 9
Cuba Sub. Ord.	10	5	5	6½	—	7 8 2
Eastern Extension	10	10	10	17⅜	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17⅜	—	*5 12 8
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	22	22	30	—2	7 6 8
Indo-European	25	8½	10	47½	+2	*5 5 3
Marconi...	1	10	10	1⅜	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	2⅛	—	*5 16 4
United R. Plate Tel....	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8	—	9 3 4
do. do. 2nd Pref. ...	5	6	6	2⅝	—	11 8 6
do. do. 5% Deb. ...	Stock	5	5	78½	—	6 16 3
British Electric Traction Ord. ...	,,	6	6	127½	—	4 14 0
do. do. 6% Pref. ...	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	40½	—3	5 9 3
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	85½	+1	5 17 0
do. do. Preferred ...	,,	96/-	96/-	105½	—	*4 9 4
do. do. Deferred ...	,,	129/5	129/5	127	—	*5 2 7
do. do. Deb. ...	,,	4½	4½	75	—	5 13 4
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	5/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	64	+1½	7 16 4
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	66½	—	Nil
do. 1st Bonds	—	5	5	69½	+1	7 3 11
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	18	53/9	—	*4 16 4
British Aluminium Ord.	1	5	10	2½xd.	—	4 17 0
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—9d.	7 9 4
British Insulated Ord.	1	15	15	3¾xd.	—	4 16 0
Brush Ord.	1	10	10	25/9	—6d.	7 15 4
Callenders	1	15	15	3⅜	—⅛	4 0 0
do. 6½% Pref....	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	7/9	—9d.	5 3 3
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	30/-	—⅛	6 13 4
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	5	15/-	+6d.	6 13 4
do. do. Pref.	1	6	6	18/3	—9d.	6 11 6
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	28/3	—1/9	5 6 2
Henley	1	15	16	3⅜	—	4 5 9
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber...	1	5	5	23/-	—6d.	*4 10 11
Johnson & Phillips	1	10	10	2⅞	—⅛	3 9 7
Met.-Vickers Ord.	1	8	8	2 /-	—1/6	6 19 2
do. Pref.	2	8	8	2⅜xd.	—	6 14 9
Siemens Ord.	1	—	7½	1⅛	—⅛	4 16 0
Telegraph Construction	12	20	10	28	—⅜	*8 11 5

*Dividends paid free of Income Tax.

Electricity in Coal Mines.—II.

A Survey of the Present Position in British Mines.

(*Abstracts of Papers read before the* Institution of Electrical Engineers.)

It will be recalled that the three papers which were presented to the Institution on April 8th provided members with a general review of the present position of electricity in mines, the application of machinery at the coal face, and the design of storage-battery locomotives for use therein. One of the papers, together with the discussion on all three, was abstracted in our issue of April 16th; the other two are dealt with below:—

The Design of Battery Locomotives.

By L. Miller, A.M.I.E.E.—*Abstract.*

The average cost of power in a mine works out at 1s. per ton of coal produced; therefore, any slight saving in power which might be achieved by the use of locomotives cannot have very much effect on the cost of the coal at the pit mouth. Any gain in output which may result from the more efficient gathering and conveying of the coal to the surface may, however, have quite a considerable effect on the price.

In considering the use of locomotives to replace rope-haulage systems, there is no doubt a very good case to be made out from the point of view of power-saving and efficient and speedy handling of the loaded trains, provided that the haulage roads are level. If gradients and faults exist, then the locomotive cannot compete with rope haulage from the point of view of speed; in fact, if the gradients are much worse than 1 in 20 the use of a locomotive may be quite impracticable.

For gathering work the locomotive cannot compete with a conveyor system from the point of view of speed. Conveyor systems can be used economically only in thick seams; in thin seams for gathering and marshalling the loaded tubs on the main haulage road and for keeping a supply of empty tubs at the coal face, the battery locomotive can be used to replace the pit pony with satisfactory results from the point of view of speed and cost and also from the purely humanitarian point of view. The locomotive can also be efficiently employed for marshalling purposes at the junction of haulage roads.

After detailing the limitations placed on the design and dimensions of a mine locomotive, it is stated that as its use can only be economically justified on narrow seams, cost is of paramount importance. Standardisation is, of course, the most satisfactory way of keeping down the cost, having got the simplest design, but the chief difficulty affecting standardisation is the gauge question. The B.E.S.A. Report on Colliery Light Rails [C.A. (C.R.) 9,295] shows that out of a total of 468 collieries 132 are using the 2-ft. gauge; there are 56 different gauges in use.

In designing a battery, the largest possible individual cells that can be accommodated in the space available should be used, which will tend to keep the voltage below 80, rather than above it. The two-motor scheme has the advantage that by connecting the armatures and fields in series-parallel it is possible to do away entirely with resistances. On straight runs any advantage due to this will not appear, but in marshalling the tubs and manœuvring, which will have to be done at a restricted speed, the advantage of the two-motor scheme will be apparent; in America the actual power consumption in service has been found to be very much in favour of the two-motor arrangement. The motor short-time rating of 1.64 h.p. per ton per mile per hour is obtained when a coefficient of adhesion of 25 per cent. is employed, plus 1 per cent. for the locomotive friction; the efficiency of the gears is taken at 95 per cent. The 1-hour rating of the motors on locomotives employed for gathering service can usually be taken at roughly half this figure where the grades do not exceed 5 per cent. and are not long.

Many things affect the adhesion factor, and the author recently had some tests carried out on an 18-in. diameter steel wheel which show the effect of several variables on the coefficient of adhesion, but the experiment gives no new information. Attention is called to the effect of increasing the lines of contact from ½ in. to 1¼ in., which shows a marked improvement in the coefficient. This illustrates the importance, from the point of view of adhesion, of using flat-topped rails. Increasing the diameter of the wheel also tends to increase the coefficient of adhesion. It is quite clear from the tests that the sanding apparatus is of great importance in obtaining good adhesion, and the sanding gear should be so designed that it cannot be put out of action when going through water.

The trend of development in controller design for heavy service is towards the contactor type. It is extremely inadvisable to rely on fuses for over-load protection. The best arrangement is an interlocked circuit breaker which can be replaced only when the controller is in the "off" position. Regarding methods of gearing the motor to the driving axle, in America the tendency is to adopt either spur or worm gearing, and the chain drive is not regarded as sufficiently robust for the service. This is what would be expected for American conditions, where a great many large trolley locomotives are in service on straight haulage work and operating at speeds up to 10 miles per hour at their rated draw-bar pull. For the small powers and low speeds required for gathering service the author believes that a properly designed chain drive will give satisfactory service. It is cheap and easily renewed at low cost, and can be accommodated in a small space without sacrificing the necessary clearance required to avoid the obstructions in the haulage roads.

The saving in power due to the use of roller bearings in the tub and locomotive axle bearings will amount to 40 per cent. of the power required to overcome friction. The use of ball bearings on the motor will result in a reduction in the length between bearings and will assist in obtaining a satisfactory flame-proof design.

The actual saving in power consumption taking into account braking, flange and air friction, grades and curves, will probably amount to as much as 20 per cent., which will enable a smaller battery capacity to be utilised for the same amount of work. The extra capital cost entailed in fitting roller bearings to the tub and locomotive axle bearings should be wiped off very soon. Roller bearings are, however, not likely to be received with any enthusiasm by the colliery personnel.

It has been suggested that where the gate roads are such as to have a heavy grade against the loaded tubs, or where they are of such dimensions as to make it difficult for the locomotive to proceed to the coal face, a winch driven by the propelling motor would be an advantage. This would enable the full rated power of the motors to be utilised without considering the question of adhesion, and the loaded tubs could be hauled up a grade on which the locomotive could not operate. In fact the locomotive would, in addition to its marshalling duties, act as a portable haulage. By arranging a sheave on the roof timbers it could be utilised when erecting or dismantling pumps, coal-cutters, erecting or withdrawing props, &c.

The problem of providing suitable flame protection resolves itself into flange protection, which, without any doubt whatever, is simple and most effective.

No data are available, so far as the author is aware, as to the running costs of locomotives as compared with ponies on gathering service in this country.

A gathering locomotive will cost £400 to £500 per annum to run, and it will be necessary to replace at least three ponies to cover this expense. Where it is possible for the locomotive to replace six pit ponies the case is very strongly in favour of the battery locomotive, from the point of view of running cost and speed of handling the coal.

Machinery at the Coal Face.

By Sam Mavor, M.I.E.E.—*Abstract.*

The mining industry of this country contains within itself the means of its own regeneration, and if relieved of legislative interference these means would become increasingly operative. It is impossible for anyone familiar with recent practice in mechanical coal-mining and with its economic results, to be otherwise than optimistic as to the future of the industry if the colliery owners and the miners are left to settle their own affairs. The problem of cost reduction is that of increasing individual output, but in mining this problem has special significance because labour accounts for 75 per cent. of the total cost of production, and apart from the number of working hours, the only way to effect substantial increase of output per man and consequent reduction of costs is the systematic application of labour-saving machinery. In other words, there are too many men in the mines; the number must be reduced, for the industry cannot afford to support them. The necessarily gradual nature of the process of adapting mining methods to the use of machinery will to a great extent avoid the imposing of individual hardship by reduction in the number of men employed. At many collieries modern coal-producing machinery is even in these days of low prices earning profits that without it would be non-existent. Unsettlement and the sense of insecurity have seriously retarded progress in the equipment of mines with machinery of production, and have thus accentuated the difficulties of the present situation.

In England the proportion of machine-cut coal to the total output is, according to the latest Report of the Mines Department, 14 per cent., whereas in Scotland the proportion is 47 per cent. The geological conditions in Scotland are not more favourable to machine mining; the difference is due partly to economic pressure compelling a reduction in cost of production, but largely to the permissibility of electricity at the coal face in most of the Scottish mines. In Scotland 93.25 per cent. of the coal-cutters in use are electric and 6.75 per cent. are compressed-air machines. It is not generally realised that a very important factor in the rapid extension of machine mining in the United States is that the comparative freedom from gas in the mines renders electricity permissible, and it is noteworthy that in the most recent years the rate of increase in the proportion of machine-mined coal has been greater in Scotland than in the United States.

The surface equipment of many collieries is splendid, but underground, where the money is lost or made, the coal faces

are crying out for machinery for winning the coal and conveying it from the immediate vicinity of the face—operations to which the whole surface and underground equipment and organisation of the mine are secondary.

Following a general outline of the principal characteristics of the coal seams of this country and of the methods by which they are mined, the development of the mechanical coal-cutter is dealt with, it being pointed out that the design of electric motors for coal-cutters is subject to many limitations. The problem is presented to the electrical designer from a totally different aspect, and the ordinary canons of electric motor design cannot be applied.

There is no recognised standard of power rating of coal-cutter motors, each maker's rating is individual and arbitrary, and, whilst it may serve for comparison of different machines by the same maker, the absence of a uniform basis prevents useful comparison of the rating of machines by different makers. The mean and the maximum powers required by the bar cutter are less than for the chain and disk types; the chain type is next in order, the greatest being required by the disk machine.

Where the mining conditions are favourable and systematic coal-cutting has been established, the machine takes the primary part in a cycle of operations organised to time table for production of 70 to 150 tons per shift, and in which 20 to 50 men (according to the seam conditions) may be engaged. The penalty of failure of the machine to fulfil its part is disorganisation of the whole scheme, suspension of the correlated operations, loss of wages to the men, loss of output and serious increase of costs to the colliery.

With the compressed-air driven coal-cutters the b.h.p.-hours required to be delivered to the compressors is roughly between four and five times that required to be delivered to electric generators for an equal amount of useful work done by coal-cutters. This relatively low efficiency of compressed air is partly inherent in the system as applied to colliery service, and partly due to the conditions under which coal-cutters are used. Wherever considerations of safety do not preclude the use of electricity for coal-cutting, electricity should always be adopted. There are, however, a large number of collieries in this country where there is no alternative to compressed air and its indispensability condones its relative inefficiency. Generally, compressed-air power systems are much less efficient than they might be, because engineers in charge have not yet acquired the habit of measurement that has so importantly contributed to efficiency in electrical engineering. Generally, compressed air is sent underground without being measured, and there is no check upon extravagance in its use or waste.

The b.h.p. rating of coal-cutters is arbitrary; the rated powers of the machines in most general use are between 20 and 50 b.h.p., but all have large overload capacity for short periods, and not infrequently they are required to develop it. Under normal conditions the energy delivered to electric coal-cutters per square yard undercut varies from about 0.2 kWh in the most easily cut materials to about 1.0 kWh in the hardest cuttable materials. The average may be taken as 0.4 to 0.5 kWh; the equivalent in the case of compressed-air machines is much higher, especially in the case of harder materials.

The application of power to the conveying of coal at and in the vicinity of the coal face is technically and economically essential to intensive mining in which the productive effort is concentrated and large outputs are obtained from comparatively small areas. Coal-cutters increase largely the yield of coal per lineal yard of face per day, and, if full advantage is to be realised from the machines, the coal produced must be promptly removed from the faces. The workings of most existing collieries are laid out for hand-mining, and the fact that the difficulties of dealing with the output from coal-cutters, without radical change in methods of loading the coal and delivering it to the mechanical haulage, are practically insuperable is becoming more widely recognised.

The drilling of rock or other strata too hard for cutting by the edge of a rotating drill is a special problem. The material must be attacked by percussive blows and the tool must reciprocate. The difficulties of applying electric power to this service are well known; the compressed-air drill holds the field.

Closely allied to the application of electric power at the coal face is the problem of improved lighting. At most modern collieries the pit bottoms are now not merely lighted by electric lamps—they are illuminated—and illumination pays because it facilitates activity and promotes safety in the operations conducted. There can be no doubt as to the desirability of improved lighting at conveyor faces. Prof. W. M. Thornton has gone far towards making available, in closed-lamp pits, the advantages of coal-face illumination that have been demonstrated where the use of existing equipment is permissible.

It must be accepted that electricity will continue to be excluded from the coal face in many collieries, but the number of these may be reduced by fuller knowledge by mining men of the characteristics of mining electrical appliances and of the conditions essential to securing and maintaining the highest degree of safety in their use, and by fuller knowledge by electrical men of the conditions of service of coal-face machinery and other in-bye electrical apparatus and of the rough nature of the treatment to which it is unavoidably subjected.

Practice of the intensive methods of mining, rendered possible by coal-face machinery, has a bearing on the permissibility of the in-bye use of electricity. The reduced pit room, the less surface of exposed gas-bearing coal, the diminished number, increased area, and improved maintenance of the air ways, and reduction of air leakages between intakes and returns, are all favourable to more effective ventilation, and therefore to safety in the use of electricity. On the other hand, the more rapid advance of the workings may in some gaseous seams liberate so much gas as to exclude electrical appliances at the face. This also applies to seams liable to the occurrence of sudden outbursts of gas, and to places in the working of normal seams where accumulation of gas may be difficult to avoid.

Everyone familiar with underground conditions knows the difficulty of securing adequate maintenance of underground electrical apparatus. It takes time to train the personnel, but experience is educating mining men in the necessity for due attention to this subject, and improvement is progressive. At large collieries with competent electrical staffs, adequate in number, very good standards of maintenance exist; only at such collieries is it wise to send underground delicate automatic devices which are only a snare if their condition and adjustment are not properly maintained.

In the main, the sphere of electricity underground will continue to be in the secondary services—ventilating, pumping, hauling and winding. In application to the primary processes of mining at and near the coal face, the use of electricity is restricted; although increasing confidence in electricity may lead to some relaxation, it is certain that compressed air, displaced by electricity from important services at and near the shaft and in intake airways, will be very much more difficult to dislodge from the region of the coal face.

The services of the mechanical and electrical engineer to the mining industry have been manifold, but abundant opportunity remains and the measure of it is the high cost of coal production. The output per underground worker is too low, therefore too many men are in the industry—that is why wages are low and costs are high. By mechanical and electrical aids to production the output per man can be increased, wages and the status of the miner can be raised, and the cost and price of coal can be reduced.

A Special Electric Furnace.

In a paper read recently before the Institute of Metals by Mr. Douglas Jepson, M.Sc., a special type of electric resistance furnace, employed in connection with experiments on the influence of gases on copper at high temperatures, is described. It can be evacuated or filled with any desired gas, and contains a crucible which holds the substance under treatment and which can be lowered from the heating zone into a water-cooled chamber, thus giving a very rapid and reproducible rate of cooling. This arrangement was found necessary, for the

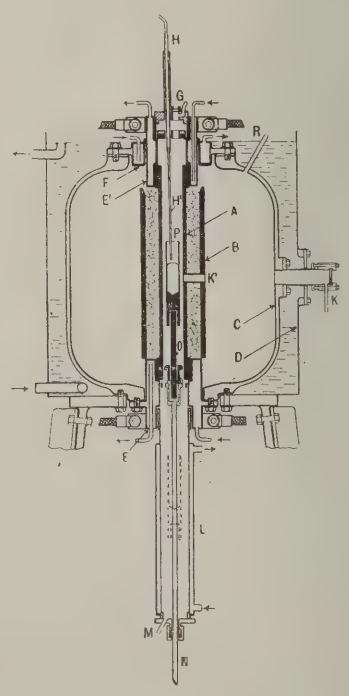


Fig. 1.—An Experimental Electric Furnace.

purposes of the investigations, after a large number of preliminary experiments had been made with a simpler type of furnace.

This furnace, fig. 1, contains a carbon resistor tube A, 520 mm. long, 66 mm. external diameter, and 48 mm. bore; this is fitted into graphite adaptors by means of accurately ground taper joints, the bushes being soldered to the electrodes E and E'. In order to reduce radiation losses, A is surrounded by another carbon tube B, insulated from the lower electrode E on which it stands, the intervening space being filled with wood charcoal. The cast-iron essvel C is entirely surrounded by water contained in the galvanised iron jacket D. The bottom water-cooled electrode E is bolted, with a vacuum-

tight joint, direct into the vessel C, whilst the top electrode E' is left free to slide in a water-cooled, insulated collar F, the sliding joint being made vacuum tight with a flexible wax. E, E', and F are made of best quality gun-metal. The top electrode is provided with a cap having two openings, one fitted with a glass window G for general observation, and the other with a sliding sheath H holding a narrow carbon tube H', which can thus be raised or lowered into the furnace. A second observation window is fitted in the side of the furnace at K, a short carbon tube connecting the corresponding apertures in the large tubes. Below the lower electrode is a water-cooled copper cylinder L of similar length to the resistor, the bottom end being closed with a removable cap M, having a special gland through which passes a long steel rod N. The upper end of the steel rod carries a series of radiation screens and an insulated carbon rod O, which in turn supports the graphite crucible P, the inside of which is 125 mm. deep and 25 mm. in diameter. Below the furnace, which is supported 4 ft. above the ground, the steel rod is connected with a long wooden lever by means of which the crucible can be moved steadily and rapidly up or down. To ensure perfectly parallel motion the rod is continued through a bush in the floor.

Evacuation of the furnace is effected by a large rotary oil-pump connected to the cast-iron vessel by a wide-bore tube R. Gas may be admitted at any of the points H, G, K, or M, the first directing the gas into the crucible, and G and K enabling the sight tubes to be kept free from fumes. A mercury manometer is also connected to the top of the furnace. Gases may be allowed to escape either at R or M.

The method of mounting the resistor with taper joints, and the holding of the upper electrode so as to be free to move only in a vertical direction, have resulted in the life of the tube being very greatly increased.

The furnace can be evacuated down to a pressure of 3 mm. of mercury in about 10 min., this vacuum being sufficient for the experimental requirements. The temperature can be raised to 2,000 deg. C. in 15 min. without undue strain. To maintain a temperature of 2,000 deg. C. in hydrogen a current of 1,550 A at 10.75 V is employed. Single-phase energy at 50 cycles is supplied from a separately excited motor generator with pressure-controlling rheostats in the field.

India's Electrical Imports.

(From Our Indian Correspondent.)

THE total value of the electrical imports into India during the calendar year 1925 was Rs.437 lakhs. This is a satisfactory advance on the previous year, during which the total trade amounted to 392 lakhs. Of the total trade, electrical machinery accounted for 210 lakhs, as against 199 lakhs in the previous year, while electrical instruments and apparatus were responsible for 227 lakhs, as against 193 lakhs in 1924. The United Kingdom increased its share from 308 lakhs to 332 lakhs, Germany from 25 to 31 lakhs, and the United States from 29 to 37 lakhs. The principal classes and values were as follows:—

	1924. Rs. lakhs.	1925. Rs. lakhs.
Control and switchgear	37.7	37.8
Generators, alternators and dynamos	33	34.5
Motors	42.6	36.6
Transformers	14.5	13.7
Turbo-generator sets	7.3	15.2
Other sorts	64.3	71.9

Two developments deserve to be noted in the table above. One is the continued decline in the imports of motors, which are now less than half of what they were in 1923. The other is the continued increase in the imports of turbo-generator sets, which more than doubled during the year.

As regards the sources of the electrical machinery, the shares of the different countries were as follows:—

	1924. Rs. lakhs.	1925. Rs. lakhs.
United Kingdom	170.4	174.8
Sweden	1.6	1
Germany	4.9	8.8
United States	13.7	17.3
Other countries	8.8	8

The share of the United Kingdom is steadily increasing. It was 147 lakhs in 1923, 170½ lakhs in 1924 and about 175 lakhs in 1925. Germany during recent years has also been making progress. In 1923 her imports amounted to Rs. 2 lakhs only. They doubled in 1924, and also practically doubled again in 1925. In the case of the United States there appears to be some improvement during the year, but its share has dwindled materially during recent years. In 1923 imports from that country amounted to 43.7 lakhs, but in 1924 they were only 13 lakhs.

As regards electrical instruments and apparatus, the imports of the various kinds of goods were as follows:—

	1924. Rs. lakhs.	1925. Rs. lakhs.
Electrical fans and parts	25.4	28
Electric wires and cables	62.3	81.7
Telegraph and telephone instruments and apparatus	11.9	8.5
Electric glow lamps	12.5	17.9
Electric lamps (other sorts)	3.5	3.8
Parts and accessories of electric lamps	1.2	2.3
Batteries	6.9	8.9
Electric carbons	0.7	0.7
Accumulators	8.6	12.7
Condensers	0.3	0.2
Electric bell apparatus	0.1	0.2
Electric lighting accessories and fittings	13.4	15.7
Meters	6.4	6
Other sorts of electrical instruments	1.5	4.2
Electro-medical apparatus	0.9	1.9
Switchboards	4.7	3.2
Unenumerated	32.5	30.7

The sources of these imports were as follows:—

	1924. Rs. lakhs.	1925. Rs. lakhs.
United Kingdom	138.8	157.6
Germany	20.5	21.8
Netherlands	7.1	8.7
Italy	5.8	6.2
Japan	1.6	3
United States	16.3	20.4
Other countries	3	9

The United Kingdom's share, though it increased during the year, was short by about 5 lakhs of the 1923 figure. Germany, Italy and the Netherlands is showing continued progress. The imports from the United States in 1923 were valued at 18 lakhs.

An analysis of the various types of goods shows that in the case of electric fans and parts the United Kingdom's share increased from 12.4 to 16.3 lakhs, and that of Italy from 5.3 to 5.8 lakhs, but the share of the United States fell from 2.8 to 1.3 lakhs. In the case of the insulated rubber wire, the total imports, of which amounted to 41 lakhs, as against 23.7 lakhs in the previous year, the imports from the United Kingdom increased from 21.8 to 37.8 lakhs, and those from Germany from 1 lakh to 2.1 lakhs. In other insulations, of which the imports were valued at 21.3 lakhs as against 17.6 lakhs, the share of the United Kingdom rose from 16 to 19.4 lakhs. In telegraph and telephone wires and cables, there was a heavy decline in total imports from 6.1 to 1.6 lakhs and the United Kingdom's share consequently declined from 5.9 to 1.4 lakhs. This was due to the growth of the Indian production under the encouragement of the Government of India. The imports of bare (electrolytic) copper wire increased from 14.8 to 17.7 lakhs, and the United Kingdom's share from 14 to 14.8 lakhs. Of the total electric wires and cables, the United Kingdom's share was 73½ lakhs, as against 58 lakhs, in the previous year; Germany's 4.4 lakhs, as against 2 lakhs; and the share of the Netherlands 2.2 lakhs, as against 1.2 lakhs. In telegraph and telephone apparatus the share of the United Kingdom declined from 11.2 to 7.4 lakhs. In electric glow lamps there was close competition between the United Kingdom and the Netherlands, the former's share amounting to 6.5 lakhs and the latter's to 5.9 lakhs. In the face of this competition from the Netherlands, the United Kingdom was able to increase her share from 3.9 to 6.5 lakhs. The share of Germany declined from 1.8 to 1.2 lakhs. In other kinds of electric lamps, the United Kingdom's share was very small, being only Rs. 44,000; the United States was the principal supplier, her share having increased from 1.9 to 2.6 lakhs. In the case of batteries, the United Kingdom's share increased from 3.7 to 4.4 lakhs, and that of the United States from 2 to 2.3 lakhs. In accumulators the United Kingdom's share rose from 6.9 to 9.7 lakhs. In electric lighting accessories and fittings, imports from the United Kingdom practically remained stationary at 8.9 lakhs, while the United States increased her share from 2.5 to 4.6 lakhs, and Germany from 1.5 to 1.8 lakhs. The United Kingdom's share in meters declined from 4.5 to 4.3 lakhs, and in switchboards it declined from 4.6 to 3 lakhs. In the case of unenumerated goods the imports from the United Kingdom fell from 21.6 to 19.3 lakhs, and those from Germany from 5.9 to 4.8 lakhs, but those from the United States increased from 3 to 3.8 lakhs.

Vehicle Operating Cost Tables.—The *Commercial Motor* Tables of Operating Costs of all types of goods and passenger-carrying petrol, steam, and electric commercial vehicles are now in their 18th year of publication. The current tables are based upon the costs prevailing in March, 1926, and the actual experience of owners of each type of vehicle under all sorts of conditions in different parts of the country. The statistics should therefore be a valuable guide to owners of single vehicles and fleets alike. The tables are issued free on application.

New Automatic Telephone Exchanges.

A Private Installation and Four Post Office Exchange Equipments.

The adoption of the automatic telephone system by the British Post Office authorities as the standard for the State service is prompting progressive manufacturers and industrialists to follow suit and equip their premises with the same system for inter-departmental communication purposes.

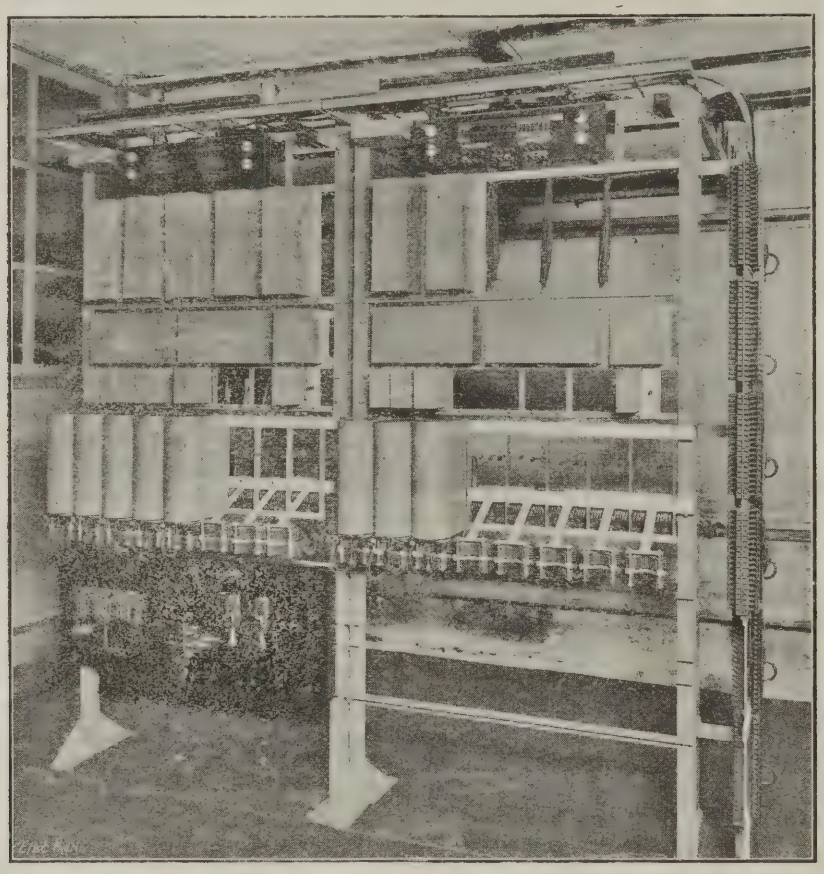


Fig. 1.—A Private Branch Exchange in a Biscuit Factory.

One of the latest concerns to install a Strowger p.a.x. (private automatic exchange) is a well-known firm of biscuit manufacturers, Messrs. W. & R. Jacobs & Co. (Liverpool), Ltd., whose offices, packing rooms, and distributing centre in Liverpool are now served by a 100-line exchange as shown in fig. 1, which was manufactured and installed by the Automatic Telephone Manufacturing Co., Ltd. The immediate capacity of the installation is 67 lines, but provision has been made for an ultimate expansion to the full 100-line capacity, or beyond, should circumstances dictate such growth.

In design, manufacture, and finish, the apparatus is precisely similar to that supplied to the Post Office for public Strowger exchanges. In the functioning of the switches, however, there is a slight difference in principle, it being based on what is known as the "finder" system; each line terminates at the automatic switchboard in a line and cut-off relay, but has no rotary line switch definitely associated with it as in the case of the larger exchanges.

Instead of line switches the rotaries, eight in number, function as "finder switches," their duty being to "find," or select, the particular pair of contacts associated with a calling subscriber's line. Each "finder" controls, or has access to, a corresponding final selector, to which it connects the calling line when it has "found" the calling party's terminals in its own bank of contacts.

Direct current at 50 volts is derived from two Alton storage batteries, each of 25 cells (one being in reserve) and 40 Ah capacity, and provision has been made for charging them alternately through a rheostat from the 230-volt d.c. supply mains. A "Record" cut-in and cut-out controls the charging, an alarm automatically drawing attention to any undue fall in battery voltage.

The present equipment of finder switches and final selectors is eight, enabling a corresponding number of simultaneous conversations to take place. Should the traffic increase, however, there is accommodation for a further eight sets, which would increase the maximum of simultaneous conversations to sixteen, or thirty-two people making use of the system at one and the same time. Refinements include a meter for registering the total number of calls passing through the exchange, and a system of automatic alarm signals indicates any abnormal condition.

The good work of the Post Office Telephone Department in modernising the country's telephone system by periodical additions to, and extensions of, the areas served by the Strowger system continues. The first town to benefit by the change in 1926 is Shrewsbury, the county town of Shropshire, where a 1,000-line automatic exchange was cut into service at the Head Post Office on January 9th.

The equipment, which is of the standard type, comprises nine rotary line-switch units and one p.b.x. unit, which will cater for 1,000 lines, of which approximately 800 are already taken up, but provision has been made for an ultimate expansion to 1,800 lines. The system is four-digit, subscribers' numbers lying 2,000 and 2,999, and the usual special numbers have been allocated.

Associated manual equipment has been provided to enable outer-area subscribers to gain access to Shrewsbury automatic subscribers through the medium of operators who will extend the incoming calls on receipt of verbal instructions in the usual course. The two main batteries (one reserve) are of the Premier Accumulator Co.'s manufacture.

The population of Shrewsbury at the 1921 census was 31,000, so that, even allowing for subsequent growth, the present telephone density of the area (about one telephone to every 40 inhabitants) leaves much to be desired. No doubt the substitution of the automatic system for the slower manual switching of local calls will help to improve this record.

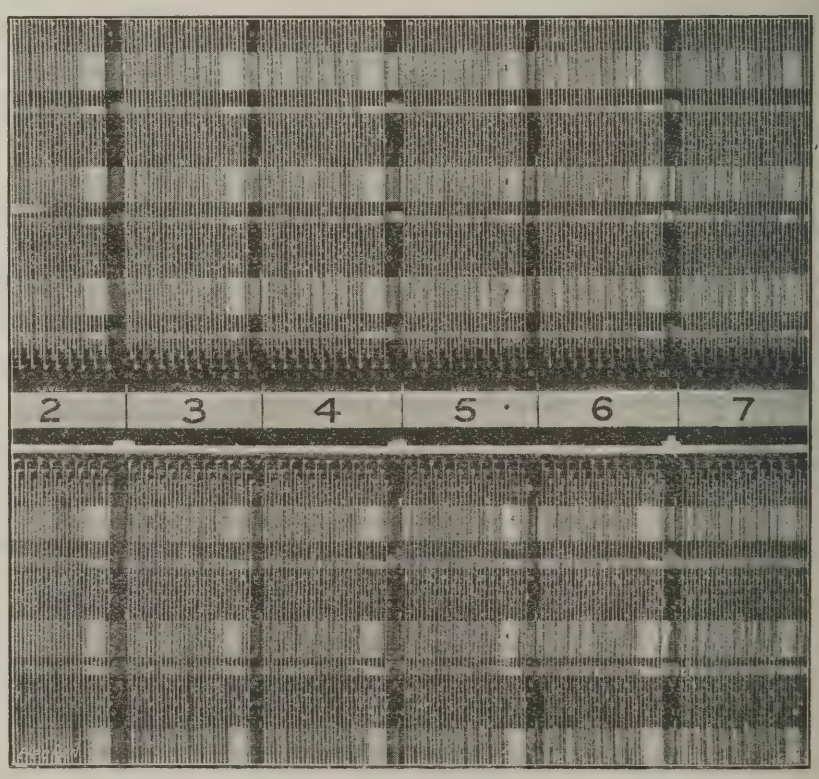


Fig. 2.—Ipswich Exchange; Link Frame Wiring, Selector Trunk Board.

By the completion of two new "satellite" Strowger exchanges at Gosport and Hayling Island, the automatic area of which Portsmouth is the centre has been materially extended. Portsmouth was one of the early towns to enjoy the advantages of a fully automatic service, having been originally equipped in 1916 by the Automatic Telephone Manufacturing Co., Ltd.

Taking post-war growth into account, the present capacity of the main Portsmouth exchange is approximately 5,200 lines. The addition of Gosport and Hayling Island's quota will bring the immediate total of the network up to nearly 6,000 automatic lines, with power to add to that number by virtue of spare equipment available.

Gosport is a Hampshire seaport on the west shore of Portsmouth Harbour, being the site of the Royal Clarence Victualling Yard and Haslar Naval Hospital, and its satelite exchange is equipped for 600 lines, but designed for expansion to 800 lines. The system is four digit, subscribers' numbers lying between 8,000 and 8,599. Switching selector repeaters are employed, their function being threefold: (*a*) To engage trunks for calls to Portsmouth; (*b*) as digit absorbers in the case of local Gosport calls, and (*c*) as repeaters.

Calls to subscribers outside the Portsmouth automatic area are made by dialling "O" when the trunk and junction operator completes the connection on verbal instructions given by the calling subscriber in the usual course; Portsmouth manual operators are retained for this duty. The main batteries are of the Chloride Electric Storage Co.'s manufacture.

Hayling Island, which lies off the coast between Langston and Chichester Harbours, is favoured as a seaside resort and the telephone exchange is a satellite of Portsmouth, the present capacity being 70 subscribers' lines, 70 p.b.x. lines, and three coin-box lines, but there is accommodation for additional lines, or 300 total.

Unlike Gosport, there are no switching selector repeaters at Hayling Island; the group selectors are located in the Portsmouth main exchange, and even local calls proceed *via* trunks to Portsmouth and back again to the Island. Whilst somewhat extravagant in the matter of inter-connecting trunks, involving two pairs for every local connection, this arrangement effects economies in space at the Island exchange and thus has compensating advantages.

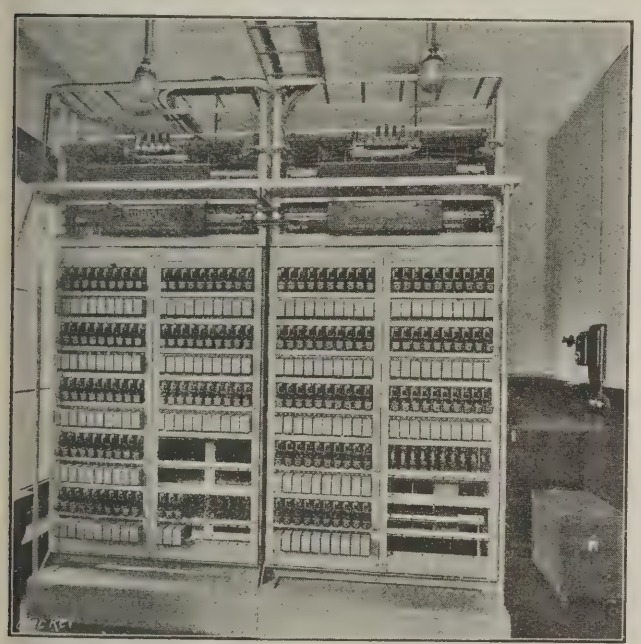


Fig. 3.—Line Switches at Hayling Island Satellite Exchange.

To simplify and centralise maintenance so far as is practicable, certain supervisory features are extended to the Portsmouth exchange. Thus, should the called subscriber fail to replace this receiver at the conclusion of a conversation, the calling subscriber having already cleared in the usual manner, an outgoing repeater will be seized, completing a loop to a first group selector at Portsmouth and a visual lamp signal will be actuated at that exchange, calling attention to the omission. Similarly, the traffic from the Hayling coin-box telephones will be handled directly at Portsmouth.

The population of Gosport, including Alverstoke, at the 1921 census was 33,580, or, allowing for estimated increase, approximately one telephone to every 60 persons. Hayling Island, at the same period, boasted a population of 2,309 souls, or, say, one telephone to every 20 inhabitants, a rather better record than Gosport's, which is probably accounted for by its comparative isolation from Portsmouth.

Both satellite installations were cut into public service on January 13th.

Ipswich, the first town of any magnitude in East Anglia to be converted, is the county town of Suffolk, with a population of 79,371 at the 1921 census. The new A.T.N. (Strowger) equipment has a present capacity for 2,000 lines, of which 1,640 subscribers' and 290 p.b.x. lines are equipped. There are thus 17 regular and 3 p.b.x. rotary line-switch units installed in the switchroom, together with one first group and two second group selector racks and a 2-way repeater rack, with complementary equipment.

The system is 4-digit, subscribers' numbers lying in one of three groups; two groups of numbers have been allocated to p.b.x. lines, and the usual special service numbers have been provided, including one for rural party lines. In addition to a 7-bay rack carrying the usual subscribers' meters, there is a traffic meter rack, a feature of the installation which aptly demonstrates another outstanding advantage of the system. In every telephone area it is the traffic (either estimated or actually determined) which governs such factors as the number of subscribers per operator's position, the number of junctions between two given points, or in the case of A.T.M. (Strowger) equipment, the ratio of group and final selectors to primary rotary line switches, &c. In manual exchanges traffic data are obtained by a "peg count" carried out by the telephonists on duty, and therefore subject to the possibility of error, but the more accurate service of mechanism has been enlisted at Ipswich and elsewhere.

This rack is equipped with four special duty meters, which perform the following functions: The congestion meters automatically indicate the number of times the last choice of a group of trunks is engaged, and thus record the number of lost calls directly due to trunk shortage. Associated with each congestion meter is a traffic unit meter which operates every half minute during the period the congestion meter is energised, thus translating the lost calls into terms of lapsed time. The overflow meter indicates approximately the number of calls rendered ineffective owing to all circuits in a group being engaged, whilst a total traffic record indicates the number of times the switches in any given group are brought into use. To this end a separate meter is provided for each group of switches, and is operated by the release relay belonging to that particular group. Thus this special meter rack ensures the accurate recording of all requisite traffic data, which should prove invaluable to the traffic department. The Post Office is to be congratulated upon the meticulous attention now being devoted to the automatic compilation of guaranteed traffic figures.

At Ipswich batteries of the Premier Accumulator Co.'s manufacture are provided, and the exchange is equipped with complete supervisory and fault-signalling apparatus.

The exchange was cut into service on March 20th last. The telephone density of Ipswich (approximately one to every forty inhabitants) leaves much to be desired. Apart from its local industries, the surrounding country is mainly agricultural and thus lends itself to rural telephone development, and it is anticipated that the introduction of the automatic system will stimulate such development.

Electricity in the Artificial Silk Industry.—A recent "Artificial Silk" number of the *Manchester Guardian Commercial* contains an article by Mr. F. Bunzl Geemen upon the uses of electricity in the artificial silk industry. In the first place the advantages of the electric drive are dealt with, and the author points out that the principal attraction is the elimination of all forms of intermediate gearing, shafting, &c., by the application of the power at the point at which it is required. The design of motors for this class of work is of a very special nature, not only because the electrical and mechanical demands are exceptionally high, but also because all parts have to withstand the attacks of the acids inseparable from the process. This necessitates the choice of special alloys for the various parts of the motor. A further considerable field of utility for electricity in the industry is for the purpose of measurement, regulation, and supervision. There is scarcely another industry in which accurate measurement and supervision of the manufacturing process is of such paramount importance. The possibility of remote measurement is a great advantage. The chemical action of electricity is used in a number of directions, including the recovery of copper from the acid used in the cupro-ammonium process, in "electric bleaching," and in the purification of air charged with sulphurous gases by high-pressure discharges.

Revised B.E.S.A. Publication.—A revised edition of the specification for insulated annealed copper conductors for electric power and light has recently been issued by the British Engineering Standards Association. Few changes were found necessary, although those made are of importance. One extra standard size (0.85 sq. in.) has been added to the list of stranded cables. Tables have been included to cover the thicknesses of vulcanised-bitumen insulated and sheathed cables, and a full list of definitions relating to conductors and cables has also been added. One of the earliest and most effective pieces of standardisation carried out by the electrical industry was in connection with the sizes of electric cables. This work was started in 1899 by the Cable Makers' Association, and at the formation of the Engineering Standards Committee, now the British Engineering Standards Association, a representative committee was appointed to continue this work. The first British standard specification for insulated electric light and power cables was issued in 1904. Copies of the revised Specification, No. 7-1926, may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 1s. 3d. each, post free.

Electric Welded Construction.

Some Applications of Electric Arc Welding.

(*Abstract of Paper read before the* Institution of Welding Engineers.)

At a recent meeting of members of the above-named Institution in London, a paper with the above title was presented by Mr. James Caldwell, who stated that to anyone considering the use of arc welding the facts of practical importance were that apparatus and materials were now on the market on a commercial basis, that the general technique of the art had been developed to a practical degree, that trained welders were available in many districts and that, with an increased demand, their number could be easily augmented.

Many tests of various natures had been made to establish standards that would give equal, or better, connection between parts than that obtained by riveting and bolting. Apart from a very large number of tests on structural mild-steel carried out by independent parties in this country, facilities had been provided by the Bureau of Standards at Washington, U.S.A., whilst the railway companies in that country, and especially the Belgian State Railways in Europe, had systematically investigated the possibilities of electric welding for constructional service. In Britain the value of electric welding products and machines was assessed by their ability to successfully meet the requirements of the Admiralty and Lloyd's Register of Shipping, whose comprehensive tests were recognised to satisfy the most stringent requirements of modern practice. Tests had shown that when using mild-steel of the usual structural qualities and flux-coated electrodes of various makes, the ultimate or breaking stress was equal to that of the original material; that the weld metal was generally less ductile than the original mild steel and, necessarily, the reduction of area was also less; that welded joints would not stand bending to the same degree as mild steel; and that it could be reckoned that for alternating stresses welded joints had 70 per cent. of the endurance of the unwelded material, and that butt joints were stronger than lap joints, either welded or rivetted. As regarded impact, Lloyd's tests were two blows from a falling weight of 2 cwt. from a height of 9 ft. on to a ¼-in. welded plate, and two blows of 4 cwt. from a height of 12 ft. on to a ½-inch welded plate to produce no sign of cracking. The performance of these tests disposed of any suspicion that the comparatively low ductility of the weld metal connoted brittleness. Below the elastic limit of the welded material the relation between stress and extension was practically equal to that of the unwelded material, but the most satisfactory and convincing proof of the value of electric-arc welding for constructional services was the success achived in the completion of pioneer undertakings. The durability of such structures was now established (the author stated that he had never known an electrically-welded structure to fail to fulfil the conditions for which it was designed, and the wear and tear of practical use).

After mentioning steam and oil pipe lines, the author said he was not aware of any example of electrically-welded hydraulic pipe line, but the attention which was devoted to the development of water power and the necessity of minimising the capital cost of such works, justified the careful consideration of arc welding as one way of reducing the cost of pipe lines between the reservoirs and power houses. In most cases those pipes had to be laid on mountain slopes over rough ground, and the cost of transport of the pipes and jointing outfit to the site was a heavy one. This element of cost naturally increased with the weight of the individual pieces, and frequently resulted in the choice of a number of small diameter pipes in parallel (although a smaller number of larger pipes would reduce the water friction and the cost of the pipes themselves); by building large pipes *in situ* out of plates cut and curved to shape in the steel works and arc-welded in place, a very great economy was possible. Small petrol-driven sets mounted on trucks could be easily handled and moved as required by the same means of transport as that used for the pipe material, or it might be possible to tap an electric line carried along the route for other purposes.

Transformer cases and tanks were extensively made by electric welding, and the output of one of the large American manufacturers amounted to hundreds per week. As some transformers were mounted on poles and in out-of-door positions, the temperature range due to load was added to by sunshine and weather conditions; in tropical and semi-tropical countries the sunshine heating was often more important than the load heating, and welded tanks endured those conditions quite well. Designs for really large oil tanks (up to 4,000,000 gallons capacity) had been worked out in this country and the U.S.A. Towards the end of 1918 the Admiralty had decided to try welded tanks for this purpose, but the return to peace conditions prevented the completion of the experiment.

A gasholder placed in commission in 1921 at Johannesburg, South Africa, was constructed entirely by means of electric-arc welding; it was of ⅜-in. sheet steel, height 25 ft., capacity 8,000 cu. ft. Much larger structures had been successfully undertaken in Australia; the capacity of the welded gasholder at South Melbourne was 3,000,000 cu. ft., diameter 200 ft., and maximum height 105 ft. The crown sheets and all the side sheets of 9/64-in. thickness were arc welded; there was 15 miles of welding, and when the holder was tested there were no more than six leaks. A similar structure at Fitzroy had a capacity of 3,375,000 cu. ft. with a maximum height of 140 ft.; the erection was completed in 16 weeks by 20 men, 8 welders and 12 helpers. "The Fitzroy gasholder was subjected to rigorous examination, and proved to be, if anything, a more effective piece of construction than the South Melbourne holder, and not a sign of a leak was discerned anywhere."

The use of electric welding for the repair of boilers was well established, but the entire construction of boilers by welding instead of by riveting had not yet gone very far; it was, however, practicable. A welded vertical boiler working at 180 lb. pressure was in use at Uxbridge. Messrs. Hawthorn Leslie, of Newcastle, had built a three-furnace Scotch-type marine boiler with most of the joints welded instead of rivetted, the patented design being known as the Hawthorn-Wyber welded boiler; this boiler, designed for a working pressure of 180 lb., was tested to 360 lb. per sq. in., and proved absolutely tight. After being in use at the makers' works for over a year no trouble had been experienced, and it had been approved by Lloyd's Register, the British Corporation, and the Bureau Veritas.

Steel drums and barrels for the transport of oils and other liquids, and wheels for motor vehicles, were included in references to many applications of electric-arc welding, and, finally, numerous cases in which it had been used for general structural work were quoted. Experience proved, said the author, that the adoption of electric welding saved time, labour, and materials, as compared with riveted joints; the design of members and parts was simplified, and stock sections could be utilised to build into stanchions, gantries, roof trusses, &c., in ways which would be impracticable if riveting were employed. Extensive practice had shown that the best conditions resulted from the use of flux-covered electrodes; also the flux covering had an important influence on the composition of the deposited metal. By a proper combination of electrode and flux composition it was possible to make welds of a great variety of ferrous metals in which the deposited weld metal would match in composition and structure the material joined. That could not be ensured by merely making the electrode metal match the work, as their composition was changed in passing through the arc; the co-operation of fluxes seemed to be essential.

Discussion.

Mr. A. E. Plumstead pointed out that in one part of the paper tensile strength of lap joints was said to be from 70 to 85 per cent. of the breaking stress of the plain plate, whilst in another part the tensile strength of lap joints was said to be 100 per cent. Referring to the statement that double-filleted lap joints generally broke across the solid plate on the edge of one of the fillets at a stress of from 70 to 85 per cent. of the breaking stress of the plain plate, and that single-filleted lap joints generally broke in two stages, the closing run first failing, after which the full fillet yielded, he said that in his view the first weld was not so strong as a butt weld, and in the case of the second a construction strain was set up during the welding which caused the lap weld to be weaker than a butt weld; in fact, it was stated in the paper that the breaking stress of a butt weld was equal to that of the original material. The American standard for tanks to withstand a pressure of from 30 to 100 lb. per sq. in. was that the welded joints must be equal to 50 per cent. of the tensile strength of the plate, which equalled 48,000 lb. per sq. in., so that he was unable to reconcile the author's figures with those. He had constructed a good many articles manufactured from ¼-in. plate, and had had difficulty in getting a neat weld; he had found it necessary to tack-weld tanks in some instances, and to run over them in order to secure water-tightness, but rather unsightly lumps were produced on the weld. He had had to repair a gasholder of a capacity of 800,000 cu. ft.; plates and rivet seams were badly corroded, and he had had to weld 120 new plates, varying in size from 4 to 6 ft. square, roughly, over the old plates, whilst the gasholder was actually in use. When the repairs were commenced the operators were rather nervous and there were big leakages to contend with, but the job was a great success.

Mr. E. MacGrath considered that a pressure of 50 lb. was very small to produce leaks in a tank 6 ft. by 3 ft. by 3 ft., made of ⅜-in. mild steel plate, even with riveted seams.

Mr. F. E. Saunders, referring to the author's statement that in Britain the value of electric welding products and machines was assessed by their ability successfully to meet the requirements of the Admiralty and Lloyd's Register of Shipping, asked whether that statement referred to plants or to electrodes. If the latter, what protection had the consumer that the same electrodes would be used, and that the electrodes used would be passed by Lloyd's?

Mr. W. J. Keith asked whether, in the event of pipe lines being welded electrically, electrolytic action might be expected in the course of time. He had been asked that question by a contractor abroad some time ago, but he had been unable to find any information on the subject in welding literature.

Mr. A. C. Brown asked if the author could give any information as to the magnetic inductance through a welded joint. There was a fairly large field for welding in the making of electrical instruments and small things of that nature, but the problem of magnetic conductivity would have to be taken into account.

The Chairman (Mr. A. L. Haggerty) suggested that the paper did not go far enough in some directions. It contained a somewhat remarkable list of the applications of electric welding, but it was surprising, even to those who were familiar with the subject, how large was the number of applications which had already been employed. It had to be borne in mind that electric welding was, to a large extent, competing with practices which were already well established, and he suggested that it was not sufficient to show that electric welding could do what had already been done by other processes; it had to be shown that it was better, and also that it was cheaper, particularly the latter. There was a general opinion among engineers, he believed, that electric arc welding was an expensive process, and it was probable that the experimental jobs which had been illustrated were extremely expensive. At the same time, there were probably many who could testify that electric welding when applied to other structures was a very much cheaper process than riveting.

Mr. A. J. Hoare, who replied in the absence of the author, did not attempt to make a full reply to the questions which had been asked, but with regard to lap welds, said he believed that Major Caldwell referred in the paper to the figures which were obtained by Sir Westcott Abell, who, acting on behalf of "Lloyd's Register of Shipping," had carried out tests at Messrs. Cammell, Laird & Co.'s works at Birkenhead in 1918. Personally, he did not think that ⅛-in. plate welding could be done so neatly with the electric arc as with acetylene. The main advantage of electrically welding ⅛-in. plate was the fact that the sheets could be welded without buckling. As to the machining of the pinion which had been built up by the electrical method, there was no difficulty in machining welded cast steel; difficulty had been encountered in machining welded cast iron, however. He was not aware that the question of electrolytic action on electrically-welded pipe lines had been raised before. The only instance he knew of in which electrolytic action had taken place was in ships' hulls, where the deposited metal stood quite as well as the previous metal did.

As to the utilisation of electric welding for the manufacture of electromagnets, he considered that the conductivity would be sufficiently good, provided the weld was made properly and the metal was absolutely solid, but if the welding were carried out in such a way that there were slag inclusions in the weld, it would reduce the conductivity of the metal.

New Japanese Customs Tariff.

The revised list of import duties put into force by the Japanese Government on March 29th was issued as a supplement to the *Board of Trade Journal* dated April 15th. It is stated that the primary object of the revision is not to raise additional revenue, although increased returns are anticipated, but to protect a number of native industries. From the new tariff we reproduce below a number of electrical and allied items. Except where otherwise stated the duty is given in yen per 100 kin (132,277 lb.); the abbreviation *a.v.* denotes an *ad valorem* percentage:—

Tariff No.	Description.	Rate of duty.
321.	Insulating tapes of tissues	23.70
419.	Sheet mica	free
419.	Sheet mica, glued together	38.10
464.	Copper wires, not exceeding 0.5 mm. dia.	19.30
	Copper wires, exceeding 0.5 mm. dia.	20.40
486.	Insulated electric wires—	
	Submarine teleg. or teleph. cables (armoured)	free
	Other armoured cables combined with india-rubber or gutta-percha	20.00
	Other armoured cables for telephone or telegraphic use	5.50
	Other armoured cables for other purposes	11.20
	Flexible cords combined with silk	25 *a.v.*
	Flexible cords, other	18.00
	Unarmoured cables combined with india-rubber or gutta-percha	26.00
	Unarmoured cables, other	25 *a.v.*
515.	Electric stoves, irons and similar utensils	35 *a.v.*
528.	(2) Electric clocks (master and subsidiary)	35 *a.v.*
543.	Ammeters, voltmeters, and volt-ampere meters	148.00
544.	Wattmeters	20 *a.v.*
	Watt-hour meters	52.30
547.	Accumulators	20 *a.v.*
	Dry batteries	17.30
	Other batteries	25 *a.v.*
	Battery electrodes	20 *a.v.*
	Other parts	25 *a.v.*
569.	Steam boilers, cast-iron	5.00
	Steam boilers, other	8.00
571.	Mechanical stokers	6.10
571.	(2) Fuel economisers	3.35
572.	Feed-water heaters	12.80
577.	Gas engines, weighing not more than 250 kg.	23.10
	Ranging to engines weighing not more than 50,000 kg.	8.2
	Other gas engines	20 *a.v.*
578.	Water turbines and Pelton wheels, weighing not more than 5,000 kg.	20 *a.v.*
	Ditto, weighing not more than 10,000 kg.	15.20
	Ditto, other	14.90
579.	Dynamos, electric motors, rotary converters, frequency changers, rotary phase converters and armatures—	
	Weighing not more than 25 kg.	42.40
	Ranging to machines weighing more than 5,000 kg.	15.80
579.	(2) Transformers weighing not more than 25 kg.	26.00
	Ranging to transformers weighing more than 5,000 kg.	7.00
580.	Dynamos combined with motive machinery	20 *a.v.*
618.	Filaments for incandescent lamps	20 *a.v.*
619.	Carbon for electrical use, powder or grain	8.30
	Carbons, each weighing not more than 300 grammes	20 *a.v.*
	Ditto, weighing more than 300 grammes	8.30
631.	Vulcanised fibres (not embossed)	17.80
635.	Incandescent electric lamps	12.80
	Chandeliers, brackets, shades, &c.	40 *a.v.*

The Contractors' Conference at Brighton.

We have already briefly announced in the Electrical Review that the First Annual Conference of the E.C.A. Allied Associations (The Electrical Contractors' Association, Incorporated, the N.E.C.T.A., Ltd., and the National Federated Electrical Association) will be held at the Royal Pavilion, Brighton, on Thursday and Friday, June 24th and 25th. We have now received particulars of the full programme of events which has been arranged for these days and for the 23rd and 26th as well. These are as follows:—

Wednesday, June 23rd.

10 a.m.—Meeting of the Council of the Three Associations.
6.10 p.m.—Arrival of Delegates and Registration at the Royal Pavilion.
7.30 p.m.—Reception by the President, Mr. T. E. Alger, A.M.I.E.E., at the Royal Pavilion; music, dancing, light refreshments.

Thursday, June 24th.

10 a.m.—Opening of Conference; address of welcome by His Worship the Lord Mayor of Brighton, Councillor J. Lord Thompson, J.P., and reply by the President.
10.15 a.m.—Presidential address by Mr. T. E. Alger.
11.30 a.m.—Annual General Meeting.
1 p.m.—Luncheon adjournment.
2.30 p.m.—Paper by Mr. Walter Finlay, W.S. secretary of the E.C.A. of Scotland, on "Co-operation Between the Supply and Contracting Sections of the Industry."
3 p.m.—Discussion.
4 p.m.—Paper by Mr. Walter Riggs, A.M.I.E.E., past-president, E.C.A. Allied Associations, on "Apprenticeship."
4.30 p.m.—Discussion.
5.30 p.m.—Conference adjourns.
7.30 p.m.—Smoking concert in the Music Room, Royal Pavilion.

Friday, June 25th.

10 a.m.—Discussion initiated by Mr. Llewellyn B. Atkinson, M.I.E.E., director, Cable-Makers' Association, on "The Need for a Standard Set of Wiring Rules to be Applied Nationally."
11 a.m.—Paper by Mr. F. W. Purse, M.I.E.E., engineer and manager, West Ham Corporation, on "The Registration of Electrical Contractors."
12.30 p.m.—Votes of thanks, and brief address by the President-Elect, Mr. H. J. Miles M.I.E.E.
1.15 p.m.—Close of business session.
3 p.m.—Garden party in grounds of Royal Pavilion.
9 p.m.—Ball at Royal Pavilion by invitation of His Worship the Mayor of Brighton.

Saturday, June 26th.

Arrangements for golf, drives, &c., have been made for those who desire to spend the week-end in Brighton.

Arrangements under the usual conditions have been made to secure reduced railway rates on vouchers signed by the Conference Secretary. Comprehensive hotel arrangements have also been made, full details of which, together with copies of the Conference programme and other literature may be obtained from the Conference Secretary, Mr. H. J. Galliers, at 32, St. James's Street, Brighton, to whom all general correspondence relating to the Conference should be addressed.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

New "Osram" Valves and Pins.

The General Electric Co., Ltd., has recently produced a new 2-V thermionic valve of the dull-emitter type (the "D.E.2"), in two patterns—for high- and low-frequency. Their filament current being 0.12A, these valves mark the half-way point between the dull-emitters proper, consuming 0.06 A, and the semi-dull-emitters, which take from 0.2 to 0.3 A. The potential which the filament will safely withstand is the full two volts, so that when a 2-V accumulator is used a low-resistance rheostat is sufficient. The h.f. type was found to operate satisfactorily as an amplifier (requiring from 40 to 50 V on the anode), and as a detector with a similar plate voltage. The l.f. valve gave satisfactory results as an amplifier, with a 3 to 1 transformer coupling, with between 60 and 70 V on the plate and a grid bias of —3 V. When resistance and choke coupled audio-frequency amplifiers are used the h.f. valve will be found suitable. The amplification factor of the h.f. valve is 12 and the impedance 45,000 ohms. The equivalent figures for the l.f. pattern are 7 and 22,000 ohms. The valve is illustrated in fig. 1.

Valve pins, even the best, have at times proved faulty in consequence of their form. The split type of pin hitherto universally used provides good contact in the early stages of its life, but invariably relaxes in time, and the usual course adopted to remedy this defect is to open the pins with a knife; not only does this weaken them, but in many cases

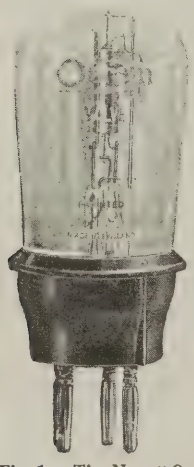


Fig. 1.—The New "Osram" D E.2 Valve.

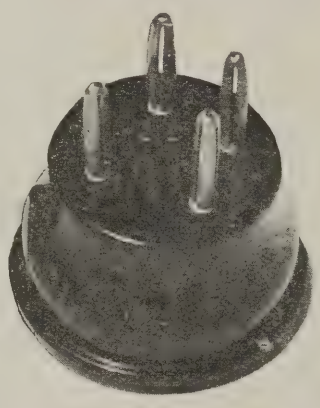


Fig. 2.—Hollow Cross-cut Valve Pins.

recourse to this measure has meant the snapping of one half of the pin. A new type of pin, fig. 2, has been evolved by the General Electric Co., Ltd., which will shortly be fitted to all "Osram" valves; the above-mentioned D.E.2 types, in fact, are already being supplied fitted with this form of contact, which might best be described as the "hollow cross-cut pin." It consists of a turned brass pin, slightly convex in shape, with a hole bored through it longitudinally; in addition, two fine longitudinal sawcuts, made at right angles, give a spring effect to the pin. The sawcuts do not extend to the tip, and thus impart resiliency without weakening. The lead-out wire from the valve is brought through the centre of the pin and soldered to it at the tip, leaving no flux or other obstruction on the base to reduce insulation between pins; this allows the valve to be pushed right home in the socket, the base lying flush with the panel. The base itself of every "Osram" receiving valve in now composed entirely of a high-grade insulating material which reduces capacity effects between the electrodes and is neat in appearance, the flange for lifting the valve and the ridge for indicating the anode pin being well-known features.

An Unusual Crystal Detector.

The adjustment of a point in contact with a surface, such as a crystal detector, requires mechanism capable of the smallest movement and the contact point should be held firmly and be of a rigid character instead of the usual springy nature. It was with such objects as these that Messrs. S. A. Lamplugh, Ltd., patented their detector, which is illustrated in fig. 3. The glass dome is held in position and sealed with a rubber ring, and only needs to be pressed in or pulled out. The universal movement enables nearly the whole of the crystal surface to be searched, and it is claimed that as little as 1/100,000th part of an inch movement of the contact is possible. So precise is the simple mechanism that the contact may be withdrawn and again advanced to the identical position at will. In addition to its handsome appearance, the usual facilities for selecting the best spot and ease of access to both crystal and contact will be appreciated.

This detector is mounted on an insulated base and holes are provided at the four corners for fixing the component to a baseboard or panel. At one end two telephone terminals are mounted, and at the other the base is moulded with a projection, and drilled with two holes through which a stiff vertical U-shaped piece of wire passes. The bottom of the U projects into a longitudinal channel cut in the underside of the base, and a cross-piece slide fits over the two vertical legs.

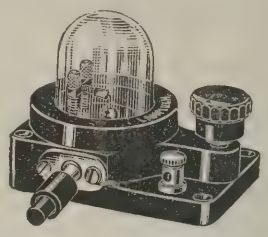


Fig. 3.—The Lamplugh Detector.

Two milled nuts screw on the ends of the legs, and hold the cross-piece in position against two springs, slipped one over each leg. A horizontal split screw in the middle of the cross-piece grips a spear-pointed wire bent vertically downwards to act as a cat's whisker. One end of a plated-metal strip passes between the bend in the U-shaped wire and the underside of the base, while a screw rotated by a knob of insulating material passes through a nut and presses on the other end of the metal strip. This combination acts as a lever with about a six to one ratio, so that an exceedingly fine control of the vertical motion of the cat's whisker is ensured.

The crystal is gripped in a pair of spring tongs moving in a metal sleeve through one side of the base. By pressing a small black knob the jaws of the tongs are opened, and with the aid of the ball-socket mounting it is possible to pick up crystals from the base, and also to obtain coarse adjustment of the contact with the whisker.

A Terminal "De Luxe."

Amongst the little things that count when utility is to be combined with elegance are the insulated terminals made by Messrs. Belling & Lee, Ltd. As indicated in fig. 4, the screw-action insulated head has a non-rotating engraved top; the stem and cross-hole facilitate connection and shielded metal clamping faces are provided. Below the insulating collar are a standard 2 B.A. stem with a nut and washer, and the transverse slot and clamping nut at the end eliminate soldering. The insulation material used is polished black

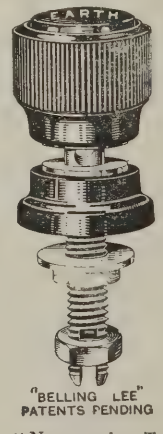


Fig. 4.—The "Non-rotating Top" Terminal.

Bakelite, and all metal parts are nickelled. Besides wireless circles, this well-made component should be serviceable to instrument makers and others in the electrical trade. Other patterns of terminal are also made, and also wire couplers and plugs and sockets, which are provided with an internal chuck grip, and present a neat appearance.

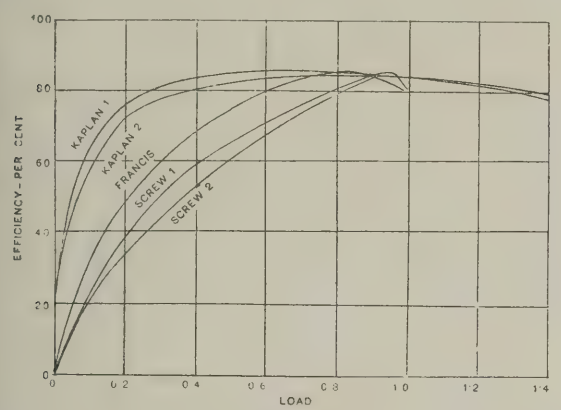
Radio Section at Padua Sample Fair.—The Department of Overseas Trade is informed that a special section for the display of radio-technical instruments is to be organised at the Sample Fair at Padua, which is to be held from June 5th to 20th. Prizes will be offered for the best types of apparatus based on the principles of least cost and highest efficiency. The competition is open to manufacturers of all nations.—*Board of Trade Journal.*

The Kaplan Hydraulic Turbine.

Its Advantages over the Francis and Propeller Types.

In a recent issue of the *Revue Générale de l'Electricité*, Mr. E. Luthy, the chief engineer of the Water Power Department of the Société des Constructions Electriques de France, gives an instructive summary of the tests of various types of turbines for hydro-electric stations carried out by Mr. Elov Englesson, the chief engineer of the Aktiebolag Karlstads Verkstaden, of Kristinehamn, Sweden, and the following notes, based on the summary, may prove of interest.

The Kaplan turbine, while of the screw-propeller type, differs from the usual design in that the blades are capable of having their angle of inclination varied while running, an arrangement which results in several advantages from the operation point of view; but, on the other hand, the blade-adjusting mechanism renders the machine more complicated than an ordinary propeller turbine. It was therefore important to devise a method of blade adjustment control which, while



Kaplan 1, specific speed, 600; Kaplan 2, sp. speed 750. Francis, sp. speed 350. Screw 1, sp. speed 500; Screw 2, sp. speed 600.

Fig. 1.—Variation of Efficiency with Varying Load of Kaplan, Francis, and Propeller (Screw) Turbines, under Constant Head.

maintaining the automaticity of the blade-angle variation, should be as simple as possible. It is to this matter that Englesson has devoted considerable attention, the result of his labours being seen in an arrangement he has patented and which has been applied to an 11,200-h.p. turbine, with a blade diameter of 5.8 metres (19 ft.), built for a water head of 21 ft. 3 in., at the Swedish State power station at Lilla Edet. The problem is solved by the introduction, in the interior of the hub, of a servo-motor on which the real automatic controller acts through the intermediary of a valve. The hub is filled with oil, ensuring the lubrication of all the bearings, an oil-tight ring preventing the escape of any of the oil. In practice it has been found that Kaplan turbines constructed in this way show very little variation in efficiency when running with either low or normal water admissions.

Determining the Maximum Suction Head.

In determining the admissible suction head of turbines, one of the problems to be kept in mind is that when the suction exceeds a certain value, what may be termed "cavitations" are formed, which give rise to a falling-off in efficiency. By cavitation is meant the free space which is established between the surface of the blades and that of the film of water, which instead of following the contour of the blade tends to leave it. These spaces become filled with water vapour and oxygenated air, a mixture which rapidly causes blade corrosion. Cavitations are caused as soon as the vacuum on the blades attains the pressure of water vaporisation.

The maximum suction head depends, therefore, on the conditions of cavitation formation, the essential elements of which are dealt with below.

(1) The height of static suction is equal to the difference between the level of the moving wheel and that of the tail-race. The risk of cavitation increases with the height of suction, it being due to the desire to keep these heights as low as possible that vertical-shaft turbines are preferred.

(2) The axial speed at the delivery end of the moving propeller being designated by c, and that of the outlet of the siphon by c_2, the kinetic height recuperated in the suction pipe is $\eta(c_2^2-c_3^2)/2g$, η being the efficiency of the siphon. The vacuum on the outlet side of the propeller increases in the same degree as the recuperated kinetic height. It follows therefore that the vacuum, and the risk of cavitation, increases with the height, correspondingly to the outlet speed to be recuperated in the siphon. In the propeller type of turbine, the height corresponding to the permitted outlet speed varies between 20 and 30 per cent. of the total available head. It is comprised between the same limits in the case of Kaplan turbines working under normal load, and reaches as much as 70 per cent. of the total head when running at an overload.

Where a high head has to be taken into consideration, the lower values indicated above must be adopted, if the limit of cavitation is not to be exceeded. In this case, the propellers have to be relatively large.

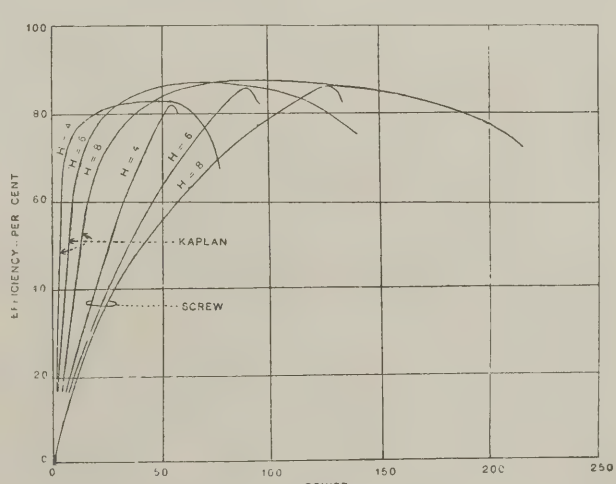
(3) As regards the length of the blades in relation to the pitch, when the turbines are intended to run at a high speed, it is necessary, in order to reduce the friction, to employ small-surface blades, that is to say, blades which are short in proportion to the pitch. This results in an increase in the specific pressure on the blades—an increasing danger of cavitation. It is to avoid these disadvantages that it is necessary for the blades to be made larger, when the height of fall and of suction are themselves greater and to adopt lower values for the specific speed.

In the Kaplan turbines so far tested, the largest blades are slightly longer than the pitch.

As the creation of cavitation also depends on a certain number of other factors, such as the temperature of the water, the profile of the blades, the circumferential speed, &c., it is almost an impossibility exactly to determine the entire conditions which give rise to cavitation. All that can be done is to approximately determine the effect of each of the factors which enter into the problem, and to determine experimentally the permissible suction heights for differing heights of fall and circumferential speeds. To enable this to be done a laboratory has been established at the Karlstad Company's works at Kristinehamn, in which turbines with a propeller diameter up to 250 mm. (9¾ in.) can be tested with any degree of suction height, positive or negative, under water heads ranging from 1 to 11 metres (3 to 36 ft.). The conditions giving rise to cavitation can thus be determined either by brake tests, or, with the turbine in operation, by a stroboscopical method by which the formation of cavitations on the propeller can be directly observed. Plant for similar experiments has also been established by the Czecho-Slovakian firm of Ignaz Storek, and at the Polytechnic School at Munich.

In determining the maximum permissible head of water there is, in addition to questions relative to cavitation, another matter to be taken into consideration—that of the solidity of the rotating propeller. Although, even for fairly large heads, one-piece rotors in propeller-type turbines can frequently be adopted, this is not possible in Kaplan turbines, the blades of which must be pivotally connected to the hub, which therefore in the case of relatively great heads must be of a correspondingly large diameter. So long as the head of water does not exceed 15 metres (50 ft.), the diameter of the hub is not excessive. It is possible without any drawbacks as regards the solidity of the rotor, to employ Kaplan turbines for a water head double that just mentioned, although in such a case the hub assumes rather a large size.

So far Kaplan turbines have only been employed in installations where the head does not exceed 17 metres (56 ft.). The



Speed, 637 r.p.m.; diameter of rotor, 600 mm.

Fig. 2.—Variation of Efficiency with Load of Kaplan and Screw Turbines, for Different Heads.

latter condition obtains at the Wiesenberg power station in Czecho-Slovakia, where there is at work a Storek 300-h.p. horizontal-spindle turbine of the Kaplan type running at 1,000 r.p.m.

The Specific Speed.

In installations where the height of head is low, Kaplan turbines can be run at a higher specific speed than those of the propeller type and still maintain their efficiency, this being rendered possible by a form of non-overlapping blade made in accordance with one of Englesson's main patents. The blades are of course short and as the losses due to friction are re-

duced, the permissible circumferential speed attains a high value.

It is obviously possible to provide propeller-type turbines with non-overlapping blades and to attain equally high specific speeds as with Kaplans. Such a turbine, however, would have a low efficiency at all the varying loads, while that of Kaplans only falls off at maximum load and maximum speed, conditions which are rarely met with, and even when they occur, the question of efficiency is not of great importance. Kaplan turbines have been constructed with specific speeds of over 1,000 r.p.m. for heads of 16½ ft. As the head becomes greater, it is necessary to reduce the specific speed, 600 r.p.m. never being exceeded for a head of 50 ft.

One of the greatest advantages of Kaplan turbines over those of a comparable type such as high-speed propeller and Francis turbines, lies in the slight variation in efficiency under differing

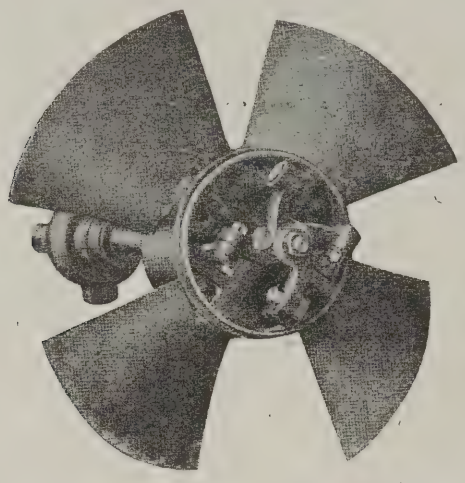


Fig. 3.—Rotor of Kaplan Turbine, with Hub Cover Removed.

loads, this arising from the use of adjustable blades. Fig. 1 is a diagram showing the efficiency curves obtained from tests of two Kaplans, two propeller-type and a Francis turbine at the Karlstad Co.'s laboratory, the diameter of the propellers in all five machines being 600 mm. (23½ in.), the suction pipe elbow through which the horizontal shaft of the turbines extended being also the same in all cases. It will be gathered that the efficiencies of the propeller-type turbines, and more especially of the Kaplans, are closely related to the shape and dimensions of the suction pipe, in which is recuperated, when running at normal load, power which may amount to 30 per cent. of the power of the total head. Englesson admits that the results of the tests at Kristinehamn with propeller-type turbines are not quite so good as those published by several German and Swiss concerns, which, however, conducted their tests with long, straight pipes, but as these are rarely met with in practice they were not employed in the Swedish tests.

Where water under a variable head has to be dealt with, Kaplan turbines, it is claimed, offer a distinct advantage as regards efficiency over propeller-type turbines, owing to the reduction in power development due to lower heads being less. This claim is supported by fig. 2, which shows the comparative curves of efficiency variation under different heads obtained in the course of tests with a Kaplan and a propeller turbine, the propeller diameter of which was approximately 23.6 in. It may be noted that the available minimum delivery corresponds generally to the maximum height of head. In the case of propeller-type turbines, it is therefore necessary that they should be run under conditions which will enable maximum efficiency to be secured and also that the water delivery is sufficient to permit this *réqime* to be attained. These difficult problems are not experienced in connection with Kaplan turbines, the efficiency of which varies but slightly under different heads or varying amounts of water delivery, the type possessing under these headings important advantages.

Tests have also been carried out as to economy in water consumption for a given power development which can be effected by the use of Kaplans as against the propeller or Francis types. A summary of the results showing the economy in percentages is given in the subjoined table :—

No. of Sets in parallel.	Economy per cent. over Propeller Turbines.	Economy per cent. over Francis Turbines.
1	38	22
2	29	15
3	20	8
4	13	4
5	7	2

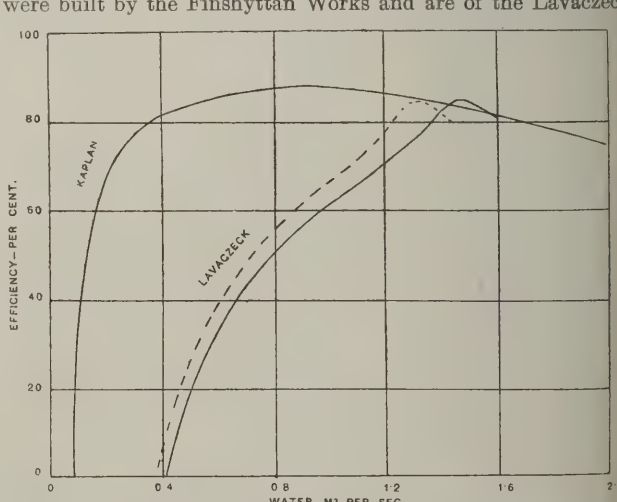
The variations indicated by the table are mainly due to the fact that an electric power station is rarely run at full load, that is at a load corresponding to maximum efficiency as regards the major number of machines. In view of the fact that a much higher specific speed is possible with Kaplans than with the propeller type and more than double that attainable by Francis turbines, it is possible to effect a reduction in the cost of alternators for any particular hydro-electric plant. Moreover, despite the high specific speed, the efficiency within very wide load variation limits is quite satisfactory, so that it is possible to reduce the number of generating sets necessary to give a certain output and so effect an economy in both the first cost and the cost of running an installation.

Another great advantage of the Kaplan turbine is that it may be run at a 50 per cent. overload without any serious diminution in efficiency. This advantage is particularly useful in case of breakdown or temporary stoppage of one of the generating sets in a power station as the remaining sets can be run temporarily at a higher load without any inconvenience or danger. Indeed, it is possible in this way to render the need for a reserve generating set unnecessary.

As it is admitted that Kaplan turbines, being fitted with adjustable blades, are more complicated than propeller turbines, it may be held that this is an undesirable factor in that it may give rise to unreliable station running. It is claimed, however, that the methods of blade angle variation that are now adopted, and the results obtained in actual practice, are such that Kaplan turbines are, from the reliability point of view, comparable with those of the fixed blade type, all reaction stresses due to the blade angle variation being taken up in the blade boss itself, so that the turbine shaft and pivot are unaffected.

As regards the question of cost, Kaplan turbines, in view of the advantages they offer, are of course more expensive to build than either the propeller or Francis types. The difference in cost between the Kaplan and the other types, however, falls proportionately as the size of the turbines is increased. Thus, whereas to develop equal power a Kaplan with a movable-blade propeller diameter of 1 metre (3¼ ft.) is 50 per cent. more costly than one of the other types, the difference falls to 15 per cent. in the case of a Kaplan with a propeller diameter of 6 metres (20 ft.). If only equal propeller diameter is taken into consideration, the difference in cost is greater, amounting to 75 per cent. for a 1-metre propeller Kaplan and 30 per cent. for one of 6 metres diameter. In considering the merits of Kaplan turbines, however, it is not so much their individual cost that has to be regarded as the relation of such cost to the total expenditure on the power plant. Figures drawn up a few years ago for the Swedish Government by the Svenska Commerskollegiet show that the average value of the cost of turbines was only 0.1 of the total cost of the plant in the case of working heads of 5 and 6 metres (16½ and 20 ft.) and that the turbine cost falls to 0.06 of the total outlay on plants where the available head of water is 10 metres (33 ft.). Thus, in the case of a plant with a head of 6 metres, and accepting that a Kaplan would cost 50 per cent. more than a propeller-type machine, the increase in the total cost of the station would only be 5 per cent., which it is claimed would be more than counterbalanced by the increased power output, which is much more than 5 per cent. above that of the ordinary propeller turbine. Moreover, owing to the higher speed of the Kaplan, a less costly alternator can, as has already been pointed out, be used, so that in the aggregate, a set consisting of a Kaplan turbine and generator need be no more costly than a propeller-type turbo-generating set. Fig. 3 shows a Kaplan propeller with the hub cover removed.

Swedish Export for April gives some particulars of the water-power station at Lilla Edet, belonging to the Swedish Government. The mean head is only about 21 ft., but the quantity of water is considerable, some 35,000 cu. ft. a second. The present installation is planned for about 15,000 cu. ft. Three turbines are installed, all of the vertical type and at mean head of approximately 10,000 h.p. capacity each. Two of them were built by the Finshyttan Works and are of the Lavaczeck



Model runners; Kaplan 950 mm. diam., Lavaczeck 950 mm. (dotted), 1,000 mm. (firm). Water reduced to 1 m. head.

Fig. 4.—Efficiency Curves of Kaplan and Lavaczeck Turbines.

type. The runners are 19 ft. 7½ in. in diameter, and are said to be the largest yet built. The most interesting set, however, is the third turbine, built by Verkstaden in Kristinehamn; this is the largest of its kind yet built. The runner of this turbine weighs 62½ tons as compared with 46 tons in the case of the other runners. The guaranteed output at a head of 6.5 m. and 62½ r.p.m was 11,200 h.p. In the hub of the runner are automatic devices for setting the runner blades at different angles according to the load. At the guaranteed maximum load the turbine handles 160 tons of water per second, but it has proved capable on overload of using 200 tons per second.

Each of the turbines drives an Asea alternator of about 10,000 h.p. The weight supported by the cross bearing of each generator is 440 tons.

The first trial run was made on December 19th. The head was at that time at minimum height, 5.6 m., for which the works had guaranteed an output of 9,200 h.p. The turbine actually developed 11,560 h.p., or more than the guaranteed maximum at 6.5 m. head; it may be expected to develop upwards of 15,000 h.p. at the normal head of 6.5 metres. Test results with model turbines give an efficiency of 89 per cent. for the Kaplan and 85 per cent. for the other type (see fig. 4), and it is estimated that the actual figure for the big Kaplan turbine will be well over 90 per cent. in actual working. The Kaplan turbine has now been running since January 7th, the power being transmitted to Trollhättan.

Before the present installation only small Kaplan turbines had been at work in Sweden. A 400-h.p. set built by the Kristinehamn Works for the city of Gävle electricity works has been running about four years, and the fact that another turbine of the same type and of 700 h.p. capacity has just been ordered is sufficient evidence that it has fulfilled the expectations of the designers. The engineer reports that at the low water prevailing, which could hardly keep another propeller turbine running with no load, the 400-h.p. Kaplan turbine developed 200 h.p.

Reviews.

The Enlarged Heat Drop Tables, H.p. Gauge Pressures, L.p. Absolute Pressures. London: Edward Arnold and Co. Price 10s. 6d. net.

The tables contained in this book are based on the system of equations formulated by Professor H. L. Callender, M.A., and have been calculated by Herbert Moss, D.Sc., and published for the Turbine Section of the British Electrical and Allied Industries Research Association. The tables are arranged in two sections—conversion tables for initial and final pressures, and temperatures, and adiabatic heat drops in B.th.u. per lb. of steam. The latter is arranged in 36 tables indexed under the final pressures, in inches of mercury vacuum, from 27.0 to 29.5 inclusive. Each table gives the saturation temperature, and the initial superheat values of from 0 deg. (saturated) to 300 deg. for 29 initial gauge pressures ranging from 2,000 to 400 lb. per sq. in. inclusive.

Electric Vehicles. By Charles W. Marshall, B.Sc. Pp. xii + 96; figs. 43. London: Chapman & Hall, Ltd. Price, 9s. 6d. net.

Electrical engineers and those on the commercial side of electrical exploitation have not up to now given to the subject of accumulator road traction the attention and effort its importance warrants. This attitude of apathy may partially be explained if not excused by the calls made on the active personnel of the industry by the rapid advances which have occurred in every branch of recent years, leaving the tired brain with little or no inclination to study that which can without inconvenience be left for some other occasion. Thus it happens that the majority of electrical men know far less about electric vehicles than would have been expected, since transport technique in all its branches exerts as a rule something akin to fascination even on the technically uninstructed mind.

And now Mr. Marshall comes along and presents a compact little volume on electric vehicles which is a model of condensation and yet which deals with salient principles in a scientific manner, devoid of loose generalisation and calculated to enable anyone within the space of an evening's reading to glean a foundational knowledge of this subject.

The treatment very rightly begins with a discussion of the factors governing traction on common roads, from a study of which it will be apparent how applicable is the electrical method of measurement to vehicle performance generally, a fact which automobile engineers, apart from those engaged in accumulator vehicle work, might profit by and reduce their units of measurement to a rational basis in lieu of their "miles per gallon" basis which expresses so badly because so indefinitely the merits of their products. To illustrate the point, a good electric vehicle running at 12 m.p.h. on a hard road (level) will dissipate 90 watt-hours of battery output per gross ton-mile (g.t.m.). A good petrol lorry under similar conditions will consume petrol at the rate of 60 g.t.m. per gallon, which, assuming 19,000 B.th.u. per lb., or say 136,000 B.th.u. per gallon, would entail 2,265 B.th.u. per g.t.m., which converted into electrical units is equal to 633 Wh. In other words, 543 watt-hours per g.t.m. disappear in engine losses in such a vehicle. Remembering that many cars give a performance of only 20 g.t.m. per gallon of fuel it will be appreciated what an immense scope for improvement in fuel energy conversion and utilisation awaits the engineers who design these machines. Prof. Riedler has examined this problem in detail and recorded many tests in a classically important series of records published in or about 1912 under the title "The Determination of the Merits of Automobiles."

Returning to our subject, Mr. Marshall concludes Chapter I—the most important in the volume in the writer's opinion—with a clear statement on the calculation of minimum battery capacity required for given total weights and mileages at 100 Wh. per g.t.m. The effects of gradients and windage are also concisely discussed.

Chapter II discusses the elementary theory of lead/acid/lead and nickel/alkali/iron accumulators, calling attention to the inevitable and fundamental limitations surrounding the problems of specific output, a study of which is commended to those ignorant optimists who at intervals claim miraculous achievements in this field. In plain fact 10 Wh per lb. of complete battery probably represents the maximum realisable output from any practical accumulator if a reasonable life is to be assured—all claims to the contrary notwithstanding. All the leading types are described and illustrated.

A tabloid history of electric vehicles is given early in Chapter III (which may be supplemented by those interested by reference to Milandre and Bouquet, whose "Voitures Automobiles Electriques—Paris, 1899," gives the story in detail), followed by a general survey of modern types of British-made electric vehicles. Mr. Marshall is very impartial and tempers any criticism he tenders by endorsements of practical efficiency in every case, he having in his technical care a large fleet of electrics, including practically every existing type and make—and some others not now made.

Charging equipment is described in Chapter IV, some detail being gone into as to the pros and cons of various equipment for a.c. and d.c. supplies. Battery charging is discussed at length and insistence rightly emphasised on the value of systematic record keeping on properly established forms in the battery department of an electric vehicle garage. Sample forms are given, such as are in use at Glasgow. Constant potential charging is recommended for lead batteries, which, provided proper control is exercised and that a small resistance be inserted in the circuit to give a little control on a fluctuating line voltage, is undoubtedly the correct manner in which to operate this type of cell. Surely it is time that some maker came along with a battery vehicle equipped to charge directly from a 220-V circuit—it is a practical scheme and would save much trouble in charging equipment besides enabling such a vehicle to take charging current at hundreds of places in many cities to-day.

The section on operating experience is of exceptional interest as it gives details of actual results obtained in running a very mixed fleet of electrics over a period of years. Actual data concerning the life of accumulators are given, from which it is established that three years' life may be expected from a first-class lead battery and from six to eight years with an alkaline accumulator of the Edison type.

Conclusion (III) on page 67 reads as follows and should be broadcast:—"There is practically no limit to the useful life of a well-designed and manufactured electric vehicle. After 100,000 miles running, one vehicle is running quite as well as when it was new. The renewals necessary are quite easily carried out, and the wearing parts are of the simplest description."

And listen to No. (IV)!:—"There is practically no danger of a good electric vehicle breaking down on everyday service."

These are the facts which electrical engineers should help to spread. The electric vehicle is a potential load builder for the power station on a grand scale. Every power station should start by having *at least one electric* instead of those old and shabby Fords we see so often and sadly.

Mr. Marshall's excellent little book concludes with a section on electric vehicle testing on the road and one dealing with running costs—also notes on practice outside this country, which latter, however, does not appear of special novelty or to represent any improvement over our own technique. The illustrations of this compact volume are most exceptionally good.

R. J. Mitchell.

Light Fixtures and Lighting Effects. By M. Luckiesh. Pp. xiv + 330; figs. 158. London: McGraw Hill Publishing Co., Ltd. Price, 20s. net.

Mr. Luckiesh's numerous works on illumination, especially its decorative and artistic aspects, are well known in this country. He is an enthusiast for the use of light as a decorative medium and his books are invariably readable.

The present work is no exception. In the preface the author makes a plea for recognition of the great possibilities of present illuminants and lighting appliances, and suggests that decorative considerations are not incompatible with scientific control of light. The first three chapters, "The Potentiality of Light," "The Influence of Nature," and "The Imprints of Usage," are introductory. The next two discuss in turn the physical basis of light and colour and their æsthetic aspects. Such points as the alleged psychological influence of various colours, the mental associations connected with them, and the basis of colour harmonies are treated, and here Mr. Luckiesh gives many useful hints. His table arranging colours in order of preference by males and females, based on statistics, is interesting. Subsequent chapters deal with the relations between light and pigment, and it is shown how, in order to obtain a satisfactory effect, the lighting and decoration schemes must be considered conjointly.

In the next section of the book we have the various Ages (Antiquity, Classical, Middle, Renaissance, &c.), analysed and illustrated. The many sketches of lighting fittings of various periods are well done, and this section of the book is worth reading by anyone who desires to know something of these various periods and gain some acquaintance with characteristic styles.

In the final section of the book Mr. Luckiesh sets about his task of showing how new illuminants may best be grafted on to old decorative schemes—for instance, how far flames may be replaced by electric lamps without the latter becoming obtrusive

—and illustrates the decorative possibilities of modern lighting devices. There is undoubtedly a good field for study in connection with the possibilities of coloured light, flood-lighting, &c. In the future anyone who has both a technical knowledge of lighting and an appreciation of considerations that appeal to the architect should find many opportunities of service. Mr. Luckiesh's book is both stimulating and readable and comes at an opportune moment.

Electrical Engineering for Mining Students. By G. M. HARVEY, M.Sc., B.Eng., A.M.I.E.E. Pp. vii+156; figs. 108. London: Sir Isaac Pitman & Co., Ltd. Price 5s. net.

To present a comprehensive account of elementary d.c. and a.c. technology within the limited compass of 156 pages is no mean task, and although the book before us is not beyond criticism, the author has accomplished this task with a considerable measure of success. The work will be a useful summary of basic theory for the young student of mining electrical engineering and will serve as an introduction to the author's larger and more comprehensive book.

The chapter on d.c. theory is generally good, but the treatment of magnetic quantities is too superficial. The equation $B = 0.4\pi IT/L$, although numerically correct for a magnetic circuit in air, is only so because of an arbitrary value of unity for the permeability. The latter quantity is not explained at this stage, and does not appear till the theory of the dynamo is considered. The chapter on this subject gives a good account of the elementary principles of armature winding, commutator, and methods of field excitation; d.c. motors are also satisfactorily treated.

The chapter on a.c. theory can only be regarded as suitable for supplementing instruction received in the class-room and laboratory, and although the author has done well in the limited space at his disposal, the development of the theory is not as coherent as one would like. As a knowledge of elementary trigonometry is assumed there is no justification for asking the student to take the $\sqrt{2}$ ratio of maximum to virtual value of alternating quantities on trust. The notion of form factor which should have been introduced at this point is brought in casually later in treating the theory of the alternator. A useful chapter on the transformer follows, in which, however, we notice the statement that the regulation of a transformer should have as low a value as possible. The student should rather have been instructed in the reasons for designing power transformers with fairly high reactance. Alternators are dealt with before polyphase circuits, and the author has not therefore been able to utilise the useful rotating field method of dealing with armature reaction. In the chapter on 3-phase circuits great pains have been taken to make this difficult subject clear to the beginner. A good deal of space is devoted to the two-wattmeter method of measuring the power factor of balanced 3-phase circuits. We cannot agree with the author that this method is an accurate one; 3-phase circuits are rarely sufficiently exactly balanced or loads sufficiently steady to give more than approximate results. We do not consider, moreover, that the lengthy algebraic transformation of the formula from the tangent to the cosine form need have been given in a book of this character. A good elementary account of the polyphase induction motor is followed by brief descriptions of the synchronous motor, the rotary converter, and the motor converter. The references to electrical instruments throughout the book are scanty. It is hardly correct to state that the moving iron type of ammeter is almost universally used for commercial a.c. measurements. Useful feature of the chapters on electrical machinery are the careful explanations of the method of obtaining efficiencies and the fully worked out illustrations.

The book will be very acceptable, not only to the class of reader for whom it has been specifically written, but also to elementary students and to electrical artisans desirous of obtaining a knowledge of basic theory. From the point of view of production, the book is a credit to the publishers.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 14th :—

Windmill (design only). No. 465,892. Class 6. Electric suction cleaning machines.—H. E. Chamberlain, trading as the Excelsior Electric Cleaner Co., 5, Robert Street, Adelphi, W.C.2.

Ever Ready (lettering and design). No. 466,193. Class 8. Electrical batteries and cells, accumulators, voltmeters, electric flexibles, electric cigar and gas lighters. No. 465,300. Class 11. Lamps ((electrical), coils (electrical), dry batteries and accumulators, all for medical or dental purposes. No. 465,301. Class 13. Electric lamps, lamp and torch cases and holders, switches, fuses, &c., and electrical fittings for motor cars.—Ever Ready Co. (Great Britain), Ltd.

Magnet (lettering and design), No. 444,263, Class 8, and No. 440,350, Class 13. Electric switchboards not containing a magnet.—F. B. Cox, trading as the Magnet Engineering Co., 65, Fleet Street, Birmingham.

Spenserphone, Spensers (Scotland), Ltd. (lettering and design). No. 467,318. Class 8. Instruments and apparatus for use in radio-telephony and telegraphy. —Spensers (Scotland), Ltd., 119, George Street, Edinburgh.

Tec, British Make (lettering and design). No. 467,465. Class 8. Electric batteries and cells, voltmeters, flexibles, cigar and gas lighters. No. 467,466. Class 13. Electric lamps and bulbs, lamp and torch cases and holders, switches, fuses, &c., and automobile fittings.—Efandem Co., tLd., 11, Fitzroy Square, W.1.

The "Have" (lettering and design). No. 461,524. Class 14. Cat whiskers of gold and silver for use in radio-telephony.—The firm trading as the Comton Wireless Manufacturing Co., 26-28, Bartholomew Square, E.C.1.

Ceag (lettering and design). No. 453,218. Class 20. Electric lamp bulbs, glass trays for charging stands, &c., all being goods for use in connection with miners' electric safety lamps.—"Ceag" Miners' Supply Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

27,889. "Terminal for electrical and wireless apparatus." J. C. N. Eastick. November 21st, 1924. (249,578.)

27,911. "Dynamo-electric machines." F. Creedy. November 21st, 1924 (Cognate application No. 17,781/25.) (249,579.)

28,146. "Electromagnetic relay devices." B. Scherer. November 24th, 1924. (249,583.)

28,231. "Aerials for wireless reception." W. J. Goddard and G. Mellor. November 25th, 1924. (249,585.)

30,714. "Directional wireless systems." B. H. N. H. Hamilton and J. Robinson. December 20th, 1924. ((249,594.)

30,995. "Thermionic valve-supporting devices." British Thomson-Houston Co., Ltd., and J. Hutt. December 24th, 1924. (249,601.)

31,009. "Electric radiator heating systems." F. W. Prentice and R. A. Culbertson. December 24th, 1924. (249,602.)

31,119. "Electro-massage apparatus." J. F. V. Pourbaix. December 29th, 1924. (249,605.)

31,136. "Timepieces for controlling electric circuits." A. Archibold and J. H. Tremble. December 29th, 1924. (249,606.)

31,152. "Electrical conductors." Sir C. A. Parsons, J. Rosen, A. W. Grey, and B. Blair. December 29th, 1924. (249,608.)

31,163. "Electrolytic production of zinc from ores or the like." S. Field, E. F. Petersson, W. E. Harris, and Metals Extraction Corporation, Ltd. December 29th, 1924. (249,609.)

31,226. "Discharge tubes comprising a cathode supported or suspended between its points of attachment." Naamlooze Vennootschap Philips Gloeilampenfabrieken. January 15th, 1924. (227,815.)

31,240. "Adjustable sensitive electrical regulating devices." C. E. Foster. December 30th, 1924. (249,612.)

1925.

72. "Resistance measurement." C. E. Perry and Evershed & Vignoles, Ltd. January 1st, 1925. (249,615.)

586. "Connection of conductors to the brushes of electrical machines." Compagnie Lorraine de Charbons, Lampes et Appareillages Electriques. January 8th, 1924. (227,453.)

1,633. "Electromagnetic sound reproducers." Fuller's United Electric Works, Ltd., and A. P. Welch. January 19th, 1925. (249,624.)

2,419. "Wired wireless systems." Electrical Improvements, Ltd., Bullers, Ltd., and L. C. Grant. January 27th, 1925. (249,630.)

3,123. "Co-operating electric switches and electric couplings." Simplex Conduits, Ltd., and H. F. McLoughlin. February 4th, 1925. (249,635.)

3,856. "Automatic telephone switching apparatus." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.). (G. Deakin and L. J. J. Schreiber). February 11th, 1925. (249,640.)

4,743. "Method of and means for eliminating higher harmonics in the aerial in radio transmission systems." C. Lorenz Akt. Ges. March 11th, 1924. (230,810.)

5,588. "Electric switches." G. Edwards and W. Edwards. February 28th, 1925. (249,655.)

5,826. "Interrupters for electric ignition apparatus." M. L. Magneto Syndicate, Ltd., and E. A. Watson. March 3rd, 1925. (249,657.)

5,845. "Operating circuit connections for a polarised relay." Siemens and Halske Akt. Ges. March 7th, 1924. (230,455.)

6,248. "High-tension or multiple-cell electric batteries." F. Ball. March 7th, 1925. (249,661.)

7,047. "Electric contact devices." Forges et Ateliers de Constructions Electriques de Jeumont. March 17th, 1924. (230,856.)

7,227. "Electrical controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). March 17th, 1925. (249,665.)

7,308. "Inductance coils for the reception of wireless telegraphy and wireless telephony." J. J. McKichan. March 18th, 1925. (Cognate Application 11,348/25.) (249,667.)

7,431. "Electron tube apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch and Signal Co.). March 19th, 1925. (249,669.)

10,358. "Oil-break electric switches and the like." Forges et Ateliers de Constructions Electriques de Jeumont. May 27th, 1924. (234,789.)

10,413. "Variable electric resistances." C. H. A. Williams and U.S Radio Co., Ltd. April 21st, 1925. (249,690.)

10,750. "Telephonic receivers, transmitters, or the like." A. M. Marquer. May 8th, 1924. (233,684.)

13,907. "Voltage drive system in induction measuring instruments." International General Electric Co. Inc. May 27th, 1924. (234 820.)

15,788. "Wireless direction-finding apparatus." G. Du B. De Bozas. June 21st, 1924. (235,898.)

16,412 "Thermionic valves." Dubilier Condenser Co. (1925), Ltd. July 18th, 1924. (237,233.)

18,672. "Electrical control systems." Forges et Ateliers de Constructions Electriques de Jeumont. August 2nd, 1924. (237,897.)

18,774. "Welding electrodes." British Thomson-Houston Co., Ltd. July 30th, 1924. (237,902.)

19,152. "Electrical signalling apparatus for attachment to motor and like vehicles." W. S. Thimblethorpe. July 28th, 1925. (249,727.)

19,156. "Method of and apparatus for protecting aerial cables." T. Varney. July 28th, 1925. (249,728.)

19,606. "Electric lighting plant for use on power-driven vehicles and the like." Luma-Werke Akt. Ges. August 6th, 1924. (238,228.)

20,737. "Electric glow-lamps." B. Marchi. August 18th, 1925. (249,737.)

23,430. "Control of dynamo-electric machines." British Thomson-Houston Co., Ltd. September 20th, 1924. (240,183.)

23,666. "Electric lanterns." B. Scherer. April 9th, 1925. (249,752.)

24,378. "Electric heaters for removing paint." O. Peyer. September 30th, 1925. (249,754.)

24,501. "Arrangements for operating electron-tube devices from lighting or power circuits." K. G. Jonasson and E. G. Eriksson. October 2nd, 1924. (240,851.)

25,114. "Thermostatic regulating devices for electric heat-producing apparatus." Aktiebolaget Birka Regulator. November 3rd, 1924. (242,252.)

25,432. "Electric motor speed-regulator systems." Metropolitan-Vickers Electrical Co., Ltd. October 14th, 1924. (241,551.)

25,729. "Device on induction wattmeters and induction meters." Landis and Gyr Soc. Anon. February 27th, 1925. (248,323.)

26,774. "Electric relay switching devices." Metropolitan-Vickers Electrical Co., Ltd. November 15th, 1924. (242,965.)

27,199. "Magneto-electric machines." Magnetos Lucifer Soc. Anon. December 18th, 1924. (244,722.)

27,875. "Rotors for electric machines." Siemens Schuckertwerke Ges. April 14th, 1925. (249,769.)

28,294. "Joining electric conductors." Westinghouse Electric & Manufacturing Co. November 26th, 1924. (243,700.)

30,448. "Dirigible headlights for motor vehicles." I. D. Robertson and R. H. Robertson. December 2nd, 1925. (249,780.)

1926.

5,622-3. "Manufacture of electric lamps with light-diffusing or coloured bulbs." General Electric Co, Ltd. November 14th, 1925. (249,796-7.)

The

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Electricity Supply in the United States.

THANKS to the public spirit of the American Chamber of Commerce in London, last week an interesting address was given by Mr. Samuel Insull on the progress of electricity supply in the United States. He is the acknowledged leader of that public service in America; he is proud of his English birth—and we are proud of him. His views on the subject of electricity supply command attention, and a report of his address will be found elsewhere in this issue.

Those who have read the Weir Committee's Report are aware that Mr. Insull was consulted by that Committee, and in some cases his remarks are quoted verbatim; that his judgment is correct, as applied to American conditions, is attested by the unqualified success of the great undertakings under his control, and the extraordinary development of electricity supply in the 10,000 square miles served by them. As he remarked in the course of his address, the output of electricity in that area is only 10 per cent. less than the whole amount generated in this country, though the population of the area is only one-tenth as great; and the capital invested in generating plant is only half as much, the load factor being over 48 per cent., or about double the average obtaining here.

Mr. Insull, therefore, in dealing with electricity supply in the United States, knows what he is talking about; and when he turns to electricity supply in Great Britain, his sole purpose is to place his great experience at our disposal and thereby to promote the welfare of his Mother country. Knowing his ability and sincerity, we are reluctant to differ from his conclusions, but, so far as they relate to this country and only so far, we must do so to some extent, for reasons which he himself indicated—namely, that the conditions in the two countries are essentially different, so that what suits one would not necessarily suit the other. The methods of control, says Mr. Insull, are different; the United States is a young country; there, less respect is shown for vested interests—and, we may add, fewer interests have grown up; drastic regulations are laid down, which the British would dislike; the industry is almost wholly in the hands of companies, which, unlike our municipalities, can and do amalgamate freely; and the

United States, ever since the outbreak of the world war, has enjoyed unexampled prosperity with only a temporary lull, so that its inhabitants have had ample means to adopt electrical methods.

Turning from these sociological features to the physiography of the subject, we find that Mr. Insull cites three great areas in which interconnection (with few interruptions) has been fully carried out. Why? Because, in every case, water-power is available in some part of the area, and the only means by which it can be utilised is by transmission in the form of electricity. It is obvious that water-power is ideally adapted for carrying the long-hour loads, whilst steam power is eminently suitable for carrying peak loads; hence the well-known plan, which has been carried out in many other countries and is by no means peculiar to the United States, being plain common sense, of operating steam and water-power installations in conjunction with one another, by means of interconnecting mains. The case of California, which has been cited as possessing a "grid," is particularly irrelevant, for there we find abundant water-power in the mountains and not much coal available; hence there has been developed a colossal system of hydro-electric stations in the remote highlands, from which a continual stream of electrical energy flows, always in the same direction, down to the plains to feed the great cities. We can and do admire this wonderful development, but it has no bearing at all upon our case.

Let us look at home. Here we have coal-fields adjacent to every industrial district, for the obvious reason that the latter grew up near the former. The load curves are very similar, the generating plant is all of the same type, depending almost wholly on fuel, and there is no economic reason whatever for transmitting electrical energy across country—any slight gain due to increased diversity factor or improved load factor, highly hypothetical at best, would be swamped by the capital charges and the energy loss on a long transmission line. Moreover, the cost of generation is a minor factor in the total cost of supply. The only sound technical reason for coupling widely-separated power stations here is that of increasing the reliability of supply, but in view of the fact that that object can be more cheaply attained by installing additional plant, this argument fails to satisfy commercial requirements. As for the provision of supply to the areas between the power stations from the high-pressure interconnecting cables, when every tapping costs many thousands of pounds, this argument is futile in the extreme. Distributing systems at lower pressures must necessarily be run on appropriate routes, and this can be done just as well in the absence of the e.h.p. links. The North-East Coast is a case in point, where also the benefits of power supply from waste-heat sources are secured. All the realisable objects of the "grid" system in this country can be attained without converting the country into one huge "district."

As regards the question of "massing" generating plant, this is a natural consequence of a large demand; it may also be argued that a large demand is the consequence of massing generating plant, but this is not so certain. Generating sets of 60,000 kW are installed in the United States, others of 75,000 and 80,000 kW are on order, and we learn, with some astonishment, from Mr. Insull that a single set of 200,000 kW is under contemplation for a new station which is now being commenced. This set will consist of one h.p. and two l.p. turbines coupled to generators, and when any one machine breaks down, the other two will be capable of carrying upwards of half the rated load, at reduced efficiency. At present we have no station of anything like 200,000 kW, and no use for any generating set above 50,000 kW capacity; we doubt, indeed, whether it is desirable to install sets of greater capacity, for various reasons. The size of generating sets is only one of many factors in the economy problem, and bears no comparison in importance with the load factor. That is really the crux of the whole matter.

Electricity Supply Data.

In our "Correspondence" columns to-day, Mr. Hugh Quigley calls in question the accuracy of the data given in our leading article of April 16th. Whilst the *Electrical World* presumably would not lay claim either to infallibility or even to "sufficient infallibility," whatever that may mean, our contemporary makes a special feature of statistical returns and analyses, and unlike the Weir Committee, draws a clear distinction between units generated and units consumed. On page 7 of its issue for January 2nd, 1926, in tabulating the figures which we used in our leader, it states in a footnote that the data given for "Total Energy Generated" for the years 1920-1925 are "as collected by U.S. Geological Survey," the authority on which our correspondent relies. We have now consulted the annual report of the Geological Survey last issued under date June, 1925, and find that the energy generated during the calendar year 1924 by public utility undertakings is there given as 59,014 million kWh, as compared with the figure of 54,413 million attributed to the same authority by the *Electrical World*, showing the discrepancy to which Mr. Quigley draws attention; the difference is due to the fact that the aggregate figures given by the Survey (which are also tabulated on p. 10 of the same issue of the *Electrical World*) are not confined to central-station output, but include energy generated by electric railway and certain other plants that contribute to the public supply. On the other hand, the American figure that we used includes 6,200 million kWh for railways supplied from central stations, whilst most of the British railway consumption is excluded from the Electricity Commission's figure. Nevertheless, if we take the original figure of the Survey for 1924 we find that the units generated per head were 520, and the units consumed (at 81 per cent.) would be only 420. Hence our suggestion that the computer of the figures for the Weir Committee "made the serious mistake of basing it upon the *energy generated*, and comparing the result with the British figure for *energy consumed*," stands unrefuted. We may add that in a comparative survey of the world's output in the issue of the *Electrical World* for January 9th, p. 99, the energy generated *per capita* in the United States in 1924 is given as 484 kWh.

The Fuel Consumption Returns of the Electricity Commission to which our correspondent turns for "the only true comparison" are not relevant to the matter. Throughout the various discussions on this subject the comparison has purported to be made not between the quantities of electrical energy generated, but between the respective *consumptions* recorded, and in every case we have accepted the figures for British consumption given on the authority of the Electricity Commissioners themselves.

Mr. Quigley challenges other figures given by the *Electrical World*, which states that it carried out a "nation-wide survey" at the beginning of 1925, covering "every industrial plant of the United States using electrical energy," and received valuable co-operation from the Manufacturing Division of the U.S. Census Bureau, besides using official data. We must refer him to our contemporary for satisfaction on the points he raises. We stated the source of the data, and gave them for what they were worth. We believe that they are reliable. There are no such data available in this country. With regard to his suggestion that our comparisons were "very much in the nature of special pleading in favour of this country," if he means that we distorted facts for that purpose, we deny it with the utmost emphasis permissible in print; if he means that we are trying to obtain justice for our country, we accept the compliment with pleasure. It is high time that someone had a good word to say for the old country.

Stage Lighting.

It is now about seven years since Mr. J. B. Fagan read his paper on "The Art of Stage Lighting" before the Illuminating Engineering Society, treating the matter from the standpoint of the actor and producer of plays. One of the main points on which he then insisted was the advisability of diffusing the light and obtaining soft shadows by methods equivalent to the use of an "artificial sky." Since that date there has been substantial progress, and stage-lighting apparatus has been much improved. The paper read before the Society by Mr. H. Lester Groom, on March 30th, contained an interesting review of such developments. Amongst these an important place should be assigned to the "cyclorama," enabling panoramic and special colour effects to be obtained, and realistic atmospheric phenomena imitated. In some cases this has made possible radical departures in methods of presentation. Mr. L. G. Applebee also contributel some striking demonstrations, including the projection of a realistic image of the moving waves of the sea. Modern electric lighting is equal to almost any task the producer may set. What is chiefly needed is a recognition on the part of producers and scenic artists of what light can do, and a realisation that expenditure on apparatus for producing novel and striking light effects is well repaid—in short, a little more imagination and "vision." The Illuminating Engineering Society has done good service in providing this opportunity of drawing attention to the possibilities of stage-lighting, and the facilities for demonstrations available at the E.L.M.A. Lighting Service Bureau, where this meeting was held, proved very useful.

The Electricity (Supply) Bill.

The communication which we have received from Mr. R. A. Chattock, president of the Institution of Electrical Engineers, and which is printed on pp. 719 and 720 of this issue, deserves the careful study of everyone interested in the future of electricity supply in this country; it is closely in harmony with the views which we have put forward from time to time, and represents also the opinions of many engineers with whom we have discussed the subject.

It will be remembered that the Council of the Institution recently entered a grave protest against certain provisions of the Bill, as being based upon imperfect knowledge of the facts and likely to prove detrimental to the national interest (Elec. Rev., p. 527). The matter cannot be left there. If the Government does not institute the proposed inquiry into the fundamental questions on which the Bill is based—and in our opinion it never will do so—it will be the plain duty of the Council to call together a meeting of those interested in electricity supply, who up to the present have had no opportunity of publicly stating their views.

The Kelvin Lecture.

That the Kelvin lecture, in memory of the greatest man of science that has lived since Newton, should be delivered by Sir J. J. Thomson, President of the Royal Society, in the theatre of the Institution of Electrical Engineers, and should deal with "The Mechanics of the Electric Field," was surely a most happy combination of circumstances; for the Master of Trinity, described by Sir Oliver Lodge as also Master of Physics, has done more, probably, than any other physicist towards solving the problems presented by his difficult subject: Certainly, if we add to his labours the achievements of his pupils and colleagues, there can be no question that the Cavendish Laboratory, over which he presided for 34 years, has led the world in the attack upon the constitution of the atom, and has gone farthest towards revealing its secrets.

Sir Joseph had no difficulty in showing that electric force might reasonably be regarded as possibly intermittent in its action, taking the pressure of a gas as an analogy, and thus he proposed to reconcile the phenomena which can only be explained on the quantum theory with those which come within the scope of ordinary dynamics. Light, in particular, and X-rays in some respects are in conformity with the theory of propagation by wave motion and in others with the corpuscular theory which Newton preferred; the hypothesis outlined by Sir Joseph combines the two theories and provides an explanation both for interference effects and for photo-electric phenomena. For this purpose the electron must possess a structure, which he visualised as an atmosphere of particles surrounding the electron, possessing a definite period of vibration, and capable of emitting radiation. Much of the lecture was devoted to a mathematical discussion of the mechanism required by this constitution, conducted in that inimitable style which gives a peculiar charm to Sir Joseph's lectures.

The Institution is to be congratulated on receiving so lucid an exposition of the new theory from its distinguished author.

If the Cap Fits——.

We have a good deal of sympathy to spare for the young man who is anxious to "get a move on," but cannot do so because of the restraining influence of those who, above him in authority, are fearful lest his enterprise may be unconventional, may be off the beaten track over which the old cart has travelled so long and so safely, may offend somebody's susceptibilities, or may bring undesirable aggrandisement to the "young upstart." Of course, not all the new ideas of impulsive youth are to be swallowed at one gulp; it does not require hoary-headed experience to recognise that, even the initiator knows it—in most cases. But in times when change is so rapid, and especially in an industry which is always moving and presenting new possibilities, new opportunities, and creating a new atmosphere, it were well for all of us, whatever our age or experience, to be susceptible to the originality, ingenuity, and suggestiveness of others and not to get into the habit of closing our armour tight as though desiring it to be proof against the fiery darts of the wicked. Experience is priceless in its value, but where the possession of it is accompanied, as it sometimes is, by too profound a regard for conventionality and red-tape procedure, enterprise can be easily stifled, the spirit of youth broken, and out-of-date methods proceed along the inevitable pathway to loss and defeat. If we were to give any direct application to these moralisings we might leave untouched some who might otherwise profit by them, for though one comes across instances of those whose schemes have been brought to naught by prejudice rather than on de-merit, and though we could quote chapter and verse and names for such happenings in electrical trade, manufacturing and particularly in electricity supply—there is the possibility that specific cases might prevent the reader exercising those powers of introspection which are so useful a means of helping him to steer his own course amid the rocks wisely. New brooms in sweeping clean may make an insufferable smother of dust; a vacuum cleaner would do the job better, of course, but if a new broom be bought the user must be allowed a reasonable amount of latitude in its manipulation. We do not seriously object so long as the cobwebs gathered around the wheels of electricity supply enterprise are cleared away, whether it be a broom or a vacuum sweeper that accomplishes it, but we do know that some electrical undertakings would please their consumers better and profit the electrical industry more, if they would show a greater measure of adaptability than they do to the present age. Are there not company directors who are fearful when their staffs make new proposals, and municipal committeemen and councillors who find it easy to defer the adoption of advanced methods which their chief engineer and his staff are restlessly eager to employ? Having said so much, we leave it to all of our readers to wear the cap if it fits them—they can easily tell!

Electrical Developments at Ilford.

The A.C. Extensions to the Distribution System.

As we mentioned in our issue of April 16th, an official visit was made on April 8th to the converting sub-stations and one of the transformer kiosks of the Ilford Urban District Council Electricity Department, when the extensions to the distributing system were inaugurated by the Revd. Herbert Dunnico, M.P., J.P., chairman of the Council.

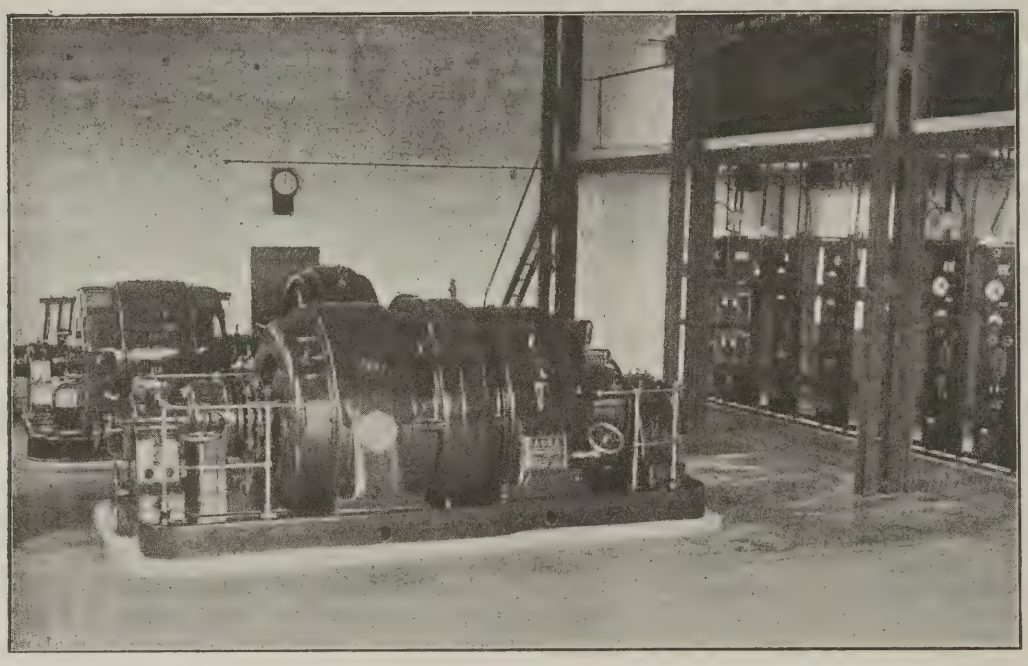


Fig. 1.—Uphall Road Sub-station.

The electricity supply in Ilford was commenced in 1901, l.p., d.c. systems for both generation and distribution being adopted. After the war it was found necessary to reorganise the systems, and two 3-phase, 6,600-V turbo-alternators were installed at the Ley Street generating station in 1920 and 1921; the sub-stations referred to have been installed at different times since then to make the necessary conversion of the a.c. energy for use on the d.c. system. In 1920 the Council was refused permission by the Electricity Commissioners to further extend the generating plant, and it became necessary to take a bulk supply of energy from an undertaking outside the district; hence in 1924 an agreement was reached between the West Ham, East Ham and Ilford authorities to an arrangement for West Ham to supply in bulk to the other undertakings interested. The necessary e.h.p. trunk transmission lines were laid between the West Ham and East Ham stations in 1922, and in 1924 they were extended from the East Ham station, *via* Barking, to the receiving sub-station of the Ilford undertaking adjoining Uphall Road, from where cables were laid to the Ley Street works.

The Uphall Road "sub" was erected in early 1924 primarily for the purpose of affording an increased supply of energy to consumers in the vicinity, and also as a receiving and metering point for the bulk supply from West Ham. The sub-station is at present equipped with two 1,000-kW La Cour converters, and arrangements are made for the installation of a third set, which is expected to be in operation by October next. The e.h.p. switchgear, which was installed by the General Electric Co., Ltd., is of the mechanically-operated remote-control type, the actual switch equipment being installed in a gallery built over the control board. A separate panel is installed on this board for the bulk-supply metering, this being equipped with two sets of meters and indicators by the Aron Meter Co., and duplicate bus-bars are provided, by means of which it is possible to connect either of the mains from West Ham to either of the link cables to the Ilford generating station.

The Gants Hill sub-station, which is situated at the junction of Cranbrook Road and Eastern Avenue, is of the fully-automatic type, the equipment being supplied and installed by the Metropolitan-Vickers Electrical Co., Ltd. It was first put into commission in December last. It is designed to come into operation when the pressure of the system falls below a given value, the reverse action taking place when the load on the system falls off. As already mentioned, a feature of the sub-



Fig. 2.—100-kVA. Transformer Kiosk.

station is that the converting plant is not disconnected from the system until 20 minutes after the load falls below the set value. The necessary conversion at Gants Hill is effected by means of a 500-kW rotary converter fed from a 550-kVA transformer. A 4-panel control board accommodates the necessary relays and switchgear for controlling the a.c. side of the machine, the d.c. equipment being installed on a separate panel of an open-type distribution board. Four Metro-Vick K-type e.h.p. oil switches are installed, two for the control of the incoming and outgoing feeders and two for the control of the supply and operating transformers. It is interesting to note that a contract has been placed with the makers for a duplicate equipment to be installed in the district, which is expected to be in operation by October of this year.

The sub-station at Grove Road was first equipped in 1916 to give an a.c. supply to the adjoining works of the Fuller Electric & Manufacturing Co., Ltd. Since that time the station has been extended, and is now equipped with three G.E.C. rotary converters, 250, 280, and 500 kW, and the necessary transformers, which were manufactured by the Brush Electrical Manufacturing Co., Ltd., A 6-panel, steel-cubicle, e.h.p. switchboard and a 7-panel, open-type, d.c. board were installed by the General Electric Co., Ltd.

The "sub" at Goodmayes, which is now equipped with two 500-kW Crompton converters, two 550-kVA British Electric transformers, a 4-panel steel-cubicle e.h.p. board, and an open-type d.c. board, both of Crompton manufacture, was first used in 1915 as a battery sub-station. The sub-station forms the back portion of a large building, the front part of which is utilised as a showroom. This is served by two large display windows on either side of the central entrance. The showroom proper occupies the full frontage of the building, and on one side are accommodated cubicles for lighting demonstration purposes.

During last year the e.h.p. mains were extended to Barkingside, and a transformer kiosk, fig. 2, was erected at the corner of Fencepiece Road and Tomswood Hill for an a.c. supply to the Tomswood Hill housing estate and district. The kiosk was supplied by Messrs. Callender's Cable & Construction Co., Ltd. It is a steel structure, about 8 ft. square, and houses a 100-kVA Fuller transformer, three e.h.p. switches controlling the transformer and incoming and outgoing feeders, and four l.p. feeders. A similar kiosk has been supplied by the Foster Electrical and Manufacturing Co., Ltd., and erected near the Hainault station for supplying the district.

The Resistance and Heating of Plunger-Type Lampholders.

By L. G. H. SARSFIELD, B.Sc., A.M.I.E.E.

Résumé.

In a previous paper* by the author on the above subject, the possibilities of the adoption of plunger-type lampholders for the connecting of domestic electrical apparatus to the supply were discussed. Graphs were given for the voltage drops across various parts of these holders, and the causes of heating were observed. The values of spring resistance were given, and the behaviour of steel and bronze springs was compared. The results of ageing were seen, and curves were given showing the temperature of the air inside lampholders. Heat runs to destruction were described and a suggestion was put forward for increasing the current-carrying capacity of this type of link between apparatus and power.

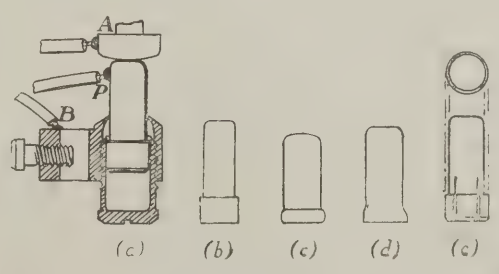
The manufacturer at whose instigation the above work was undertaken subsequently raised the question of the current-carrying capacity of the contact between the plunger tops and the adaptor, and the experiments here described were designed with this in view and also to obtain the actual temperatures of the other component parts of ordinary lampholders. Messrs. Tucker's lampholders were again employed throughout the following investigations.

Heat Runs with Ordinary "Telac" Lampholders.

Batten-type holders were set up in free air on a table and current was led to and from them at the sleeve blocks "B" (fig. 1 (*a*)).

The source of supply was a battery of accumulators. The load was connected to each holder by means of an ordinary adaptor, and consisted of two variable resistances in series. One of these was of the carbon-plate type and accommodated the heavy currents employed during the latter part of each of these tests.

Fine wire thermo-couples (copper Eureka) were soldered to both poles of the holders and adaptors at the sleeve blocks "B," plungers "P," and adaptors "A" in the positions shown in fig. 1 (*a*). The spring has been omitted in order to simplify the drawing. The point at which a couple was attached to a plunger was near to its top, so as to avoid fouling the sleeve block when compressed downwards, as it is when in use. By this means the temperatures of the different parts of the units were obtained. There was no difficulty in securing temperatures at currents as low as three amperes, although in the previous series of heating tests, mentioned in the first paragraph, five-ampere temperature values were the lowest obtainable. This was due to the fact that the one thermo-couple then used was placed midway between the two plungers and not attached to the active metal, so that there was a difference of temperature between the latter and the couple itself.



a, Mode of attachment of thermo-couples; *b*, *c*, *d*, Types of plunger now in use; *e*, Split plunger.

Fig. 1.—Details of Apparatus.

The thermo-couple wires were led from the sleeve blocks and plungers through the tubular portion of the holder by way of holes suitably drilled therein. The wires were insulated with varnished cambric tubing of outside diameter about 1/10th in. The holes made for the plunger couples were slotted vertically, so as to prevent any restraint upon the plungers due to the couple wires. All the thermo-couples were alike, and were calibrated with the micro-ammeter used throughout the whole series of observations.

Beginning at 3 amperes, current was passed through each holder and the temperature registered by the micro-ammeter deflection. Conditions were considered to be steady for each value of current when there was no

* Electrical Review, February 13th, 1925.

readable alteration of the instrument needle after five minutes. Observations were made at 3, 4, 5, 6, 8, 10, 12, 15, 20, 25, 30 amperes, except, of course, when a holder would not permit the higher of these values.

Fig. 2 gives the heating curves for new holders with standard bronze springs, each line being the mean of four sets of readings, *i.e.*, on both poles of two separate units individually tested. Fig. 3 gives similar curves for one holder about 15 years old, but provided with slightly tarnished new bronze springs in place of the steel ones originally found in it.

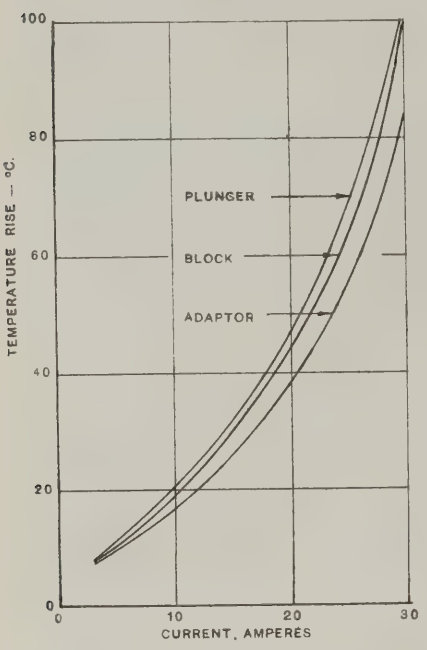


Fig. 2.
Lampholders fitted with new ordinary plungers, new blocks, and new bronze springs.

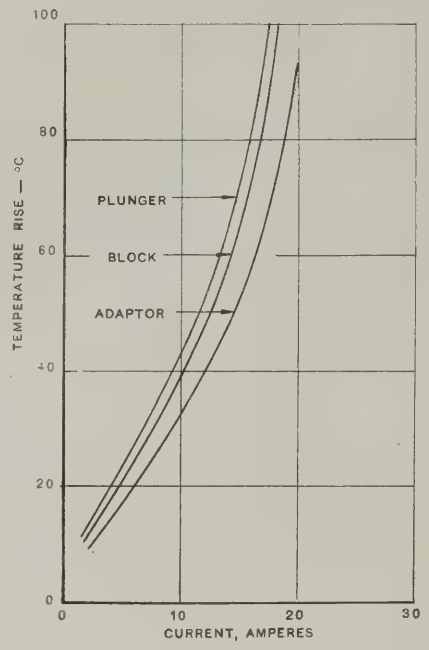


Fig. 3.
Old lampholder fitted with slightly tarnished bronze springs.

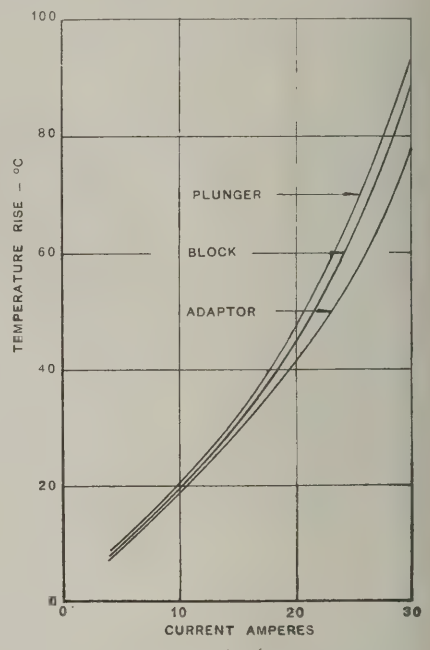


Fig. 4.
Lampholders fitted with new split-plungers, new blocks, and new bronze springs.

Curves showing the Temperature Rise with Varying Current Strength.

The difference between the two sets of curves is very marked, and whereas, after obtaining the 30-ampere readings with the new units, a current of 40 amperes was passed through one of them for five minutes before collapse of the spring (indicated by unsteadiness of micro-ammeter reading and "clicking" noises), the springs of the old unit were collapsing before 20 amperes could be reached. Judging from the adaptor temperatures in figs. 2 and 3, the coolest contact of the three in each case is that between the adaptor and the plunger, and this suggests that it is not this part of the holder which, up to the present time, forms its current capacity limiting feature. The hottest part in every case, however, is the plunger.

The previous series of experiments showed the contact resistance between the plunger and the sleeve block to be greater than that between the plunger and the adaptor for old steel-sprung units, and it was with a view to improving the former contact that bronze springs were adopted. The results were encouraging.

Split-End Plunger.

A new method was suggested, however, in the author's previous article* for improving the contact between the plunger and the sleeve block. It was proposed that the flanged open end of each plunger should be a cylinder which would be a fair fit in its sleeve block, so that when compressed or released the plunger would always be in contact with the inside of the block.

*Electrical Review, February 13th, 1925.

Experiments were carried out by Messrs. J. H. Tucker and Co. as to the best method of obtaining this effect, with the result that the standard cylindrical ends of their plungers were saw-cut through along two diameters at right angles (fig. 1 (*e*)). This arrangement permits the plunger end to be sprung slightly outwards, and a positive contact with the inside of the screwed cylinder which enters the bottom of the sleeve block is thus obtained. The fit is not such as to introduce undue friction, and, moreover, the rubbing surfaces tend to keep bright due to the movement of one with respect to the other whenever an adaptor or lamp is inserted in, or withdrawn from, a holder. With this scheme the spring is no longer the main current-carrying medium, and therefore steel springs may be used with confidence. In fact, they would be better than bronze ones, on account of their superior mechanical properties. A test of a holder fitted with split-end plungers and steel springs is described later.

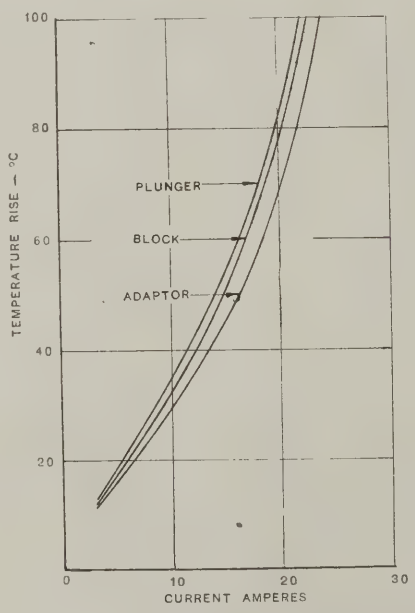


Fig. 5.—Lampholders fitted with artificially-aged ordinary plungers, blocks, and bronze springs.

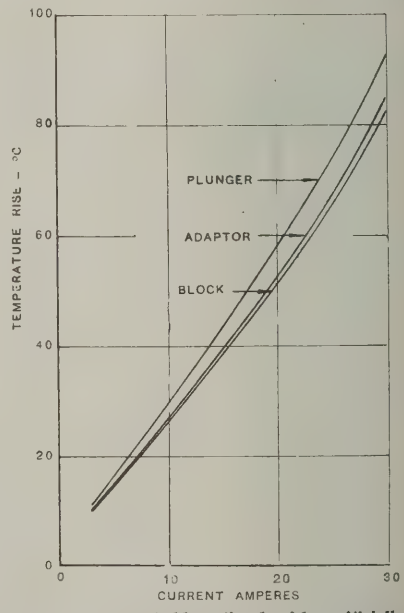


Fig. 6.— Lampholders fitted with artificially-aged split plungers, blocks, and bronze springs.

Curves of Temperature Rise with Current.

Resistance of Split-End Plunger.

The values of voltage drop between plunger and sleeve block for split-end plungers were compared with the values for ordinary plungers. Six plungers of each type were fitted with new bronze springs in sleeve blocks.

Without mounting these in holders, current leads were soldered to the plunger tops and to the blocks, and thus the only movable contact in each unit was that whose resistance was required. A current of 3 amperes was passed through each unit, and by means of flexibles soldered one on to the plunger and one on to the block and connected to a milli-voltmeter, the voltage drop across each unit was measured.

Three voltage drop readings were taken for each unit—

(*a*) with the plunger fully extended under the influence of the spring;
(*b*) with the plunger pressed in as far as possible; and
(*c*) the maximum swing observed on the instrument during a number of rapidly applied compressions and releases.

The mean values are below, and they point to the improvement of contact due to the split-end plunger :—

	(*a*)	(*b*)	(*c*)	
Ordinary plunger ...	7.9	2.0	15.3	millivolts
Split-end plungers ...	2.3	1.5	3.3	,,

The "*c*" values of the "ambient" plunger are particularly significant, and testify to the regular travel of the plunger, in and out. This is a feature of importance, especially when the holder is subjected to mechanical shock, since (as mentioned in the previous article) the looseness of fit of the plunger in the sleeve block, common in many types of holder, may constitute the spring the only electrical connection between them. This is, of course, very undesirable.

Heat-runs with Split-End Plungers.

In order to compare the temperature rises of holders having split-end plungers with standard ones, units were arranged as described in paragraph 3. The heating curves for new units fitted with split-end plungers are plotted in fig. 4.

Each line is again the mean of four sets of readings. As would be expected, they are similar to those of new ordinary holders (fig. 2), but the latter have steeper slopes and higher temperatures beyond 20 amperes. Slight permanent compression of the springs was noticed after 30 amperes in each of the two holders tested, but one was subjected to further test and carried 40 amperes for five minutes, followed by 50 amperes for three minutes. This caused crippling of the springs, *i.e.*, permanent compression to about half the original length, but not entire collapse.

Two new holders, one with split-end plungers and the other with ordinary plungers, were then equipped with new steel springs and the current-temperature curves taken for each. The mean temperatures for the two poles of each unit at 30 amperes were as follows :—

	Adaptor.	Plunger.	Block.	
Ordinary plungers ...	76.3	92.5	84.3	deg. C.
Split-end plungers ...	57.1	65.9	59.5	,,

After the 30-ampere readings were taken, the ordinary type holder sustained 50 amperes for five minutes, with the result that one spring was slightly compressed and the other crippled, while the holder having split-end plungers sustained 50 amperes for five minutes and the springs were apparently unaffected.

It is, however, the performance of old holders which must be the test of serviceability, but as no old split-end plunger units were available, artificial ageing was resorted to. Two split-end plunger and two ordinary units, each fitted with new bronze springs, were dipped into a boiling liquid consisting of equal proportions of sodium hyposulphite and lead acetate. This gave them a light brownish-blue coloration on the outside which is similar to the appearance of really old parts. The insides of the ordinary type plungers and blocks remained practically new, while owing to the saw-cuts in the split-end type their inner surfaces were tarnished, though not to the same extent as their outsides.

These plungers were set up in holders for heat runs in exactly the same manner as those already described, and fig. 5 gives the mean temperature curves of the two poles for the ordinary type, while fig. 6 gives those for the split-end type.

The difference between the two sets of curves is easily seen, and it is definite over the whole range of the curves. For instance, the average temperature rise represented by the three curves for the holder fitted with split-end plungers at 5 amperes is 15.3 deg. C., whereas that for the ordinary type is 17.4 deg. C., which means that there is about 12 per cent. reduction of heating at this current rating. Since the slope of the curves for ordinary holders increases with current so much more rapidly than that of the curves for the split-end type, this percentage gradually grows, and at 20 amperes reaches about 28 per cent.

After the heating curve readings were taken on each of these artificially-aged units, higher currents were passed through them; the ordinary type withstood 40 amperes for four minutes and then smoking commenced, while the split-end plungers withstood 40 amperes for eight minutes, and subsequently 50 amperes for three minutes, without damage to the springs.

The appearance of the one really old ordinary unit whose temperature rise was measured (fig. 3) was similar to that of the artificially-aged units described above. This old unit collapsed at about 20 amperes. A holder was, however, put on test which had been fitted with split-end plungers artificially aged until they were almost black outside and dark brown inside, i.e., in a condition much worse than any really old units ever seen by the author. It gave a plunger temperature rise of 110 deg. C. at 20 amperes, and subsequently withstood 30 amperes for eight minutes. After such a severe test the springs were crippled.

All these experiments support the view that the split-end plunger is a good current-carrying proposition, and application is being made for a patent in respect thereof. The properties of this type, which render it able to carry large currents satisfactorily, must contribute to greater reliability at all ratings, and, furthermore, make the plunger practically independent of a current-carrying spring. Steel springs, as already mentioned, may thus be used—their electrical inferiority to bronze ones being of small account, while their mechanical superiority is valuable.

	Spring Steel.	Spring Bronze.	
Young's modulus ...	13,000 tons/sq. in.	5,000 tons/sq. in.	approx.
Annealing temp. ...	350°C	250°C	approx.

By employing split-end plunger lampholders, the need for wiring power plugs in order to use most domestic appliances is obviated, and it is suggested that the convenience of being able to connect up such apparatus to a lighting point is important and calculated to popularise the use of electrical gear in our homes. The increase in cost for split-end plungers in all the lighting points of a domestic installation would be negligible.

It is a pleasure to acknowledge the co-operation of the Governors of the Merchant Venturers' Technical College, Bristol, and Prof. D. Robertson, D.Sc., who provided facilities in their electrical engineering laboratories, and also the kindness of Messrs. J. H. Tucker and Co. in supplying the lampholder parts used in these experiments.

A New Fire-Damp Indicator.—At a recent meeting of the Austrian Natural Science Society, of Innsbruck, Herr Martienssen, of Kiel, read a paper in which he described a new electric safety lamp for the use of miners in places where firedamp explosions are feared. After many unsuccessful attempts, Martienssen claims to have succeeded in producing a firedamp-indicating electric lamp by using small semi-circular loops, made of a preparation of palladium, placed in a small glass bulb which is closed at its upper end by a porous stone. By means of a button switch, the current from a small accumulator carried in the base of the lamp is passed through the filament, which causes its extremities to assume a dark red colour, this serving as an indication that the apparatus is in proper working order. If there is methane in the air in the mine, the centre of the filament commences to become more or less incandescent, and if the methane percentage reaches 8 per cent. the filament will remain incandescent even when the current from the battery is switched off. In this way Martienssen considers that it is possible to estimate approximately the quantity of methane in the air in mines.

Electrical Progress in New Zealand.

Some Particulars of the Mangahao Hydro-Electric Scheme.

It will be recalled that the first of the three large water-power schemes adopted by the New Zealand Government in 1918 for the supply of electrical energy throughout the North Island was the one on the Mangahao River, the other two projects being those at the Waikaremoana Lake and the Arapuni Rapids (Electrical Review, August 29th, 1924, p. 314). The Mangahao undertaking is situated close to a large potential load of some 12,000 kVA in the Wellington area, and the site is capable of developing 24,000 kVA. The Mangahao River is almost solely dependent on rainfall for its flow, and therefore its water volume varies considerably. The normal flow is about 150 cusecs, but it has been as low as 70 cusecs. The scheme provided initially for two main storage reservoirs, a third to be added at a later date. The larger reservoir is on the Mangahao River, the smaller one being on the River Tokomaru close to its junction with the Arapeti stream. The two reservoirs are connected by a large concrete-lined tunnel, 7 ft. in diameter and about a mile long, driven through the intervening range of hills. Another tunnel connects the second reservoir to a surge chamber above the power house, from where steel pipes convey the water to the station situated at the junction of the Mangaore and Mangatangi Creeks. The net water drop is 870 ft., and the total fall from the upper reservoir is 995 ft. Fig. 5 shows the general lay-out of the scheme. The construction of the Mangahao and Arapeti dams has proved to be a much more difficult matter than was at first expected, due primarily to the trouble in finding a suitable rock foundation for the base of the dams and to the frequent floods that have occurred since the construction was commenced. The preliminary surveys of the dam sites failed to reveal that both the Mangahao and Tokomaru Rivers had, at some distant period, changed their beds, and in the course of time had cut new beds parallel to the old ones. This discovery necessitated the construction of a cut-off wall from the end of the dam to the solid rock on the far side of the old channel as a seal to prevent water loss by seepage round the end of the dam. The Mangahao dam is 100 ft. high, 118 ft. long, and 95 ft. thick at its base. An automatic steel crest surmounting the structure maintains a constant water level in times of flood. As the water rises over the crest, the increased pressure causes the latter to fall, the distance being governed by a concrete counterweight. The Mangahao reservoir holds 525,000,000 gallons of water.

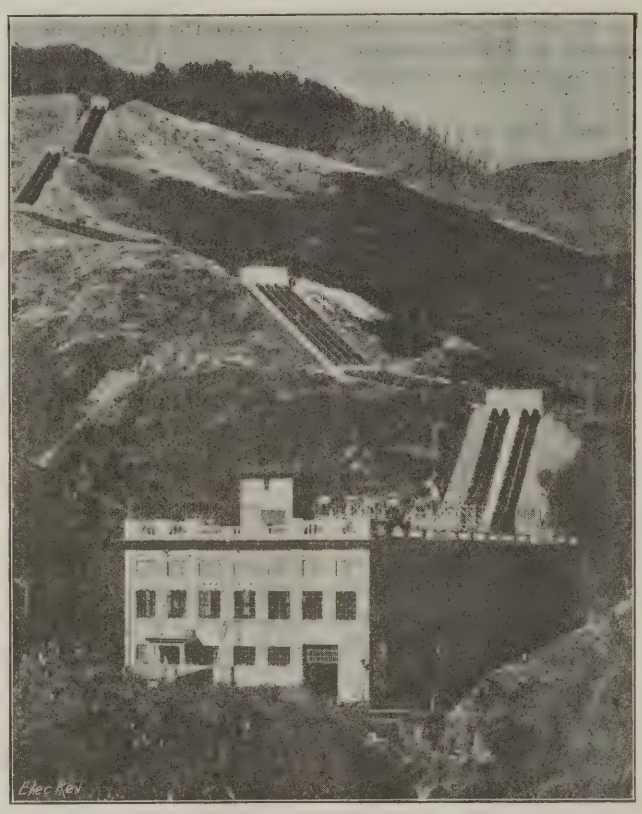


Fig. 1.—Mangahao Station and Pipe Line.

The Arapeti dam is 430 ft. long and of 66 ft. maximum width; and the reservoir has a capacity of 290,000,000 gallons.

The generating-station scheme provides for five main turbines of the Pelton type. Three of these

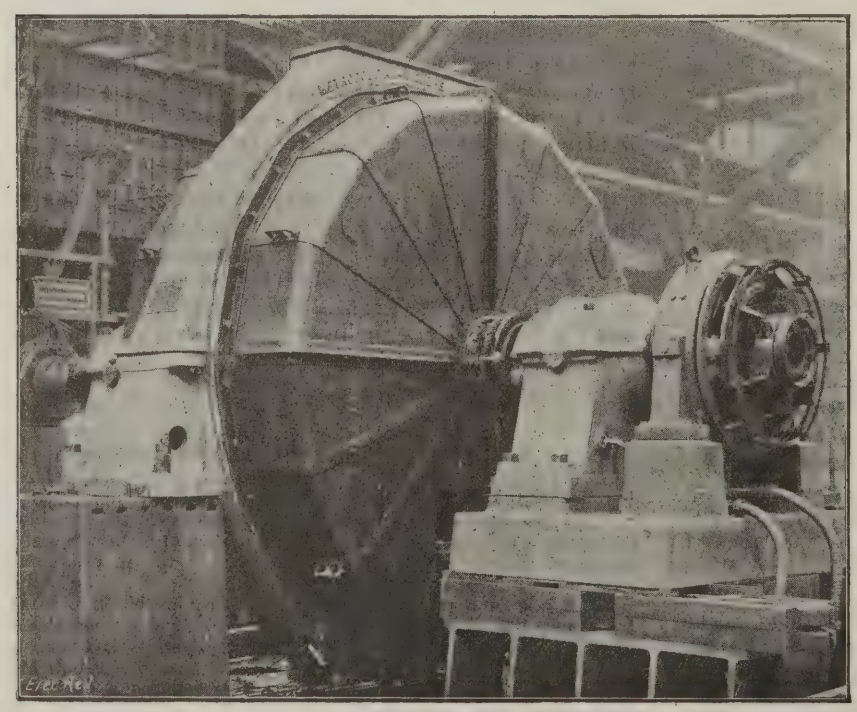


Fig. 2.—6,000-kVA Alternator.

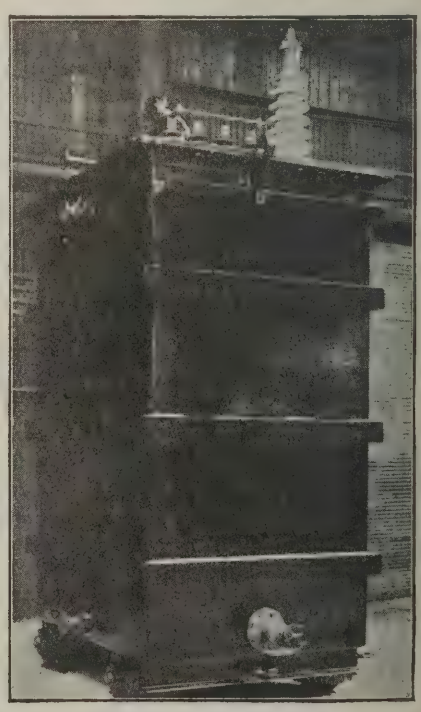


Fig. 3.—Single-phase Step-up Unit.

are designed for a maximum output of 8,000 h.p., and two for a 4,000-h.p. output, both sizes running at 375 r.p.m. under a head of 825 ft. The larger turbines have two jets each, and the smaller machines are provided

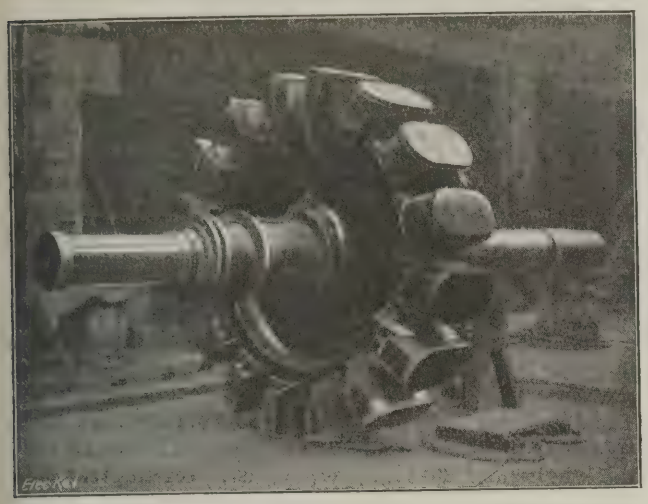


Fig. 4.—Rotor of 6,000-kVA Machine.

with only one jet. The machines are controlled by automatic oil-pressure governors which operate directly on deflectors and indirectly upon the needles. The deflectors cut into the jets and disperse them at times of sudden reduction of load. The needles feed forward slowly, controlled by dashpots, and gradually cut off the supply of water to the required extent. For increasing loads, both the deflectors and the needles are withdrawn simultaneously.

The larger generators are each of 6,000-kVA capacity, and the smaller ones 3,000 kVA. These machines generate 3-phase energy at 11,000 V, 50 periods; fig. 2 shows one of the larger sets, and fig. 4 its rotor. The alternators are excited from separate exciter units, driven either by water power or induction motors. The 3,000-kVA machines are also fitted with direct-coupled exciters. The turbines and alternators are housed in one large room running almost the full length of the building, and the transformer banks are situated in a separate room. Between these two departments are housed the switch and control rooms. The masonry cubicles containing the 11,000-V apparatus are situated on the main floor level. The control room is immediately above the cubicle room, and is so arranged that the switchboard operators have a clear view into the turbine house.

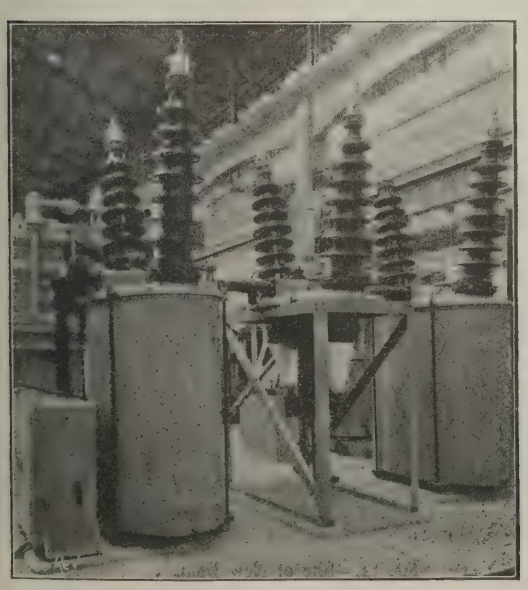


Fig. 6.—110-kV Oil Circuit Breakers.

The 110-kV switchgear is placed partly inside and partly outside the station, the transformer-controlling equipment inside and the feeder switchgear outside.

The transmission lines are dead ended at special points on the building structure, jumper connections linking up to the apparatus on the roof. Fig. 7 shows one of the 110,000-V overhead horn-gap switches.

For the districts immediately around the station energy at the generating pressure is transmitted, but for the long-distance transmission, the pressure is raised to 110,000 V. The main transmission lines are fed through two banks of transformers, and it is interesting to recall that these were the first power trans-



Fig. 5.—General Layout of Mangahao Scheme.

formers of this size to be manufactured in Great Britain for a 110,000-V transmission system. Each three-phase group is of 12,000-kVA capacity, and consists of three single-phase, 4,000-kVA transformers connected in delta on the l.p. and star on the h.p. sides. In addition, one single-phase unit forms a spare to the two groups. Single-phase units, fig. 3, were adopted to facilitate transport over the difficult roads leading to the site. Tappings are arranged on the l.p. windings for 10,750 and 10,500 V, and the full output may be obtained at all the tappings.

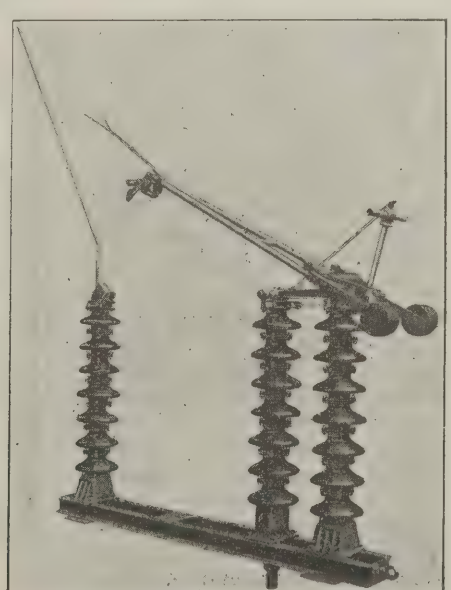


Fig. 7.—110-kV Overhead Switch.

The transformers are of the oil-immersed, forced-cooled, double-wound, core type, and their mechanical construction is such as to allow transport on their sides in the tanks; fig. 11 shows one of the transformers arranged for transport. The h.p. coils are wound

in sections of disk coils, of one turn per layer, thereby reducing the voltage stress between the turns to a minimum.

The main insulation is designed to avoid all danger of creepage along the surfaces, and the end turns of

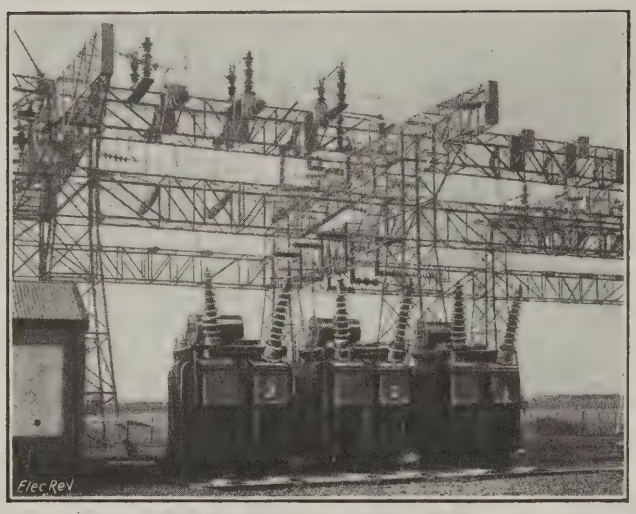


Fig. 8.—Bunnythorpe Sub-station.

both the h.p. and l.p. windings are specially insulated to withstand surge voltages and transient disturbances. The dielectric field is so controlled as to render the pressure gradients as uniform as possible, and the windings are adequately braced to withstand mechanical shocks which may occur under working conditions, including those produced under short circuits. A spring clamp device is arranged between the coils, so that it takes up effectively any shrinkage which may occur in the coils. One set of oil-cooling apparatus, comprising cooler, centrifugal oil pump, motor and controlling gear, is provided for each three-phase group. The h.p. terminals are of the oil-filled porcelain type. The construction of these transformers was described fully in the Electrical Review of October 20th, 1922.

Four high-pressure transmission lines are connected to the station; two of these go north to Bunnythorpe, some 25 miles away, whilst the other two run south to Khandallah, 63 miles, for the supply to the City of Wellington. A duplicate transmission line connects Khandallah with Bunnythorpe, *via* Masterton, Eketahuna, and a switching station at Woodville, whence a branch is also connected to Dannevirke.

The main-line transmission is undertaken by the Public Works Department, and the local distribution is carried out by the various power boards throughout the country. For this purpose sub-stations have been or are being established at Khandallah, Bunnythorpe, Wanganui, Masterton, Eketahuna, Dannevirke, Waipukuran, Napier, and Otaki. From these sub-stations and from the power station at Mangahao energy will be supplied at 11,000 volts to the power boards. The equipment of these sub-stations consists of the main transformers, switchgear, lightning arresters, and recording instruments.

The sub-station of Bunnythorpe, fig. 8, is of the outdoor type and supplies Palmerston North and the surrounding Marawatu district. The equipment consists of a 110,000/11,000-V, 3-phase, 4,500-kVA transformer bank, figs. 9 and 10, and oil circuit breakers, fig. 6, of 400-A normal-current capacity and 495,000-kVA rupturing capacity are being installed on the 110,000-V lines which connect with the switching station at Woodville to the east, and to the north with the Wanganui sub-station, whence a projected line will eventually link up with the Arapuni hydro-electric generating station, two hundred miles further north. Similar oil circuit breakers are installed at the Woodville switching station.

The sub-station at Dannevirke, figs. 13 and 14, is also of the outdoor type, equipped with two 1,500-kVA, three-phase, 110,000/11,000-V transformers.

The greater part of the main and local lines are run on hardwood poles, the former of Australian wood, the latter of Australian wood or New Zealand silver pine, the lines being carried on suspension-type insulators. The 110,000-V lines are composed of 19/13 copper cables spaced at 10 ft. between centres. Figs. 15 and 16 show the single- and double-type poles used for the transmission lines.

Between Khandallah and Packakariki, a distance of about 20 miles over country difficult to patrol, steel towers carrying double circuits are to be used instead of poles in order to reduce to a minimum the risk of line troubles on this section.

Fig. 1 shows the completed generating station and pipe line.

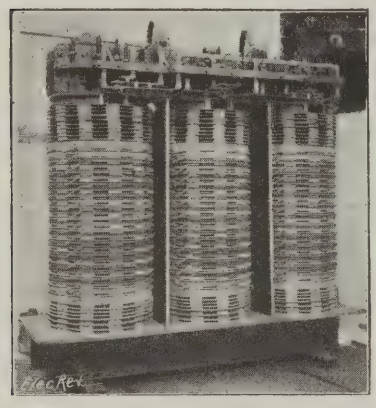


Fig. 9.—Interior of Step-down Transformer.

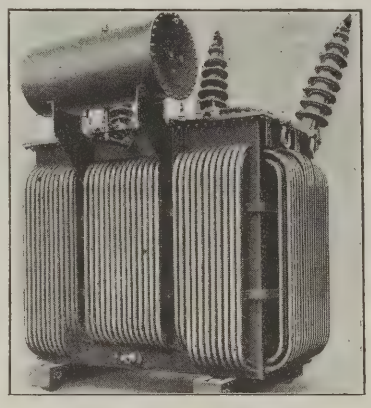


Fig. 10.—Three-phase Unit.

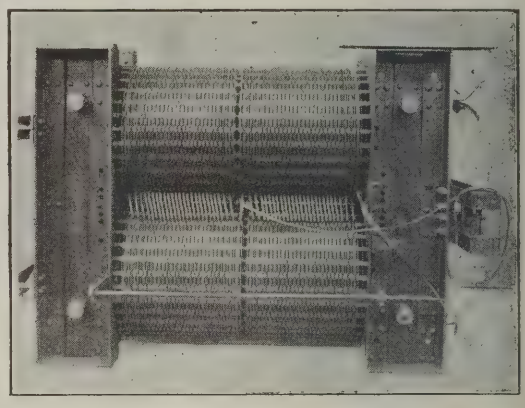


Fig. 11.—Step-up Transformer arranged for Transport.

The popularity of the electricity supply has rendered it necessary to proceed with the construction of the third dam to provide a means for increasing the load. The construction of this dam involves the laying of some 3½ miles of road, and this is now completed, and work on the dam itself commenced. Fig. 12 shows the site of this dam. A Keystone drill is working overtime testing the geological formation at the dam site, and the bush surrounding the surveyed



Fig. 12.—Site of New Dam.

district has been felled. Cottages for the use of the workmen are completed, and service buildings and a community cookhouse are in operating order. The first supplies of material for the dam are now being carried through, and excavation work on the dam site is well under way. The completion of the new dam will double

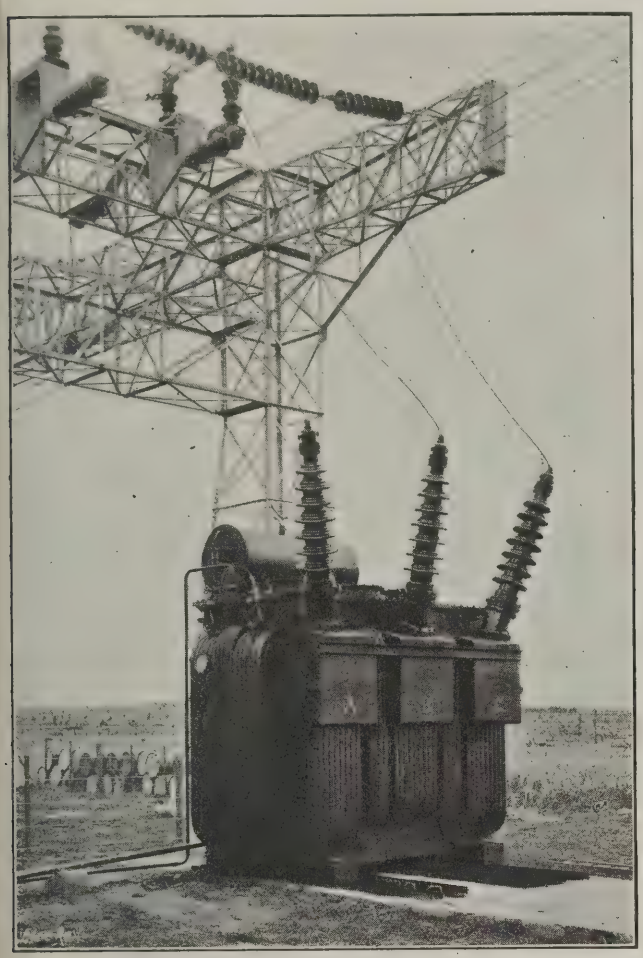


Fig. 13.—A Section of Dannevirke Sub-station.

the storage capacity of the present scheme, and make available, with some few extensions at the power house, an additional 12,000 kW, thus doubling the capacity of the station.

The transmission scheme from Mangahao is being enlarged almost daily, and the various sub-stations within its area are linking up practically every hamlet and isolated settlement within the effective radius. Already over 600 miles of transmission lines have been erected, and the total is steadily increasing.

In conclusion, we are indebted to Messrs. Ferranti, Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.,

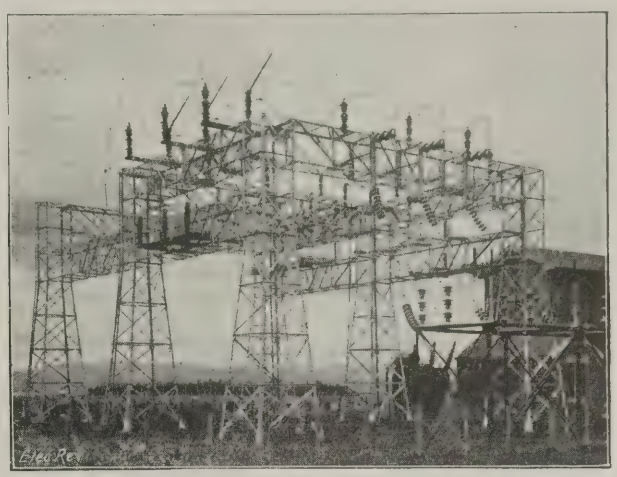


Fig. 14.—The Sub-station at Dannevirke.

for their assistance in the preparation of this article. Messrs. Ferranti supplied the step-up transformers, and

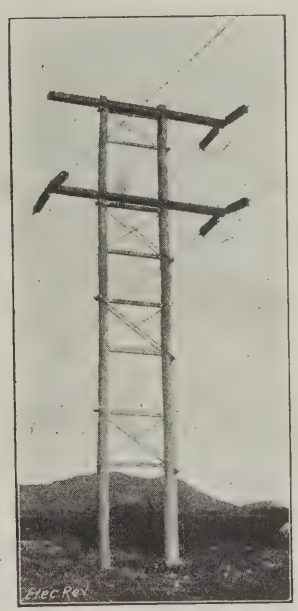


Fig. 15.—Double Pole.

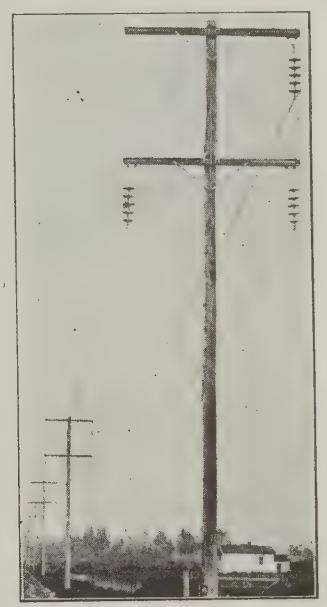


Fig. 16.—110,000-V Line.

Messrs. Metropolitan-Vickers supplied the alternators and the sub-station equipments.

The I.E.C. Meeting in America.—I.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

On Good Friday, April 2nd, the Cunard Liner *Andania* sailed from Southampton with the following British delegates who were attending the New York meeting of the International Electrotechnical Commission:—

Col. R. E. Crompton, C.B., R.E. (Hon. Sec., I.E.C.).

Sir Archibald Denny, Bart. (Chairman, B.E.S.A.).

Sir Richard Glazebrook, K.C.B. (Chairman, British National Committee).

Mr. C. P. Sparks (Vice-Chairman, British National Committee).

Mr. C. Le Maistre, C.B.E. (General Sec., I.E.C.).

Mr. Ll. B. Atkinson (Director, Cable Makers' Assn.).

Mr. S. C. Bartholomew (General Post Office).

Mr. E. G. Batt (General Electric Co., Ltd.).

Mr. W. S. Burge (English Electric Co., Ltd.).

Capt. P. Dunsheath (W. T. Henley's Telegraph Works Co., Ltd.).

Mr. A. R. Everest (British Thomson-Houston Co., Ltd.).

Mr. W. Lee (Silvertown Lubricants, Ltd.).

Mr. S. W. Melsom (Callender's Cable & Construction Co., Ltd.).

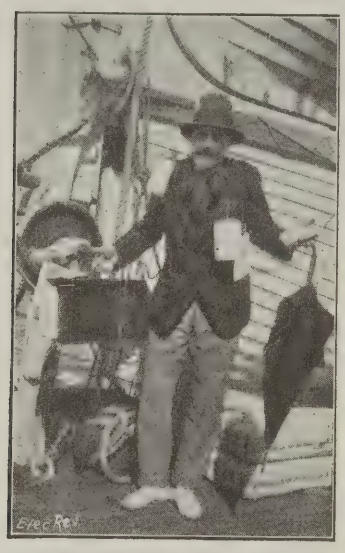
Dr. A. C. Michie (Electrical Research Association).

Mr. R. B. Mitchell (President, Incorporated Municipal Electrical Association).

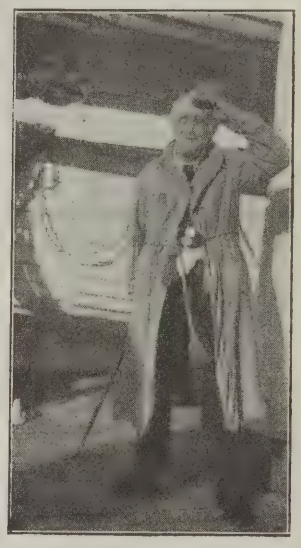
Mr. W. S. Marshall (Shell-Mex, Ltd.).

Mr. A. P. Mossay (Electric Vehicle Committee of the U.K.).
Mr. J. S. Peck (Metropolitan-Vickers Electrical Co., Ltd.).
Mr. C. Rodgers (Secretary, British Electrical and Allied Manufacturers' Association).
Mr. T. Roles (City Electrical Engineer, Bradford).
Mr. P. F. Rowell (Secretary, Institution of Electrical Engineers).
Mr. F. Wallis (English Electric Co., Ltd.).
Lt.-Col. K. Edgcumbe (Everett, Edgcumbe & Co., Ltd.)

The British contingent, consisting of twenty-three members, was joined at Cherbourg by the representatives of twelve other countries, constituting in all upwards of ninety engineers, a veritable Electrical League of Nations.



Lt.-Col. K. Edgcumbe.



Col. R. E. Crompton.
A Fancy Dress Competition.



Mr. S. C. Bartholomew.

The various European countries represented, with the principal delegates attending are as follows:—

Austria: Herr Bretschneider (Vice-President, Austrian Standards Committee).

Belgium: M. E. Uytborck (Secretary, Belgian Electrotechnical Committee).

Czecho-Slovakia: Prof. V. List (Chairman, Czecho-Slovakia Electrotechnical and Standards Committee).

France: M. E. Roth (Société Alsacienne de Constructions Mécaniques).

Germany: Prof. Dr. P. Strecker (President, German Electrotechnical Committee).

Holland: Prof. C. Feldmann (President, Dutch Electrotechnical Committee).

Italy: Signor G. Semenza (President, I.E.C.).

Norway: Mr. E. Heiberg (Director, Norwegian Industrial Standardisation Bureau).

Poland: Mr. Roginski ((Secretary, Polish Standards Committee).

Russia: Prof. M. Châtelain (Chairman, Russian Electrotechnical Council).

Sweden: Mr. A. F. Enstrom (President, Swedish Standards Committee).

Switzerland: Mr. E. Huber-Stockar (President, Swiss Electrotechnical Committee).

It must have been a source of extreme gratification to that wonderful old man, Colonel Crompton, to move about as he did throughout the voyage with all the enthusiasm and activity of youth, among this body of world-famous engineers brought together largely through his own instrumentality. It will be remembered that the International Electrotechnical Commission owes its inception to a paper which he presented at the St. Louis Electrical Congress in 1904.

The present General Secretary, Mr. C. Le Maistre, to whose energies both in the preliminary preparations and during the voyage, it is largely due that the visit to America is proving such a great success, has also worked with the I.E.C. since its inception. As is well known, he has also been closely associated with engineering standardisation in this country through the B.E.S.A. for upwards of twenty-five years, and during that time he has materially contributed to bringing its objects to fruition.

At the close of the Congress of 1904, a resolution was adopted by the Chamber of Government Delegates to the effect that steps should be taken to secure the co-operation of the technical societies of the world by the appointment of a representative Commission to deal with electrical standardisation.

Two years later thirteen nations sent delegates to a conference in London presided over by Mr. Alexander Siemens, and the I.E.C. was then constituted on a permanently organised basis.

International meetings have been held during the past twenty years in Brussels, Turin, Cologne, Paris, Zurich, Berlin, Geneva, and The Hague, and to all these meetings the Americans have sent delegates, often in considerable numbers. It is therefore an event of great importance that after such a period of useful development the seal should be set on the Commission's active growth by the acceptance of an invitation from across the Atlantic by a body of engineers representative of all interests.



Col. Crompton and Sir Archibald Denny.



Herr Stolz, Dr. K. W. Wagner, Col. Crompton, Mr. Ll. B. Atkinson, and Mr. C. P. Sparks, ready to land.



Mr. P. F. Rowell and Prof. V. List.

On Good Friday afternoon the *Andania* steamed down the Channel in brilliant sunshine, but we were not to be let off so lightly for very long. During the night the meaning of the Atlantic swell became evident, and then the weather became worse until a strong cold head wind, amounting at times to a gale, and a rough sea, took all interest out of life for many of the delegates.

The cordial greeting received by wireless on Saturday from the American Committee had a special significance, and hearty support was given to the reply, in which all joined in the keen anticipation of setting foot on the hospitable and immovable soil of America.

On Easter Monday, the *Aquitania*, also sailing to New York, but at a much higher speed, pased us, and the usual facetious greetings were flagged across the few hundred yards that separated us. Offers to tow and threats to report for excessive speed were equally ignored, however, and she passed ahead out of sight to reach New York days before we did.

The weather continued bad, so that one evening, out of ninety stalwart delegates, only about ten faced dinner; but time brought its own cure, and by Tuesday the weakest member was sufficiently recovered to attend an informal reception by the President, Signor Guido Semenza, in the ship's lounge.

Signor Semenza apologised for not having called the meeting earlier, and hoped that as Captain of the Conference in New York, he would prove a better sailor than on the Atlantic. He explained that although no official meeting was possible in the absence of the American delegates, it was important for the various members to get together and make each other's acquaintance so that the informal exchange of views might facilitate the work of the Conference later on. The General Secretary, Mr. C. Le Maistre, then read the names of the members constituting the different committees, and Sir Archibald Denny, chairman of the oldest standardising body in the world—the British Engineering Standards Association—said a few complimentary words on the success of the I.E.C. in bringing together so many distinguished members under such a distinguished president.

In spite of the unpleasant weather encountered on the Atlantic, the voyage was made a very happy one by a series of sports and social events organised by an entertainments committee under the able presidency of Colonel Edgcumbe. The British delegates took high places in the competitions, Mr. S. C. Bartholomew scoring a great success in a fancy dress competition, of which some snapshots are reproduced herewith.

By a happy thought, the Cunard Company gave a dinner one evening in Mid-Atlantic in honour of the Electrotechnical Commission, at which speeches were made by Sir Archibald Denny and Signor Guido Semenza. There was unanimous support from all present for the sentiments expressed by both speakers with regard to the excellent service and the arrangements made for the delegates' comfort during the voyage. After the health of the chef had been drunk, and responded to by that august Frenchman in a few admirably chosen phrases, Herr Hoenig, Chairman of the Swiss Committee, supported the thanks to the ship's staff in half a dozen languages, concluding with an original witty poem in German, detailing the voyage of the good ship *Andania*, and the company adjourned to the lounge, where an excellent concert was enjoyed until a late hour. Among the first-rate musical talent aboard, the delegation was fortunate in having as a fellow passenger a well-known modern composer, and when his next song is being widely sung, many will recall how he favoured the I.E.C. with the first public performance of it, from his rough manuscript in mid-Atlantic. The gathering resulted in a handsome collection in aid of seamen's charities.

Early on Sunday morning, April 11th, the *Andania* called at Halifax, Nova Scotia, and on Tuesday, the 13th, the skyscrapers of New York towered up alongside. The European delegation had arrived.

The delegates were welcomed at the pier by a committee headed by Dr. John W. Lieb and Prof. Elihu Thomson, and were taken to the Hotel Astor, where they were quartered during the Conference, in a special fleet of motor cars decorated with the blue and white flag of the Commission.

On Tuesday evening, April 13th, an official welcome was given to the delegation at a meeting held in the auditorium of the Engineers Societies Building, under the chairmanship of Dr. Lieb, chairman of the Reception Committee. Telegrams from Mr. Thomas Edison and Lord Balfour were read, and the Secretary of Commerce, Mr. Hoover, being unable to attend as arranged, spoke a few words of welcome from his home in Washington by means of amplifiers and loud speakers in the hall. In extending the welcome of the United States Government to the members of the International Electrotechnical Commission, he said: "The subjects you are about to consider are of the first importance to the continued progress of electrical science and of industry, and I need not say that your labours and the conclusions that you reach are also of the first importance to all your respective countries and to mankind in general. If we would have the freest flow of discovery and invention in electricity we must have common terms and common standards."

Dr. Elihu Thomson, in his words of welcome, spoke of the achievements of the I.E.C. during the past quarter of a century, and then proceeded to touch upon some of the wonders which would be shown to the delegates.

Dr. Howard T. Barnes spoke on behalf of the Canadian National Committee, and was followed by Colonel Crompton, who received an enthusiastic greeting from the meeting, the entire body of delegates and guests rising and cheering him. Colonel Crompton ran over his early experience in founding the I.E.C., showing how the progress had necessitated considerable tact in bringing together opposing interests. Now, for the first time since the war, representatives of all the nations of the world, including ancient enemies (now become friends), had come together, and he believed that it was the pleasure of doing this work that kept him alive.

After Monsieur Genissieu (France), Mr. Enstrom (Sweden), Prof. List (Czecho-Slovakia), and Dr. Strecker (Germany) had spoken as representatives of the nations of Western, Northern, Eastern, and Central Europe, respectively, Signor Guido Semenza, the President of the Commission, delivered an address on the "Accomplishments and Aims of the International Electrotechnical Commission."

At a luncheon given by the United States National Committee, at the Commodore Hotel, New York, on April 14th, an able and effective speech was delivered by Dr. Michael Pupin, President of the American Institute of Electrical Engineers. As a student at college Dr. Pupin learned that the Greek philosopher said that "To know thyself is the first step to wisdom." After 40 years he had concluded that the second step to wisdom was "to know thy neighbour." "In Europe," he said, "we suffer from neighbourphobia. Everybody's afraid of his neighbours," and then he described how as a boy he lived in a simple Serbian village near the Danube where within 20 miles there were 12 villages representing five different races—Serbs, Hungarians, Germans, Slovak, and Rumanians—and yet they were the happiest people on earth. Why? Because every village had its market days, when the peasants from other villages came to trade, and when they enriched their experience by the experience of their neighbours. They welcomed one another as neighbours, and, looking at the delegates from all over the world, Dr. Pupin felt that the best greeting he could give was the old Serbian one: "Welcome, our dearly beloved neighbours."

Sir Archibald Denny, in replying on behalf of the visiting standardising bodies, referred at some length to the activities of the British Engineering Standards Association. He hoped that a hearty effort would be made during this visit to lay the foundation of an international standardising association.

Signor Semenza, in a witty speech, spoke of the great painter who explained that his best picture was due to his efforts to attain the high quality of the frame purchased for it by the man who ordered it. In the frame of welcome and entertainment provided by the Reception Committee the Commission must provide a beautiful picture in the work carried out in the technical sessions. Dr. Sharp, President of the U.S. Committee, and Dr. Mailloux, past-president of the I.E.C., also spoke.

The technical sessions of the Conference opened at 9.30 on Wednesday morning, April 14th, and continued daily, morning, afternoon and evening, until the 22nd.

D

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

New Businesses Registered.—The following businesses have recently been registered under the Business Names Act:—

N. W. J. Gorrill & Co. (radio and electrical factors), 6, Clapham Court Terrace, Kings Avenue, S.W.4.

Radio Services (radio accessories, sets and tools), 2, Winchester Street, Salisbury.

Piccadilly Sign Co. (electric signs), 22-24, Charing Cross, Whitehall, S.W.1.

South Wales Electric Lamp Service (electrical engineers), 3, Temple Buildings, Goat Street, Swansea.

Adelphi Electrical Co. (electrical engineers and contractors), St. Stephen's House, Victoria Embankment, S.W.

Aldwych Engineering Co. (general engineering supplies), 71, Lincoln's Inn Fields, W.C.2.

Northern Electric Co. (electrical contractors and wireless dealers), 292, Stratford Road, Manchester.

Rays Wireless Stores, 87a, Seven Sisters Road, Holloway, N.7.

Gordon Radio Co. (manufacture and sale of wireless apparatus), 69-73, Mansell Street, Aldgate, London.

Thrale Engineering Co. (electrical and mechanical engineering), Cromwell House, Fullwood Place, W.C.1.

I. C. Tofield & Co. (electrical engineers and representatives), 110, Dale End, Birmingham.

Unemployment.—The total number of persons registered at the exchanges as wholly unemployed on April 12th was 1,024,400. This was 25,386 less than on April 5th and 180,370 less than on April 13th, 1925.

The E.T.U. and Fusion.—The members of the Electrical Trades Union are to be consulted by means of a ballot upon the question of merging the organisation in the Transport and General Workers' Union which has already absorbed a number of trade unions.

Employment during March.—Although the general tendency of employment during March was improvement, the *Ministry of Labour Gazette* shows that this did not apply to the engineering industry in which, as a whole, there was a general decline. In the electrical engineering section unemployment increased from 6.6 to 6.7 per cent. and compared badly with the proportion of 5.5 per cent. in March, 1925. On the other hand, conditions improved in the electrical wiring and contracting industry and in electrical cable, wire and lamp manufacture. In these groups the percentages of unemployed were 7.9 and 7.4 respectively, as compared with 8.6 and 7.8 per cent. in February. Improvements also occurred in the transport section and in the gas, water, and electricity supply industries as a whole.

The Timber Market.—Our timber trade correspondent reports that the market for timber for general construction work is more healthy than it was a month ago. Although there are still large stocks on the market the consumption has shown considerable improvement, and is likely to increase in that respect provided labour troubles in the mining and engineering industries are avoided. Housebuilding is proceeding splendidly, thus creating a good demand for general wood requirements. Hardwoods for the cabinet and fancy box trade are in fair request, and at firm rates, especially teak, rosewood, and ebony. Mahogany is not quite so strong in value, comparatively, as the other descriptions mentioned, increasing supplies having arrived this year compared with the corresponding period of 1925. Taken generally, however, there is an improvement in the call for that choice wood compared with a month ago, the demand for good quality material especially being very satisfactory.

Social Event.—The first dinner of the Cambridge Instrument Co., Ltd., was held at the Hotel Russell on Saturday, April 17th, when Mr. S. W. Hersant presided over an assembly of 120. The guests of the evening included the directors of the company, Mr. R. S. Whipple, Mr. C. Mason, Mr. R. W. Paul, Mr. F. Wakeham and Mr. W. H. Apthorpe, with their ladies. The event concluded with a dance.

The L.C.C. and Foreign Purchases.—The General Purposes Committee of the London County Council reports that it has considered the difficulties which British manufacturers have to face in competing with firms in a foreign country with either a low rate of exchange or low rates of wages in operation, and whether the Council should, in dealing with tenders for articles of foreign manufacture, pay regard to the economic conditions of the country in which the articles are produced. The Committee's practice is to concur in preference being given, within limits, to British, as against foreign, tenders. It has decided that it could not advise the Council to go beyond this and to bar all tenders for goods of foreign manufacture, or to undertake the practically impossible task of assessing the relative economic factors in the countries concerned in any particular case.

Canadian Radio Exhibitions.—The *Board of Trade Journal* states that a National Canadian Radio Exhibition is to be held at Toronto from October 25th to 30th. Similar exhibitions are to be held at Winnipeg from September 13th to 19th, and at Montreal from October 4th to 9th. Inquiries should be addressed to the Canadian Exhibition Co., 204, King Street East, Toronto.

New Municipal Showrooms.—The Shoreditch Lighting Committee has recommended to the Borough Council that premises be purchased for a showroom and demonstration purposes. The total estimated expenditure will be £12,500, including alterations and equipment.

E.D.A. Activities.—We have received another batch of pamphlets from the British Electrical Development Association. They maintain the E.D.A. traditions of "readability," effective argument, and attractiveness, and should prove useful to supply authorities and others engaged in increasing the load. The new publications deal with the domestic applications of electricity, electric vehicles, and electricity for power purposes. Accompanying the leaflets is a short pronouncement upon the multi-part tariff system received from the State Electricity Commission of Victoria.

Local Exhibitions.—St. Helens.—At the recent electrical exhibition organised by the Corporation Electricity Department, the General Electric Co., Ltd., had a very attractive display. A range of "Magnet" domestic electrical appliances were exhibited and demonstrated, and included a refrigerator, cooker, wash-boiler, egg whisks and other appliances. A section of the G.E.C. stand, illustrated in the picture herewith, was made up in the form of shop windows, and the space, dressed by local retailers, was used to demonstrate the "Gecoray" system of shop-window lighting. The general lighting of the rest of the stand was very effective.



The G.E.C. Stand at St. Helens.

Proposed Tasmanian Hydro-Electric Grant.—After an investigation carried out at the request of Mr. Bruce, the Australian Prime Minister, Sir Nicholas Lockyer has issued a long report on Tasmanian disabilities as a result of federation, containing a number of recommendations. Among these is a proposal that the Commonwealth Government should make a grant of half a million pounds to relieve Tasmania of a portion of the capital cost of the hydro-electric scheme in consideration of the State's assistance in having established an electrolytic zinc industry.—*Reuter* (Melbourne).

Electrical Imports of the Philippines.—Mr. T. Harrington, British Consul-General at Manila, has forwarded a report on the commercial and economic situation of the Philippine Islands, to June, 1925, to the Department of Overseas Trade (Stationery Office, 9d. net). This shows that the total value of electrical machinery imported during 1924 was £481,807, as compared with £247,071 in 1923, the proportion of the total imports thus rising from 1 to 2 per cent. As was the case in most other commodities the United States was pre-eminently the principal supplier contributing goods to the value of £438,974 in 1924, Great Britain's share being only £2,421.

Hours of Work in Australia.—The N.S.W. High Court, on April 19th, upheld the appeal of three New South Wales firms against the judgment of a magistrate that employés working under the Federal 48-hour week award were entitled to full wages for 44 hours' work, under the State Act. The Court decided that the 44-hour week was not applicable to employés in industries covered by the Federal award. The employers are reported to be gratified at the Court's decision and anticipate a period of greater prosperity in the industrial world. The Trades Unions are disappointed. Fifty thousand workers are affected and 2,000 employés of the Clyde Engineering Company downed tools for a day as a protest.—*Reuter* (Sydney).

The Chinese Attitude.—A writer in the February *Journal* of the Associated Chambers of Commerce in China and Hongkong deals with the age-long exclusiveness of the Chinese and their antipathy to foreign ideas and products. He considers that all indications point to an augmentation of this sentiment in recent years, and that the result will be a constant endeavour to impose heavy tariffs upon foreign goods to protect and foster native industries. "The tendency will be towards the exclusion of all foreign things. China for the Chinese and all goods to be supplied by the country itself is the tendency of the Chinese mind; the traditional spirit of exclusion will be carried out in all departments of life."

Threatened Tramway Strike at Manchester.—At a meeting of the employés of the Manchester Tramway Department, last week, it was decided to cease work on Whit Monday and three succeeding days as a protest against the refusal of the City Council to grant the men an extra four days' holiday. They already receive eight days per annum.

Trade Announcements.—Mr. S. Whiston, late with Carrington & Button, has commenced business as an electrical engineer at 12, West Street, Crewe.

The Wenham Lighting Corporation, Ltd., of 184, Gray's Inn Road, the whole of the share capital of which is held by the Whitworth Electric Lamp Co., Ltd., has acquired the business of the Dawson Electric Co., St. Peter's Church Walk, Nottingham, and it will conduct this business as a branch. Mr. A. E. Dawson, formerly proprietor, has been appointed managing director to the Wenham Lighting Corporation, Ltd., and he will manage both businesses from 184, Gray's Inn Road, W.C.1.

Messrs. R. A. Evans, Ltd., of Leicester, have opened a district office at 46, Grosvenor Chambers, Deansgate, Manchester ('Phone: "City 4550"), under the direction of Mr. E. Grayson Holt, to deal with business in the Lancashire and Yorkshire area.

Mr. S. D. Schofield has removed from Penistone to Bolton, and his address is now: Engineer Representative, Holophane, Ltd., 23, Yarrow Place, Bolton.

Lead.—Reporting on April 24th, Messrs. James Forster and Co. stated:—"The demand from cable makers is still very disappointing. . . . The key of the position seems to lie with Germany. As long as this market is used for the dumping ground of surplus lead from the Continent, so long will the price remain depressed. When the Continent resumes taking its normal quantities, the position will be quickly relieved here, and if this were to coincide with better buying by cable makers, we should quickly see the price over £30 per ton again."

Catalogues and Lists.—Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—Price List 391/1, giving particulars of lighting fittings for mining service. Fully illustrated.

Messrs. J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.—Folder No. 1010, illustrating and describing the "Single Cord" ceiling switch. Priced.

The Eagle Engineering Co., Ltd., Eagle Works, Warwick.—A price list of electrical accessories, fittings, switchgear, &c.

Houghton-Butcher (Great Britain), Ltd., High Holborn, W.C.1.—"Houghton's Radio News," containing illustrated and priced details of radio apparatus of all makes. Articles on window-dressing and other sales subjects appear.

Messrs. F. V. Collins & Co., 155, Kingston Road, Wimbledon, S.W.19.—A card advertising the "Newlink" solderless connector for radio work. Priced.

Electradix Radios, 218, Upper Thames Street, E.C.4.—An illustrated and priced catalogue of radio apparatus and electrical appliances.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A number of illustrated catalogue sheets, dealing with many examples of the company's manufactures, superseding lists previously published.

Messrs. de Leeuw & Co., Ltd., Sentinel House, Southampton Row, W.C.2.—A reprint of an article dealing with Freed-Eisemann radio apparatus.

Messrs. Edward Deane & Beal, Ltd., 3, Monument Street, London Bridge, E.C.3.—A brochure illustrating and describing "Consummate" evaporative condensing plant.

Trelleborg Ebonite Works, Ltd., Audrey House, Ely Place, E.C.1.—A showcard advertising the company's ebonite sheet, tubes, rods, &c., and a price list of ebonite panels.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—A series of illustrated pamphlets, giving full details of the company's cable boxes of many types, mainly for use with oil-immersed transformers.

Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.—Lists 260 and 261, giving prices and particulars of "Sparta" low- and high-pressure batteries for radio work.

Messrs. Campbell & Isherwood, Ltd., Raleigh Street, Bootle, Lancs.—An illustrated pamphlet advertising portable electric grinders and hand drills.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—A priced and illustrated pamphlet dealing with the Philips rectifier for battery charging.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—A well-produced illustrated brochure describing twelve 12,500-kVA, 110,000-V transformers supplied to the Tata Power Co., India.

Metro-Vick Supplies, Ltd., Trafford Park, Manchester.—A well-illustrated, priced catalogue of "Silverstone" lighting glassware, including bowls, shades, &c.

Orion Lamps, Ltd., 15, Eldon Street, E.C.2.—A price list of "Orion" vacuum and gasfilled lamps of several types.

Messrs. J. W. Brooke & Co., Ltd., Adrian Works, Lowestoft.—A pamphlet advertising the "Brooke" 40/60-h.p. marine engine.

Higgs Motors, Witton, Birmingham.—A stock list of a.c. and d.c. motors of all sizes and patterns.

Messrs. Crompton & Co., Ltd., Chelmsford.—An illustrated booklet describing the construction and uses of the "Alltest" d.c. instrument, which can be employed as a voltmeter, ammeter, resistance indicator, &c.

The Standard Spring Co., Bank Street, Hall End, West Bromwich.—A folder illustrating various patterns of springs made by the firm.

Book Notices.—"The Anglo-American Year Book, 1926." (Pp. 504.) London: American Chamber of Commerce in London. Price 15s. net.—This year book is a mine of interesting facts and figures for those who desire to foster Anglo-American relationships. A number of special articles appear in the 1926 edition, including two on legal matters from the English and American points of view. Mr. Nutting, of the American Consulate-General, contributes statistics of trade between the two countries during 1925.

"Kelly's Directory of the Electrical Industry, Wireless and Allied Trades." (Pp. xxvi + 1,256.) London: Kelly's Directories, Ltd. Price 30s. post free.—This, the third, edition of the directory has been thoroughly revised—no light task in view of the continuing expansion of the industries covered. The body of the volume consists of a county directory, the towns being arranged under their counties in alphabetical order. The names of contractors, &c., and other details, are given. In addition to this there are alphabetical and classified lists of electrical firms; a directory of supply undertakings; and a list of trade names. It is of interest to note that the volume contains the names, &c., of 4,500 radio retailers.

"Post Office Electrical Engineers' *Journal*." Vol. XIX. April, 1926. London: Electrical Review, Ltd. Price 1s. 6d. net.

"The Mining Electrical Engineer." Vol. VI, No. 67, April, 1926. Price 1s. net.

"*Proceedings* of the Rugby Engineering Society." Vol. XIX, Session 1924-5. Published by the Society. Price 10s. 6d.—The total membership of the Society at the end of the year in question was 367, as compared with 346 for the previous year. The revenue for the year was £255, resulting in a balance of £18.

Bankruptcy Proceedings.—M. D. Rosenbloom (trading as D. Rose & Co.), electrical engineer, 25, Osborn Street, London.—An application was made on April 20th to Mr. Registrar Mellor, at the London Bankruptcy Court, for an order of discharge on behalf of this bankrupt, who failed in January, 1924. Mr. V. Armstrong, Official Receiver, reported that the liabilities amounted to £3,657; the assets, valued at £515, had realised £342, and a first and final dividend of 1s. 1d. in the £ had been paid. Born in Russia, the bankrupt came to this country in 1898 and had not been naturalised. He commenced business in 1904 and was successful until 1923, when an action was brought against him for the infringement of electric lamp patents. Following a private meeting of creditors a deed of assignment was executed, but the bankruptcy proceedings supervened on a creditor's petition. The application was opposed by the Official Receiver on the grounds (1) insufficiency of assets to equal 10s. in the £ on the amount of the liabilities; (2) omission to keep proper books of account; (3) trading with knowledge of insolvency; (4) failure to account satisfactorily for the deficiency in assets to meet the liabilities; and (5) misconduct in relation to the supply of accounts and non-attendance as often as required on the Official Receiver and the trustee. His Honour suspended the discharge for three years.

G. R. Sparrow, 11, Cloudesdale Road, Balham, late of Brixton, electrical engineer.—The receiving order in this matter was made recently on debtor's own petition. The statement of affairs shows liabilities of £492, against assets of £11, leaving a deficiency of £481. Debtor attributes his failure to unemployment and illness. In 1921, with £30 capital, he commenced business in partnership with his son and another at Beer Lane, E.C., as electrical engineers and contractors. The business was successful until March, 1922, when illness kept him away. Upon his return, he found that the business had declined and creditors were pressing. A meeting of creditors was held in July, 1922, but no action was taken, and the landlord subsequently sold the stock for rent, and the business ceased.

Thomas Barton, electrical engineer, formerly carrying on business at Ainsworth Street, Blackburn.—This debtor applied for his discharge at Blackburn County Court, on April 19th. The Official Receiver said that a first dividend of 15s. in the £ had been paid, and a further dividend was probable. Bankrupt's conduct had been very satisfactory. Judge Bradley said that Mr. Barton's conduct had been estimable in every respect. He granted an immediate discharge.

C. J. Nichols (C. J. Nichols & Co.), 7, Park Street, Bridgend.—First meeting, April 30th. Public examination May 14th, at the County Court, Bridgend.

W. C. Rhodes (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham.—Last day for proofs for dividend, May 6th. Trustee, Mr. C. Hoult, Official Receiver, 191, Corporation Street, Birmingham.

J. McFadden, electrician, 177, Higher Hillgate, Stockport.—First meeting April 30th, at the Official Receiver's Office, Byrom Street, Manchester. Public examination June 1st, at the Court House, Stockport.

Company Liquidations.—Radio Equipment Co., Ltd., 5, Dyers Buildings, Holborn, E.C.—Under a compulsory winding-up order made against this company on March 2nd, upon the petition of a creditor, the statutory first meetings of the creditors and shareholders were held on April 20th, at Carey Street. The Official Receiver reported that accounts had been lodged showing unsecured debts £5,575; preferential claims £31, and loans on debtors' bonds, £979; assets valued at £314, and a total deficiency of £6,273 with regard to contributories, the issued capital being two £1 shares. The company was formed as a private company in July, 1922, with a nominal capital of £100, to carry on business as manufacturers of and dealers in wireless equipment and primarily to act as selling agents for radio goods to John Hall & Co., of Birmingham. The promoter was Mr. P. J. White, and the failure of the company was attributed to increasing difficulties in competing with foreign manufacturers, by reason of which the margin of profit was too small; also to insufficiency of capital to enable the company to advertise adequately. The chairman added that he had collected approximately £30 from the assets and was unable to say whether anything like the estimate of £314 would be realised. A liquidator was appointed.

Hawk Coil Co., Ltd., wireless manufacturers, St. Mary's Road, Surbiton.—The creditors were called together on April 20th at the offices of Mr. F. Bryant, 16, Clapham Junction Station Approach, S.W., who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented which disclosed liabilities of £1,582, all due to unsecured creditors, and net assets of £135, leaving a deficiency of £1,447. The Liquidator stated that the company was incorporated in May last with a nominal capital of £1,500, of which £1,255 had been issued. Of the latter amount £750 represented the purchase consideration for the business taken over, and the balance was cash. The turnover since the incorporation had been about £2,400, and there had been a loss on the trading of over £500. In January last the coil which the company made was greatly improved, and it necessitated the existing stock being broken up. The patent was estimated to be of no value. It was decided that the voluntary liquidation should be continued with Mr. Bryant as liquidator with a committee of inspection. The following are creditors:—

	£		£
Bankers	204	Spears & Co.	54
Ankh Insulator Co. ...	80	Solidite Mfg. Co., Ltd. ...	35
Barclay's Advertising Co.	59	Trader Publishing Co. ...	50
Coley, R. J.	332	Walker & Co.	168
Coley, R. J., Ltd.	51	Horry Offer, Ltd.	50
Hopes, Ltd.	20	Parker, Turnbull & Co. ...	30
Phillipson's Press, Ltd. ...	212		

A. Emanuel & Sons, Ltd., George Street, Manchester Square, W., electrical engineers, &c.—A meeting of creditors was held on April 22nd at Andertons Hotel, Fleet Street, E.C., when the representative of Messrs. Walkers, Parker & Co., Ltd., London, the largest trade creditors, was elected to the chair. The chairman said that the firm was a very old-established one, and had always enjoyed a good reputation. All were sorry that it had come down. Mr. Walter Boniface, the receiver for the debenture holders, and the liquidator in the voluntary liquidation of the company, presented a statement of affairs, which showed liabilities of £17,920, all due to trade creditors. In addition, there were fully secured creditors for £30,360, against which they held security valued at £51,460, leaving a surplus of £21,100. The bank was creditor for £14,677, and held debentures for £15,000. The net assets were £57,066, leaving a surplus of £39,146 as regarded the creditors. The liquidator reported that the company was incorporated in 1885 with a nominal capital of £58,500, which was increased in 1889 to £100,000. The issued capital amounted to £83,500. The company was formed for the purpose of acquiring the business previously carried on by Mr. Abraham Emanuel, who became the sole director, and he also appointed his son, Mr. Elliott Emanuel, to be a director. Mr. Abraham Emanuel died in 1894, and Mr. Elliott Emanuel in 1904. Since that time there had been various changes in the directorate, and the present directors were Mr. A. Emanuel, Mr. T. Rose, Mr. D. R. Fraser, and Mr. O. G. Cooper. Mr. Alfred Emanuel was the managing director. The fees of the directors were limited to £100 per annum each, but they had been engaged in other capacities in the company and had received salaries. The balance sheet at December 31st, 1920, showed surplus assets of £10,769. The sum of £18,190 was written off as loss for the year 1921, and there was a reserve to carry forward to 1922 of £15,273. The year 1922 resulted in a further loss of £16,590, so that there was on January 1st, 1923, an adverse balance of £1,317, and further losses were incurred as follows: 1923, £10,583; 1924, £1,847; and 1925, £6,555, making a total of £20,302 to December 31st, 1925. The directors attributed the loss in 1921 to a big drop in the turnover following the "boom" year of 1920. They stated that the losses incurred in 1922 and 1923, were largely accounted for by a drastic writing down of stocks in addition to reduction in selling prices. In order to provide working capital, debentures were issued from time to time, and in July, 1922, there were in existence first debentures for £5,000 and second debentures for £25,000. The latter were held by the bank to secure an overdraft of £24,150. An advance of £30,000 was later obtained. The overdraft to the bank had been repaid, and the first debenture of £5,000 was paid off. Further funds being required to carry on the business, first debentures were issued for £6,000, £4,000, and £5,000 to the bank. The directors were unable to repay the bank, and on March 17th last the bank appointed Mr. Boniface as receiver. The latter immediately consulted the largest creditors, and it was decided that voluntary liquidation should take place. Accordingly, the necessary resolutions were passed by the shareholders on April 7th last.

Mr. W. Baker, of the Wholesale Traders' Association, said that this was one of the few cases met with at the present time where there was a substantial surplus of assets, and there was every prospect of the creditors receiving payment in full. He suggested that the voluntary liquidation of the company should be continued. It was unanimously resolved that the voluntary liquidation should be confirmed, with Mr. Boniface as liquidator, whilst an advisory committee was appointed consisting of the representatives of Messrs. Stewarts and Lloyds, Ltd., and the Armorduct Cable Co.

The following are creditors:—

	£		£
Armorduct Cable Co., Ltd. ...	413	Metallic Seamless Tube Co., Ltd.	93
Atlas Carbon & Battery Co., Ltd.	55	Midland Electric Mfg. Co., Ltd.	101
Bayley & Halstead, Ltd.	83	Newton, J. M. & Sons, Ltd. ...	124
Belling & Co.	57	Nettlefold & Sons, Ltd.	103
Bisseker, H., Ltd.	55	North Bitchburn Coal Co., Ltd.	75
Blundell, Spence & Co., Ltd. ...	143	Perfecta Seamless Steel Tube and Conduit Co., Ltd.	116
Braby, F., & Co., Ltd.	82	Planet Foundry Co., Ltd. ...	65
Brimsdown Lead Co., Ltd. ...	109	Russell, J., & Co., Ltd.	55
Cameron & Robertson, Ltd. ...	147	Scottish Tube Co., Ltd.	191
Central Cables & Accessories, Ltd.	132	Scupham & Wood, Ltd.	52
Crabtree, J. A., & Co., Ltd. ...	97	Standard Gas Fittings Co., Ltd.	109
Davies, Kent & Stewart, Ltd.	80	Standard Metals, Ltd.	104
Davis, C., & Co.	506	Stearn Electric Co., Ltd. ...	253
Foster Engineering Co., Ltd. ...	98	Stewarts & Lloyds, Ltd.	789
General Electric Co., Ltd. ...	325	Stewarts & Lloyds, Ltd.	408
Hadfields, Ltd.	111	Thompson, S., & Co., Ltd. ...	124
Hawkins Bros. & Co., Ltd. ...	60	Tipper Bros.	78
Hayward, Tyler & Co., Ltd. ...	197	Tucker, J. H., & Co., Ltd. ...	53
Huntalite, Ltd.	54	Twigg, C., & Co.	65
Hutchison, A., & Son, Ltd. ...	102	Twyfords, Ltd.	213
King, C. E.	114	Vulcan Electric & Mechanical Co., Ltd.	234
Kingsland Steam Joinery Works, Ltd.	226	Walkers, Parker & Co., Ltd.	7,021
Lancaster & Co., Ltd.	92	Walworth-Munzing, Ltd. ...	92
Leach, S. G., & Co., Ltd. ...	66	Whitley Partners, Ltd.	58
London Galvanized Iron Co., Ltd.	56	Wootton, H. A., & Co.	50
Markt & Co., Ltd.	64	"Z" Electric Lamp & Supplies Co., Ltd.	110

East Anglian Electricity, Ltd.—A meeting of members is called for May 26th, at the Great White Horse Hotel, Tavern Street, Ipswich, to hear an account of the winding up from the Liquidator, Mr. C. P. Dawes.

Northern Radio Co., Ltd.—A meeting of members will be held at 12a, Hyde Street, W.C., on May 26th, to hear an account of the winding up from the Liquidators, Messrs. W. A. Appleton and W. L. Sibley.

H. E. Davis, Ltd.—A petition for the winding up of this company has been presented to the High Court by Messrs. Albert Lee & Co. (1923), Ltd., creditors, of 8 & 9, New Zealand Avenue, E.C., and will be heard in London on May 4th.

British Wireless Supply Co. (1924), Ltd.—A petition for the winding up of this company has been presented to the County Court of Yorkshire by Messrs. Ellison & Hillman, radio factors, 123, Albion Street, Leeds, and will be heard at the County Court, Leeds, on May 4th.

Roto Sign Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. A. Prestage, Albion House, Westminster, S.W.1. Meeting of creditors May 6th, at Albion House. Particulars of claims to the Liquidator by May 24th.

Potteries Radio Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. O. Wilson, 36, Spring Gardens, Manchester. Meeting of creditors May 3rd, at the offices of the Liquidator (This notice is formal; all creditors will be paid in full.)

Henley Engineering Co., Ltd.—Winding up order made by the High Court on April 15th.

Dissolution of Partnership.—Kelsall & Co., electrical and mechanical engineers, Glanyllyn, Taff's Well, Glamorgan.—Messrs. J. Kelsall and J. J. Croft have dissolved partnership. Mr. Kelsall will attend to debts and continue the business under the same style.

Private Arrangements.—H. Brear, electrician, Calder Wharfe Mills, Ravensthorpe, Dewsbury.—A meeting of creditors was held recently, when a statement of affairs was submitted which showed liabilities of £962, of which £472 was due to the trade and £490 to cash creditors. There was also a fully secured creditor for £147, who held securities valued at £167. The net assets were £530, leaving a deficiency of £432. The business has been in existence for many years. During 1923, 1924 and 1925, there were losses on the trading of £248, £161, and £319 respectively. Since December, 1925, there was a loss on the trading of £100. The accounts at November 30th, 1924, showed a capital of £168, and the debtor was of the opinion that his assets were worth considerably more than the amount shown in the statement. An offer was made of a composition of 10s. in the £, payable by two instalments, the last to be secured. It was agreed to accept this provided

that a satisfactory guarantee was forthcoming, failing which a deed of assignment will be executed to Mr. Walker, of Messrs. W. Dawson & Son, accountants, Bank Chambers, Dewsbury. A committee was also appointed. The following are creditors :—

	£		£
Austin, J., & Sons, Ltd.	40	Scattergood & Johnson	120
Metropolitan - Vickers Electrical Co., Ltd.	30	Taylor, J., & Son	25
		Tungstalite, Ltd.	34

Raymond Palmer, trading as the Electrical Supply Stores, electrical and wireless dealer, Crown Street, Halifax.—The creditors of the above were called together on April 23rd, at Bradford, when a statement of affairs was submitted which showed ranking liabilities of £3,492, all were £2,383, leaving a deficiency of £1,109. It was stated that the debtor left the Army in April, 1919, and two years later started trading as a wireless dealer from a private house. It was stated that accounts had been prepared from time to time, and in June, 1923, debtor's capital was £193, whilst by June, 1925, it had increased to practically £500. During the 21 months ended June, 1925, there was a profit on the trading of £750, whilst the drawings were £450. Since July 1st of last year there had been a loss on the trading of £700. It was stated that, in addition to the assets shown, the debtor possessed an equity in a house and other small items. A resolution was passed in favour of the execution of a deed of assignment with Mr. C. H. Baker, C.A., Standard Buildings, City Square, Leeds, as trustee, together with a committee consisting of Mr. P. S. Booth and the representatives of Messrs. Louin & Murray, E. Robertshaw & Co., Siemens Bros. & Co., Ltd., and the General Electric Co., Ltd. The principal creditors are :—

	£		£
Frenhal, D., Ltd.	64	Ward & Goldstone, Ltd. ...	58
General Electric Co., Ltd. ...	280	Baxendale & Co., Ltd.	66
Louin & Murray	163	Beardsall & Co., Ltd.	170
Robertshaw, E., & Co.	357	B.N.B. Wireless Co.	163
Siemens Bros. & Co., Ltd. ...	91	Brown Bros., Ltd.	55
Siemens & English Electric Lamp Co., Ltd.	97	Sellars, H. W., & Co.	190

For Sale.—The Superintending Engineer, N.W. District, W. & B., Department of the R.A.F., Uxbridge, invites offers for an electrically-driven pumping set. Yorkshire (West Riding) Electric Tramways Co., Ltd., has for disposal two 320-h.p. Diesel engines, coupled to two Dick, Kerr 200-kW generators, one 264-cell Tudor battery, one reversible booster, and one 10-ton overhead travelling crane. Mr. S. E. Buckley, of Oakmere Farm, Potter's Bar, invites offers for a 30-gallon National calorifier and boiler, &c. (See our advertisement pages to-day.)

Deed of Assignment.—M. Martin (D.B.M. Electrical Co.), 23, The Royal Arcade, and 32, West Street, Weston-super-Mare.—Particulars of claims to the Liquidator, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., by May 11th.

New Czecho-Slovakian Company.—A new company has lately been formed at Aussig with a capital of 2½ million crowns and the title of the Bohmische Glühlampenfabrik Gesellschaft, to acquire and extend the Plechatry incandescent lamp works near that town.

New French Companies.—La Société des Etablissements S.N.A.P. is the name of a new company which has lately been formed in Paris with a capital of one million francs to manufacture radio apparatus.

La Société Secteur Electrique de Domme is the name of a new company which has lately been formed at Domme with a capital of 2¾ million francs to supply electricity in the Department of Dordogne.

New Italian Companies.—Among the new hydro-electric undertakings recently formed in Italy are the Società Idroelettrica del Vizze, Milan, capital 120,000 lire; the Società Idroelettrica Sile, Treviso, 100,000 lire; La Società Idroelettrica Pontecorvo, 50,000 lire; La Società Idroelettrica Dolomiti, Rome, 1,000,000 lire; and La Società Idroelettrica Val d'Enza, Reggio Emilia, 20,000 lire.

The concerns recently organised in connection with the radio industry include the Società Brunet, Milan, capital 500,000 lire; and La Società Radio Elettro-Meccanica Bruno Biancoli & Co., Bologna, capital 300,000 lire.

La Società Elettro Ferrovia Trentina has lately been formed in Milan with a capital of 100,000 lire to construct an electric railway in the Trentina district.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during February last were valued at £38,715, bringing the total for the first two months of the year to £91,122, as compared with only £46,407 in the corresponding period of 1925.

Brazilian Railway Electrification.—The British Engineers' Association reports the receipt of complete data comprising plans, details of rolling stock, permanent way, traffic reports, &c., relative to the proposed electrification of the first section of the Sorocabana Railway, Brazil, tenders for which will shortly be called for. This important undertaking covers the section between Sao Paulo and Santo Antonio, a distance of 152 km., and present indications are that over 50 locomotives will be required. The electric power will be supplied by the Sao Paulo Tramway, Light & Power Co., and associated companies.

French Thomson-Houston Developments.—It is reported from Paris that the Société Thomson-Houston has transferred its telephone branch to the International Telephone and Telegraph Corporation. A few months ago the former established a subsidiary company to work its telephone branch, one half of the capital being issued to the International Corporation for the sum of $2,000,000. Now the French company has ceded to the International Corporation the second half of the capital for an amount exceeding $3,000,000, or about 100,000,000 fr. It is stated that the telephone branch has never yielded any profits to the French company.

Polish Foreign Electrical Trade.—The *Board of Trade Journal* publishes statistics showing that during February last Poland imported apparatus, conductors, and other electro-technical materials to the value of 1,435,000 zloty (£35,000). The exports of similar goods were valued at 57,000 zloty (£1,400).

Lighting and Power Notes.

Australia.—New South Wales.—According to the *Australasian Electrical Times*, Mr. H. G. Carter, chief electrical engineer, N.S.W. Department of Public Works, has submitted an important report to the Government on the power resources of the State. The State was divided into three districts for purposes of the survey: The northern district, from the Manning River to the Queensland border; the central district, between the Manning River and an east-west line through Kiama; and the southern district, between the Kiama line and the Victorian border. Large central stations would serve each district, and the networks serving the latter would be gradually interconnected. In the central district, 12,000 million tons of coal can be made available, but water power resources are small—not more than 25,000 h.p. The question of circulating water will govern the possibilities of building inland fuel-fired stations. In the southern district 500,000 h.p. of the total of 700,000 h.p. of the State's water-power resources are located, and there is little coal. In the northern area there are considerable resources of both fuel and water power. In developing the State's resources, Mr. Carter says, coal will play as large a part as, if not larger than water power.

Aylesbury.—Loan Sanctioned.—The Town Council has received sanction to loans of £40,000 for mains and services, and £4,000 for sub-station equipment and kiosks.

Barking Town.—Electricity in Bulk.—The Urban District Council has completed arrangements for obtaining a bulk supply from the power station of the County of London Electric Supply Co., Ltd., at Creeksmouth, which it is anticipated will be available toward the end of June, upon which the Council's generating station will be closed down. The taking of this bulk supply has necessitated the erection of a new transformer station adjacent to the present generating station.

Barnes.—New Plant.—The London and Home Counties Joint Electricity Authority has notified the Urban District Council that it has recommended the Electricity Commissioners to sanction the extension of the Council's power station by the installation of a 3,000-kW set.

Bexhill.—Shop-Window Lighting.—The Electricity Committee has recommended the following terms for electricity supply for shop-window lighting :—(*a*) A two years' agreement to be entered into with persons concerned, supply to be limited to the period 7 p.m. to 10 p.m. (*b*) Price proposed, 2d. per kWh, plus meter rent of 1s. per quarter.

Bradford.—Electric Cookers.—The Corporation Electricity Committee has decided to introduce a scheme for letting out electric cookers on hire. The charge for large cookers will be 12s. 6d. per quarter, and for small cookers, 10s. These charges will include the cost of wiring, which will be done by local contractors. The charge for energy for cooking will be ½d. per kWh.

Brazil.—Sao Paulo.—The Sao Paulo Tramway, Light and Power Company has been granted the right of utilising rivers and land in the municipalities of Sao Paulo, Sao Bernardo, Santo Armaro, Itapecirica, Una, Conceiçao de Itanhaen, Mogy das Cruzes, Sallesopolis and Santos for developing hydro-electric energy, and extending power transmission lines to the City of Sao Paulo and to any other city for which the company has obtained a concession. It is hoped that when these new works are completed the company will be able to meet the demands of the City of Sao Paulo and the neighbouring towns.

Canada.—Bathurst, N.B.—At the coming session of the New Brunswick Legislature, authority will be sought to increase the hydro-electric plant of the Bathurst Company to 20,000 continuous h.p. At the present time the company's power plant on the Nepisiquia river is capable of developing 10,000 h.p.

Chesterfield.—Price Reductions.—The Town Council has reduced the charge for electricity for lighting to 4d. per kWh. Meter rents for heating and cooking have been abolished.

Continental. — ITALY. — The Società Idroelettrica Ligure Meridionale has secured a concession to establish a hydro-electric power station with a capacity of 17,354 h.p. to utilise the water power of the River Calore, near Montella. The Società Idrolettrica del Isares has also secured powers to utilise the River Isares, near Cardano, to develop 152,700 h.p.

SWITZERLAND.—The St. Gall-Appenzell Power Co. has decided to erect a large new hydro-electric station at Limmern at an estimated cost of £2,040,000.

BELGIUM.—The Société du Chemin de Fer Electrique d'Ostende-Blankenberg et Extensions, in its report for last year states that the plant at its power station at Slykens has recently been extended and now comprises four steam turbo-generators with a total capacity of 14,000 kW. In addition to furnishing the power for its light railways, the company is now supplying electricity for lighting and power purposes throughout the war-devastated area of Western Flanders. In order to maintain an uninterrupted supply a connection has lately been made with the distribution system of the Société des Centrales Electriques des Flandres which has power stations at Langerbrugge and Zeebrugge.

JUGO-SLAVIA.—Plans are being prepared for the construction of a power station to be erected at Varvariu in Central Serbia.

FRANCE.—La Société des Forces Motrices de la Valée d'Aspe has secured a concession to establish two 80,000-V transmission lines between Pau and Bedous.

The Société de l'Energie Electrique Alpine, of Gap, has secured a concession to establish a hydro-electric power station to utilise certain falls near Saulec in the Hautes Alpes Department.

Dover.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £3,000 for services.

East Ham.—LOANS.—The Electricity Committee has obtained sanction to the borrowing of £10,500 for mains and switchgear. The committee is applying for sanction to loans of £5,000 for machinery at the power station, and £14,600 for feeder cables to Manor Park sub-station.

Ecuador.—GUAYAQUIL.—The municipality has concluded a contract with the Guayaquil Electric Light Co., to provide an electric lighting service for twenty years. A hydro-electric plant will be constructed near Bucay. All equipment will be purchased abroad.—*Reuter's Trade Service* (Guayaquil).

Faversham.—LOAN.—The Town Council has applied for sanction to a loan of £2,400 for cable renewals.

Finchley.—LOAN.—The Electricity Committee is seeking sanction to a loan of £29,000 for plant and sub-stations.

Fleetwood.—NEW PLANT.—The Mid-Lancashire Electricity Board has considered the application of the Town Council for sanction to carry out electricity extensions, and has approved the proposal to spend £31,000 on the installation of additional machinery instead of taking a bulk supply from the new Ribble station at Preston.

Gravesend.—INQUIRY.—Col. Ekin held an inquiry on April 22nd, into the application of the Corporation for power to supply electricity in the parishes of Darenth, Fawkham, Hartley, Horton Kirby, Longfield, Southfleet, Stone, Swanscombe, Chalk, Denton, Ifield, Meopham, Nursted, and Cobham. Mr. R. M. Montgomery, K.C., who appeared for the Corporation and the Dartford Urban District Council, said that it was proposed that the charges for electricity in the added districts should be the same as at Gravesend. With regard to the Kent Electric Power Co., Ltd., and the West Kent Electric Power Co., Ltd., he said that they had done nothing in the area named for over 20 years, and only laid down mains after the Corporation had given notice of its intention to apply for an Order. They had had applications for supply from Greenhithe, Swanscombe, Meopham, and Denton. There was opposition by the Kent Electric Power Co., Ltd., and the County of London Electric Supply Co., Ltd., and on behalf of the former Mr. Craig Henderson, K.C., stated that the Company had a sub-station in Swanscombe, and mains were laid for supply in that area and also at Cobham and Meopham. It had spent more than half a million in developments.

Harrogate.—LOAN.—The Town Council has applied for sanction to a loan of £44,000 for electricity purposes in place of £21,281 already applied for

Hull.—ELECTRICITY SUPPLY.—The Beverley and Cottingham local authorities have applied to the Corporation for a supply of electricity, the former stipulating that the charge to consumers must not be more than 40 per cent. above that to consumers in Hull. The Corporation Electricity Committee is to consider the applications.

Irish Free State.—LETTERKENNY (Co. DONEGAL).—The Donegal Mental Hospital Management Committee is installing new electric lighting plant at a cost of £1,420.

Japan.—SHINANO-KAWA POWER STATION.—The Shinyetsu Denryoku K. K. has received the sanction of the Government to the erection of its Shinano-kawa power station, which will have a capacity of 166,000 kW. The work of construction will commence this year, and be completed in four years. The cost is estimated at 90,000,000 yen.

Llantarnam.—INQUIRY DECISION.—In connection with the inquiry held in November last by the Electricity Commissioners into the rival applications of the South Wales Electrical Power Co., and the Urban District Council, for powers to supply electricity in the Llantarnam and Llanfrechfa Upper districts, the Commissioners have granted the Council's Order, and rejected the company's application in so far as its relates to Llantarnam.

London.—SHOREDITCH.—The Lighting Committee has recommended to the Borough Council a scheme for wiring small houses for lighting only, except that a special adaptor will be fitted for an electric iron or other small domestic appliance. The scheme will apply only to houses in streets where mains are already or will be laid, and electricity will be charged for at the ordinary flat rate for lighting, plus 1½d. per kWh for rental Payment will be made through prepayment meters. It is proposed to set aside £500 in the estimates for the current year for this purpose.

HACKNEY.—The Electricity Committee has recommended the expenditure of £11,750 and £8,250 for the erection of sub-station buildings at Stamford Hill, and the provision of plant required respectively.

Sanction has been received to a loan of £19,000 for buildings and cranes in connection with the electricity undertaking.

POPLAR.—The Electricity Committee has received sanction to loans of £23,500 for buildings, £18,500 for plant, and £7,500 for steam and feed water systems, &c.

PROPOSED CHANGE-OVER.—The Notting Hill Electric Lighting Co., Ltd., has applied to the L.C.C. for consent to an alteration in its system of supply to 400-200 V, 3-wire, d.c.

Louth.—ELECTRICITY SCHEME.—The Town Council has asked the Electricity Commissioners to supply the names of six firms of electrical engineers whose terms to prepare a report on an electricity scheme are to be ascertained.

Luton.—ELECTRICITY EXTENSIONS.—The Electricity Committee has decided to increase the boiler capacity at the power station at a cost of £14,500, and to install converters, &c., at a cost of £14,000.

Newport (Mon.).—LOAN.—The Electricity Committee is seeking sanction to a loan of £3,000 in connection with its assisted wiring scheme.

Newport Pagnell.—OPPOSITION TO SCHEME.—The Rural District Council has decided to oppose a proposal of the Northampton Electric Light & Power Co., to erect poles in Olney, for overhead cables.

Northern Ireland.—WHITEHEAD (Co. ANTRIM).—Application is being made to the Electricity Commissioners by Messrs. Curran Bros., Belfast, for sanction to the erection of a generating station for the supply of electricity to the town.

Peak District.—ELECTRICITY SUPPLY.—The position in regard to electricity supply in this district is becoming more complicated. The New Mills Council has refused to join with Chapel-en-le-Frith, Whaley Bridge, Disley and Maccesfield Councils in applying for an Order to supply electricity in the district, and the Councils do not feel justified in moving without New Mills' co-operation. Meanwhile the Power Development Company has applied for an Order to supply all the districts named except New Mills.

Portsmouth.—LOAN.—The Electricity Committee is applying for sanction to a loan of £37,000, in connection with the supply of electricity to its added areas.

Retford.—LOAN.—The Town Council is applying for sanction to the borrowing of £40,412 in connection with its electricity scheme.

Sale.—CORRECTION.—Under the heading "Price Reductions," we stated in our last issue that the revised private house domestic rate was 20 per cent. of the rateable value, plus 1½d. per kWh during the summer quarters and ¾d. per kWh during the winter quarters. We regret the error; the correct "unit" charges are ½d. and ¾d. respectively, the idea being, of course, to increase the summer consumption.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has during the past month approved extensions and works at an estimated cost of £1,145, and extensions of mains for general distribution purposes, at an estimated expenditure of £17,361.

South Africa.—JOHANNESBURG.—According to the *South African Engineer*, work on the municipal power station extension is now in hand. The new building will house a 10,000 kW set, two boilers and pumping plant, with all accessories. It is expected that the erection of the machinery will begin about June, and be in operation by September.

DURBAN.—At the forthcoming session of the Natal Provincial Council application will be made on behalf of the Town Council for increased borrowing powers to an amount of £775,000, which will include £350,000 for electricity purposes.

QUEENSTOWN.—The Town Council is to proceed with its scheme for an entirely new power station and equipment. estimated to cost £30,000. The plant will include two 250-kW sets and two 8,800-lb. boilers.

South-East Lancashire Electricity Advisory Board.—TRANSMISSION LINE: RADCLIFFE TO PADIHAM.—The Engineering Advisory Committee has considered a proposal of the Lancashire Electric Power Co., to provide a 33,000-V transmission line to interconnect its Radcliffe and Padiham stations, at an estimated cost of £86,386, and has resolved that the scheme be approved.

ASHTON-UNDER-LYNE.—The Committee has received details of the Manchester offer for bulk supply, and an estimate of the cost of plant extensions at Ashton, and has decided that the question shall be adjourned.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

South Shields.—LOANS SANCTIONED.—The Town Council has received sanction to loans of £10,000 in connection with the provision of pre-payment meters and wiring installations to be let on hire, and £8,500 for mains and sub-station equipment.

EXTENSION OF SUPPLY.—The Electricity Committee is to extend the electricity supply to the housing estate, at an estimated cost of £7,500.

Special Orders.—Application has been made to the Electricity Commissioners by the Aldershot Gas, Water & District Lighting Co., for a Special Order authorising it to extend its area of electricity supply, so as to include the urban district of Fleet, and certain parishes in the rural districts of Hartley, Wintney, Basingstoke, Guildford and Hambledon.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Wrexham Rural District Council to supply electricity in the district and part of the rural district of Hawarden; the Teignmouth Electric Lighting Co., Ltd., to supply in part of the rural district of Newton Abbot; and the Electrical Distribution of Yorkshire, Ltd., within the rural district of Hemsworth.

Tramway and Railway Notes.

Continental.—FRANCE.—The Compagnie des Tramways de Cherbourg has received sanction to proceed with the electrification of the steam tramway between Querquerville and Urville-Hague.

ITALY.—On April 21st, the Minister of Communications opened the section of the railway between Spezia and Sestri Levante (24 miles in length), which was recently electrified. The whole of the line between Modena and Spezia, a distance of 225 miles, has now been electrified, and it is intended eventually to continue the line as far as Leghorn. Italy will then possess the longest stretch of electrified railway track in the world.—*Reuter* (Spezia).

AUSTRIA.—The *Elektrotechnik und Maschinenbau* gives some particulars of the progress of the electrification of the railway system in Austria. The first programme included the electrification of the Salzkammergut line, which was completed in the summer of 1924, and the Alberg line between Innsbruck and Bludenz, opened in May last year. Work on the second programme was immediately commenced, this comprising the electrification of the Arlberg line west of Bludenz. Altogether 45 miles of the Vorarlberg lines are in course of electrification, while similar work has also been commenced on the lines east and south of Innsbruck, the necessary capital outlay having been voted by the Austrian Parliament. The second programme also includes the electrification of the Salzburg-Worgl and Kufstein-Worgl-Innsbruck-Brenner lines, a total of approximately 190 miles. The section between Kufstein and Innsbruck is expected to be completed by the end of the present year, those between Innsbruck and Brenner and between Worgl and Saalfelden by the end of 1927, and that between Saalfelden and Salzburg by the end of 1928. The power for the railways in this second programme will be supplied from the Lake Achen, the Mallnitz, and the Stubach hydro-electric power stations. Contracts have already been placed for the electrification of the Kufstein-Worgl-Innsbruck line, and the preliminary work is well in hand. It is estimated that 75 electric locomotives will be required in connection with the second electrification programme, orders for 42 of which have already been given.

BELGIUM.—In its report for last year, the Compagnie Générale des Tramways d'Anvers states that it is to modernise its power plant, and it has been decided to install mercury rectifiers at its transformer station in place of the rotary machines at present in use. Two new transformer stations are also to be erected—one in Antwerp and one in Hoboken.

Darlington.—RAILLESS-CAR SCHEME COMPLETED.—The conversion of the Corporation's tramway system to the railless-trolley system has been completed, the last route (Harrogate Hill service) having been inaugurated on April 11th.

Japan.—NEW ELECTRIC RAILWAYS.—Applications have been made for sanction to the construction of the following electric railways:—Between Koriyama and Yimoto-machi, Fukushima-ken; from Onomichi, Hiroshima-ken to Kouko-machi, Okayama-ken; three railways, with a total mileage of 32, in the Toyama Prefecture; and from Shimizu, Shizuoka-ken to Minobu. Yamanashi-ken, a distance of 12 miles.

Musselburgh.—PROPOSED TRAMWAY PURCHASE.—According to the *Tramway and Railway World*, the Town Council has proposed that the tramway of the Musselburgh and District Electric Light and Traction Co. in the burgh shall be taken over by the Edinburgh Corporation. The company states, however, that it is not prepared to sell the undertaking at the present time upon the same terms as laid down for 1931, and the matter has been dropped.

Southend-on-Sea.—MOTOR OMNIBUSES.—The Town Council has decided to withdraw its tramway service on the Prittlewell route, and substitute motor omnibuses, augmented by railless cars.

United States.—NEW YORK.—The *Electric Railway Journal* reports that the Board of Transportation has made a formal request to the Board of Estimate for funds amounting to $100,000,000 to be spent in the construction of new subways, including a new tube from 53rd Street to Queens.

Telegraph and Telephone Notes.

Australia.—TELEPHONE SERVICE.—The annual report of the Postmaster-General shows that the telephone service working cost, for the 12 months ended June 30th, 1925, was £3,128,913, and the total revenue was £3,661,110, leaving a gross surplus of £532,196. Interest charges, however, exceeded that amount by £258,619, which represented a loss on the year's working. Capital expenditure, says the *Australian Electrical Times*, was approximately £4,000,000. Arbitration awards imposed an extra burden of £144,000 in wages during the year, in which 14,379 new telephone subscribers were connected in the metropolitan areas, and 20,301 in country districts.

TELEGRAPH SERVICE.—The telegraph services made a working loss of £53,886 for the 12 months, or, with interest added, a total loss of £227,174.

Bolivia.—RADIO-TELEGRAPHY.—The Government has thrown open for public use the 13 Marconi stations throughout the Republic in order to facilitate general communication. Heretofore the Government has prohibited the popular use of its system, the theory being that the Government service for administrative and military matters would be interfered with. According to *Commerce Reports*, the general tariff is 2.50 bolivars over and above the rate which is paid over the State telegraph line for radiograms in Spanish. For messages in a foreign language, code, or cipher, double tariff is charged.

France.—NEW TELEGRAPH APPARATUS.—A new apparatus has been installed on the Brest-Casablanca submarine cable, 1,600 miles long, which increases the working of the cable by 80 per cent. Double Baudot-Picard apparatus serves simultaneously two transmitting and receiving sectors at a speed of 140 revolutions per minute, which corresponds to 5,600 words. This improvement is due to the work of M. Carrat, Inspector of Telegraphs in Paris.—*Reuter* (Paris).

Greenland.—TELEGRAPH SERVICE.—Since February 1st last, telegraph communication with Greenland has been available to the public. Messages are transmitted by cable to Iceland and thence by wireless.

Irish Free State.—AUTOMATIC TELEPHONY.—By the end of the present year the Irish Free State will have an automatic telephone service, with about 1,400 lines. The first exchange will be in Ship Street, Dublin, and the main framework has just been installed. The installation of the fittings has been begun by a British firm which has secured the contract, and some half-a-dozen Irishmen are studying the mechanism of automatic telephones in England.

The Telephone Service.—EASTBOURNE'S AUTOMATIC PLANT.—The whole of the Eastbourne Corporation's old common-battery manual system has been replaced by a Relay centralised automatic installation, which links up 50 stations, and the switchboard in the Town Hall is built on the expanding bookcase principle, so that additional units can be added from time to time without disturbing the existing service. Under the old manual scheme, a Town Hall call to any of the outlying stations had to go through the operator at the Town Hall, who passed it through the Eastbourne public exchange, which in turn passed is through the operator at the wanted station, taking from 30 to 50 seconds, or more, and each call cost 1½d. An automatic call goes through direct in three seconds, and costs nothing. Moreover, departmental service is available all night as well as all day, and public exchange service is available over certain night lines included in this new equipment. At present 19 departments are linked up under the new scheme. Other municipalities which have adopted the Relay scheme include Battersea, Birkenhead, Birmingham Estates, Burnley, Cardiff, Hampstead, Lambeth, Leyton, the Manchester Tramway Department, and Weston-super-Mare.

TAXI-CAB TELEPHONES.—Taxi-cab telephones that can only be used for incoming calls (from the hirer to the cab rank) are being installed in various parts of Liverpool, by arrangement between the Post Office and the Liverpool Motor Cab Trade Protection Society. Manchester and Bradford have made similar arrangements for the installation of such telephones, which have been tried successfully in London. In the box containing the telephone no means of calling the exchange is provided, and the door is automatically controlled, so that an ordinary call cannot be made from that end. When a hirer calls up the cab rank, a gong sounds inside the box, and the door opens to permit the driver to reply. The Society, which rents the telephones from the Post Office, intends to have a telephone installed on every rank in the city.

Radio Notes.

Australia.—NEW TRANSMITTER.—Transmission tests from the new station at Brisbane, Queensland, have been heard 1,400 miles away at Samarai, New Guinea. The station was using 5,000 watts.

LICENCES.—Following the reduction in the number of licences in Western Australia, it would appear from figures supplied by the Postal Department that the popularity of wireless is also steadily declining in New South Wales, whereas in Victoria it shows a tendency to increase. During the month ended February 28th, 1,694 new licences were

issued in New South Wales, as compared with 7,545 in Victoria. There were then 31,625 licences in New South Wales and 44,033 in Victoria, the total for the Commonwealth being 94,227. During the month 4,273 licences were cancelled in the Commonwealth; the number now in force per cent. of the population is 1.4 in New South Wales, 2.7 in Victoria, and 1.6 for the whole of Australia.—*Reuter's Trade Service* (Melbourne).

India.—Broadcasting in Karachi.—The Karachi Radio Club has secured a transmitting set which has been loaned to it by the International Trading Co., agent of the Marconi Co. in Bombay. The municipality having granted permission, the transmitting set has been erected in Frere Hall, whence broadcasting will take place. Experiments made so far have given good results, and when sufficient progress has been achieved, it is proposed to arrange a regular broadcast programme.

Poland.—New Station Opened.—A new Polish broadcasting station was opened at Warsaw on April 18th, the speakers including Count Skrzynski, the Prime Minister, M. Grabski, Minister for Education, and M. Chamieo, president of the Polish Broadcasting Society.—*Reuter* (Warsaw).

Radio Slander.—First English Case.—In the King's Bench Division, before Mr. Justice McCardie, a settlement was announced last week of the action, the first of its kind, brought against the British Broadcasting Co., Ltd., by Messrs. Williams & Norgate, Ltd., publishers. The B.B.C. expressed an apology and regret that the inaccurate statement in question should have been broadcast and would pay the firm an agreed sum in respect of damages and costs.

Spain.—Proposed New Station.—The organising committee of the Radio Club of Alicante recently met at the Círculo Mercantil and discussed the constitution of a club and the opening of a broadcasting station. Another meeting will be held shortly to nominate the board of the club. The organising committee is of the opinion that a monthly subscription of two pesetas will cover the cost of the broadcasting.—*Reuter's Trade Service* (Madrid).

United States.—"Air Piracy" Claim.—It is reported that the Government has lost the "air piracy" case against the Zenith radio station, charged with broadcasting at illegal hours and on illegal wave lengths. The decision denies that Secretary Hoover has the power to regulate the air, and may result in chaos unless legislation by Congress is enacted.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—Melbourne.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Brisbane.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Adwick-le-Street.—May 19th. Urban District Council. H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (April 16th.)

Belgium.—Antwerp.—May 28th. Municipal Council. Three electric cranes at the Entrepôt Royal. Particulars (Cahier des Charges) for 3½ fr. from Hotel de Ville.

Bristol.—May 13th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (See this issue.)

Cheadle and Gatley.—May 3rd. Electricity Department. Electric lamps for street lighting for the year ending March 31st, 1927. Form of tender, &c., from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle, Cheshire.

Doncaster.—May 4th. Electricity Department. One 1,000-kW motor converter and l.p. switchgear. (April 23rd.)

Dublin.—May 4th. Electricity and Public Lighting Department. E.h.p. and l.p. cables, cast-iron pillars, and stoneware troughing, section pillars, compound and other materials and accessories for one or two years. (April 23rd.)

Farnworth. — May 14th. Electricity Department. Cables, street-lighting pillars, pillars and boxes, cut-outs and meter boards, and meters. (See this issue.)

Glasgow.—May 6th. Electricity Department. L.p. cables, small i.r. insulated cables and flexibles, meters and carbons for 12 months. (April 23rd.)

Hull.—May 20th. Electricity Department. Underground cables. (See this issue.)

Ilford.—May 11th. Electricity Department. One 1,000-kW La Cour motor converter. (See this issue.)

India.—India Store Department. May 7th. 15 motor-coach underframes and bodies, 30 motor bogie trucks. (March 12th.)

May 11th. One 200-kW La Cour-type motor converter. (April 23rd.)

May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*

May 15th. Madras and Southern Mahratta Railway Co., Ltd. Telephone line material (comprising porcelain insulators, galvanised terminal irons, &c.), copper line wire (1,302 miles), copper binders, tapes, &c. (April 23rd.)

May 18th. Porcelain insulator cups. (See this issue.)

London.—London County Council.—May 4th. Electric wiring and fittings at the Alton Street elementary school, Poplar, E. (April 16th.)

H.M. Office of Works.—May 7th. Steel conduits and fittings for electric wiring. (April 23rd.)

St. Marylebone.—May 5th. Electricity Department. L.p. and e.h.p. underground cables for 12 months. (April 23rd.)

Metropolitan Asylums Board.—May 19th. Installation of electric cable, &c., for arc-light treatment apparatus. (See this issue.)

Manchester.—May 11th. Tramways Committee. Electric tramcar bodies, trucks, motors, and controllers. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

Middlesbrough.—Electricity Department. Extension of electricity supply distributors, total length approx. 1,000 yd. (See this issue.)

New Zealand.—Auckland.—June 21st. Electric Power Board. L.p. insulators, &c.*

Wellington.—May 12th. Post and Telegraph Department. 18 switchboards.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

Dunedin.—May 28th. Otago Harbour Board. One portable electrically-driven cargo stacker.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

Preston.—The Tramways Committee has decided to obtain quotations for the supply of a new double-deck tramcar and the adaptation of an existing one for use on the Ashton route.

Seaham Harbour.—May 5th. Urban District Council. Overhead l.p. pole line, h.p. cables, sub-station equipment, h.p. switchgear. Specifications (£2 2s.) from Mr. J. E. Favell, consulting engineer, 22, Oxford Street, Newcastle-on-Tyne.

South Africa.—Johannesburg.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (April 23rd.)

Stockton-on-Tees.—May 10th. Electricity Department. Paper-insulated cables, a.c. meters, and house-service cut-outs. (See this issue.)

Turkey.—May 15th. Direction Générale des Postes et Télégraphes. 111,000 metres of 3, 7, 10 and 12 pair aerial telephone cable; 10,000 metres of 3, 7, 10 and 12 pair underground cable, with joint boxes and accessories.*

Walthamstow.—May 12th. Electricity Department. One 1,500-kW motor converter. (April 23rd.)

Warrington.—May 10th. Electricity Department. E.h.p. sub-station truck-type switchgear. (April 23rd.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—Melbourne:—Postmaster-General's Department. Accepted:—

Night switching and dialling keys, ring-back keys, and speak-and-ring keys (£1,971).—Telephone Mfg. Co., Ltd.
Plug-seat switches (£782).—British L. M. Ericsson Mfg. Co., Ltd.
5 miles of cable, 12 pair (£1,187).—Hackbridge Cable Co., Ltd.

Brisbane.—Postmaster-General's Department.

Four loading coil cases, containing 80 coils each (£1,104).—Standard Telephones & Cables (Aust.) Ltd.

Sydney.—New South Wales Railways.

21,000 yd. 66,000-V, single-core lead-covered cable (£10,944).—Enfield Cable Works (Aust.), Ltd.

—*Tenders.*

Barnes.—Urban Council. Accepted:—

Supplying and laying cables (£8,463).—Siemens Bros. & Co., Ltd.

Belfast.—Electricity Department. Accepted:—

Time switches for 12 months.—Venner Time Switches, Ltd.

Bexhill.—Electricity Committee. Recommended:—

500 yd. 3-core cable (£143).—Enfield Cable Works, Ltd.
Cable for switchboard extension (£121).—British Insulated Cables, Ltd.

Government Contracts.—The following Government contracts were placed during March, 1926:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Rewinding motor alternators.—Small Electric Motors, Ltd.
Aluminium sheets, &c.—British Aluminium Co., Ltd.
W./t. ammeters.—H. W. Sullivan, Ltd.
W./t. boards.—W. McGeoch & Co., Ltd.; Whipp & Bourne, Ltd.
Circuit boxes.—Basebe, Sadler & Co., Ltd.; Engineering & Lighting Equipment Co., Ltd.; Foster Engineering Co., Ltd.; General Electric Co., Ltd.; Hawkers, Ltd.; Player & Mitchell; Whipp & Bourne, Ltd.
Electric cable.—Anchor Cable Co., Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India Rubber Works, Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.
Cells.—Fuller's United Electric Works, Ltd.
Coils, w./t.—H. W. Sullivan, Ltd.
W./t. condensers.—Dubilier Condenser Co., Ltd.; Sparklets, Ltd.
Electric travelling crane.—J. Booth & Bros., Ltd.
Electric heating elements.—Credenda Conduits Co., Ltd.
W./t. frameworks.—Westminster Engineering Co., Ltd.
W./t. heterodyne units.—H. W. Sullivan, Ltd.
W./t. inductances.—H. W. Sullivan, Ltd.
Electric lamps.—Siemens & English Electric Lamp Co., Ltd.
W./t. masts.—C. F. Elwell.
Mica.—Mica & Micanite Supplies Co., Ltd.; Dacier, Ltd.; Micanite and Insulators Co., Ltd.; Mica Mfg. Co., Ltd.
W./t. motor alternators and motor generators.—Newton Bros. (Derby), Ltd.
Electric motors.—Brush Electrical Engineering Co., Ltd.
W./t. panels.—H. W. Sullivan, Ltd.
Automatic starters (w./t.).—Watford Electric Mfg. Co., Ltd.
Switchboard and switchgear.—Edison Swan Electric Co., Ltd.
Changeover switches.—General Electric Co., Ltd.
Tin wire.—C. Clifford & Son, Ltd.; British Insulated Cables, Ltd.
Valves.—Mullard Radio Valve Co., Ltd.
Valves and lamps.—Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

WAR OFFICE.

W./t. valves.—British Thomson-Houston Co., Ltd.; A. C. Cossor, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.

AIR MINISTRY.

8,000 inert batteries.—Edison Swan Electric Co., Ltd.
Cable and boxes (Karachi).—Standard Cables & Telephones, Ltd.
Motor alternator (Kidbrooke).—Electric Construction Co., Ltd.
Repair of magnetos.—British Thomson-Houston Co., Ltd.
W./t. mast stays.—Bullivant & Co., Ltd.
Transmitter and receiver.—Marconi's Wireless Telegraph Co., Ltd.

POST OFFICE.

Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.
Battery stores.—Accumulators of Woking, Ltd.; Alton Battery Co., Ltd.; D.P. Battery Co., Ltd.; Hart Accumulator Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. and Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Joint-box castings.—United Steel Co.'s, Ltd. (T. Butlin & Co.).
Testing and protective apparatus.—Automatic Telephone Mfg. Co., Ltd.; British Thomson-Houston Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.; Standard Telephones & Cables, Ltd.
Cords for telephones.—British Insulated Cables, Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fire Brick Co., Ltd.; Doulton & Co., Ltd.; Hepworth Iron Co., Ltd.; H. R. Mansfield, Ltd.; J. Oakes & Co. (Reddings Collieries), Ltd.; Oates & Green, Ltd.; Standard Brick & Terra Cotta Co., Ltd.; Sykes and Son.
Electric light fittings.—Cable Accessories Co., Ltd.
Hand lamps.—Cable Accessories Co., Ltd.
Lamps.—Edison Swan Electric Co., Ltd.
Insulating tape.—Connollys (Blackley), Ltd.
Replacing batteries (Manchester (Central) telephone exchange).—D. P. Battery Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—London-Dorking: Siemens Bros. & Co., Ltd. London-Welwyn: W. T. Henley's Telegraph Works Co., Ltd.
Electric lighting (Brighton new sorting office and telephone exchange).—A. Hawkins & Sons.
Radio station power plant (St. Albans).—British Thomson-Houston Co., Ltd.
Telephone exchange equipment.—Macclesfield: Standard Telephones and Cables, Ltd.; sub-contractors: Electric Construction Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines. North, Leith, Birmingham (East): Standard Telephones & Cables, Ltd. Kelvin, Cheltenham, Ipswich, Torquay: Automatic Telephone Mfg. Co., Ltd. Southend (2nd relief): Siemens Bros. & Co., Ltd.; sub-contractors: English Electric Co., Ltd., for charging machines; Crompton & Co., Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Beauchief, Hereford: Siemens Bros. and Co., Ltd. Foleshill (Coventry): General Electric Co., Ltd.; sub-contractors: Crompton & Co., Ltd., for charging machines; Automatic Telephone Mfg. Co., Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Harrogate: General Electric Co., Ltd.; sub-contractors: Crompton & Co., Ltd., for machines; D. P. Battery Co., Ltd., for batteries. Clerkenwell: General Electric Co., Ltd.
Private branch exchange telephone equipment.—Motherwell County Hospital; Gaumont & Co., Ltd. (W.); Armitage & Rigby, Ltd. (Manchester); Ye Mecca, Ltd. (S.E.); Burnley Corporation; Shell-Mex, Ltd. (S.W.); A. Dunkelsbuhler & Co. (E.C.); Swan & Edgar, Ltd. (W.); Maypole Dairy Co., Ltd. (E.C.); Camberwell Board of Guardians (S.E.); T. Forman & Sons (Nottingham).—Relay Automatic Telephone Co., Ltd.

H.M. OFFICE OF WORKS.

Imperial Institute, S.W., wiring.—F. Troy & Co., Ltd.
Cable.—Lydbrook Cables, Ltd.

CROWN AGENTS FOR THE COLONIES.

Cables.—British Insulated Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Standard Telephones & Cables, Ltd.; St. Helens Cable and Rubber Co., Ltd.
Copper wire, &c.—Shropshire Iron Co., Ltd.; R. Johnson, Clapham and Morris, Ltd.; Elliott's Metal Co., Ltd.
Electric portal cranes.—W. Arrol & Co., Ltd.; Wellman, Smith & Owen Engineering Corporation.
Electrical materials.—F. Smith & Co., Ltd.
Tubular poles.—Siemens Bros. & Co., Ltd.

Irish Free State.—DUBLIN.—The following contracts were placed by the Controller of Stores (Posts and Telegraphs) from February 23rd to March 22nd, 1926:—

Battery boxes, Leclanché.—G. Perry & Co., Ltd.
Broadcasting supply instruments.—Marconi Wireless Telegraph Co., Ltd.
Cable.—F. Routledge; Victor Zorn; Enfield Cable Works, Ltd.
Copper wire.—W. F. Dennis & Co.; Siemens-Schuckert (Ireland), Ltd.
Generators.—Sterling Telephone & Electric Co., Ltd.
Megger.—Evershed & Vignoles, Ltd.
Cable rings.—Standard Telephone & Cables, Ltd.
Telephone cabinets.—Siemens Bros. & Co., Ltd.; British L. M. Ericsson Mfg. Co., Ltd.
Switchboard parts.—Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; International Electric Co., Ltd.

London.—LONDON COUNTY COUNCIL.

Tram track rails (about 4,400 tons) for the next 12 months:—

Bolckow, Vaughan & Co., Ltd. (Accepted.)	**£46,607**
Cargo Fleet Iron Co., Ltd.	48,819
Alexr. McBean & Son (for Dorman, Long & Co., Ltd.) ...	50,415

20-V, 20-amp. accumulators.—Edison Swan Electric Co., Ltd.

Education Committee. (Accepted.)

Alterations to electric lighting, Shap Street school, Shoreditch (£226).—G. Keetch.

STEPNEY.—Electricity Supply Committee. Accepted:—

4 tons plumber's solder (£408).—G. W. Neale, Ltd.
12 feeder boxes and 12 sub-feeder boxes (£399).—British Insulated Cables, Ltd.
24 single feeder boxes (£150).—W. Lucy & Co., Ltd.
4 tons sheet lead (£175 10s.).—G. Farmiloe & Sons, Ltd.
100 tons pitch (£494).—Gas Light & Coke Co.

GREAT WESTERN RAILWAY.

Two 30 cwt. electric luggage lifts at Queen Street station, Cardiff, and an 8-cwt. electric lift at the west end of the general offices at Paddington.—Smith, Major & Stevens, Ltd.

Morley (Yorkshire).—

Electrical wiring, &c., municipal houses on Middleton Road estate (£341).—F. W. Rhodes.

Northampton.—Rural Council. Accepted:—

Wiring Council houses at Bugbrooke and Nether Heyford (£5 17s. 9d. per house).—Northampton Electric Light & Power Co., Ltd.

Peterborough.—Town Council. Accepted:—

Boiler plant (£34,190).—International Combustion, Ltd.
Pulverised fuel plant (£24,936).—Simon-Carves, Ltd.
—*Peterborough Standard.*

Preston.—Electricity Committee. Recommended:—

Cables (£6,633).—British Insulated Cables, Ltd.
Transformers.—English Electric Co., Ltd. (£1,226); Ferranti, Ltd. (£1,000).

Preston-Blackpool transmission line:—

45,000-V underground cable (£15,572).—W. T. Glover & Co., Ltd.
Transformers (£21,138).—English Electric Co., Ltd.
Switchgear (£3,907).—Metropolitan-Vickers Electrical Co., Ltd.
Overhead line in Longton area (£3,711).—Callender's Cable & Construction Co., Ltd.

Retford.—Town Council. Accepted:—

Generating plant (£12,020).—Electric Construction Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—

Replating the traction battery (£3,050, less allowance for old plates, £738).—Chloride Electrical Storage Co., Ltd.

Swansea.—Electricity Committee. Accepted:—

Oil purifier (£175).—Haslam & Stretton, Ltd.

Todmorden.—

Electric lighting installation at Todmorden Hall, Post Office.—B. Beattie.

Torquay.—Electricity Committee. Accepted:—

1,000-kVA, 3/2-phase transformer group (£832).—British Electric Transformer Co., Ltd.
Switchgear (£574).—British Thomson-Houston Co., Ltd.

Tynemouth.—Electricity Committee. Accepted:—

Cable.—Standard Telephones & Cables, Ltd. (£604); Macintosh Cable Co., Ltd. (£142 and £1,635).

Forthcoming Events.

Royal Institution.—Friday, April 30th. At 21, Albemarle Street, W.1. At 9 p.m. Lecture on "Wireless in the Empire," by Dr. W. H. Eccles.
Thursday, May 6th. At 5.15 p.m. Lecture on "The Imperfect Crystallisation of Common Things," by Sir William Bragg. (Lecture II.)

Junior Institution of Engineers.—Friday, April 30th. At the Royal United Service Institution, Whitehall. At 7.30 p.m. Gustave Canet Memorial Lecture, "Air Transport," by Air Vice-Marshal Sir W. Sefton Brancker.
Friday, May 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette, "Distortion in Wireless Reception," by Mr. A. V. Ballhatchet.

Institution of Engineers-in-Charge (Inc.).—Friday, April 30th. At the Holborn Restaurant, London. At 6 p.m. Annual dinner.

Institution of Electrical Engineers (Western Centre).—Monday, May 3rd. At the Chamber of Commerce, Swansea. At 6 p.m. Paper on "An All-Electric House," by Dr. S. P. Smith.

(Wireless Section).—Wednesday, May 5th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "The Lateral Deviation of Wireless Waves and the Development of an Accurate Direction-Finder," by Messrs. R. L. Smith and R. H. Barfield.

(Scottish Centre).—Friday, April 30th. At the Y.M.C.A. Hall, Constitution Road, Dundee. At 7.30 p.m. Lecture on "The Past, Present, and Future Development of Wireless Telephony," by Capt. P. P. Eckersley. Saturday, May 1st. Excursion to St. Andrews.

Society of Engineers.—Monday, May 3rd. At the Science Museum, South Kensington, S.W. At 5.30 p.m. Paper on "Landmarks in the History of Prime Movers," by Mr. H. W. Dickinson.

National Association of Supervising Electricians.—Tuesday, May 4th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7.15 p.m. W. E. Highfield Shield Competition.

Roentgen Society.—Tuesday, May 4th. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

Edinburgh Electrical Society.—Wednesday, May 5th. At the Royal Scottish Society of Arts, 117, George Street. At 8 p.m. Business meeting.

Royal Society of Arts.—Wednesday, May 5th. At John Street, Adelphi, W.C. At 8 p.m. Lecture on "Radio: Its Past, Present, and Future," by Mr. C. F. Elwell.

Electrical Association for Women.—Friday, May 7th. At the Criterion Restaurant, Piccadilly, W. At 1 p.m. Luncheon.

(Manchester District Branch).—Wednesday, May 5th. At the Lesser Free Trade Hall, Manchester. At 7.30 p.m. Public meeting.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 8th. At Brecon. Annual meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

COLERIDGE electric irons.

Notes.

The Burgh of Hamilton Vacancy.—In our last issue in our "Personal" column we reported, on the authority of our Glasgow correspondent, that "Mr. W. J. Cooper, acting electrical engineer at Hamilton Electricity Works, has been appointed electrical engineer for the Burgh of Hamilton." In our advertisement pages of the same issue we published the Town Council's invitation for applications for the appointment. We subsequently received a communication from the Town Clerk of Hamilton informing us that the "Personal" column statement was incorrect, and had caused inconvenience to applicants. Further investigation shows the facts of the situation to be as follows:—The Town Council Electric Lighting Committee unanimously agreed to recommend that Mr. W. J. Cooper, at present acting electrical engineer, be appointed electrical engineer for the burgh. When the recommendation came before the Town Council, there was an amendment that the Council advertise for an engineer. The voting was six for the recommendation and six for the amendment. The Provost gave his casting vote for the amendment, and it was therefore agreed to advertise.

In the absence of the exact details, our correspondent accepted as authentic a report published in Glasgow. We have to express our regret to those concerned for any inconvenience to which they have been put in connection with the matter.

The Electricity (Supply) Bill.—This Bill came before a Standing Committee of the House of Commons on Tuesday last. Criticism was directed against the proposed Central Board, which, Sir Joseph Hall suggested, would in effect be merged in the Electricity Commission. Sir Charles Wilson considered that there was no need for such a board, as the Electricity Commissioners were quite competent to accomplish the aims of the Bill. Mr. Wallhead protested against the subjugation of efficient municipal undertakings to the Board.

A report of the proceedings will appear in our next issue.

Stage Lighting.—A discussion on this subject took place at the meeting of the Illuminating Engineering Society on March 30th, which was held at the E.L.M.A. Lighting Service Bureau. Mr. J. W. T. Walsh presided. Mr. H. Lester Groom, who opened the discussion by presenting a paper, illustrated by slides and exhibits of apparatus, pointed out that lighting on the stage was now called upon to discharge functions not associated with it in the past. It did not merely serve to permit the spectator to follow the play, but also enabled certain mental effects to be created, so that it reinforced and supplemented the action. In this connection he quoted from Kenneth McGowan's book on "Continental Stage Craft." The aim of stage lighting is to provide light of any intensity, hue and tint, just when and where it may be required. For this purpose a great variety of lighting implements is needed.

Mr. Groom then proceeded to describe and illustrate the action of footlights, battens or border lights, spot lights and portable units, and the cyclorama. The most important development of recent years has been the effort to obtain a representation of realistic and natural atmospheric effects on the stage. For this purpose cycloramas are extensively used abroad, and consist of two types, a solid "sky dome" consisting of a plaster surface supported by a metal framework, and a movable canvas "artificial horizon" cloth running on a curved rail, which can be rolled up out of the way when not required. The use of this device involves some modfiication in the lighting of the acting area, as care has to be taken to prevent light from battens, footlights, &c., striking the canvas. Special floods called "acting area floodlights" are used and are dimmed down sufficiently to avoid interference with the lighting of the cyclorama. Details of cyclorama lighting and panorama and cloud-forming apparatus were given, and the arrangement of the battery of colour-elements was described. Taking the complete range of conditions from a small theatre to a large opera house, the power consumption for this equipment may range from 20 to 100 kW.

Mr. Groom also discussed the choice of dimmers, on which successful lighting largely depends, and emphasised the importance of the whole stage lighting being controlled from one central position. In the final section of the paper a reference to the possibilities of colour on the stage was made. The author explained how modifications in the colour of light, falling on a painted background, may entirely change the appearance of scenery; this principle has been applied to produce ingenious transformations in the garments of dancers; in the same way fluorescence of garments impregnated with special dyes, under the action of ultra-violet light, has been used.

There is now a distinct tendency for kinema theatres to combine the exhibition of films with displays of a more or less theatrical character and some of the latest theatres, especially in Germany, have been fitted with complete stage-lighting equipment. The cyclorama apparatus may form a valuable auxiliary in kinema displays, provided sufficient depth of stage is allowed to give a proper perspective. At the recently opened Plaza Theatre in London a completely equipped stage, including the cyclorama, has been provided.

In conclusion Mr. Groom remarked that the stage lighting of the future would require the co-operation of the scenic artist, the producer, and the stage-lighting expert.

The discussion was opened by Mr. L. G. Applebee, who exhibited a variety of stage-lighting units and lantern slides illustrating the application of flood lighting at the Searchlight Tattoo at Wembley. An effective demonstration was also given of projecting apparatus enabling the motion of waves of the sea, falling snow, and fire and smoke to be imitated.

Local Society.—A meeting of the Birmingham Electric Club took place on April 23rd, when Mr. C. G. McDonald opened a discussion on "Regulations for the Electric Equipment of Buildings." The summer outing of the club is arranged for May 14th to the English Electric Company's works at Preston.

Electro-Farming Conference.—Under the auspices of the British Electrical Development Association Agricultural Sub-Committee, the second British Electro-Farming Conference will take place on July 8th in the Members' Tent on the Showground of the Royal Agricultural Society at Reading, by the courtesy of the Council of the Royal Agricultural Society. Further details of the Conference will be issued later.

The L.C.C.'s Annual Estimates.—The estimates for the year 1926-27 were to be submitted to the London County Council at its meeting on Tuesday last. The agenda for the meeting contained a number of amendments to items in the estimates, including one providing for the operation of petrol and trolley omnibuses by the Council, and another to empower the Council to own and operate tube railways, and to acquire the existing underground railways.

Extensions at Wallasey.—The opening of the new extensions to the Wallasey Corporation power station was performed on April 21st by the Mayoress, Mrs. J. W. Holdsworth, in the presence of a large company of electrical engineers and local representatives, and the event was celebrated by an official luncheon after the ceremony.

The Mayor of Wallasey, Alderman J. W. Holdsworth, J.P., in proposing "The Electricity Undertaking, Engineer and Staff," said that Wallasey inaugurated her electricity supply in 1897, from which time it had proved itself an asset both from the point of view of finance and service. A matter of £120,000 had been contributed to the relief of rates. The Corporation was proud of its electricity undertaking, and claimed that it was second to none in the country. He paid a tribute to Mr. B. T. Hawkins, the borough electrical engineer, and his staff. New consumers were being connected at the rate of 1,000 per annum in spite of the zeal and energy of the Corporation Gas Committee. Their immediate neighbour, Birkenhead, was drawing large supplies of electricity from Wallasey, and in return Wallasey was taking large supplies of Birkenhead water.

Mr. E. M. Hollingsworth, M.I.M.E., M.I.E.E., said it was some years since he had visited the Wallasey undertaking, whose progress had been incredibly rapid. Wallasey was in the forefront of electricity supply. Its record as regarded thermal efficiency, low cost of production, average selling prices, and reliability of supply was outstanding. He had burned midnight oil in trying to understand the Electricity Supply Bill, particularly Clause 30, which referred to the lopping of trees, &c. In going through the Wallasey power station his sympathy with the promoters of the Bill was intensified. If there were more stations like Wallasey's the problem of the Government would be simple.

Alderman E. G. Parkinson, J.P., proposed "Neighbouring Electricity Undertakings." Electricity, he said, was rapidly becoming a marked feature in the life of this country. The electrical industry was still in its youth, and almost every day there seemed to be something fresh to learn.

Councillor G. P. Dennis, chairman of the Birkenhead Electricity Committee, urged the need for co-ordination in the matter of electricity supplies between the Merseyside boroughs. If it were possible to get the electrical engineers of Liverpool, Birkenhead, and Wallasey together, to draw up a scheme for the electrical development of the Merseyside towns it would be of advantage to the whole district.

Councillor J. Hughes complimented the contractors and Mr. A. T. Brotherton, Brush Electrical Engineering Co., Ltd., and Mr. W. Bayliss, Messrs. Babcock & Wilcox, Ltd., made suitable replies.

Councillor J. McMillan, M.B., said that the scheme which had been consummated that day had cost over £100,000. The financial policy of the Electricity Department was to build up reserve funds so that no matter what the Government decided to do, Wallasey would always have a financially sound electricity undertaking.

Councillor J. Hughes said that in 1913 each kWh generated at the Wallasey undertaking required 7½ lb. of fuel; in 1918, when the new station was opened, the fuel consumption was 3.89 lb., and to-day it was 2.7 lb. They had over 10,000 consumers. The capital expenditure in 1913 was £123,000, and in

1926 £453,748. The gross revenue had increased from £32,517 to £124,000 within the same period.

On behalf of the electrical contractors, Mr. Brotherton then presented a silver salver, suitably inscribed, to the chairman of the Electricity Committee and also to the Mayoress. The members of the Council also presented a roll-top desk and a bookcase to the chairman of the Electricity Committee, to mark the occasion of his recent marriage.

After the luncheon the visitors made a motor tour round the northern extremity of the Wirral Peninsula, returning via Birkenhead. The extensions include two 35,000-lb. Babcock & Wilcox boilers, a 5,000-kW Brush-Ljungström turbo-alternator, an electrically remote-controlled switchboard, by the Metropolitan-Vickers Electrical Co., Ltd., and coal- and ash-handling plant and auxiliaries.

Italian Railway Electrification.—In connection with the recent decision of the "Ferrovia Nord" (Italy) to electrify portions of its suburban railway system between Milan and Saranno and between Bovisa and Meda, it is understood that the Brown Boveri organisation has secured the contract for the electrical equipment "against very strong competition." At present the work to be carried out consists of:—(1) The electrical equipment for the sub-station at Novate, consisting of three 2,000-kW sets of power rectifier plant operating at a d.c. pressure of 3,000 volts, the step-down being from three-phase, 22,000 volts at 42 periods. (2) The electrical equipment of eight four-axle motor coaches, each provided with four 184-h.p. (one hour rating) motors, operating two in series across 3,000 volts. (3) The electrical equipment of eight trailer coaches, provided with drivers' cabs. A train will generally consist of a motor coach at one end, with two or three ordinary trailers according to requirements, and a trailer with a driver's cab at the other end. Control will thereby be obtained at both ends without the necessity of using two motor coaches. The normal speed of the trains will be about 33.5 m.p.h., and the maximum speed about 62 m.p.h. The latest improvements with regard to electro-pneumatic safety control will be embodied, being such that in the event of an accident to the driver the train will be automatically brought to a standstill. The safety arrangements operate in such a manner that a time interval must elapse before they come into operation; that is to say, they will only operate after a certain distance has been covered, so that if the driver leaves his position for a few moments the train will not unnecessarily be stopped. An interesting feature is the fact that high-power rectifiers are being again used for the conversion, while a further point is that the control, as well as the arrangement of the trailers, is not only suitable for suburban service, but also for underground conditions. The electro-pneumatic control referred to can be applied equally well for cases where other systems are at present in use.

Fatalities.—An inquest was held at Torquay on Herbert Burney (14), an apprentice to Mr. S. E. Hunt, electrician, 8, Torwood Street, Torquay, who received a fatal electric shock in the basement of his employer's premises. It appears that an old flexible cord which was supplying a light in the cellar from the shop above, was making contact with tubing stored in that department, and that the boy obtained the shock from contact with the tubing. The cellar was damp. Mr. H. F. G. Woods, the Torquay Borough Electrical Engineer, said it was obvious that the flex produced had been badly rubbed in two places, and that if it became entangled with the tubing the whole of the latter would become alive. It was stated by two doctors that the lad was in a somewhat abnormal condition and that it was due to that fact that a shock at 200 volts had killed him. In recording a verdict of "Accidental Death," the Coroner said he could not shut his eyes to the fact that there had been thoughtlessness, and for all he knew a jury might have taken a more serious view of it. He hoped those who read the facts in the papers would take notice of them and adopt proper precautions and see that these thoughtless things were not done. The Coroner thanked Mr. Hunt for doing what he could for the boy.

While working on the construction of a concrete bed on the City and South London Railway extension to Morden at Balham, on April 26th, Edward Cox slipped and touched the "live" cable, receiving a fatal shock.

The Illuminating Engineering Society (U.S.A.).—The twentieth annual convention of the Illuminating Engineering Society will be held at Spring Lake, N.J., from September 7th to 10th, inclusive, with headquarters at the Essex and Sussex Hotel, a short trip from New York and Philadelphia. A well-rounded papers programme is being prepared, with special features showing the developments in specific fields which have taken place during the twenty years of existence of the Society. Special and unique features are also being planned for the entertainment programme.

Educational.—The Polytechnic, Regent Street, W.—Electrical Engineering Department, Wireless, and High-frequency Section.—A special course of six lectures on "The Thermionic Valve and its uses in Wireless Circuits" will be delivered by Mr. W. H. Date, on Wednesdays, commencing May 12th, from 6.30 to 8.30 p.m. Fee for the course, 7s. 6d. Particulars, &c., from the Director of Education.

A special course of six lectures on "Electrical Engineering Economics" will be given on Thursdays, commencing May 13th, by Mr. D. J. Bolton. Fee for the course, 7s. 6d.

Borough Polytechnic Institute, Borough Road, S.E.—Short courses of lectures and laboratory work on electrical engineering, including alternating currents, automatic telephony, cable jointing, and physics, commence on May 3rd. Full particulars can be obtained from Mr. J. W. Bispham, the Principal. (See our advertisement pages to-day.)

Electrical Association for Women.—In connection with the newly-formed Manchester District Branch of the above Association, a public meeting will be held in the Lesser Free Trade Hall, Manchester, on May 5th, when the chair will be taken by Mr. B. Mouat Jones, D.S.O., Principal of the College of Technology. The meeting will be addressed by Miss Ellen Wilkinson, M.P., President of the Branch, Mr. J. A. Roberts, M.I.E.E., and Miss C. Haslett, Director of the Association. Further particulars with regard to the meeting can be obtained from the local Hon. Secretary, Miss G. L. Entwistle, A.M.I.E.E., c/o the Motor Department, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.

Appointments Vacant.—Telegraph foreman (£400), for the Government of Gold Coast. Plumber-jointer, for the Stepney Borough Council Electricity Department. Assistant mains engineer (£208 to £260), for the Gillingham Borough Council Electric Lighting Department. Electrical engineers (several), for the Calcutta Electric Supply Corporation, Ltd. Switchgear engineer (£362), for the Hackney Corporation Electricity Department. Showroom manager (£314), for the Borough of Burnley Electricity Department. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.—Mersey and North Wales (Liverpool) Centre.—The annual general meeting of the above centre was held on April 19th, when the officers and Committee for the 1926-27 session were appointed. The new chairman will be Mr. P. J. Robinson; vice-chairmen, Prof. F. J. Teago, D.Sc., and Mr. S. E. Britton; hon. sec. and treasurer, Mr. Oscar C. Waygood. After the meeting, Prof. S. P. Smith read his paper on "An All Electric House," which was followed by a very interesting discussion.

South Midland Centre.—The annual general meeting of the above centre was held on April 28th, when the Report of the Committee was presented. The total membership of the centre at March 31st last was 1,018, representing an increase of 33 on the number for the previous year.

North Western and Mersey and North Wales (Liverpool) Centres.—The Committees of the above centres have arranged for a re-union to be held at Chester on May 12th. The programme includes visits to Poole Bank Farm, Tarvin, and Yew-tree Farm Sealand (both equipped with electrical appliances), the works of Brookhirst Switchgear, Ltd., and the Chester Corporation hydro-electric station.

Institute of Physics.—Physics in Industry.—The tenth lecture of this series, which is being given under the auspices of the Institute of Physics, will be delivered by Mr. H. E. Wimperis, Director of Scientific Research, Air Ministry, and will deal with "The Relationship of Physics to Aeronautical Research." The lecture, which will be open to the public, will be given in the Physics Theatre, Royal College of Science, South Kensington, on May 11th, at 5.30 p.m., and the chair will be taken by Sir William Bragg, President of the Institute.

Junior Institution of Engineers.—At the question and discussion evening on Friday last, the opportunity was taken of discussing further Mr. Allison's lecture of the previous week on the electrical equipment of automobiles. Points were raised as to the standardisation of voltage, the output of magnetos, and the manufacture and use of automobile lamps. Other topics also received attention.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

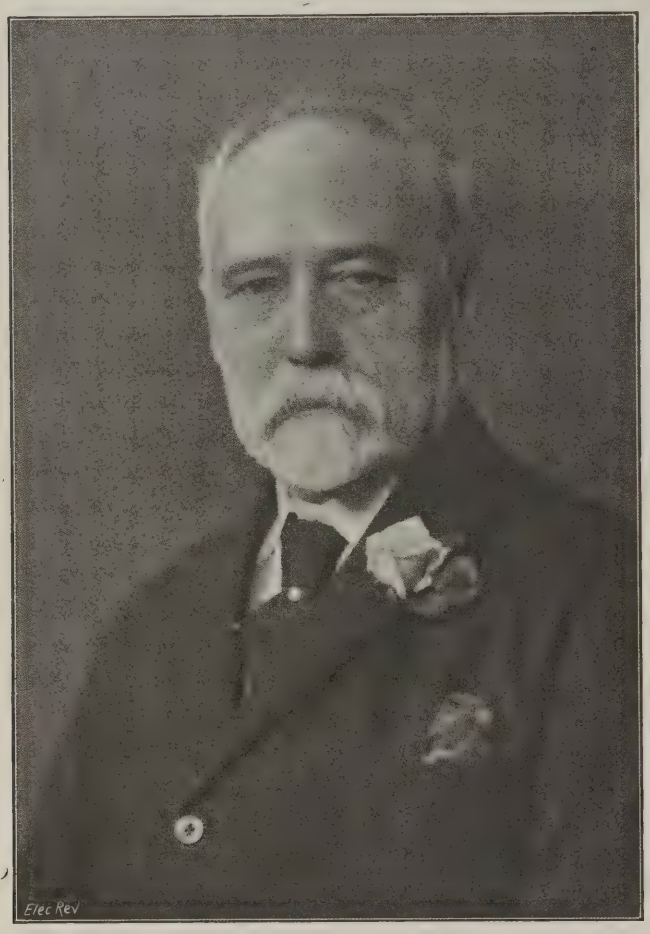
It is reported that Mr. G. F. Moller, M.I.E.E., general manager of the Lanarkshire Tramways Company, Ltd., has resigned his position.

Mr. M. Epstein, M.A., Ph.D., was elected to succeed Mr. Oppenheimer as chairman and managing director of the Phœnix Telephone & Electric Works, Ltd. Dr. Epstein joined the board in May, 1922, and during Mr. Oppenheimer's illness has acted as deputy managing director. Mr. Edwin J. Reid, M.I.E.E., another of the directors, has been appointed technical manager. There will be no change of policy in connection with the business.

Mr. J. Roberts, who has been in charge of the power station at the Port of Richborough, has been appointed power-station superintendent to Messrs. Lake & Elliot, Braintree, who supply electricity in bulk to Braintree and Bocking.

Herr Georg Schmidt, the director of the telegraph and telephone division of the Siemens & Halske Co., Berlin, recently celebrated the completion of forty years' service with the company.

We wonder how many men there are amongst us to-day who can look back upon a record of nearly forty-two years' active connection with British electrical manufacturing in a business operating under their own name. Mr. Francis Henry Nalder, managing director and chairman of Nalder Bros. & Thompson, Ltd., who is still taking an active part in the operations of that concern, of the latest extension of whose works we gave



F. A. Swaine] [*London.*

Mr. F. H. Nalder.

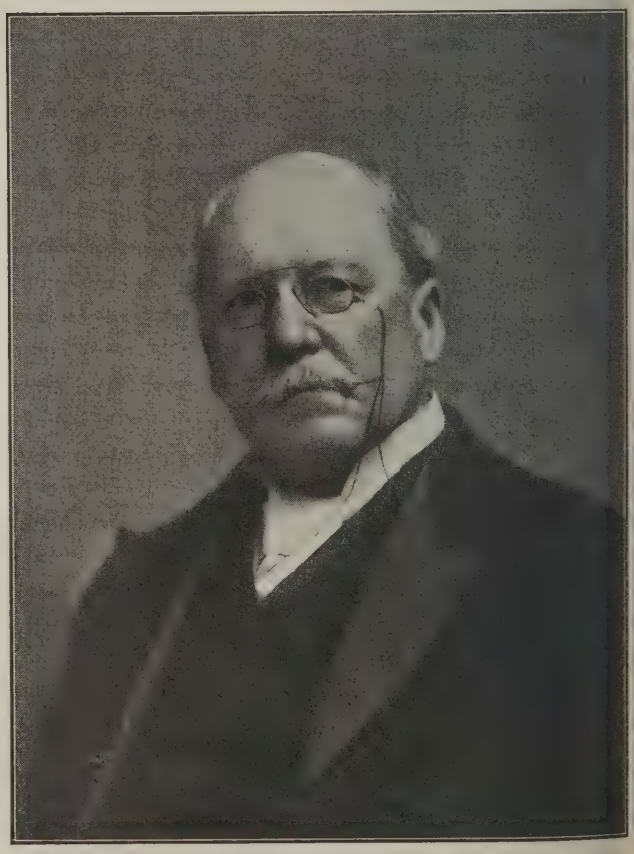
an illustrated account in the Electrical Review for February 5th, 1926, dates his first productive electrical work from the end of the year 1884, when he started in business with his brother, Mr. H. Nalder. The firm thus founded opened a small works in Brentford early in 1885, and an extension soon followed. After more than forty-one years, the name Nalder still stands at the head of an extending business as our recent article indicated. Mr. Nalder was born at Reigate in May, 1859, so that notwithstanding his lengthy practical experience, he is still, as we like to regard years, comparatively young, for has not our old friend, George Offor, just passed the 99th mark? After education in England and Germany, Mr. Nalder first had four years' experience in a London merchant's office, from which he branched off to the School of Telegraphy and Electrical Engineering at Hanover Square, and subsequently to Finsbury Technical College. Then in 1884 came the Brentford development already mentioned. Two years later he was joined in partnership by Mr. C. W. S. Crawley; the works were then moved to Horseferry Road, Westminster, and extended operations were entered upon in the following year, 1887, when Mr. Alfred Soames became a partner in the firm, and the name was: Nalder Bros. & Co. Once again larger works became necessary, and the records show that in 1890 Red Lion Street, Clerkenwell, was the firm's centre of operations. The spirit of enterprise with which Mr. F. H. Nalder was possessed in those early years is evidenced by the fact that he paid four visits to the United States and Canada in the period 1891-1893, studying the course of electrical progress and development there. Other visits to the States took place in 1901 and 1904 respectively, the latter on the occasion of the International Electrotechnical Congress. When in 1896 circumstances led to the division of the business, Mr. Nalder went into partnership with the late Mr. Ernest Thompson, and established the firm of Nalder Bros. & Thompson, which devoted itself to the manufacture of every description of instrument that is employed on a switchboard, also switchgear, automatic switches, &c., and occupied works at 34, Queen Street, E.C. Still progressing, additional works had to be taken, and these, in 1899, were opened at Dalston, the business being at the same time converted into a private limited company. From this change we may take a long jump to 1914, when the Queen Street lease came to an end, and removal to the present headquarters, 97a, Dalston Lane, was undertaken, the Kingsland Green works being still retained. The larger scale operations that thus became possible helped the company to handle the demands which arose out of the requirements of the nation while at war. Before touching upon other matters, it may be remarked that the business of Nalder Bros. & Thompson, Ltd., is still Mr. Nalder's principal interest—and indeed his hobby too—for he is as alert as ever regarding new methods of manufacture, development work, and the getting of new business. It is interesting to record that his second son, Mr. D. W. Nalder, is engaged in the company's works. Personal interests have not prevented Mr. Nalder from devoting attention to the larger interests of the industry as a whole, for, as would be seen from a statement made here in another connection last week, he was one of the first members of the National Electrical Manufacturers' Association when it was born in 1905. When some six years later that organisation was put on to a larger basis and its name was changed to the British Electrical and Allied Manufacturers' Association, Mr. Nalder was appointed its first chairman, and he has been on the Council of the Association ever since, with the exception of one year during the war. He is a Governor of Battersea Polytechnic, of the Hackney Technical Institute, and of the Devas Institute; also chairman of Oertlings, Ltd., chemical balance and scientific instrument makers. He was elected as an Associate Member to the Council of the Institution of Electrical Engineers in 1890, during the presidency of the late Dr. John Hopkinson. While he is therefore one of the oldest members of the premier professional body, he also showed his appreciation of movements of a modern character on the social side of the profession a few years ago by becoming an original member of the Engineers' Club. He has been a prominent Freemason for many years.

Messrs. H. A. Lingard and Mr. W. E. Rawlinson, of the International General Electric Co., were among the passengers sailing by the Cunard liner *Aquitania* from Southampton to New York on April 24th.

Mr. Stanley H. Chatterley, late Midlands district manager for the Sterling Telephone & Electric Co., Ltd., has been appointed general manager of Cantie Switches, Ltd., Nottingham, an associated company of Brookhirst Switchgear, Ltd.

The Electric Heating Co., of George Street, Croydon, has recently appointed Mr. H. J. Dean Osgood to take over the entire control of the works. Mr. Osgood was formerly with the Dowsing Radiant Heat Co. and Messrs. H. W. Sullivan and Co.

Obituary.—Sir Henry Mance.—It is with deep regret that we have to record the death of Sir Henry C. Mance, C.I.E., LL.D. The sad event was mentioned by the president at last week's meeting of the Institution of Electrical Engineers before the delivery of the Kelvin Lecture. Members stood in silence as a mark of respect for a distinguished past-president and one of the oldest of their fellow-members. In 1873 he joined as an Associate,



Elliott & Fry] [*London.*

The late Sir Henry Mance.

becoming a full member in 1877 and president in 1897. Sir Henry passed away on Wednesday, April 21st, and the funeral took place on Saturday at Oxford. Sir Henry Christopher Mance was born at Brockley in 1840, and was therefore in his 86th year. After being privately educated, he entered the service of the Electric & International Telegraph Company at the age of 18, and in 1863 he joined the Persian Gulf Tele-

graph Expedition, which was responsible for establishing telegraphic communication between England and India. Three years later he was appointed superintendent of the Persian Gulf section of the system, and had charge of various cables and some hundreds of miles of overhead line from Karachi to the Persian Gulf. In 1879 he was appointed engineer and electrician of the line, and he held that post until he retired from the service in 1885, when he received the honour of knighthood. In his "Narrative of the Formation and Development of Telegraphic Communication Between England and India," which he entitled "Telegraph and Travel," and published in 1874, Colonel Sir Frederick John Goldsmid records the laying of the cable from Jask to Bushar, and, amongst others, favourably mentions the work of Mr. Mance, one of the superintendents. This cable was laid in 1869. Perhaps Sir Henry's most notable contribution in the form of scientific inventions was the heliograph, which was produced in 1869, and demonstrated its great value in many military campaigns. For his services in this connection he was created a Companion of the Indian Empire in 1883. But he made numerous other contributions in the shape of electrical discoveries and inventions, including a method of locating faults in ocean cables, a method of testing the internal resistance of electric batteries, &c. During his service in the East he was for a time traffic manager, was responsible for cable-repairing expeditions, and for the erection of a factory at Karachi for the manufacture of telegraph cable. He contributed a number of papers to the *Proceedings* of the Society of Telegraph Engineers on subjects connected with telegraphy and telegraphic apparatus and testing, and for one of these papers he was awarded the Paris Exhibition Premium in 1884. He was a member of the Institution of Civil Engineers and of the Physical Society. After his retirement from the telegraphic service in India he devoted his experience and attention to various electrical and other undertakings. He was the founder of the Oxford Electric Co., Ltd., and chairman of the board until his death. He was also a director, and for some time chairman, of the Electrical Construction Co., Ltd., and was on the board of the West African Telegraph Co., Ltd. He was also for many years chairman of that very successful manufacturing enterprise—Messrs. Davis & Timmins, Ltd., to whom we are indebted for the loan of the very striking and life-like photograph from which the accompanying picture has been reproduced. Of Sir Henry's three sons, one—the eldest—Brigadier-General Harry Osborne Mance, C.B., C.M.G., D.S.O., was Director of Railways, Light Railways and Roads at the War Office from 1916 to 1920.

At the funeral at Oxford on Saturday, the Institution of Electrical Engineers was represented by Mr. R. A. Chattock (president), Mr. R. W. Paul (member of Council), and Mr. R. H. Tree (chief clerk).

Mr. H. H. Markham.—We regret to record that Mr. Herbert H. Markham passed away on April 17th at the age of 48 years. Mr. Markham joined the Western Electric Co., Ltd. (now Standard Telephones & Cables, Ltd.), in 1911, and was appointed manager of its Manchester branch, subsequently occupying similar positions at Birmingham and London. In 1921 he made an extended tour through Africa for the company, and in 1925 was appointed sales manager of the Calcutta office. Unfortunately, he was struck down with malaria, which necessitated his return to England in February of this year. Previous to his connection with the Western Electric Co., Mr. Markham was in the service of Messrs. Johnson & Phillips, Ltd., and the Sturtevant Engineering Co. He was a Freemason, being a member of the Kelvin Lodge and Kelvin Mark Lodge. He passed away in his sleep, the cause of death being heart failure due to enlarged heart weakened by malaria and rheumatic fever.

Lord Stuart Wortley.—Lord Stuart Wortley, whose death at the age of 74 occurred on Saturday last, had long been connected with the London tube railway service. He was a director of the City & South London Railway Co., and of the London & Suburban Traction Co., also deputy chairman of the Underground Electric Railways Co., of London.

Mr. S. Green.—The death occurred recently of Mr. S. Green, a director of the Clowne Electric Light Company.

Will.—The late Mr. William Taylor Green, of the Leeds Corporation Electricity Department, left £3,970.

New Companies Registered.

J. P. Castle & Co., Ltd. (213,307).—Private company. Registered April 20th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with J. P. Castle, and to carry on the business of electrical and mechanical engineers as carried on by him at 40, Chancery Lane, W.C. The first directors are:—J. P. Castle, Sepham Farm House, Shoreham, Kent, engineer; Mrs. K. S. Castle, Sepham Farm House, Shoreham, Kent; J. L. Girling, Whitehouse, Felixstowe, engineer. Qualification, £10. Remuneration: 10 guineas each per annum (chairman, 15 guineas). Solicitors: Johnson and Johnson, Cromwell House, Fulwood Place, W.C.1. Registered office: 72, Shoe Lane, E.C.4.

Handcross Electricity Co., Ltd. (213,247).—Private company. Registered April 17th. Capital, £10,000 in £1 shares. Objects:—To carry on the business indicated by the title. The first directors are:—J. R. Warren, Handcross Park, Handcross; A. F. Page, M.R.C.S. (Eng.), L.R.C.P. (Lond.), The Red House, Handcross; E. S. Hibbs, Casterbridge, Handcross; D. Tulley, The Post Office, Handcross; G. Broadbridge, High Street, Handcross. Qualification, 50 shares. Remuneration as fixed by the company. Secretary: W. H. Hogger. Solicitor: R. S. Ross, Horley, Surrey. Registered office: The Post Office, High Street, Handcross, Sussex.

Official Returns of Electrical Companies.

Sylvex, Ltd.—Debenture dated April 12th, 1926, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. Wolsey, 29, Gloucester Road, N.4.

Radio Communication Co., Ltd.—Satisfaction in full on April 14th, 1926, of debentures, authorised February 23rd, 1923, securing in the aggregate £100,000.

H. E. Davis, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C., was appointed receiver and manager on April 12th, 1926, under powers contained in debenture dated December 2nd, 1924.

Builth Wells Electric Supply Co., Ltd.—Particulars filed of £2,500 debentures, authorised September 4th, 1925, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,875 (on April 1st, 1926).

Dunstable Central Motor and Electrical Co., Ltd.—Debenture dated March 25th, 1926, to secure £300 and such further sums not exceeding £100 as the lender may between the said date and March 30th, 1930, be called upon to pay to Lloyd's Bank, Ltd., under a guarantee, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. E. McCabe, 8/9, Byward Street, E.C.

T. W. Jefferson, Ltd.—H. W. Bowler, of 30, North John Street, Liverpool, C.A., was appointed receiver and manager on April 12th, 1926, under powers contained in debentures created June 30th, 1922.

Reading Electric Supply Co., Ltd.—Particulars filed of £150,000 6 per cent. first mortgage debenture stock, redeemable at a premium, authorised January 7th, and covered by trust deed dated March 4th, 1926, the whole amount being now issued. The company has power to issue further stock not exceeding the amount of the share capital of the company for the time being paid or credited as paid up. Property charged: Land, premises, plant, &c., at Reading and the company's undertaking and property, present and future, including uncalled capital. Trustees: British Trusts Association, Ltd., 32, Bishopsgate, E.C.

Satisfaction in full on March 30th, 1926, of trust deed dated December 31st, 1921, securing £100,000.

British Insulated Cables, Ltd.—Satisfaction (a) to the extent of £200,000 (being amount issued) on various dates on and before February 5th, 1926, of mortgage or charge dated November 29th, 1910, securing £500,000 5 per cent. mortgage debenture stock, and (b) in full on various dates on and before April 8th, 1926, of mortgage or charge securing an issue of 4½ per cent. debenture stock dated July 22nd, 1901, as modified by indentures dated May 21st, 1902, September 27th, 1905, and November 28th, 1910, securing £500,000.

Coatbridge and Airdrie Electric Supply Co., Ltd.—Satisfaction in full on December 30th, 1925, of charges, &c., dated November 28th, 1907, to December 15th, 1921, securing £89,494 7s, 7d.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

English Electric Co., Ltd.

The annual meeting of the company was held on April 21st, under the chairmanship of Sir Charles E. Ellis, G.B.E. In moving the adoption of the report (*vide* Elec. Rev., April 16th, p. 630), the chairman said that for the first time they had prepared a consolidated balance sheet, embracing the accounts of all their subsidiary companies, and incorporating those of Willans & Robinson, Ltd., of which company they owned the entire share capital. It was their present intention that that company should remain a separate entity. The item in the balance sheet, "Sundry creditors and credit balances (including secured bank loans)," amounted to £1,296,007. As against this "Debtors and debit balances" amounted to £1,752,956, and the "Stocks and work-in-progress" to £1,353,278, or a total of £3,106,234, leaving the substantial surplus of over £1,800,000. Referring to the item "Investments, £424,585," the chairman said that in the amalgamation of the accounts they had found it necessary to provide from certain reserves for a depreciation of nearly £80,000 from the investment account. In common with other large post-war amalgamations, they had found that among the various classes of business which their constituent companies had developed there were some which were only very indirectly related to the main business of the English Electric Company, formed as it was to specialise almost entirely on electrical and mechanical engineering products. They had therefore decided to dispose of those extraneous businesses, but unfortunately two of those concerns had produced such unsatisfactory trading results as to cause a capital loss which was responsible for the major portion of the depreciation referred to. The profit and loss account was disappointing. In the first place the orders secured were lower in value than in the previous year, due almost entirely to a sudden falling off in export orders. Certain foreign governments which were in the market for the company's products demanded long credits notwithstanding their unsettled economic position and their unconventional economic principles. The board could have obtained sufficient business of that kind to have increased the turnover substantially, but it was decided that the risks were too great, and attention was directed elsewhere. In the latter part of the year the Power & Traction Finance Co. obtained a contract in Greece to the value of over two millions sterling. So far as the contractors were concerned, the transaction was on a cash basis, and of the total contract a large part represented plant and material to be manufactured in the company's works. The negotiations for that important contract were prolonged and none of the orders came into the books during the year under review and only a portion of the work would fall into the current year. There had recently been an improve-

ment in orders secured and at the present time they had unexecuted orders exceeding in the aggregate the whole output of 1925. While there were not to their knowledge any orders in hand which were unprofitable, if the negotiations proceeding between the Engineering Employers' Federation and the unions should result in a stoppage of work or a considerable advance in wages, the company's results would be materially affected. In comparing their results with those of some competitors it had to be remembered that their business was largely confined to the heavy side of electrical engineering. The company did not manufacture cables and apart from a small interest in the Siemens & English Electric Lamp Co., Ltd., it derived no revenue from lamps, radio apparatus, or electrical supplies. On the technical side progress had continued and the company stood higher to-day in technical achievement than at any previous time. The Great Indian Peninsula Railway, the first railway in India to be electrified, was running satisfactorily, as was the newly-electrified section of the Southern Railway. Their water-wheel installations in Brazil and India were operating efficiently and reliably. In steam turbines their new double-cylinder machine had produced an efficiency which it was impossible to reach with the ordinary single-cylinder machine, and they had several more sets on order similar to the initial 20,000-kW installation. The unsettled situation of the coal industries affected their very considerable colliery trade. At the present moment few collieries were prepared to proceed with their normal programmes of electrification. The present uncertainty regarding electricity supply was not only affecting supply undertakings themselves but large industrial electrification schemes were being held up for lack of definite information whether it would be cheaper to take a bulk supply than to install generating plant. During Mr. Pybus's absence, through ill-health, Mr. V. Watlington took up the position of managing director, and performed the duties of that office very satisfactorily, and he had consented to retain it. It was necessary for a company like theirs to have a chairman who could devote practically the whole of his time to the company. Unfortunately, his (Sir Charles's) other engagements precluded that and he had recommended that Mr. Pybus should be appointed chairman and that had been adopted. He felt that with Mr. Pybus and Mr. Watlington devoting their energies to the service of the company, the question of management would be put into the best possible shape. The board had asked him to become deputy-chairman, which he was very glad to do. Mr. W. L. Hichens seconded the motion, which was carried after a short discussion.

Johnson and Phillips, Ltd.

The profit for the past year, after providing for bad debts, and charging to revenue about £21,000 for maintenance of buildings, plant, &c., was £209,897. Adding £127,792 brought forward, less £50,000 paid in dividends in May last, there is an available balance of £287,689. After meeting directors' fees, debenture interest, &c., transferring £43,750 to reserve, and debiting a 7½ per cent. dividend paid in November last, there remains a balance of £152,132. It is proposed to pay a final dividend of 10 per cent. on the old ordinary shares, making 17½ per cent. for the year, and a dividend of 10 per cent. on the new ordinary shares, leaving £92,133 to be carried forward. The premiums in respect of the shares issued in 1924 and 1925, amounting to £106,250, have been transferred to the reserve, which now stands at £250,000. The meeting was to be held yesterday (Thursday).

German Companies.

The *Wolfram Lamp Company*, of Augsburg, proposes to increase the rate of dividend from 6 per cent. to 10 per cent. for 1925.

The *Company for Electrical Undertakings*, Berlin, which is an investment concern, reports net profits of 4,730,000 marks for 1925, as compared with 2,670,000 marks in the previous year, and the rate of dividend is increased from 6 per cent. to 10 per cent.

The *Electra Company*, Dresden, which is financially interested in a number of electrical undertakings, reports net profits of 1,230,000 marks for 1925 as compared with 840,000 marks in the nine months forming the preceding year. It is proposed to pay a dividend at the rate of 10 per cent., as in 1924.

The *Bavarian Aluminium (Innwerk) Company*, Munich, after having written off 660,000 marks for depreciation, has closed its first year's activity with net profits of 862,000 marks, permitting of the payment of a dividend at the rate of 6 per cent. The undertaking has been transferred to the United Aluminium Works Company, which is owned by the Reich, in return for the issue of shares in the latter company.

The *North German Cable Works Company* reports that it would have been possible to have earned moderate profits in 1925 if it had not been for the quietness which set in during the latter part of the year to such an extent that two-thirds of the men had to be dismissed and some departments brought to a complete standstill. After having made provision for depreciation the accounts indicate net profits of 25,000 marks, as against 101,000 marks in 1924, when a rate of 5 per cent. was paid; no distribution is proposed.

The *United Aluminium Works Company*, Lauterwerk (Lausitz), which is a State undertaking, reports that the stock of orders brought into 1925 was comparatively important. Down to May business was brisk at satisfactory prices, but afterwards the rolling mills and makers of aluminium manufactures suffered from the bad economic situation, so that there was a falling off in the receipt of new orders, and prices became depressed. As a consequence the net results, despite the starting of the Toging aluminium works, were only slightly more favourable than in 1924. With the bringing into operation of the latter works the production increased from 11,800 tons in 1924 to 19,400 tons last year. The bauxite mines in which the company is interested were further developed and will ensure a supply of raw material for decades. The accounts show net profits of 3,930,000 marks, as compared with 3,570,000 marks in 1924, and the dividend is maintained at 7½ per cent.

Swiss Companies.

The *Swiss Company for Electrical Industry*, Basle, which is a holding company, reports that the tendency to improvement continued in 1925 and in many respects became strengthened. At the same time the opportunity for the profitable disposal of interests in certain Italian, Czecho-Slovakian and German undertakings had presented itself. The net profits are returned at 4,710,000 fr., as against 2,290,000 fr. in 1924; the rate of dividend remains at 8 per cent.

The chairman of the *Neuhausen Aluminium Company*, speaking at the recent annual meeting, is reported to have stated that the German companies had been able to reduce their debts to the Swiss company by 800,000 fr., but none of them had been able to pay any dividends.

The *Power Transmission Company*, Rheinfelden, which belongs to the A.E.G. and Lahmeyer concern, states that the sale of energy reached an unprecedented level in 1925, although the unfavourable conditions during the current year are exercising an influence on the consumption. After negotiations extending over 16 years the way was made clear to a concession for the establishment of new hydro-electric works of 10,000 h.p. above Rheinfelden at Ryburg-Schworstadt, at an estimated expenditure of 60,000,000 fr. The net profits for 1925 amount to 1,430,000 fr., as against 1,160,000 fr. in the previous year, and the dividend is increased from 8 to 10 per cent.

Belgian Company.—The directors of the *Société Belge pour la Manufacture des Câbles et Fils Electriques* state that after providing for depreciation, the net profits for 1925 amount to 1,000,000 fr., permitting of the payment of a dividend of 25.45 fr. per share on the ordinary capital.

French Company.—The *Société de Construction Electrique*, of Lyons, has declared a dividend at the rate of 8.50 fr. per share gross out of net profits and balance forward amounting to 471,000 fr. in 1925.

Dutch Company.—*Philips Glowlamp Works.*—It is reported that the directors of this company are again declaring a dividend of 16 per cent. upon the common stock.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Ever-Ready Co. (Great Britain).—49,800 ordinary shares of £1 each, fully paid, Nos. 449,001 to 498,800.

Oxford Electric Co.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000; and 55,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 55,000.

South-eastern Power and Light Co.—$22,228,800 6 per cent. gold debentures, Series "A," Nos. M1 to 18,098 ($1,000), D1 to 8,000 ($500), and C1 to 1,308 ($100).

Stewarts & Lloyds.—39,130 deferred shares of £1 each, fully paid, Nos. 4,035,580 to 4,074,709.

Traction and Power Securities Co.—£34,964 4½ per cent. debenture stock.

Application has been made to the committee to allow the following to be officially quoted:—

Electrical Finance and Securities.—76,162 shares of £1 each, fully paid, Nos. 1 to 76,162.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Midland Electric Corporation for Power Distribution.—70,000 new ordinary shares of £1 each, issued at par, partly paid and fully paid, Nos. 280,001 to 350,000.

Oxford Electric Co.—100,000 ordinary shares of £1 each, fully paid, Nos. 1 to 100,000; 55,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 55,000.

South-eastern Power and Light.—$10,000,000 6 per cent. gold debentures, Series "A," within Nos. M1 to 18,098 ($1,000), D1 to 8,000 ($500), and C1 to 1,308 ($100).

Stewarts & Lloyds.—39,130 deferred shares of £1 each, fully paid, Nos. 4,035,580 to 4,074,709.

Traction and Power Securities Co.—£34,964 4½ per cent. debenture stock.

National Electric Construction Co., Ltd.—The report for 1925 shows a profit of £21,891, and after deducting debenture interest, depreciation, &c., and adding £4,721, there was an available balance of £21,137. It was recommended that this balance should be dealt with as follows:—To reserve and renewals account, Dewsbury and Ossett Tramways, £1,000; to dividend-equalisation reserve, £1,000; to general reserve, £7,000; dividend of 10 per cent., £6,747; carried forward, £5,390. The dividends from the undertakings in which the company is interested were well maintained and the profit from contracting work was again satisfactory. The meeting was to be held yesterday (Thursday).

Northern General Transport Co., Ltd.—In his speech at the annual meeting, on April 22nd, the chairman (Mr. R. J. Howley, C.B.E.), dealt principally with the motor omnibus side of the company's affairs. Referring to the tramway undertakings, he said that the Gateshead & District Tramways Co. and the Tynemouth & District Electric Traction Co. continued to do well, but he thought that the position of the Jarrow and District Electric Traction Co. could not be expected to show improvement until the shipbuilding industry recovered to a substantial extent. The report and accounts were adopted and subsequently a resolution was carried increasing the capital of the company to £700,000.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The directors have decided not to pay any further dividends on any of the preference stocks in respect of the year 1925.

Indo-European Telegraph Co., Ltd.—The report for the past year showed that the revenue increased from £294,371 in 1924 to £310,345. After providing for taxation and adding £18,779 brought forward there remained a balance of £133,838, which it was proposed to distribute as follows:—Writing down cost of reconstruction of the line in Russia and Poland, £5,000; a final dividend of £1 2s. 6d. per share, making 7 per cent. for the year, and a bonus of 15s. per share, both free of tax; £5,000 to dividend-equalisation fund; and £15,000 to retirement trust fund, leaving £16,339 to be carried forward. The meeting was to be held yesterday (Thursday).

Melbourne Electric Supply Co., Ltd.—The report for a period of fourteen and two-fifths months ended November 12th, 1925, shows a balance at the credit of profit and loss account of £567,610, as compared with £414,071 for the preceding 12 months. After providing for debenture interest, &c., and adding £23,336 brought forward, there is an available balance of £449,059. Of this £270,988 is transferred to general reserve, £20,000 to income tax reserve, £4,000 to reserve for bad debts and £10,000 to staff pension fund. A final dividend of 5 per cent. actual has been paid on the ordinary shares, making 10 per cent., free of tax, for the year ended August 31st, 1925.

Babcock & Wilcox, Ltd.—In presenting the report for 1925 (*vide* Elec. Rev., April 16th, p. 630) at the annual meeting on April 20th, the chairman (Sir John Dewrance) said that the company was fortunate to be able to show such good results at a time of severe depression in the engineering industry. He hoped that no further labour troubles would supervene to worsen the position. If the threatened engineering strike could be averted and the trouble in the coal industry cleared up, there was every prospect of an even more satisfactory year for the company.

City Electric Light Co., Ltd.—The report of this company (of Brisbane) for the year ended January 31st last showed that after making provision for sinking fund, renewals, &c., and adding a sum of £17 brought forward, there remained a balance of £104,875. Out of the year's profits the directors paid an interim dividend in September last, amounting to £50,288, and they recommended a further dividend of 3 per cent. upon the 6 per cent. preference shares, 3½ per cent. on the 7 per cent. preference shares, and 5 per cent. on the ordinary shares, in proportion to the amount paid thereon, free of State tax. This absorbed £54,535, leaving a balance of £52 to be carried forward.

Urban Electric Supply Co., Ltd.—The directors' report for 1925 records a profit of £91,905, to which is added £10,892 brought forward, making £102,797. After paying the interim preference dividend and purchasing £74 of funded certificates, it is proposed to place £35,000 to depreciation reserve, £10,000 to general reserve, to pay the final preference dividend, to purchase £1,250 of funded certificates, and to pay a dividend of 7 per cent. on the ordinary shares, leaving £18,683 to be carried forward. The meeting was to be held yesterday (Thursday).

Greenock and Port Glasgow Tramways Co., Ltd.—The surplus for 1925, after providing for renewals, &c., is £2,766, and the addition of £689 brought forward makes available £3,456. It is proposed to transfer £1,084 to reserve and to carry forward the balance (£2,372). The company has purchased motor omnibuses to combat competition. During the year mortgages were redeemed to the extent of £32,500, and £33,999 released from sinking fund was transferred to reserve. Meeting: May 3rd.

Hadfields, Ltd.—The report for 1925 states that the company, in common with others, suffered during the year from the severe cutting of prices. The directors recommend a dividend of 3 per cent. on the ordinary shares, leaving £83,204 to be carried forward. The company has acquired approximately three-quarters of the share and debenture capital of Messrs. A. Harper, Sons & Bean, Ltd., and a satisfactory return is expected. Meeting: To-day (Friday).

Newmarket Electric Light Co., Ltd.—The directors' report for 1925 stated that the balance on the year's working, after providing for debenture interest, depreciation, &c., amounted to £3,248, and the addition of £485 brought forward gave an available balance of £3,733. A dividend of 8 per cent., free of tax, is paid, £1,000 is transferred to general reserve, and a balance of £608 is carried forward.

Prospectus.—*Northampton Electric Light and Power Co., Ltd.*—The directors have issued to shareholders particulars of and forms of application for 70,000 ordinary "B" shares of £1 each at 27s. per share. Renunciation letters accompany the prospectus. The issue is to provide capital to meet rapidly increasing business. Applications have to be sent to the Bank by May 12th.

Swansea Improvements and Tramways Co., Ltd.—The net profit for the past year, after providing £20,000 for renewals, was £13,847—an increase of £534. A dividend of 6 per cent. (as for 1924) is being paid on the ordinary shares, £3,000 is put to reserve, and £7,969 is carried forward.

G. D. Peters & Co., Ltd.—The report for 1925 shows a net profit of £7,203, to which is added £3,316, including the sum brought forward. After meeting taxation and paying the preference dividend for the first half of the year, it is proposed to carry forward £4,150.

Herbert Morris, Ltd.—A dividend at the rate of 7½ per cent. per annum has been declared on the ordinary shares for the half-year ended January 31st last.

Montreal Light, Heat and Power Co.—A dividend of $2 per common share has been declared in respect of the quarter ending April 30th.

Stocks and Shares.

Monday Evening.

The Budget influences at work in the Stock Exchange were slight as compared with those exercised by the varying phases of the coal crisis, which change from day to day in such a fashion as to render markets cheerful in one session and disconsolate in the next. With the outlook altering almost hour by hour according to the results of the various meetings which are being held, it is not possible to expect Stock Exchange business to show expansion. There are, however, some markets in which activity prevails, and amongst these the section devoted to Underground Electric issues is the hub of lively speculation and speculative investment.

Following upon the rise of last week, the Underground £10 shares are another ⅛ up at 3⅞, while the "A" hold their gain at 12s. A fair amount of attention is being devoted to the company's 6 per cent. income bonds, the dividends on which are paid, of course, free of tax. Being an income bond, the interest is dependent upon the earnings of each half-year, and this gives the stock its speculative flavour. It is within comparatively recent years that the bonds have received their full 6 per cent., but in view of the progress made by the company, they are now worth including in any sound list of speculative securities that yield a good return on the money. The likelihood of capital appreciation is bounded by the consideration that, in a reorganisation scheme of the company's capital, these bonds might be repaid at par. London and Suburban Traction preference are better, while London United Tramway debenture is left at 48.

St. James' and Pall Mall shares have come into demand, and at 16⅛ are 5s. up. Westminsters are better at 43s. 3d. Chelseas rose to 2, and City of London ordinary to 45s. 9d. Urban ordinary and preference have moved up. The moderate stream of selling which has been going on in the electricity supply share market for some time past, and for which the Government's Bill has been responsible, is now less obvious, and the effect of the demand from investment becomes apparent in these improved quotations. The provincial shares are better with those of the London companies. Midland Counties ordinary have recovered to their par value. Yorkshire Electrics are 1s. up at 27s. 6d. Bournemouth and Poole show a nominal fall at 55s. 9d., but this is ex dividend and bonus, so that the net result is negligible. Electric Supply Corporation shares have recovered the dividend deducted from the price last Thursday. The market as a whole may be described as stronger than recently has been the case. The Budget is favourable, rather than otherwise, to gilt-edged and investment issues. The Chancellor of the Exchequer has dealt but light blows to the Stock Exchange this time.

The General Electric Company is about to divide its existing 1,850,000 common shares of $100 each into 7,400,000 stock of no par value. It may be remembered that the company holds the controlling interest in the British Thomson-Houston Co., Ltd. The Americans are fond of the "no par" value denomination for stocks and shares, though the British investor is not sufficiently familiarised with the system for it to attract support on this side. One of the objections heard against it is that, where shares are of no par value, this opens an easy door to manipulation of prices in the market. Many of the best-class American companies, such, for instance, as the General Electric, having adopted the principle, the latter is likely to become better known in this country by reason of the favour with which some British investors regard stocks and shares in American companies, which are held to be less liable to labour disturbances than those which trouble our domestic industries.

The telegraph market is steady, though Great Northerns are another £1 down on top of the £2 fall which they suffered last week. Indo-European hold their advance. The company's report shows a profit of £123,000, an increase of about £12,000 on the previous year's figures. The bonus, as we mentioned last week, has been increased. Oriental Telephones are a little harder. Automatic Telephones, nominally 1/16th lower, are actually unchanged, the price being now ex dividend. Marconis lack public interest and the group is quiet.

Anglo-Argentine Trams are a good market, although no further developments have occurred so far as published information goes. There is an impression that the trouble between the Buenos Aires Municipality and the company is in a fair way to becoming settled. Brazilian Tractions are better, and Meixcan Light preferred show a gain of 3 points. The company's common shares are, however, 2 down at 29½.

Amongst manufacturing shares, Telegraph Constructions have lost 10s., but apart from this decline the list is not bad. Babcocks, now ex dividend and bonus, are quoted at 50s. Johnson & Phillips strengthened, and English Electrics further hardened as a result of the meeting. Rubber shares enjoyed an all-round advance on the Colonial Office modification of the Stevenson scheme. The alteration fixes 1s. 9d. per lb. as the pivotal price around which the next change of exportable allowance shall revolve. The move came as a very pleasant surprise to the market, and completely changed the previously dull complexion of prices. It is taken for granted that there will be a loud outcry of protest from American consumer interests.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	1925.	Price Apr. 26 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	55/9 x all	—	4 16 0
Brompton Ordinary	1	10	10	1⅛	—	*6 3 1
Charing Cross Ordinary	1	15	15	45/9	—	6 11 2
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	+1/16	6 0 0
City of London	1	15	15	4f/9	+1/16	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/6	—	5 16 5
County of London	1	15	15	56/-	—	5 7
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	32/6xd.	+1/16	6 3 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	35/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	+6d.	6 0 0
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/6	—	5 12 0
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅛	+¼	5 8 6
South London	1	15	15	2⅜	—⅛	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	22/-	+1/6	3 12 9
do. 6% Pref.	1	6	6	1xd.	+6d.	6 0 0
Westminster Ordinary	1	15	15	43/3	+1/3	6 18 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/-	—	7 10 0
Yorkshire Elec.	1	8	8	27/6	+1/-	5 16 5

Home Rails.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66½	+½	7 10 5
do. District	,,	3½	3½	£2	+1	6 17 3
Underground Electric Ordinary	10	Nil	Nil	3⅞	+⅛	Nil
do. do. "A"	1/-	Nil	Nil	12/-	—	Nil
do. do. Income	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	101xd.	—	5 18 10
do. Def.	,,	1½	1½	28¾	—	6 6 4
Automatic Telephone	1	3	6	2⅜xd.	—	4 4 3
Chili Telephone	5	6	5	6⅞	+⅛	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	17⅜	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17¾	—	*5 12 8
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	22	22	29	—1	7 11 8
Indo-Etropean	25	8½	10	47⅞	—	*5 5 3
Marconi	1	10	10	1 5/16	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/-	+9d.	*5 14 3
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17½	—	*5 15 11

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	60/9	+9d.	9 1
do. do. 2nd Pref.	5	6	6	2 1/16	+1/16	11 3
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	127½	—	4 14 0
do. do. 6% Pref.	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	91½	+1	5 9 3
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	96/-	96/-	105½	—	*4 9 4
do. do. Deferred	,,	129/5	129/5	126	—1	*5 3 2
do. do. Deb.	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	+6d.	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	64	+1½	7 16 4
Mexican Light Common	100	Nil	Nil	29½	—2	Nil
do. Pref.	100	Nil	Nil	72⅜	+3	Nil
do. 1st Bonds	—	5	5	69½	—	7 3 11
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	13	2½xd.	—	*5 4 0
British Aluminium Ord.	1	5	10	40/6	—9d	4 18 9
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅜	—	4 16 0
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3⅜	—	4 0 0
do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	7/9	—	5 3 3
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	30/-	—	6 13 4
Enfield Cable, Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	5	15/9	+9d.	6 7 0
do. do. Pref.	1	6	6	18/3	—	6 11 6
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	28/3	—	5 6 2
Henley	1	15	16	3⅜	—	4 5 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	+6d.	*4 8 11
Johnson & Phillips	1	10	10	2 1/16	—1/16	3 8 0
Met.-Vickers Ord.	1	8	8	2⅛/-	—1/6	6 19
do. Pref.	2	8	8	2⅜	—	6 14
Siemens Ord.	1	—	7½	1 5/16	—	4 16
Telegraph Construction	12	20	10	27½	—½	*4 7

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price April 27th.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£250	£5 dec.
Grade II	,, ,,	£175	£3 dec.
Grade III	,, ,,	£95	£1 dec.
c Brass (rolled metal 2" to 12" basis)	per lb.	9⅛d.	...
c ,, Tubes (solid drawn)	,,	11½d. to 1/-	...
c ,, Wire, basis	,,	9½d.	
c Copper Tubes (solid drawn)	,,	1/0½	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£90	...
d ,, (Electrolytic) Bars	,,	£65 10s.	20/- inc.
d ,, ,, Sheets	,,	£14 10s.	...
d ,, ,, Wire Rods	,,	£75 10s.	20/- inc.
d ,, ,, H.C. Wire	per lb.	9½ d.	½d. inc.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
n German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/11	2d. dec.
l Iron Pig (Cleveland Warrants)	per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£30 5s.	5/- dec.
g Mercury	per bot.	£15	10/- to 15/-
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2¾	...
p ,, ,, wire	,,	1/3¾	...
o Platinum	per oz.	£23 10s.	...
d Silicium Bronze Wire	per lb.	1/-	...
r Steel, Magnet, in bars	,,	7¾d.	...
n Tin, Block (English)	per ton.	£276 15s. to £277 5s.	£5 15s. dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Works and Staff Magazines.—The Fifth Conference of Editors of Works and Staff Magazines, organised by the Industrial Welfare Society, was held in Caxton Hall, Westminster, on Friday last. Since 1920, when the first of this series of conferences was held, the attendance has increased steadily, and over 100 firms were represented by about 120 delegates on this occasion. Papers were read and discussed, and at a luncheon in connection with the Conference, at the Hotel Rubens, Sir Ernest Benn, C.B.E., and Captain Harold Macmillan, M.P., addressed the delegates.

Standardisation in Australia.—A conference of secretaries of the Australian Commonwealth Engineering Standards Association, established towards the end of 1922, was held in February, officers from headquarters (Sydney), from Adelaide, Brisbane, Melbourne and Hobart being present. The chairman (Mr. E. S. Maclean) drew attention to the rapid progress of work and growing support in introducing the principles of standardisation into industry. From a report by the engineer-secretary, Mr. W. R. Hebblewhite, the *Melbourne Age* noted that 153 sectional, sub- and panel committees have been constituted, involving a total membership of approximately 1,000. No fewer than 138 specifications were under consideration, of which 27 had been published, and 15 would be issued shortly. The subjects included machine parts, electrical material, railway and tramway rails, rolling stock material, and colliery equipment. A complete organisation had been established to complete a survey of the power resources of Australia with a view to making recommendations for its utilisation. State Governments had been very sympathetic, and officers of various departments had been encouraged to assist the various sub-committees.

The New Metro-Vick Showrooms.

Facilities for Contractors.

The recently-opened showrooms and offices of the Metropolitan-Vickers Electrical Co., Ltd., and Metro-Vick Supplies, Ltd., in Charing Cross Road, W.C.2, are an excellent example of their kind, being situated in an almost ideal position, and possessing ample space for the correct display of fittings and appliances. The premises were formerly employed as a pickle and preserve factory by Messrs. Crosse & Blackwell. The substantial outer walls have been retained, but the interior has been reconstructed to meet the new requirements. There is a basement, the ground floor and four storeys above, and distinction is added to the building by a turret at the corner seen from the busy Oxford Street, upon which illuminated signs have been fitted. The corner of the ground floor directly beneath the turret has been equipped with attractive open windows, in which appliances are displayed and illuminated at night by an efficient window-lighting system. The outer showroom is handsomely panelled in walnut, and the floor is covered with rubber tile flooring. The main showroom, three views of which are reproduced herewith (figs. 2, 3 and 4), is a very spacious apartment, and the decorative scheme has been admirably carried out. Each lighting fitting is given plenty of room (which is not always the case), and can be seen to advantage. In the centre of the showroom is a glass-panelled case, in which a selection of domestic appliances, &c., is shown.

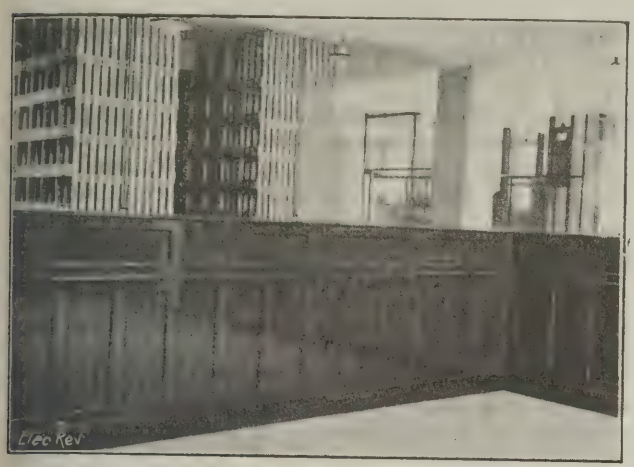


Fig. 1.—The Trade Counter.



Fig. 2.—A View of the Main Showroom.





Figs. 3 and 4.—Corners of the Main Showroom.

The exhibits include radio apparatus, but actual demonstrations of this are carried out in a smaller adjacent room. The store-rooms are capacious, and enable large supplies of lamps, fittings and appliances to be held at the premises. The trade counter (fig. 1) is conveniently situated, and in consonance with the rest of the arrangements, is of ample dimensions leading to quick service. The furnishing of the main showroom was carried out by Messrs. Waring & Gillow, Ltd., to the designs of Messrs. Yates, Cook & Darbyshire, and the floor-coverings were supplied by Messrs. George Spencer Moulton. The wiring and lighting arrangements were carried out by The Engineering Works (Electrical and General), Ltd., under the supervision of the Illuminating Engineering Department of Metro-Vick Supplies, Ltd. Messrs. Harcourts, Ltd., a subsidiary of Metropolitan-Vickers, provided the interior art-metal work. The facilities thus provided are for the trade only. Books of introductory tickets for the use of contractors' customers are being provided.

Metro-Vick House is situated near the Tottenham Court Road "Underground" station, and there are numerous services of omnibuses passing the premises.

The facilities provided for trade customers include an illuminating engineering department, and a writing room with stenographic service. The bulk of the building is occupied by the services of Metro-Vick Supplies, Ltd., but a number of the departments of the Metropolitan-Vickers Electrical Co., Ltd., are also housed there. These are:—The offices of the motor and plant department; meter office, stores, and testing laboratory; and the London erection stores and offices.

Exports and Imports of Electrical Goods and Machinery in March, 1926.

THE Board of Trade Returns of our foreign trade in electrical goods during March, although not very satisfactory in comparison with the preceding month, show up better against the March, 1925, figures, which is, no doubt, a fairer comparison in view of seasonal fluctuations. The exports declined by £99,275 from the February level. The decrease was fairly general, but was considerably off-set by four increases, the most important of which occurred in the case of submarine, telegraph and telephone cable (£45,552). The exports of batteries and accumulators, insulated wires and cables, unenumerated electrical machinery and "other" motors and generators showed very considerable decreases. The machinery section exhibited smaller exports in all classes, but in the telegraph and telephone section there was a substantial rise. Comparing the figures with those of March, 1925, it is seen that increases and decreases were balanced between the items. Insulated wires and cables make the most satisfactory showing, but the machinery section displays a decline, while the telegraph and telephone section shows a rise.

Turning to the imports, it is observed that only three decreases occurred, the most marked of which was in telegraph and telephone instruments. The largest increase was in the case of unenumerated electrical machinery, and here, it may be pointed out, the rise in imports was almost exactly the same as the fall in exports. Another important class in which larger imports were recorded simultaneously with smaller exports was insulated wires and cables. As compared with March, 1925, the decreases preponderated in number and value, the largest being again in the case of telegraph and telephone apparatus. Insulated wires and cables experienced the greatest increase.

The re-exports show a considerable rise in both comparisons, the increase being fairly generally distributed.

All three sections, comparing the first three months of this year with the corresponding period of 1925, show decreases, but it is satisfactory to note that the fall in exports is considerably outweighed by that in the import section.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.	Electrical imports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.	Electrical re-exports for Mar., 1926.	Inc. or dec. as compared with Feb., 1926.	Inc. or dec. as compared with Mar., 1925.
Electrical goods and apparatus (unenumerated)	£191,155	+ £32.181	+ £34,301	£88,866	+ £9,238	− £6.722	£7,306	+ £2 736	+ £1,621
Insulated wires and cables	292.869	− 47,654	+ 52.760	62.521	+ 17,510	+ 12,899	1,974	+ 1,318	+ 651
Glow lamps	41,035	− 3,639	− 2,276	22,079	+ 5,379	− 6,765	1,107	− 1,464	+ 741
Arc lamps and parts	894	− 318	+ 361	1,128	+ 1,013	+ 282	1,404	+ 1,383	+ 1,403
Batteries and accumulators	67.597	− 33,327	− 24,324	36.979	+ 9.971	+ 9.802	2,202	+ 1,542	+ 1,454
Meters and instruments	36,196	+ 6,792	+ 4,118	23,586	+ 9,790	− 3,826	1,672	+ 288	+ 764
Carbons	1,271	− 410	− 3,385	8,881	+ 3,726	+ 617	188	+ 102	− 75
Electrical Machinery—									
Electrical machinery (unenumerated)	272,640	− 65,775	− 4.190	117,155	+ 65.721	− 10,854	11,758	+ 7,039	+ 6,616
Railway and tramway motors	44.274	− 2,794	− 8 363	—	—	—	—	—	—
Other motors and generators	167,499	− 38,066	+ 12,063	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	3 408	− 1,492	− 2,070	4	− 2	− 59	18	− 8	+ 18
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	86,907	+ 25,077	+ 19 095	9.821	− 6,475	− 8,579	22	− 7	− 75
Submarine telegraph and telephone cable	49.601	+ 45.552	+ 38,835	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	223,921	− 15 402	− 36,853	34.090	− 14,377	− 42,439	4,667	− 544	− 875
Totals	£1,479,267	− £99,275	+ £80 072	£405,110	+ £101,034	− £55,644	£32,318	+ £12,381	+ £12,243

	Exports.	Imports.	Re-exports.
Decreases for three months of 1926	− £153,208	− £227,708	− £9,105

Electricity Supply in the United States.

An Interesting Address by Mr. Samuel Insull.

AT a luncheon given by the American Chamber of Commerce in London (Inc.) at the Hotel Cecil on Thursday last week, the hon. treasurer, Mr Robert Grant, Junr., presiding, Mr. Samuel Insull, of Chicago, U.S.A., was the guest of honour. Amongst the many other guests were Lt.-Col. Wilfrid Ashley, M.P., Minister of Transport, Lt.-Col. J. T. C. Moore-Brabazon, M.P., Parliamentary Secretary to the Minister of Transport, Mr. H. E. Levis, Maj.-Gen. Sir Philip Nash, K.C.M.G., Mr. C. H. Merz, Dr. H. F. Parshall, Mr. George Balfour, M.P., Mr. T. P. O'Connor, M.P., Mr. S. J. Goddard, Mr. R. A. Chattock, Pres. I.E.E., and Mr. O. D. Young, chairman of the General Electric Co. (U.S.A.), and of the Radio Corporation of America.

In a brief address on electricity supply in the United States, Mr. INSULL said that the conditions there were different from those obtaining in this country; their methods of controlling local monopolies were different from ours, and where we had to go to Parliament for sanctions, they went to the Commissioners of the respective States. The difference in conditions had something to do with the progress of development of power supply; moreover, the United States was a young country, with less respect for vested interests, and hence electricity supply had gone ahead there far more rapidly than in Britain. Up to a certain point, the development had followed similar lines. When Mr. Insull entered the business, there were several systems operating in the same city, due to the popular belief in the virtues of competition—which, however, was disastrous both to the suppliers of electricity and, still more, to the users, owing to the resulting increase in cost; but the city areas were gradually provided with a good supply of electricity. The larger developments dated from the introduction of the steam turbine; Sir Charles Parsons was largely responsible for the modern system of "massing" electrical generation. Dr. Ferranti, too—20 years before his time—had shown the way to the mass production, transmission, and distribution of electricity, whilst Dr. Hopkinson had shown them how to sell it, the instrument which enabled them to arrive at a just scale of charges being also the invention of an Englishman, Mr. Arthur Wright. Thus, much of the information required to put electricity supply on sound lines came from this country.

The massing of production led to the development of general power supply systems over large areas. Round the city of Chicago, in an area of 10,000 square miles, a population of four millions absorbed only 10 per cent. less electricity than the whole of the United Kingdom, though the investment in generating plant was only half as great. The mass production

or "super-power" idea was spreading rapidly in the United States; from Minneapolis to Virginia, and across the Alleghanies, practically the whole region (with very few interruptions) was connected in one vast super-power or "grid" system. The effect of that was to enable them to take advantage of the water power in Wisconsin supplemented by the steam plant in Chicago and the Lake Michigan area, small plants on the coal fields, larger ones on the Ohio River, &c. That was a territory larger than the United Kingdom. Farther south, there was a large interconnected area where the steam plants of Alabama helped out the industries that depended on the water power of North Carolina. On the Pacific Coast, from Canada to Mexico, there was one vast power system, over which energy was transmitted as far as 250 miles in some cases. Power produced very cheaply in the mountains was carried to the great cities over long transmission lines at very high pressures. It was a common thing to see interests financially unconnected, feeding into a common network. The result was that they could build huge power plants and run them with a minimum consumption of fuel.

In five years the fuel saved by the increased efficiency of generating plant in the United States amounted to 60 million tons of coal, a saving of one-third; and the Commonwealth Edison Company carried on through the war without increasing its rates, largely as the result of the higher efficiency of the apparatus employed.

The interconnection of distribution systems allowed of the massing of production in plant of the highest possible efficiency and of large size. A common size of turbo-generator was 40,000 kW; in larger stations they were installing sets of 60,000, 75,000, and 80,000 kW. In a new station for which they were just breaking ground, the first set would be of 200,000-kW output. A low cost of power was attained not only in big centres but also in small communities, and would have a notable effect on social conditions. Mr. Henry Ford had in view a scheme for the manufacture of motor-car parts in rural areas. By cheap power they hoped to check the drift from the country to the town; by supplying electric light and power to farmhouses, they would change the conditions of living entirely. The availability of cheap power in small communities would lead to the old-fashioned method of specialising in local manufactures. The conditions under which children could be brought up would be improved, and the vast movement going on in America quite possibly might largely revolutionise the conditions under which people lived in country towns.

The question was of peculiar importance to Britain. They were subject to drastic regulations and much interference with business in the United States, which would be distasteful to Englishmen, but they profited by close contact with the members of the Public Service Commissions; in America there was less protection from competition than in this country, but they went ahead with the work as a commercial proposition. He believed in the system, because more money could be made on that basis than out of isolated undertakings—it was all a question of dollars and cents. The right policy of any man serving the public was to supply it at the lowest price that would return a reasonable profit.

No man ever forgot his mother country. The United States was to him the country of opportunity, the country of adoption—he wished the country of his birth to profit by the experience gained in the country of his adoption. He was not talking on theoretical lines, but as one responsible for nearly 250 millions sterling of securities in the hands of the public, and he hoped his electricity supply friends in this country would put aside all selfish interests and even make sacrifices in order to give Britain the service she was entitled to.

The Chairman expressed the thanks of the gathering to Mr. Insull for his address, and Mr. T. P. O'Connor proposed the health of the Chairman, which was heartily honoured.

Australian Industry and Tariffs.

The Position of Electrical Manufacturing.

By G. A. JULIUS, B.Sc.

(*Abstract of a Presidential Address before the* Institution of Engineers, Australia.)

We live in an age of manufacturing and that nation is the wealthiest which produces the greatest quantity of manufactured goods with its available labour. Accordingly, Australia aims at being a manufacturing nation, and in recent years a determination has been manifested to make the country self-supporting in every way. Factories have sprung up everywhere and the Federal Government has aided the movement by the imposition of tariffs, the granting of bounties and other means. Here and there, however, a doubt is being felt whether the system is a right one. It is seen that the debt per capita has risen to an enormous extent; that the wages paid have risen to a similar extent and are still rising; and that the average productive activity over all industries is steadily falling. Looking at the experience of Great Britain and the United States it is apparent that the former's development and use of the steam engine was the factor which made her the mistress of the world's wealth. While, however, her rise of recent years has been very steady, enormous advances have been made by the United States. The accepted reason for this is that Great Britain is not now using sufficient mechanical power in her industries to get the most out of her workers. Legislative restrictions have retarded the growth of electricity supply until now Great Britain lags behind the United States in this respect, although steps are being taken to remedy this. America has developed the use of electricity so that now war-time efficiency and economy are permanent conditions of her industrial and home life. The curve of prosperity in the United States has closely followed that showing the increase in the use of power in industry, and this is not due to the protective tariffs which have been imposed upon foreign goods. Statistics show that the American workman adds a value of £600 in the process of manufacture when provided with 3¾ h.p., while the wage earner in Australia, having less than 1½ h.p. to assist him, adds a value of £322. For every £1,000 spent in wages approximately £2,400 is added to the value of the product in America, as against £1,750 in Australia, in spite of the fact that wages are materially higher in the United States. It is obvious that the industries which employ the largest amount of power produce the greatest wealth, and that those which use little power produce a correspondingly small value per capita. Unfortunately many of the industries employing the largest number of people are among the smallest users of power and it is possible that the application of more power is impracticable. The Australian Government should give every possible encouragement to those industries which use the largest amount of power. Australia stands high as regards "real wages" but this does not appear to be due to increased quantity production, whereas in the United States this is the direct cause of the high wages paid. The statistics reveal that the position of Australian manufacturing industries is not so good as might have been expected, and it would appear that too little use is being made of mechanical power. Everybody should think, talk and act in terms of "more power," since under modern industrial conditions it is mechanical power which creates wealth, and the prosperity of the people is regulated to a considerable extent by the amount of power consumed. The aim should be the expansion of the larger and more efficient factories instead of the increasing of the large number of small establishments. The existing Customs tariff merely encourages any small factory to start that undertakes to make anything at all, necessary or otherwise. The present tendency is well illustrated by the Australian electrical industry which in 1924 was divided up amongst 193 establishments employing 2,641 persons. Of these 55 employed fewer than four hands each, 162 employed fewer than 20 persons each, and only two reported the employment of over 100 persons. Experience teaches that the manufacture of electrical apparatus can only reach its proper effectiveness when carried out under large-scale operations. Unless the industry is organised and carried on in a big way, its products are little more than the output of hand labour, with consequent high costs and loss of efficiency in the utilisation of labour. Comparing the Australian electrical industry with that of the United States, it is seen that the h.p. installed per employé is less than ½ as against 2. The added value in 1923 for each £1,000 spent in wages was £2,428 in the United States and £1,465 in Australia. Between 1909 and 1923 there was actually a decrease in Australia in the added value per £1,000 of wages, while in the United States there was an increase. In the Australian electrical industry, too, there has been practically no increase in the power installed per employé, whereas in all other industries it has increased from ¾ h.p. in 1908 to about 1½ h.p. in 1924. Disregarding consideration of the small market in Australia, the necessity for continuous changing of methods and designs must seriously handicap the establishment of electrical manufacturing plants on any adequate scale at present. One of the most potent factors in the remarkable development in electrical engineering in our generation has been the organisation in the older countries of a relatively small number of very large companies, with enormous financial resources, which have enabled them to maintain highly-trained specialists in every branch of design, and their business is of such magnitude that the development cost does not bear unduly on any single product. The establishment of branch or associated factories of home concerns can be considered, but apart from the heavy overhead expenses, it is apparent that, except in particular cases, apparatus thus fabricated in two factories could not be produced as cheaply as if wholly turned out by one factory. Electrical goods, in general, are merely tools for other industries; they should therefore be produced as cheaply as possible. Australia's large debts and

her urgent need of development raise a pressing demand for the creation of national wealth, and this involves the highest efficiency in the utilisation of labour. While the Commonwealth cannot look forward to any material export trade in electrical manufactures, she already exports large quantities of valuable materials which could be worked up into a condition of higher value before shipment.

In 1923-24, Australia paid nearly £859,000 in duty on electrical apparatus, nominally to protect electrical manufacturers in the country, and in 1921 the amount was nearly £933,000. The number of persons employed in the industry was 2,641, with an average wage of £174 per annum, but the total cost to Australia—that is wages and duty together—was £521 per employé. The value added per employé was only £243. Taxation to support the electrical industry was therefore far in excess of the wealth produced by the industry, and undoubtedly retarded the introduction of power into other industries and checked progress. It is calculated that since 1907 an amount of £6,500,000 has been paid in duty on electrical plant (excluding wires and cables). This represents an annual burden of £650,000, and it is now increasing at the rate of £85,000 per annum Not only has this affected industry; it has also retarded the use of electricity in the home, for domestic appliances, particularly cooking ranges, carry a price which makes their use impossible for the majority of people. The main result of the present system is to enhance the cost to the consumer. While it is true that there are electrical factories which are worthy of all possible assistance, there is overwhelming evidence to show that the present method of extending assistance to manufacturers has failed of its purpose. The minor interest of the electrical manufacturer has obscured the major interest of the light and power industry. Although large power-producing installations are being erected, the present policy will rob them of all possibility of real success. The manufacture of electrical apparatus in Australia can never be worth while until a real demand has been created for such apparatus, and this demand can never be created unless the material is available to the public at a reasonable price. The continued starting up of small organisations is unhealthy and can never lead to success.

The issues at stake are so great, and Australia will continue to lose so much if the present policy is adhered to, that there are good grounds for believing that the Government will be ready to handle this question along strictly business lines and to devise some solution for the problem, bearing in mind that whatever plan may be devised its first responsibility is to the people as a whole. If the latter ground were the sole consideration, the correct solution would appear to be absolute free trade so far as essential electrical equipment is concerned. It is noteworthy that New Zealand has practically adopted this policy, admitting the majority of essential electrical apparatus free if British, or with a 10 per cent. duty if foreign. The author ventures to think that if no other satisfactory solution can be found it would be in the interests of an overwhelming majority of the community if such a policy were adopted by Australia, realising, of course, that a relatively small number, the local manufacturers of electrical equipment, would suffer. It is believed, however, that a way can be found which will secure the desired and essential result, without sacrificing the interests of those engaged in electrical manufacture, wherever it is proved to be worth while. That is by the establishment of a system whereby a bounty would be given for such approved articles as were manufactured in Australia. The money saved in duties would more than cover the relatively small sum of money necessary to cover the bounty. By this means it is considered that the development of electrical manufacturing works would be greatly accelerated. For the immediate future the co-operation should be invited of all electrical manufacturing companies, both Australian and otherwise, to assist in educating the Australian people to an appreciation of the domestic and industrial advantages which must accrue from a greatly increased use of electricity.

The Rugby Radio Station.

An All-British £400,000 High-power Telegraph Station.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E.

(Abstract of Paper read before the WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHEN the Government decided upon the provision in England of a wireless station with a world-wide range, the Wireless Telegraphy Commission which was originally appointed under the chairmanship of the late Lord Milner with Dr. W. H. Eccles (vice-chairman), Mr. E. H. Shaughnessy and Mr. L. B. Turner as members, undertook its general design and Post Office engineers prepared detailed drawings and designs for the equipment as a whole and for most of the plant.



Fig. 1.—The Main Station Building.

To ensure reliable communication when working on a wave-length of about 18,000 m. (16.66 kilocycles) a minimum working current of 500 amperes in an aerial supported on 820-ft. masts would be required, and it was decided that the high-frequency generating valve plant should be capable of dealing with an input of 1,000 kW to provide for a possible necessary low working efficiency of 50 per cent. Such an installation would produce an aerial current of about 700 amperes to meet bad atmospheric conditions. It was decided to erect in the first instance an aerial having a designed capacity of 0.045 μF on 12 insulated 820-ft. masts and to ascertain its limitations. The station buildings are about the centre of the site which has an area of 900 acres (about 1½ miles long by 1 mile wide) at Hillmorton, about four miles south-east of Rugby.

Power Plant.—Electricity is purchased in bulk from the Leicestershire and Warwickshire Electric Power Co., the incoming supply being 3-phase, 50-cycle, with an earthed neutral and 12,000 volts between phases; automatic regulators are installed at the company's sub-station.

All larger motors (*i.e.*, over 100 kW) are synchronous machines capable of operating on 0.9 leading power factor and as a result the station can be operated on unity power factor.

The e.h.p. a.c. 6-panel switchboard consists of 5 truck cubicles and a metering cubicle, two being connected to the auxiliary 450-kVA transformers situated immediately below the switchboard, whilst a third (of 2,000-kW capacity) controls the main motor-generator sets. The low-pressure, a.c., 416-volt switchboard is of the normal slate pattern containing 16 panels, and controls all auxiliary power. These switchboards, together with a number of others and cabling, were supplied by the General Electric Co., Ltd.

The valve transmitter set called for a supply of d.c. power of from 1,000 to 1,500 kW at from 10,000 to 18,000 volts, with the negative side at earth potential, the higher voltage being provided to cope with probable developments in transmitting valves in the near future. Owing to the possible failure of valves, it was essential that whatever type of plant was installed it would have to be capable of standing a dead short-

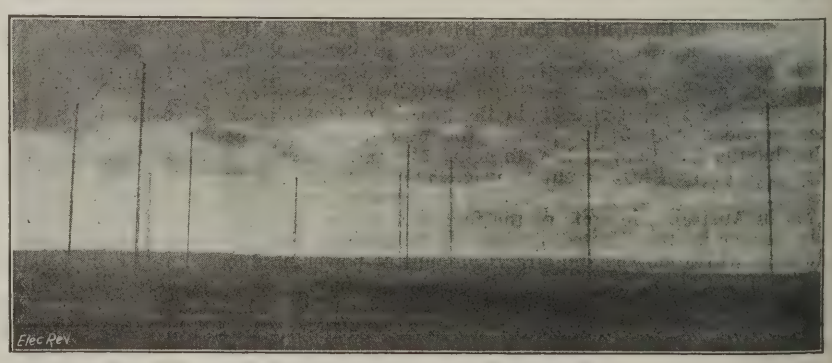


Fig. 2.—A General View of the Masts.

circuit with impunity. Other special requirements were ability to operate under rapidly fluctuating loads, low self-inductance, and absence of voltage ripple, and it was finally decided to install motor-generator sets manufactured by the British

Thomson-Houston Co., Ltd. Three sets are provided, fig. 3, each having an output of 500 kW at 6,000 volts d.c., and consisting of a three-phase self-starting synchronous motor of 640 kVA wound for 2,200 volts between phases, rigidly coupled to two d.c. generators connected in series, and two exciters, one of which is the main exciter and the other the motor field exciter; the main exciter provides field current for both d.c.

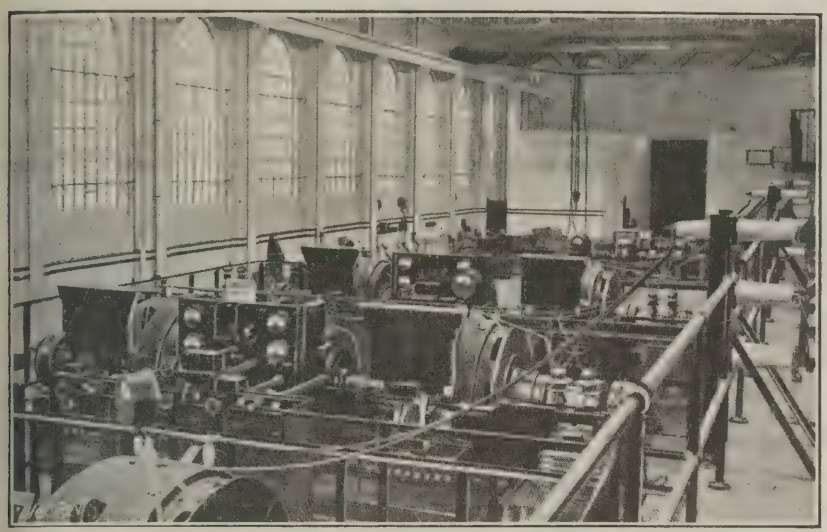


Fig. 3.—Main Motor-generator Room.

generators and for the field of the motor exciter. Each d.c. generator is a bipolar machine of 250 kW at 3,000 volts, provided with interpoles and compensating windings. The magnet frames of cast steel are split diametrically and in order to avoid awkward joints in the pole-face windings the break has been arranged through the centre of the main poles which consist of twin poles, each half carrying its own spool. Another unique feature of the magnetic circuit is a band of laminations incorporated in the yoke to provide an unlamped path for the commutating flux under rapidly varying loads. The commutator is of the same diameter as the armature, and all metallic parts in the vicinity of the commutator which are connected to the frame are protected by insulating shields. A series of fan blades mounted between the armature and commutator provides a blast of air across the commutator. The brush gear is completely encased in bronze boxes, the connections to which produce magnetic fields directed to blow out from the machine any arc which may be formed at the brushes.

In order to avoid the use of insulated couplings between motor and generators, each set is supplied with power through a separate transformer, manufactured by Messrs. Johnson and Phillips, wound for 2,000 volts on the primary side and 2,200 volts on the secondary side. The insulation of the secondary winding from the primary winding and core bunched was subjected to a flash test of 50,000 volts. The secondary side is connected directly to the motor terminals by means of a 3-core paper-insulated cable, and all a.c. switchgear is on the primary side of the transformer. The base-plates of each set are insulated from earth by being mounted on groups of porcelain insulators. The neutral point of the motor stator is connected to the base-plate as is also the mid-point between the d.c. generators through a leakage relay. In this way the potential of any portion of the set relative to the frames is limited to 3,000 volts d.c. When working in series each set has a base-plate potential corresponding to its position in the circuit; thus, the first base-plate will be at 3,000 volts, the second at 9,000 volts and the third at 15,000 volts above earth in each case. Each main base-plate carries two high-speed circuit breakers, each connected in series with a generator armature, set for instantaneous tripping on about 5 times full-load current; it inserts a blocking resistance in circuit and at the same time trips the generator field contactor, the contacts being fully opened within 0.02 sec., whilst in order to suppress the generator fields as rapidly as possible the field contactors open the circuit without inserting discharge resistances. Each set is completely surrounded by an earthed metallic screen and the foundations contain a metallic network which is connected to the earthed screens. All controls are operated by means of insulated spindles from outside the screens. The e.h.p. d.c. terminals of each set are connected to a 2-position selector switch mounted on a gallery carrying the busbars; in one position the switch connects the machine in series with the busbars, whilst in the other position the machine is isolated and the gap in the busbars bridged. The switch cubicles were supplied by the British Thomson-Houston Co., Ltd. In spite of the large dimensions of the machines for their output, necessitated by voltage requirements, the test-results showed an over-all efficiency of over 87 per cent.

In addition to the ordinary tests, the machines were subjected to short-circuit tests while fully excited; in the case of one set this test was repeated 20 times, in all cases without flash-over or damage of any kind. A copy of oscillograms taken on a single set by the B.T.-H Co. is shown in fig. 5.

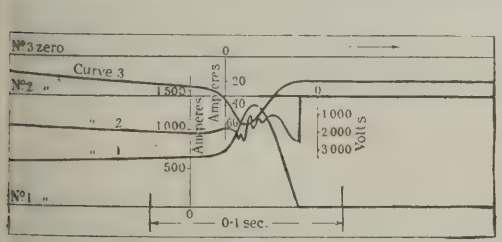
The d.c. supply from the busbars is transmitted to the valve room through armoured concentric paper-insulated cables, the inner conductor in each case being the h.p. conductor, whilst the outer conductor carries the return current at approximately earth potential. The cables terminate in a steel cubicle switchboard supplied by the General Electric Co., Ltd., and the use of oil circuit-breakers to rupture h.p. d.c. circuits is thought to be a novelty, but tests on short-circuits of 18,000 volts showed that the switches could successfully clear a fault without damage.



Fig. 4.—Power Valve Units, Exciter Panels, Control Desk and Auxiliary Switchboard (Right).

The valve-filament supply of the station is obtained from two 200-kVA frequency-converter sets, each consisting of a 416-volt, 50-cycle synchronous motor driving a 200-kVA, 354/478-volt, 100-cycle, three-phase alternator. Each set is provided with a pony motor and exciter. Tirrill regulators on each alternator control panel limit a.c. voltage fluctuations, and as an additional safeguard the regulators are fitted with excess-voltage cut-outs to provide against the possible failure of the regulator. The voltage maintained by the Tirrill regulators can be varied by remote control from the valve room.

For the operation of control and protective circuits, and as



Curve 1.—Short-circuit current (1 cm. = 756 amps.)
Curve 2.—Voltage across high-speed breaker, commutating pole, and compensating windings (1 cm. = 3,271.8 volts).
Curve 3.—Shunt field current (1 cm. = 48 amps.).

Fig. 5.—Short-Circuit Oscillogram.

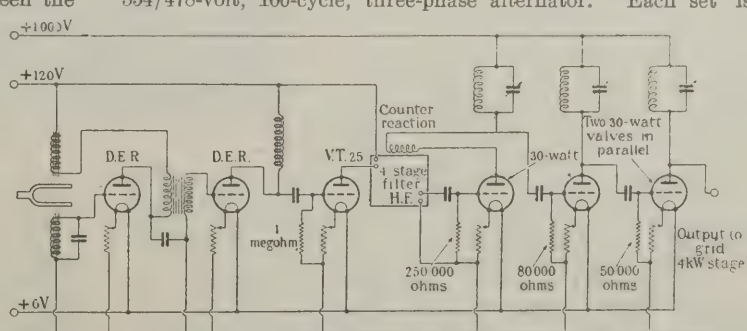


Fig. 6.—Tuning-fork Unit.

an emergency lighting supply, a small secondary battery has been installed with 30-kW charging generator and booster sets in duplicate. All circuits and machines are provided with protective devices designed to prevent damage from high-frequency currents. On the e.h.p., d.c. generator sets, spark-gaps having non-inductive resistances in series are connected across each generator armature; on other machines or feeders straight-filament lamps in cast-iron boxes are shunted across the machine terminals or feeder. In a few cases where the machine current is small a condenser of 2 μF capacity with lamps in series is used. A supply of current was required for providing aircraft obstruction lights on certain masts. As the masts are highly insulated from earth it was impracticable to take a supply directly from the mains. The difficulty was overcome by mounting a 2-kW, 240-volt, d.c. dynamo on the mast and driving it by means of a suitable 50-cycle squirrel-cage motor on the ground through the medium of a rubber motor-cycle belt. The motor is weather-proof and actuated by a Venner time switch.

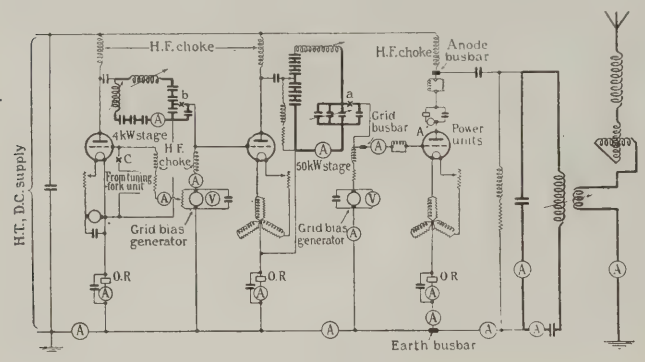


Fig. 7.—Transmitting Circuit.

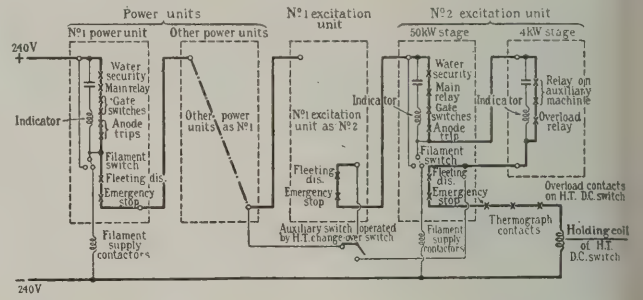


Fig. 8.—"Series" Control Circuit.

High-Frequency Generating Valve Plant.—The aerial was designed so that it could be used as one large aerial or be readily divided and two separate down-leads were provided so that it could be used for simultaneous transmissions when necessary. However, it was decided to carry out experiments in transatlantic telephony in association with the American Telegraph and Telephone Co., and the smaller part of the aerial has been reserved for this purpose for the present. The primary source or master oscillator is a valve-maintained tuning-fork having a frequency of about 1,800 cycles per second (adjustable within small limits), and the high-frequency required for controlling the main set is obtained by selecting the 9th harmonic of the tuning-fork frequency. The frequency produced by this means is remarkably constant, the variation with temperature of the tuning fork being about 1 cycle in 10,000 per deg. C. A small adjustable electric heater enables the temperature of the box containing the tuning-fork to be kept constant. The output from the fork is of the order of micro-watts and is amplified once at low frequency. The 9th harmonic is then selected, filtered, and amplified three times with low-voltage valves, giving a final output of 100 watts from the last of these three stages. The tuning fork and all the above stages of amplification are contained in two copper boxes mounted one above the other, the various stages being screened from each other by copper partitions (fig. 6).

The output from the tuning-fork unit is amplified three times before it is delivered to the aerial circuit, the various stages being designed to deal with input powers of the order of 4 kW, 50 kW, and 1,000 kW respectively and giving output powers of 2 kW, 30 kW and 540 kW respectively. The combination of the 4-kW stage and its associated 50-kW stage forms an "excitation unit," which with the tuning-fork units are provided in duplicate.

The final stage of amplification (*i.e.*, the power units) is not in complete duplicate. The practice of having a number of units capable of being worked in parallel on common busbars has been adopted.

High-pressure D.C. Supply.—The excitation units and the power units utilise the same high voltage d.c. supply, which is switched on to the 4-kW stage, the 50-kW stage and whichever power units are in use, by the pressing of a single button on the control table.

Fig. 7 shows the circuit arrangements from the output of the tuning-fork unit to the aerial; the tuned high-frequency circuits are indicated by the thick lines and a particular characteristic is the use of a single tuned circuit between one stage of amplification and the next, and the use made of capacitative coupling for giving the necessary voltage variations on both anodes and grids. Some of the advantages of such capacitative couplings are:—(1) A condenser provides a low-impedance path for the harmonics necessarily generated by a valve transmitter when it is operated as an efficient power amplifier, and thus acts as a desirable harmonic filter; (2) the actual voltage-swings are easily and accurately calculable, both for design and during adjustment; (3) the power factor of a good condenser being very low, the voltage and current are practically in quadrature.

Three busbars run the length of the installation for the anode, grid, and filament (earthed) respectively, and to bring a particular unit into operation in parallel with others it is only necessary to connect it to the busbars by one 3-way switch, and the filament switch.

The 4-kW stage utilises glass valves of the so-called 600-watt type—*i.e.*, capable of a dissipation of 600 watts—and the panel can be equipped with 1, 2 or 3 such valves. The 50-kW stage utilises three water-cooled valves similar to those in the power units, and the coils forming the inductances of the high-frequency circuits of both stages are constructed of cable of insulated and stranded wires, wound on a framework of American whitewood in a similar manner to the large inductances described later. The cable of the 4-kW stage inductance is 243/36 S.W.G. and that of the 50-kW stage is 729/36 S.W.G. The condensers of these high-frequency circuits are mica condensers in oil. Associated with each excitation unit is one motor driving four generators, utilised for the following purposes:—(1) 500/1,500 volts, $\frac{1}{2}$ amp.; anode supply for various amplification stages of tuning-fork unit; (2) 15/20 volts, 60 amps.; filament supply for 4-kW stage, and also for tuning-fork unit by means of potentiometer; (3) 40/600 volts, 12 amps.; grid-bias voltage for power units; (4) 200/600 volts, 1.5 amps.; grid-bias voltage for 50-kW stage and also for 4-kW stage by means of potentiometer.

With such a chain of amplifiers one probable difficulty is the self-oscillation of the system in whole or part due to retroaction from the later to the earlier stages, but this tendency can be reduced by screening between the various stages.

Power Unit.—When the design for Rugby was prepared, the largest power valve commercially available which had been subjected to severe traffic tests was the Western Electric water-cooled valve which is capable of dealing with an input of 20 kW, of giving an output of 10 kW, and continuously dissipating 10 kW when operated at a d.c. anode voltage of 10,000 volts, the filament consumption being 41 amperes at 22 volts. All the valves used in the installation were manufactured by the Western Electric Co. at New Southgate, England.



Fig. 9.—Main Condenser Banks in Intermediate Circuit.

An efficiency of the order of 95 per cent. can be expected from the coupled circuit to the antenna, which means that for an aerial power of 500 kW an output from the valves of about 520/530 kW is required. The determining factors in deciding the size and number of the power units were as follows:—(1) The number of valves in each unit should be preferably a multiple of 3 in order to permit the balancing of the filaments between the 3 phases; (2) the number of units must not be unduly large, in order to avoid complication of wiring and excessive duplication of meters, &c.; (3) the number of units should be sufficient to enable the number of valves in use to be varied in suitable steps (*a*) for the station to work on low power if this proves to be economically desirable, or (*b*) for the utilisation of a smaller number of greater power valves as the manufacturing technique of power valves develops; (4) the number of units should be suitable to provide two transmissions of the order of 300 kW aerial power and still leave a

spare unit. These considerations led to the decision to provide 5 power units, each capable of an output of 180 kW from 18 10-kW output water-cooled valves; 3 power units would be required for a 500-kW aerial power transmission, leaving two units spare; also two transmissions of over 300 kW aerial power could be undertaken by using two power units for each, leaving one unit as a spare in reserve. A power unit consisting of 18 valves is a rectangular enclosure with 9 valves on each side and the two anode panels are supported from the floor by 4 18-in. insulators that also supports the copper water pipes between these panels which not only act as headers for the water supply to the anodes, but also as the anode busbars for the valves in the panel. In the event of any particular valve taking an excess current due to softness or any other reason, the corresponding relay operates, releasing a hammer normally held up by the armature of the relay which in turn operates a mechanism which trips the high-pressure d.c. switch by breaking the "holding coil" circuit.

The distilled water is supplied through 30 ft. of 2-in. diam. rubber hose wound on a horizontal wooden drum at the bottom of the power units. The long length of water in the rubber hose provides the necessary insulation of the anodes from the earthed metal parts of the water cooling system, and the drum carrying this hose is a part of the insulated anode system. The short lengths of rubber tube from the headers to the valves provide the insulation required between valves to permit the insertion of relays, coils, &c., in the individual valve anode circuits. The insulation of the anode system of one power unit under working conditions with water flowing is of the order of 520,000 ohms, giving a leakage current through the water at 10,000 volts of only 20 mA.

The Paralleling of Valves.—One of the difficulties is the tendency of the valves to "self-oscillate," individually, or in groups, the inter-electrode capacity of adjoining valves, or groups of valves, forming the condenser of the oscillating circuit in association with the inductance of the connecting leads, &c. These difficulties are increased with water-cooled valves where the existence of the water jacket increases the inter-valve and inter-electrode capacities very considerably. The system is made stable by one or more of the following devices:—(1) The provision of a small condenser between the grid and filament of each valve, as close to the electrodes as possible, in order to make the grid-filament impedance capacitative. (2) The use of "stopper" circuits in the individual anode, and/or grid circuits, consisting of an inductance in parallel with a resistance high compared with the impedance of the inductance at the transmitted frequency. For undesired oscillations, however, which are of a much higher frequency, the added inductance becomes a large proportion of the inductance of the circuit and the resistance across it provides sufficient damping for the conditions of self-oscillation of the valves to be unfulfilled (Western Electric Co.). (3) The insertion of a series resistance in the individual anode or/and grid circuits which acts as a damping for self-oscillation, but is not of high enough value to cause a large power loss at the transmitted frequency.

The paralleling of the power units themselves also involves consideration as to the method of prevention of inter-oscillation between power units.

At Rugby the combined anode of the power unit is fed to the main anode busbar through a "stopper" circuit consisting of an inductance of 100 μH in parallel with a resistance of morganite plates of 8.5 ohms. The combined grid of the power unit is fed to the main grid busbar through a "stopper" circuit consisting of an inductance of 50 μH in parallel with a resistance of 300 ohms formed by 6 straight-filament lamps in series.

Safety Devices.—Safety devices for the protection of the staff are provided. The protection of plant is of special importance, because the closing of the h.p. switch for a very short period under incorrect conditions might result in the destruction of a number of valves, and there is a possibility of valve failures which amount to a short-circuit of the 10,000-volt d.c. supply. All the safety devices and relays are therefore linked in one series circuit through the "holding" coil of the high-pressure d.c. switch. A disconnection in any one place will prevent the switch from being closed, and also the breaking of the circuit at any point during transmission due to a fault or an overload will open the switch. Fig. 8 is a skeleton diagram showing the circuit arrangement of this "series" control wiring.

(*To be continued.*)

The Electricity (Supply) Bill, 1926.

Some Authoritative Constructive Criticism.

The following statement has been sent us by Mr. R. A. Chattock, president of the Institution of Electrical Engineers, and city electrical engineer, Birmingham:—

Since the Bill was published there has been a large amount of criticism from various points of view. Most of this has been destructive and will not, I think, help the Government to any great extent. It seems to me, therefore, desirable to try to put forward something constructive.

The Bill is designed to make the handling of electric current easier, to cheapen its production, and make it available throughout the country.

It is apparently the complaint of the Government that existing facilities have not done this, and that to this extent the present supply undertakings have failed. I think this complaint, if it is really justified, is due rather to the inefficient and hampering legislation in the past, than to the shortcomings of the undertakings.

There is no doubt that the existing machinery is cumbersome, and requires simplification. As an example, the Birmingham undertaking has waited for nine months for sanction to supply a rural district outside the Birmingham boundary. Doubtless other undertakings are hampered in the same way.

I feel that it is unfair to criticise the industry on this account. What is wanted is the provision of greater facilities to prevent these delays, and machinery to make easier and simpler the obtaining of wayleaves for overhead lines.

There is no indication in the Bill that the present hampering restrictions will be done away with. I am afraid that the establishment of the proposed Board will tend to make things still more difficult. It will, in fact, be the buffer between the industry and the Electricity Commissioners, and we can only anticipate a slowing-up of the present procedure when it is established.

The main duties of the proposed Board can apparently be divided into two sections:—

1. To control and cheapen the cost of generation.
2. To provide for main transmission throughout the country.

Considering the case of generation first, if we look at the large industrial centres which have already established highly efficient generating stations of large capacity, which stations would probably be "selected" by the new Board, it certainly does not appear that control of any such stations can materially affect the cost of producing electricity in them. It is only when we come to the large number of small generating stations throughout the country that improvement can be looked for.

If, therefore, the big stations in the industrial centres are allowed to develop on present lines, and if those undertakings are required to extend their stations, and, if necessary, build new ones in order to furnish a supply to very much larger areas, there does not seem to be any need to interfere with them so far as generation is concerned.

When we come to transmission, however, a different picture presents itself. The establishment of main transmission lines from the large industrial generating centres to the rural districts and the smaller towns in the country is work for which there is at present insufficient machinery set up.

Here is where a Central Board might do very valuable work. Powers could be given to it to purchase from the existing large centres what current it required for distribution, and to retail it in bulk to the distributing authorities outside those centres. Such current might be purchased at cost price and retailed at a price which would cover the cost of transmission and administration.

In this way the smaller undertakings would, in a very large number of cases, be placed in the position of obtaining their current at a cost cheaper than they could generate it at their own stations. When this happens it would be commercially sound for them to purchase what they require in bulk and eventually to close down their generating stations. Such procedure would not savour of coercion as is hinted at in the Bill.

This very process has been going on within the large industrial areas already. Birmingham has closed down four small generating stations, and it transmits current from its large generating stations to those centres from which it is distributed. This change has come gradually, and only when it has proved to be sound commercially.

It would be attractive to the large centres to sell current in this way, at cost price, as their turnover would be largely increased, and though their load factor would only be slightly improved, the fact of the larger turnover would really enable current to be produced more cheaply.

The stimulus of competition in low cost of production would also remain between different areas a most valuable asset. There would be no such incentive left under the scheme outlined in the Bill.

As regards the establishment of main interconnecting lines between large centres, I cannot see that the cost of this is justified. There will be sufficiently large generating stations in each area to justify coupling them up regionally, and the cost of doing this will be very much less than coupling up nationally. Ample spare plant to ensure reliability would be justified in each area amongst its own group of stations, and there should be no necessity whatever to draw current from other centres, perhaps a hundred miles away, at a much higher cost.

Development on these lines will render the standardisation of frequency unnecessary, while if current of standard frequency was required in an area which is at present non-standard, there would be no objection whatever to the installa-

tion of generating plant built for standard frequency in non-standard stations.

This plant would have the benefit of the high economy of the large station behind it, and any current produced by it would cost no more than the bulk of the current supplied from such a station.

There does not therefore appear to be any justification for an upheaval such as is proposed in the non-standard areas, at such a colossal cost as is indicated in the Bill.

I am convinced that the pooling of the load factors of different areas would make practically no improvement in the average load factor. I agree that this looks an attractive proposition, but it is, in my opinion, very questionable whether the diversity factor is really great enough to create any improvement.

The hours of employment in industry are practically identical in all areas, so that the power load would be demanded over identical periods each day. The habits of the residential population do not vary in different areas, their meal times, their hours of rising, and their times of retiring to rest are the same, and one cannot imagine that there would be any diversity here.

If an improvement in the average load factor is desired, I maintain that the railway system throughout the country should be electrified. If this were done, the load factor would be undoubtedly improved. The comparatively high load factor obtained on the North-East Coast is largely due to railway supply, whilst in America load factors of 40-45 per cent. are obtained, also due to railway electrification.

As regards week-end pooling of plant throughout the country, the large expenditure which would be required for the interconnecting lines would certainly not be justified by this. Regional week-end pooling in each area would provide all that is necessary for obtaining the highest economy of operation.

A very important consideration in connection with the proposed "Gridiron" is the danger of concentrating such an enormous capacity of plant on to one system. The tendency at the present time is to sectionalise the main system network more and more, partly to limit the effect of disturbances, and partly to enable the control switchgear to operate with certainty. Even at the present time the large size and capacity of the switches that have to be employed is increasing the cost of switchgear out of all proportion to the rest of the station.

I am convinced that we shall come to an arrangement in which each large generator will supply its own group of circuits, entirely distinct from any other. As the load falls off, generators will be paralleled, and the load transferred so as to keep those running on circuit properly loaded up.

In Birmingham, in order to provide the safeguards indicated above, the city has already been divided up into two sections, and further division is contemplated as the capacity increases. This has been found necessary on a system which at present has a total capacity of 140,000 kW.

In the Weir Report reference is made to the necessity for interconnection between areas, and in support of this (see Clause 25) Mr. S. Insull, President of the Commonwealth Edison Company of Chicago, stated in evidence that in his judgment any man who refuses interconnection (and he did not exclude England) does not understand the fundamental economies of the business.

I was very surprised to see this reference to Mr. Insull's evidence before the Weir Committee, because some two years ago several engineers, including Mr. Insull, Junior, from the Commonwealth Edison Company of Chicago, called on me in Birmingham and discussed a proposal to split up the high-tension system.

They informed me that they had suffered very serious interruptions due to disturbances which it was impossible to control owing to the enormous plant capacity that was grouped on to the interlinked system, and they were considering the question of sectionalising the system in order to limit the plant capacity of any one section.

Again, quite recently I received a communication from Mr. George A. Orrok, consulting engineer to the New York Edison Company, in which he stated that in the Hell Gate and Sherman Creek Stations in New York they are now isolating the large generators, each one being connected to a group of feeders in order to minimise the effect of disturbances that may occur.

Further, again, Mr. Alexander Dow, the President of the Detroit Edison Company, has published an article* in which he describes a method which he calls the "Loose Linking of Large Power Sources" in order to minimise system disturbances and reduce the duty on the circuit breakers without sacrificing flexibility and enonomy of operation. He states that continually increasing demands and generating capacity, together with the close knitting of the transmission system, forced them into adopting this method some years ago.

The service was becoming jeopardised by the amount of generating capacity behind the circuit breakers. The whole connected capacity was ever ready to spill an immense amount of energy into a fault whenever one developed. They could not allow conditions to continue that were favourable to system-wide disturbances. They have even applied this method to the two halves of one generating station.

Experience has shown that the tieing of sections together in this way does not require any greater reserve capacity of generating plant than in a system that is closely interconnected all the time.

In Mr. Dow's opinion, even if more reserve capacity were required, it is not so expensive to provide it by means of reserve generating plant capacity as by heavy tie lines between generating stations. In this way they have minimised the duty of circuit breakers, and consequently the possibility of failure and service interruption.

I therefore feel that a case has not been made out for pooling the generating resources in this country, but that very valuable results would be obtained by placing all main transmission lines and the purchase and sale of electricity passing through them in bulk in the hands of one, or possibly several, boards.

* See Elec. Rev., February 12th, 1926, page 269.—Eds.

British Plant in China.

Some Small Gas-Engine Electricity Generating Stations.

The British machinery market in China has held its own from the beginning. Numerous steam power plants for electricity supply have been installed in the provinces, ranging from the huge 20,000-kW Parsons and Metropolitan-Vickers turbo sets in the Shanghai Municipal Electricity Department, to the small home-lighting sets found in the small towns; yet the introduction of gas-engine plant is a recent event, dating back only a score of years. A typical installation of such a plant is that of the Kiangwan Electric Light Co., Ltd., Kiangsu, a description of which may prove of interest as the equipment is all British.

The town Kiangwan is only four miles north of Shanghai and is situated on the Shanghai-Woosung branch of the Shanghai-Nanking Railway, so that the transportation problem is not so difficult as is experienced in the interior. The company had three vertical hot-bulb oil engines of Continental make in the early stage of its development, but with the growth in the demand it was decided to increase the plant capacity by two 100-kW gas-engine sets. As an emergency measure to meet the demand pending the arrival of the machinery, the company obtained from local stock one "Mirrlees-Diesel" vertical, single-cylinder, open-type engine, 50 h.p., 250 r.p.m., to drive an International G.E.C. 40-kVA alternator, a small petrol engine compressor being used for charging the air bottles. The two gas-engine plants were erected during the summer of 1922, when one set arrived about a month prior to the second one, thus enabling the engineer to supervise their erection separately. The engines were manufactured by the National Gas Engine Co., Ltd., and are of the twin-cylinder horizontal type, each developing 150 b.h.p., at 210 r.p.m. They run on producer gas, suction-gas plant having been supplied by the makers of the engines; anthracite is used as fuel. Each gas engine belt drives a 127-kVA alternator, 3-phase, 50 periods, 2,400 V, 750 r.p.m., directly coupled to an exciter, manufactured by Messrs. Bruce Peebles & Co., Ltd.

The switchboard was supplied by Messrs. Whipp & Bourne, Ltd.; it is of the open type, consisting of four panels, excluding the feeder and exciter panels. The oil switches, made by Messrs. Erskine, Heap & Co., Ltd., are fitted with overload and no-volt trips. Synchronising equipment is provided, but the alternators are running on separate circuits and are therefore not required in parallel. Other electrical apparatus like distributing panels, transformers, and protective gears, are native made, but large quantities of cables and wires were supplied by Messrs. W. T. Henley's Telegraph Works Co., Ltd. The erection was carried out by native engineers and labourers under the supervision of Mr. R. A. E. Denton, of the British Electrical and Engineering Co. of China, Ltd., Shanghai, who supervised the Diesel-engine erection also. The plant has been running since it was first put down and the repair costs have been negligible.

A similar 127-kVA set is installed in the city of Tatung, on the Yangtse River in the Kiangsi Province, and another gas-engine installation is to be found in the works of the Yangchow Electric Light and Power Co., Ltd., Yangchow, Kiangsu Province. The latter consists of a direct-coupled vertical engine alternator set. The engine, also made by the National Gas Engine Co., Ltd., is of the six-cylinder, three-crank, tandem type developing 450 b.h.p. at 300 r.p.m., with anthracite suction gas-producer plant. The alternator is of Messrs. Mather & Platt's manufacture, and is rated at 300 kW, 0.8 power factor, 2,300 V, 50 periods, 3-phase. The switchgear was supplied by Messrs. Erskine, Heap & Co., Ltd. The set was installed by the Jardine Engineering Corporation, of Shanghai, in 1924, and has given every satisfaction.

At the present time crude-oil engines are more favourably considered in China than gas engines. British plant is still prominent on the market, though the prices are not very competitive with those of the Germans.

Swiss Electric Locomotives.—Work is in hand at the works of the Sécheron Co. at Geneva on the electrical equipment of four locomotives which, it is claimed, will be the most powerful in the world. The engines, which are intended for service on the Lotschberg mountain railway, are being provided with six 700-h.p. motors, and are intended for the haulage of trains for which two engines have hitherto been required. The locomotives have nine axles, and are 82 ft. in length.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

The Guildford Corporation Bill.—The clauses in this Bill by which the Guildford Corporation seeks power to sell electrical fittings and wiring, and to open showrooms, were considered by Section A of the Local Legislation Committee of the House of Commons last week. As in the case of the Colwyn Bay and Doncaster Bills, there was opposition from the local contractors.

Mr. W. J. Jeeves, K.C. (who appeared with Mr. Rowand Harker, K.C., for the Corporation), said that the electricity undertaking at Guildford was acquired by agreement in 1921. Since the Corporation had acquired the undertaking the consumption of electricity had been more than doubled, and the price reduced by 32½ per cent In view of that record, he was confident that the Committee would agree that the Corporation could be trusted to conduct the undertaking in the best interests of the consumers. The erection of a new generating station was contemplated, because the present station was working almost to its full capacity, and the area of supply had been increased. The great majority of the houses in Guildford were of the small type, and the present position was that if the occupier of a house could not put down in a lump sum the price of his installation, he could only hire it and pay a rental for all time, and had no opportunity to buy it. The contractors in Guildford had done nothing to increase the consumption of electricity in the town. Their view, that the exercise by the Corporation of the powers asked for would drive them out of business, was an entire misconception, because the contractors would get more work than at present, as was shown by the results achieved in other towns.

Mr. W. E. Affleck (the electrical engineer to the Corporation) was the first witness. He was cross-examined by Mr. Craig Henderson, K.C. (who appeared with Mr. M. N. Drucquer for the contractors). Following a statement by the witness that one of the main reasons why he wanted selling powers was that he wished to develop electric cooking and sell cookers on the deferred-payment system, Counsel urged that the Corporation could develop electric cooking just as well by means of simple hire, under its existing powers, and suggested that in its present stage the electric cooker was liable to become obsolete at a not very distant date, so that the wise man would hire rather than purchase a cooker. Witness disagreed with this view, and said that there were a number of people in Guildford who were anxious to purchase electric cookers by the deferred-payment system. The large majority of contractors in Guildford were inefficient. If the Corporation had wiring and selling powers, it could carry out wiring as well as it could be carried out by the few first-class contractors there, and probably cheaper than one or two of them.

Discussion then turned upon the desirability or otherwise of the Corporation being bound to carry out wiring through the contractors. Witness objected to this, however, on the ground that the Corporation would have to finance the contractors, who stood to gain everything and to lose nothing. He said that his charge for wiring would be as near cost as possible. Counsel said that that would make it impossible for the contractors to compete. It was suggested by the Chairman that, in the event of wiring and selling powers being granted to the Corporation, it should exercise caution, and obtain quotations from contractors for the equipment of houses of various sizes before establishing its own wiring department. Witness was confident, however, that he could keep a staff of ten wiremen continuously employed for a good many years to come, and said that he would not recommend his Committee to establish a showroom and launch a big development campaign without the powers to wire and sell.

Mr. J. B. Rapkins (Mayor of Guildford, and chairman of the Electricity Committee) gave evidence, and attributed the increased consumption of electricity in Guildford mainly to the facts that the Corporation had improved the efficiency of the works and had decreased the price. He said that it was necessary that the wiring should be carried out by the Corporation rather than by the contractors under Corporation supervision. Counsel held, however, that it was merely a matter of preference; the contractors had no objection to supervision. As to the suggestion that the contractors had done nothing to help the development of electricity, Counsel said that the Corporation had not encouraged them to do so.

Mr. L. L. Robinson (Borough Electrical Engineer, Hackney) spoke of the results achieved in Hackney, where the Borough Council had possessed wiring and selling powers since 1906, and said that the exercise of those powers had been beneficial to contractors, the Borough Council and the consumers alike. As evidence that the exercise of those powers had not injuriously affected the contractors, he said that during the last year 296 installations had been executed by the Borough Council's workmen; 98 had been executed by contractors to the order of the Borough Council; 378 were executed directly for the consumers by local contractors; and 491 directly for the consumers by contractors whose business premises were outside the Borough Council's area. A very large number of those orders had originated from the canvassing work of the Borough Council. His experience was that most of the contractors were in a small way of business and could not do much canvassing; also, they did not put forward hire-purchase systems. He did not think many contractors charged less than cost plus 35 per cent. for installations, "cost" being labour and materials. It was suggested by Mr. Craig Henderson, in cross-examination, that the best work was done by contractors in Hackney on the basis of 20 per cent. on cost, this including overhead charges. Witness said that that was not his experience.

Mr. W. Finlay (secretary and solicitor to the Electrical Contractors' Association of Scotland) was the first witness on behalf of the opposition, and spoke of the excellent results accruing from the co-operation of the supply authorities and contractors in Glasgow and Edinburgh. He agreed that it was wiser to hire an electric cooker than to buy it at the present time, in view of the possibility of obsolescence, but added that the charge for energy for heating and cooking in Guildford to-day was 2½d. per kWh, at which price it was not a practical proposition. He had visited Guildford, and had found that at least three of the contractors there had up-to-date showrooms. Cross-examining Mr. Jeeves pointed out that the prices which were charged in Glasgow for installations were prices which were settled by the Glasgow Corporation and the contractors in consultation, and Glasgow was able to work such an arrangement because the Corporation had powers to execute the work itself. In Edinburgh, however, the Corporation had not those powers, and he suggested that that was the reason why there was no controlled schedule of prices there. Witness replied that there was no necessity for a controlled schedule of prices in Edinburgh, because the Corporation did not sell installations and had not yet started hiring them. It was put to the witness by Mr. Jeeves that there was no reason why the Guildford Corporation should not co-operate with the contractors if granted wiring and selling powers, but witness pointed to the statement of Mr. Affleck, that he proposed to charge a price for installation work which was as near cost as possible. The Chairman said that the only point at issue was that the wiring should be done through the contractors. He pointed out, however, that the Corporation had to find the money, and had to take the risk involved in maintenance, which was important. He asked why contractors should not guarantee the efficiency of installations or apparatus which they supplied during the period covered by the deferred payments. Witness replied that an apparatus or installation might fail in a short time owing to abuse by the user, but if it failed because the installation was bad in the first place, then it was the fault of the person who had inspected it on behalf of the Corporation.

Mr. T. E. Alger (president of the Electrical Contractors' Association) said that the Association did not object to hire purchase so long as the wiring was carried out by the contractors, and that the Association had no part in the control of prices.

Mr. W. J. Brown (of Messrs. Tiley & Brown, electrical contractors, Guildford) said there were eight *bona-fide* contractors in Guildford—and that was a conservative estimate—with permanent staffs numbering about 64. There were sufficient firms of standing to carry out the whole of the wiring required there. He welcomed supervision of his work by the Corporation. He agreed that his firm were also ironmongers and general engineers, and that electrical contracting constituted the smaller part of the business. He believed that none of the contractors in Guildford had offered publicly to wire houses on the hire-purchase system, and in his view it was not a commercial proposition.

Mr. Craig Henderson, in his summing up, urged the view that the question under discussion was one which should be settled by Public Act. The general law did not confer upon municipal electrical authorities the powers which were now asked for by the Guildford Corporation, and a special case had to be shown before the general law could be extended to them. No special circumstances had been put forward, however, with regard to Guildford, and it had been admitted by Mr. Affleck that there were electrical contractors there who were competent to carry out the necessary installation work, as well and as cheaply as he could do it. There was no case for the granting of selling powers, but, if they were granted, they should be limited to genuine hire-purchase.

Mr. Jeeves (for the Corporation) adopted the argument that Mr. Craig Henderson's remarks constituted a plea for the continuation of the middle-man, which must inevitably result in increasing the price to the consumer. But if the powers were granted, the middle-man would not be eliminated, and he would still have a chance to compete. It was unreasonable that the Corporation should go to the expense of providing a showroom and of canvassing, but should not be allowed to reap the benefit.

The Chairman, in announcing that the Committee had decided to grant the powers, said that the evidence had led it to the conclusion that the provision of electrical installations in small property by means of a system of deferred payments had been very successful. The Committee felt that the Corporation should "go slow" in this matter and seriously consider every move in the interests of the consumers. Where there were reputable wiring firms, upon whom it could rely to do good work at reasonable prices, it would do well to employ them and to seek their co-operation. Also, whatever staff the Corporation employed in the exercise of the powers should be fully occupied, in order to avoid waste and increased costs. The powers would also enable the Corporation to protect itself against high prices.

Mr. Jeeves intimated that the policy which the Committee had advocated would be the policy which would appeal to the Corporation, and Mr. Drucquer intimated that the contractors would do their best to co-operate loyally with the Corporation.

Trans-Atlantic Telephonic Communication.—On April 20th, Sir H. Brittain asked the Postmaster-General whether, following the recent successful trans-Atlantic telephonic communications, any further developments were taking place.

Sir W. Mitchell-Thomson said that he was not in a position to give the House any further information with regard to those tests at present. Experiments continued to be conducted with a view to solving the numerous technical difficulties involved in simultaneous two-way radio-telephone transmission where land telephone lines must be associated with the radio link at both the transmitting and receiving ends.

Bristol Corporation Scheme.—On April 20th, Colonel Woodcock asked the Minister of Transport whether it was the intention of the Electricity Commissioners to withhold permission to the Bristol Corporation to proceed with its power station at Portishead until such time as the Electricity (Supply) Bill had been placed upon the Statute Book.

Colonel Ashley said he understood that the Electricity Commissioners did not propose to come to a decision on the point until Parliament had considered the Bristol Corporation Bill, but it might not be necessary to defer the consideration of this matter as suggested.

Smoke Abatement.—In the House of Lords, on April 22nd, during the Committee stage of the Smoke Abatement Bill, Earl De La Warr moved the insertion of the following new clause:—"It shall be the duty of a local authority on submitting proposals for the provision of houses for the purposes of the Housing Acts, 1890 to 1924, to satisfy the Minister that suitable arrangements are to be made for heating and cooking as are calculated to prevent or reduce the emission of smoke."

Viscount Gage, resisting the amendment on behalf of the Government, said that the Minister of Health was opposed on principle both to placing restrictions on the discretion of local authorities, and to attempting to interfere with the ordinary domestic habits of the people, except where it could be clearly shown that such action was necessary. Very great progress had already been effected without compulsory measures in connection with housing schemes in the substitution of gas for coal for cooking. Numerous examples also existed where electricity had been installed as the lighting and cooking agent, and experiments with all-electric houses were being tried on a considerable scale by several local authorities.

Lord Newton said that new housing estates were being put up all over the country, and it would be a crime if when public money was spent on such places they should be allowed to defile the atmosphere with their old-fashioned methods of heating and cooking.

Lord Banbury held that both gas fires and electric heaters were very expensive, and to pass the clause would add to the cost of the new houses.

The new clause was rejected by 40 votes to 8.

Power-Station Engineers.—On April 26th, Mr. Hore-Belisha asked the Prime Minister, whether he had received a letter from the Executive Council of the Electrical Power Engineers' Association pointing out the hardship which accrued to power station engineers, in view of the operation of Admiralty Order C.E. 194/25, whereby, although their responsibilities remained the same, they had been reverted to the minimum of the scale for their grade, resulting in many cases in a financial loss of £50 a year plus the appropriate bonus; and whether it was proposed to remove the grievance brought about by the operation of this regulation.

Mr. Davidson said that the matter referred to had recently been under consideration and a favourable decision had now been reached. This fact had been communicated to the Electrical Power Engineers' Association.

The Budget.—The Chancellor of the Exchequer introduced his "Budget" for 1926-27 on April 26th. No proposals of a revolutionary nature affecting business were put forward, but the following will have a bearing on business:—The assessment of income tax on a three-years' average is to be abolished in favour of assessment in respect of the preceding year, commencing in 1927; it is not proposed to renew the Trades Facilities Act next year; the import duty on arc lamp carbons is to be raised to 1s. per lb.; and the Key Industry Duty is to be extended, until 1936, to cover component parts of scientific instruments and amorphous carbon electrodes, not including primary battery or arc lamp carbons, at a rate of 33⅓ per cent. *ad valorem*. The tax on electric vehicles is to remain unchanged at £6 per annum.

Legal.

Cable Engineer Sent to Prison.

At Garstang Police Court, on April 22nd, Gerald S. Race, of Knott End, was charged with stealing £63 belonging to the Pirelli-General Cable Co., Ltd., of Southampton, which recently carried out a contract in the Preesall district. It was stated that prisoner took up the position of chief engineer in January last, and he had control of the work. Each week he had to send the firm a requisition for wages, &c., and received the necessary cheque. From January 1st to March 26th he requisitioned £1,235, and he disbursed £1,197, leaving a balance in hand. The company also sent him during the same period £25 for insurance stamps. The cards, however, had not been stamped and prisoner was subsequently arrested in Ireland. Mr. T. W. Busby, assistant contract manager to the company, said that prisoner's wages were £5 10s. per week.

Prisoner was also charged with obtaining money by false pretences from A. Parkinson, taxi proprietor, Knott End. The allegation was that prisoner ran up a bill of £7 for taxi fares, and also obtained £7 from Mr. Parkinson. He made out a cheque for £14, but this was dishonoured by the bank.

Prisoner said if the Court would give him another chance to make good, he would take advantage of it. He was sent to prison for one month, in the second division.

Claim for a Dynamo.

At Burnley County Court, on April 22nd, Messrs. George Mitchell & Co., electrical engineers, Burnley, sued W. Eccles, junr., electrical power and lighting engineer, Blackburn, for £43 10s. Plaintiffs claimed that they had supplied a second-hand dynamo to the following specification: 220 V, 800 r.p.m., and from 9 to 10 kW.

Defendant alleged that the machine was not up to its reputed capacity, and that the insulation was defective at the time of delivery.

The Judge found for defendant, stating that the plaintiffs had not carried out tests to support their claim that the dynamo was of the character claimed for it.

Richmond E.L. & P. Co.'s Pension Fund.

Mr. Justice Romer, in the Chancery Division on April 20th, heard a petition for the alteration of the objects in the memorandum and articles of association of the Richmond (Surrey) Electric Light & Power Co., Ltd.

Mr. Uthwatt, for the company, said the object was to give the company power to set up a pension fund for its employés.

His Lordship said he did not like the unrestricted power given in the proposed alteration under the head of "charitable objects." He thought it should be limited to objects directly or indirectly for the benefit of the company. With this amendment he confirmed the petition.

A Bankruptcy Offence.

After a trial lasting two days, the hearing was concluded at the Central Criminal Court, on April 23rd, of the case against William Henry Pease (39), an engineer, of Abbey House, Victoria Street, S.W.1, who surrendered to his bail and pleaded "not guilty" to an indictment which charged him with obtaining credit without disclosing the fact that he was an undischarged bankrupt. He was found guilty, and the Judge passed sentence of three months' imprisonment in the second division.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Heating of Buried Cables—Report No. 2.

There would appear to be a serious slip in the formula published in the above report relating to the temperature rise in three-core cables, and as the report itself is such an invaluable document and basis of reference, and I cannot find any corrections publicly attached to the report, it seems to be in the interest of the electrical profession, more particularly of those engineers, who, like myself, are not connected with cable manufacturing firms, that the correction should, as early as possible, be given sufficient publicity to save others from having to repeat the investigation which I have had to do to discover the source of the error. (Of course I know that in the case of the big cable manufacturing firms, who have had representatives on the Standardising Committee, the information conveyed in his letter has no doubt been imparted verbally to their staffs.)

Put very briefly, the trouble is as follows:—

The value of the resistivity "K," if calculated from equation (25) on page 534 of the *Journal* of the Institution of Electrical Engineers for May, 1923, will give results which are 300 per cent. too high.

If, then, one were to put this value obtained for "K" into equation No. 33 in order to obtain the value for "S" (the thermal resistance per unit length), one again gets results 300 per cent. too high.

The same remark applies more or less to equations 15, 18, 26, 29, 42, 44, 48 and 52.

Again, in equation (58), in the first term of the denominator, a symbol (r_a) is given, which would appear to be the resistance of one of the cores of the cable, but which is stated on page 566 to be the "inner radius of the containing tube."

Also equation (37) contains a printer's error. Finally, it may be mentioned that the definition of (H) as given at the top of page 521, is involved in equation (25).

The writer may say that equation (25) is correctly given in Report No. 1 (see page 196 of the *Journal* of the I.E.E. for February, 1921), and he has had occasion several times to use the formulæ give on this page and therefore did not notice until quite recently the discrepancy between this formula and that given in Report No. 2.

What is, however, common knowledge to those who are daily getting out thermal resistances of cables is not necessarily the same thing to those who have only occasionally to use such formulæ, and naturally would refer to a report like the one quoted as the last word on the subject.

I fully appreciate the immense labour which must have been entailed in putting together all the information in the report and checking it while it was yet in the manuscript form, but I cannot understand why no "errata" slip was attached

to the report to prevent the uninitiated from falling into the trap.

I feel that an apology is due to Mr. Melsom for publishing this information without first consulting him, but as he is over in America and as it seems of importance, as early as possible, to take steps which will save others from wasting precious time in trying to reconcile these formulæ, I hope he will excuse the irregularity.

No one appreciates more than I do the colossal nature of the work which he has carried through, and it is with the greatest diffidence that I make the suggestion of inaccuracy in equation (25) conveyed in the present letter.

A. M. Taylor,
Major S.O.2.

Birmingham, *April 20th*, 1926.

Electricity Supply Data.

I have read with interest your article on the above subject in the issue of April 16th, but venture to suggest that the *Electrical World* is not an authority of sufficient infallibility to permit the conclusions you derive from examination of its data. I find, for example, that the statistics of output of electricity as given by it differ materially from those published by the U.S. Geological Survey. The following table illustrates the position fairly clearly.

The Production of Electricity in U.S.A.
(Millions of Units).

Year.	Electrical World.	U.S. Geological Survey.	Difference.
1924 ...	54,413	59,013	4,600
1925 ...	59,517	65,408	5,891

The difference in the two sets of figures is sufficient, I think, to weaken some part of the case you put forward in your article. The only true comparison lies in the output of electricity from all undertakings in Britain as given in the fuel consumption returns of the Electricity Commission and the output as given by the U.S. Geological Survey.

For the year April 1st, 1924-March 31st, 1925, the British figures are 7,415 million units and the U.S. figures 60,371 million units, equivalent respectively to 175 units and 525 units (working on 42.5 million population in Britain and 115 million in U.S.A.). The American output is, therefore, three times the British per head of population.

I would venture also to question the percentage of units sold to units generated used in calculating consumption in the United States, namely, 81 per cent. In view of the fact that the British figure is 83 per cent., it seems very low. I find it also difficult to believe that "the central-station industrial field as it exists to-day is only 37 per cent. developed" in the United States, when the article states that American industry is 65 per cent. electrified, and that the output from private industrial plant aggregates 12,000 million units. According to the *Electrical World*, the total energy sold by central stations for power purposes in 1925 amounted to 27,867 million units. Assuming that 85 per cent. of this went into industrial consumption, the total would be 23,700 million units. The total capacity of power plant used in manufacture in the U.S.A. was, in 1924, 24,600,000 kilowatts and 37 per cent. of this would be 9,100,000 kilowatts. We are led to believe, therefore, that the total of 23,700 million units was consumed by 9,100,000 kilowatts or 2,600 units per kilowatt. The actual figure as calculated from the statistics given on page 45 is 1,600 units per kilowatt. The discrepancy between those figures requires explanation before we can believe that the central station industrial field is only 37 per cent. developed in the United States.

According to the U.S. Geological Survey, the increase in the output of electricity between 1920 and 1925 was 51 per cent., while the ratio of waterpower to the total output fell from 37.5 per cent. in 1919 to 34 per cent. in 1925, and will probably continue to decline. The comparisons given in the first paragraph of your article, in addition to being very much in the nature of special pleading in favour of this country, suffer from the fact that the 6,000 light and power systems mentioned for the U.S.A. do not represent 6,000 different administrations and cannot be compared with the 595 undertakings in Britain. Until we know the degree of amalgamation and centralisation of administration existing in the United States and in Britain, such a comparison is scarcely justifiable. In addition to this, the 584 stations listed for Britain include stations owned by non-statutory undertakings.

Hugh Quigley.

London, *April 19th*, 1926.

[We refer to this subject in our leading columns.—Eds. Elec. Rev.]

Three-phase, Four-wire Distribution.

In reply to "Inquirer's" queries in your current issue, I would advise him that there is no marked variation of pressure on a three-phase, four-wire supply when a three-phase star/star-connected, core-type transformer supplies unbalanced loads from each line to neutral, provided the unbalancing is not too great. The total out-of-balance current may be as high as approximately 20 per cent. of the normal full-load current without the phase pressures dropping by more than 2 per cent. Three-phase groups of single-phase transformers should, however, on no account be star/star connected for supplying three-phase, four-wire unbalanced loads.

It is certainly possible to operate a star/star-connected, three-phase, core-type transformer to supply a single-phase load should one of the transformer windings become defective, but on the other hand, transformer failures represent so small a percentage of the total number of transformers installed, that, in my opinion, this advantage should not be given undue prominence. If the unbalanced load is likely to exceed 20 per cent. of the normal full load of the transformer, it would be better to install delta/star-connected, three-phase, core-type units, and in practice probably 90 per cent. of the number of transformers installed are so connected. "Inquirer" will find fuller information concerning the points he has raised in the "J. & P. Transformer Book."

S. Austen Stigant,
Manager, Transformer Dept.,
Johnson & Phillips, Ltd.

London, *April 26th*, 1926.

Electric Vacuum Cleaners.

I appreciate Mr. Sacré's kind comments on what he is good enough to call the usefulness of my article on "Electric Vacuum Cleaners," while I do not agree with all his contentions. However, I agree strongly that salesmen do harm to their industry when they disparage competitive types of machine.

I agree that a very high-speed rotating brush probably damages a carpet as much as an excessive suction. However, I do not think a fixed brush in front of the suction orifice can be as effective as a rotary brush. It appears to me that the fixed brush must drive the dust straight up in the air in front of the machine and out of reach of the suction. Surely, the main purpose of combining brush and suction is to loosen the dirt and then suck it up.

For this reason I feel that the ideal machine is one that incorporates adequately powerful suction and a low-speed brush which does not damage the carpet any more than a fixed brush does, and operates more efficiently. The type of machine I am considering is the Standard (Western Electric), Premier Duplex, Hamilton Beach and Hoover, although I think the last mentioned has too small a suction and too high a brush speed. The secret of efficient design is to provide a high gear ratio between motor (*i.e.*, fan) speed and brush speed, so that the fan secures powerful suction and the brush rotates comparatively slowly.

As to the advantage of being able to fix on a stiff brush when required, this does not compare favourably with the most cleverly designed machine I know, which, besides having a geared, low-speed brush, has a switch for cutting the brush out of action when it is not required and the extension tools are being used.

My flour test is, as Mr. Sacré infers, a "sticky" one, both literally and metaphorically, but this is a severe test to bring out the abilities of only the best machines.

I disagree with Mr. Sacré's assertion that the "bag" type of machine is unhealthy or that it lets dirt get back into the room. I have never known this occur, and he must have run across a cheap machine with a badly made bag. Since reading his reply, I have made a careful test on two different types of machine, running them both over dirty carpets, and at the same time applying moistened, white, blotting paper all over the outside of the inflated bags for some time. The bags were found to contain considerable dirt, but the damp blotting paper showed not the slightest trace of dust or dirt. I think this test proves conclusively that a properly made bag is perfectly dust-tight and healthy. But even if the bag is placed in a cylinder, as Mr. Sacré prefers, surely air must come out of the bag in the cylinder just as out of a bag anywhere else, to allow a proper suction to be maintained. The bag is still the deciding factor.

Since no dust gets back into the room, I do not see the value of a disinfecting pad applied to dust-free air.

Replying to Mr. Sacré's question about adequate suction, I consider that a manometer should register between 14 and 16 inches on a properly designed machine at the fan chamber opening, with the bag on and the brush rotating. A new machine which has not been "run in" and is a bit stiff should never reach less than 12 inches.

A. G. Harrison Dent.

London, *April 26th*, 1926.

I have read with interest Mr. H. Harrison Dent's article in your issue of April 16th, and it is quite clear that he looks upon a vacuum "sweeper," as he calls it, as an article largely for carpet cleaning; but why cleaning should be so confined to carpets it is difficult to follow. Upholstered furniture, curtains, &c., all absorb dust and require almost as much cleaning as a carpet, and the demand is growing for an outfit with an all-round cleaning capacity, more mobile and easier to use than the ordinary vacuum sweeper.

Admittedly the vacuum sweeper has attachments for general cleaning purposes, but as Mr. Dent points out, suction is of special importance when using these attachments, and as the brush type of carpet sweeper (the type Mr. Dent seems to prefer) generally has a comparatively low suction, these attachments are of little or no value and are seldom, if ever, used.

The main point a user has to decide is whether a "carpet sweeper" is required or an all-round cleaning outfit, and it will be found that with the education the householder is receiving on this subject the all-round machine is preferred. The development of the enclosed-bag-type cleaner on wheels or

sleigh with its easy work and wide range of use has been brought about by the increasing demand.

Mr. Dent states that in his view a vacuum cleaner with a revolving brush is best for cleaning carpets. It therefore seems clear to me that Mr. Dent has not had the same amount of experience with the more modern types of domestic cleaning outfits fitted with the enclosed bag. These are suction-type machines, and have no mechanical devices to assist in the cleaning process, and I have had it proved to me many times that this type of suction machine will clean carpets quite as well as the other type referred to. The great popularity which the enclosed-bag-type suction machine has attained, testifies to the satisfactory character of the service it gives.

H. F. Simon, A.M.I.E.E.

London, *April 23rd*, 1926.

Overhead Transmission Lines.

I am sure interested readers of the Electrical Review will greatly appreciate Mr. Nelson's letter in last week's issue. I have myself found this gentleman's words true as regards rusty ironwork and bolts on pole fittings. While rustless steel or iron channel arms would certainly solve the main problem, may I make a further suggestion regarding bolts, insulator pins, bracings, and stay threads? If, when a transmission line is first erected, all such fittings mentioned above are coated with a solution composed of tar, tallow, and pitch carefully mixed together and applied with a brush, it will be found that the threads are rustless at all times. The tar itself acts as a waterproof liquid for mixing purposes, while tallow acts as grease on the threads, and pitch has always been used for warding off dampness from electrical fittings. May I say as a linesman with erection and maintenance experience that I have found the above method quite satisfactory and used to-day by some of our best mains contractors. I hope to read further suggestions that might greatly help in future developments in this particular section.

M. Simpson.

Leamington Spa, *April 26th*, 1926.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 21st :—

Magnet and Wire (design only). No. 465,650. All goods in Class 5. No. 465,651. Class 6. Machinery of all kinds. No. 465,652. Class 8. Instruments and apparatus for radio-telephony. No. 465,653. Class 13. Incandescent lamps (ordinary). No. 465,654. Class 15. Shades, globes, and reflectors made of glass. No. 465,655. Class 16. Electric insulating materials made of earthenware and porcelain. No. 465,656. Class 18. Electric alarms, signals, &c., as systems in buildings. No. 134,559. Class 25. Cotton-covered wire. No. 465,657. Class 32. Silk-covered wire. No. 465,658. Class 40. India-rubber-covered wire. Magnet No. 465,642. Class 6. Machinery of all kinds. No. 465,643. Class 8. Instruments and apparatus for use in radio-telephony and not consisting of or containing magnets. No. 465,644. Class 13. Incandescent electric lamps (ordinary). No. 465,645. Class 15. Shades, globes and reflectors made of glass. No. 465,646. Class 16. Electric insulating materials made of earthenware or porcelain.—General Electric Co., Ltd.

Parlophone, No. 465,325, and Parlaphone, No. 465,326. All goods in Class 8. —The Parlophone Co., Ltd., 1, Broad Street Place, E.C.2.

Hart. No. 467,914. Class 8. Electric secondary batteries and parts thereof. —Hart Accumulator Co., Ltd.

Sistoflex. No. 462,595. Class 50. Electrical insulating substances made of asbestos, mica, resin, oils, or bitumen.—Spicers, Ltd., 19, New Bridge Street, E.C.4.

Correction.—One of the notices appearing in our last issue referred to the Magnet Engineering Co., Birmingham. This firm is at Liverpool. Application No. 444,263 is in respect of "electric switches (not containing a magnet)."

A New Electric Signalling Installation.—According to the *Electrical World*, a stretch of 226 miles of double track on the Union Pacific Railroad from Cheyenne, Wyo., to North Platte, Neb., has been equipped with a new inductive type of signalling equipment, which is considered a marked improvement over the complete block system. A total of 131 locomotives have been equipped to operate in conjunction with the new system, the locomotive equipment including a 32/350-V, d.c. motor generator, the current of which is cut down and changed by amplifiers. A transmission line parallel with the track is employed, and energy is transmitted at 2,300 V, a.c., from the plant of the Cheyenne Light, Fuel & Power Company and the central stations at Kimball, Sidney and North Platte, Neb. Two sets of transformers are employed, the first reducing the pressure to 110 V and the other to 1½ and 3½ V at the rails. The combination of the track current with the current generated on the locomotive operates the control lights in the engine cab—green for "clear" and red for "slow down." When the green is showing, the engine progresses at schedule speed; when red shows, it indicates a train or car on the track in the block ahead. A limited time is permitted for the reduction of speed to 20 miles an hour, and if this is not accomplished by the engineer, an automatic application of air to the brakes will result. Since the new system was first started eight months ago more than 11,000 engine movements have been recorded in the division mentioned without any difficulties being experienced. The equipment was manufactured by the Union Switch & Signal Company and is of the two-speed continuous inductive type.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

28,649. "Inductance coils for use in connection with radio apparatus." Igranic Electric Co., Ltd., and S. R. Wright. August 27th, 1925. (249,902.)

31,205. "Sound amplifiers." T. Young. December 30th, 1924. (Cognate application 12,275/25.) (249,918.)

31,215. "Electric gas-filled discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 25th, 1924. (236,155.)

1925.

387. "Equipotential cathode tube." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). January 6th, 1925. (249,939.)

680. "Variometers for wireless receiving apparatus and such like." W. Leigh. January 9th, 1925. (249,943.)

863. "Thermionic valves." H. L. Crowther and N. F. S. Hecht. January 10th, 1925. (249,948.)

1,127. "Electric resistances." H. B. Prentice. January 14th, 1925. (249,951.)

1,495. "Voltmeters." H. Butler and A. Chinn. January 17th, 1925. (249,954.)

1,919. "Electrical junction boxes and the like." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. January 22nd, 1925. (249,957.)

1,964. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. January 22nd, 1925. (249,958.)

2,524. "Electric switches." British Thomson-Houston Co., Ltd., and H. Trencham. January 29th, 1925. (249,962.)

2,822. "Mounting of cartridge-type fuses." English Electric Co., Ltd., and A. M. Pooley. January 31st, 1925. (Cognate application 15,688/25.) (249,966.)

4,102. "Loud speakers." E. Forster. February 13th, 1925. (249,979.)

4,882. "Electrical heating installations." Vickers, Ltd., and J. Etchells. February 21st, 1925. (249,983.)

7,430. "Electrically-actuated controlling apparatus." Westinghouse Brake and Saxby Signal Co., Ltd. (Union Switch & Signal Co.). March 19th, 1925. (250,000.)

7,496. "Variable electric time-switch." G. Cotterell. March 19th, 1925. (250,001.)

7,652. "Electrode connections for electric furnaces." M. McGee. March 21st, 1925. (250,002.)

7,933. "Device for indicating sparking and other disturbances in, and for automatically cutting out, transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Addition to 198,936.) (250,004.)

8,266. "Electrical junction boxes and the like." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. March 27th, 1925. (250,007.)

8,463. "Brush-holders for electric machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. March 30th, 1925. (250,010.)

9,550. "Thermionic generators, amplifiers, and the like." K. E. Edgeworth. April 9th, 1925. (250,022.)

9,814. "Sound-receiving apparatus." Submarine Signal Corporation. November 15th, 1924. (242,940.)

11,632. "Telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. May 5th, 1925. (250,037.)

12,485. "Means for testing electrical insulating materials." Dubilier Condenser Co., Ltd. (in voluntary liquidation). May 17th, 1924. (234,112.)

14,126. "Adjustable grid leaks." W. P. Fraser. May 29th, 1925. (250,052.)

17,357. "Apparatus for removing gases from storage batteries and storage-battery rooms." J. M. Clark. July 6th, 1925. (250,070.)

20,316. "Ignition apparatus for internal-combustion engines." W. J. Stonier. August 12th, 1925. (250,088.)

20,725. "Electric motor control systems." A. H. Jackson. August 18th, 1925. (250,089.)

21,295. "Electrical frequency-multiplying systems, more especially for wireless signalling." W. Dornig. October 11th, 1924. (241,167.)

21,690. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. October 3rd, 1924. (240,805.)

21,962. "Electrical condensers." Dubilier Condenser Co., Ltd. (in voluntary liquidation). (W. Dubilier). September 2nd, 1925. (Addition to 235,448.) (250,039.)

22,033. "High-frequency electric furnaces." Westinghouse Lamp Co. January 5th, 1925. (245,414.)

22,447. "Alternating-current electric motors." British Thomson-Houston Co., Ltd. September 8th, 1924. (239,549.)

23,643. "Electric motor controllers." British Thomson-Houston Co., Ltd. September 23rd, 1924. (240,458.)

23,774. "Radiography." Etablissements Gaiffe-Gallot et Pilon. November 18th, 1924. (243,320.)

23,836. "Electric self-starters for the engines of motor vehicles." Soc. des Appareils Magondeaus. June 30th, 1925. (249,935.)

23,867. "Electric self-starters for the engines of motor vehicles." Soc. des Appareils Magondeaux. July 30th, 1925. (Addition to 249,935.) (250,106.)

25,097. "Radiators for cooling the oil of oil-cooled electrical apparatus." Nordon Frères. October 13th, 1924. (241,205.)

25,333. "Loud speakers or ear-phones for wireless reception and other applications." Soc. Anon. des Brevets Kornfeld. January 9th, 1925. (245,727.)

28,306. "Electric heating units and methods of making same." British Thomson-Houston Co., Ltd. November 18th, 1924. (243,337.)

28,541. "High-tension cables." M. Sieverts Fabriks Aktiebolag. November 20th, 1924. (243,342.)

28,676. "High tension cables." M. Sieverts Fabriks Aktiebolag. November 20th, 1924. (243,345.)

29,821. "Rheostats." G. H. Whittingham. July 12th, 1924. (Divided application on 236,898.) (243,742.)

1926.

287. "Systems of electric distribution." British Thomson-Houston Co., Ltd. January 24th, 1925. (246,455.)

372. "Ceiling-plate for electric lamp fittings." J. Coggans. January 6th, 1926. (250,146.)

878. "Arc-welding electrodes." British Thomson-Houston Co., Ltd. January 13th, 1925. (246,140.)

1,250. "Holders for incandescent electric lamps." Israel Akt. Ges. Geb. December 16th, 1925. (250,150.)

2,577. "Electric cables." Fuller's United Electric Works, Ltd., and A. P. Welch. May 14th, 1925. (Divided application on 12,623/25.) (250,154.)

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The Progress of the Bill.

DURING the two days' consideration allotted to the Electricity (Supply) Bill by Standing Committee C of the House of Commons, last week, important changes in the constitution of the new authority were adopted, in principle, which will go far to remove the objectionable features of the original proposals under this head. As we pointed out in our issue of March 26th, a Central Electricity Board which would act as a mere appendage to the Electricity Commission would not serve the purpose for which it was created—namely, to co-ordinate and control the generation of electricity throughout the country. It was necessary, we said, that there should be but one controlling authority—the Central Board—and that the Electricity Commissioners should either become an advisory body to the Board, or be incorporated with it. The latter course, which we favoured, was put forward by the Labour party in Committee, but was rejected on the ground that it was a short-cut to nationalisation of the industry; the alternative, however, was adopted, and the Bill will provide the Board with full executive authority, whilst the Electricity Commissioners will prepare the technical schemes and submit them to the Board for approval. This seems to be a satisfactory solution of a very contentious problem, and the Government has been well advised in adopting it at so early a stage. It is understood that after considering and publishing a scheme put before it by the Electricity Commissioners, the Board will hold an inquiry if necessary; and that an independent tribunal will be set up, not by the Minister of Transport, but perhaps by the Lord Chancellor or some other authority, to hear appeals from the decisions of the Board.

With these proposals the opponents of the Bill have expressed their content. There are, however, many other controversial features in the Bill, and the list of amendments to be considered by the Committee is a long one, comprising some 220 handed in up to April 29th; many of these are of course either consequential or mutually exclusive. Some are designed to prevent injustice to existing power companies; others, to strengthen the obligation laid upon the Central Board

to delegate its functions where possible to joint electricity authorities and other existing authorised undertakers; others, again, to provide the right of appeal against the decisions of the Board or the Electricity Commissioners, the Railway and Canal Commission being usually named as the arbitrator.

An interesting suggestion is made in connection with Clause 14, which enables the Electricity Commissioners to put pressure on an authorised undertaker to take a supply of electricity in bulk owing to its being available from the Board at a lower price than the local power station's working costs—namely, that regard shall be had to any reduction of costs which might reasonably have been anticipated from improvements of the plant then in contemplation; it is often urged that much lower costs could be attained in small stations if the Commissioners would allow them to be extended by the addition of modern plant. A further suggestion in this connection is an entirely new clause, giving power to close any uneconomical station after three years from the date of the Act, but specifying that in comparing the cost of bulk supply and local generation the latter shall not be loaded with the capital charges in respect of the generating station; this is but reasonable, for otherwise the cost to the consumers would be increased by the change-over.

Another proposed new clause is of great importance, and will, we hope, be added to the Bill; it provides that everyone owning a generating station shall furnish to the Electricity Commissioners statistics relating to its operation. As we have pointed out, the Commissioners at present have no certain knowledge, and have no means of obtaining such knowledge, with regard to the capacity and output of private generating stations, so that no trustworthy comparison can be made between the actual consumption of electricity for all purposes in this country, and that recorded in respect of foreign countries. This is a very regrettable circumstance, and it is important that provision shall be made to deal with it, for other reasons besides that above-mentioned.

Again, a clause is put forward which will confer upon local authorities full powers to supply and fix electrical installations, including fittings, motors, &c., on the premises of their consumers, the only remaining restrictions being that they shall not manufacture any of the material, and that they must carry on the work without financial loss.

We regret to observe, however, that the omissions to which we have called attention have not been dealt with by proposed amendments; apart from a derisory clause relating to the lopping of trees, there is not a word about wayleaves and other facilities so urgently necessary—indeed, almost indispensable—to the rapid extension of electricity supply into the rural areas. Seeing that the rural consumption is one of the main factors relied upon by the promoters of the Bill for the cheapening of electrical energy all round, is it not extraordinary that no provision is made to facilitate that development?

Women and Electrical Progress.

ONE of the most promising movements that is in progress in the electrical world at this moment—at any rate so far as this country is concerned—is the attraction to our ranks of women of a suitable personality and character for helping forward domestic electrical enterprise. If they will excuse the use of such a term, the women who are to afford the right "material" for this branch of development will require to have reached a certain standard of educational fitness and must give evidence of zeal and enthusiasm which will assure a maintained interest in the study of certain aspects of electricity supply work and in the pursuit of knowledge respecting the apparatus which is demonstrated, displayed and sold in showrooms for the use of consumers in the home. Our readers are not unfamiliar with the organised efforts that have been made to bring electrical women together for their mutual advantage and therefore for the good of the industry. There are classes of work in the domestic electrical department which women, and women alone, can do with full effectiveness, as we have shown on several occasions, and the mere men who are running the industry and take a large view of the scope for future electrical development are ready to encourage their co-operation. But nobody will lose sight of the fact that on attractiveness and personality alone they will not succeed in giving that quality of service which so specialised an industry demands. There is no need for personal charms to be sacrified in order to secure business efficiency. The study need not be laborious, indeed it can be made most pleasurable, and the Electric Lamp Manufacturers' Association has discovered how to secure such a result by the arrangement of its first Home Lighting Course for Women, which was held with such success in London last week, and is referred to on a later page of this issue. From our own personal observation we are in a position to congratulate all concerned in this experimental effort upon its complete success, which we believe points the way for other conventions of a similar nature at which women shall be familiarised with the details and operation of other special classes of domestic apparatus, including cooking appliances, electric fires, vacuum cleaners, and so forth. What the Lighting Service Bureau has done through its manager, Mr. W. E. Bush, and the staff will assuredly spread the gospel of more efficient illumination and the advantages that accrue therefrom in the domestic circle, but such educational work is essential in respect of the other appliances mentioned, both for women and for men connected with the showrooms that are springing up in all parts of the country.

The E.T.B.I.

FAMILIAR objects in our daily routine attract little attention, no matter how great their importance; but now and again something occurs to bring them into sharp focus, and we realise their significance, almost with a sense of contrition. Thus it is with the Electrical Trades Benevolent Institution; its annual Festival Dinner brings it into the foreground in the autumn, and its annual general meeting in the spring—the rest is silence, though we know its beneficent work is being efficiently carried on throughout the year by its untiring hon. secretary, Mr. F. B. O. Hawes, and a few members of the Committee.

But we ought not to think of it only two or three times a year; it is one of those things which ought never to be far from the top of the agenda. What can we all do to help? The answer is easy—give it publicity. That can be done most effectively in two ways—by forming a local Committee, and by telling one's friends, employés, and colleagues what it is and what it does.

The splendid work accomplished by the Local Advisory Committees already existing in Cardiff, Manchester, Newcastle-on-Tyne, and Glasgow, explains the earnest desire of the Committee of Management that more of them should be formed. The fact that 81 grants were made last year, no qualified applicant being turned away, proves the need for the Institution as well as the necessity of supporting it, and the best possible form of support is that of subscribing membership. We trust that all our readers will personally endeavour to make the E.T.B.I. more widely known, even if they have no other connection with it—that costs nothing, but is worth much—and we warmly commend it and its work to the whole industry as well worthy of encouragement and support.

Electricity Meters.

IN *The Times* of April 23rd appeared a letter from a consumer at Notting Hill Gate, in which he said that, believing he had not consumed the electricity he was charged for, he had his meters tested, with the result that the lighting meter was found to over-register by 4½ per cent. and the power meter by 5¼ per cent. (Incidentally, too, he gave the test result of his gas meter, which was 16.28 per cent. fast!) We refer to this case not because we think that there are many cases of consumers having meters over-registering, but the reverse. The tendency, so far as the mechanical parts of a meter are concerned, is that the meter goes slow with length of time in service. Moreover, not only is there a tendency for meters to slow down on ordinary load, but also for meters not to start on one or two lights. The only places where the metering can be really accurate are where the undertaking has an efficient meter department, and where meters are left out on circuit for only a limited period; also where the meter readers have instructions to test the meters for starting, which can be done in a minute by turning on a light. It is perhaps in the smaller undertakings that meters are put in and remain for years, probably even till something goes flagrantly wrong. This is the more important since the smaller undertakings depend largely on a small sale of high-priced units, and units lost at 5d. or 6d. easily mount up to a considerable sum. Some undertakings invoice to consumers only about 75 per cent. of their output—some even less; losses in mains, &c., are, of course, included in the unmetered percentage, but there is every reason to think that this big margin of "lost" units might be materially reduced by a reorganisation of the metering arrangements of the undertakings.

Elsewhere in this issue we give some particulars concerning the meter-testing laboratory of the North Metropolitan Electric Power Supply Co. This rather suggests that the ideal to aim at, in order to obtain efficiency in dealing with large quantities of meters, is elaborate organisation rather than apparatus.

Tramways in 1924-25.

IN this issue we review the latest return relating to tramways and light railways (including railless traction systems) published by the Ministry of Transport, covering the year 1924-25. From the return it will be gathered that this "obsolete" system of transport is still doing a fair amount of business, having carried 4,620 million passengers during the period covered, about 177 millions more than in the preceding year.

The financial position, unfortunately, did not show an improvement. The ratio of working expenses to receipts rose from 77.74 to 79.10 per cent. (it was only 64.51 per cent. before the war), and the net receipts declined from 4.33d. to 3.80d. per car-mile. The total amount received from the rates was £521,801, while the undertakings contributed £281,732 to the rates, making a balance of £240,069 on the wrong side. Against this a sum of £52,803 was carried forward by the local authority undertakings after, in the aggregate, meeting all charges. It is necessary to bear in mind that these undertakings are not primarily profit-making concerns, and are designed to work to meet their expenses as closely as possible. The most interesting part of the return is probably that which classifies the municipal undertakings according to their financial results. Taking the numbers alone the position seems to indicate improvement, but in the aggregate there was a deficit of £282,907, as compared with a credit balance of £74,154 in 1923-24. One more undertaking was able to cover all charges, and show a balance, making a total of 99 out of 156 systems, while the undertakings which were unable to cover their working expenses were reduced from 11 to 8. In 1921-22 only 81 undertakings, out of 157, were able to cover all charges, while 14 failed to meet their working expenses. In that year, too, there was an aggregate deficit of £254,982.

Another point which should be considered when studying the return is the enormous influence of the L.C.C. result upon the whole. In 1924-25 the L.C.C. tramways received £237,836 from the rates, whereas in the preceding year they earned a substantial profit.

While the figures given in the return are not as satisfactory as they ought to be, we fail to discern in them any reason for making a clean sweep of tramways, quite apart from the question which would arise when arrangements had to be made to redeem the capital invested in tramway systems, which amounted to about 100 millions at the close of the period covered by the return.

On the other hand, we think that there is a case for a certain measure of protection against unlimited and irresponsible motor-omnibus competition in towns where an efficient tramway system has been built up.

The Problem of School Lighting.

THE discussion on school lighting, opened by Dr. James Kerr at the meeting of the Illuminating Engineering Society on April 29th, was attended by many representatives of the medical and scholastic professions. Dr. Nash, who presided, is himself chairman of a committee of the Medical Officers of Schools Association which is now studying the subject; and of those who joined in the dicussion several were themselves on the staff of technical institutions and able to speak from the teacher's standpoint. Dr. Kerr's paper gives the impression that the original report of the joint committee of the Illuminating Engineering Society, which has influenced the methods of leading educational authorities considerably, still contains in substance what is necessary for adequate school lighting. Only on two points were modifications suggested: an increase in the illumination to 5-7 foot-candles, and a limitation of the brightness of lighting units to 3 candles per sq. in. when located within the direct range of vision. These requirements can be easily met with modern fittings, of which examples were shown at the meeting. Further discussion between experts would probably not add greatly to our knowledge of the essentials of school lighting. What is needed is to bring the correct methods before the notice of educational authorities and medical officers of health. From this point of view the meeting served its purpose well. Good lighting received the endorsement of Mr. J. B. Lawford, one of the most eminent ophthalmologists in this country. Representatives of educational bodies, whilst explaining their own difficulties, showed themselves in complete accord. The practical need, very clearly put by Dr. Nash in winding up the discussion, is to induce authorities to meet the cost of proper methods, and the Society, in creating an atmosphere sympathetic to the claims of good illumination, is doing good work.

The General Strike.

As we are preparing these pages for the press, a "general strike" throughout the country has begun which embraces within its scope certain Trade Unions associated with the printing trades; almost inevitably, therefore, for the first time in its career of more than half a century, this journal will be prevented from appearing at the normal time. We trust that our readers will absolve us from reproach on account of this lapse, seeing that it is not in our power to avert it.

With regard to the strike itself, we can only say that we look upon it as a national misfortune of the first magnitude, which will have the gravest consequences; it is the more to be regretted in view of the fact that trade was distinctly reviving, unemployment was decreasing, and the prospects were brighter than they had been for years. That a speedy solution may be found for the nation's difficulties will be the earnest hope of every patriotic citizen.

Trolley Omnibuses at Ipswich.

The Corporation Fleet made by Messrs. Ransomes, Sims & Jefferies, Ltd.

THE Ipswich electric tramways were opened in November, 1903. The system comprises a little over eleven miles of route, only a portion of which is double tracked, the actual length of single line being a little over fifteen miles.

About three years ago the Corporation was faced with the necessity of either relaying practically the whole of the permanent way, or adopting some other method of public passenger transport in the town. While the tramway system had never been really remunerative, it would be still less so when burdened with the heavy expenditure which the relaying of the track would entail. Accordingly, on the score of economy in operating cost, it was decided to substitute railless electric trolley 'buses.

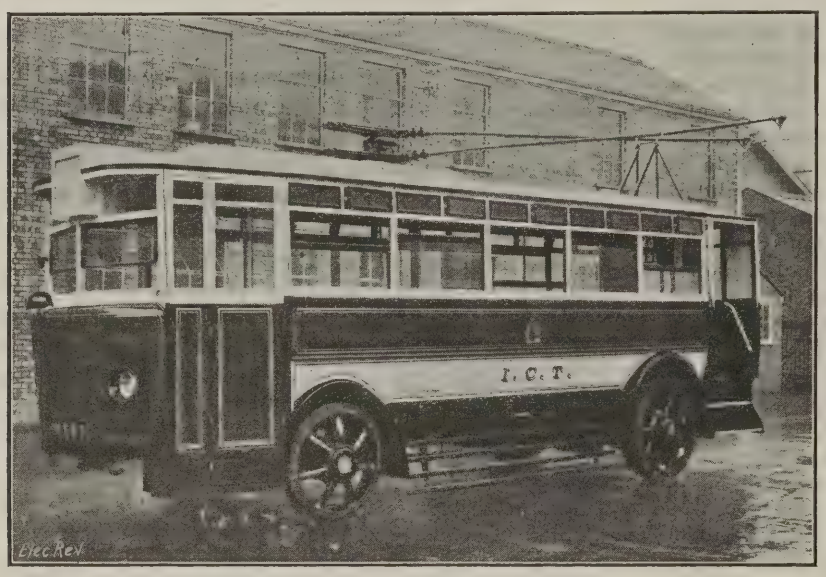


Fig. 1.—Ipswich Corporation Electric Trolley 'Bus.

In order to try such 'buses on a section of about two-thirds of a mile in the centre of the town between The Cornhill and the railway station, which had been run for years as a shuttle service, three electric trolley 'buses were hired from Messrs. Railless, Ltd., and after a few months' use they were purchased, their operation having demonstrated the suitability of this class of vehicle. Last year, therefore, having secured the necessary statutory authority, the Corporation embarked upon the larger scheme of abolishing the tramways in sections. Meanwhile, a further trial had been made between The Cornhill and the Wherstead Road terminus, for which purpose a trolley 'bus of a new design had been supplied by Messrs. Ransomes, Sims & Jefferies, Ltd. Later trials were also made of vehicles loaned by Messrs. Tilling-Stevens and Messrs. R. Garrett & Sons, Ltd.

As the result of inviting tenders for the thirty 'buses required for carrying out the substitution in the eastern district of the town, orders were placed with Messrs. Ransomes, Sims & Jefferies and Messrs. Garrett for fifteen 'buses each, and the Orwell works have already delivered ten of the new 'buses, which incorporate special features.

The chassis is provided with a single motor, capable of developing 50 b.h.p. on the standard rating of the British Engineering Standards Specification for Traction Motors (namely, a run of one hour, during which the temperature of any part of the motor must not rise above that of the atmosphere more than 75 deg. C.), but on the test bed it is called upon to develop 100 b.h.p. for a short while. The controller is of the straight series type, the main drum being operated by a foot pedal, and the reversing drum, which is mechanically interlocked with the main drum, by a lever on one side of the driver's seat. A dial on the dash board has a pointer connected with the controller which indicates to the driver the position of his main-drum contacts at any moment. The power developed by the motor is transmitted to the back axle by a tubular propeller shaft of special steel provided with enclosed universal joints at each end, the couplings of these joints, where attached to the motor shaft and to the worm shaft on the back axle, being provided with plines. The back axle itself is a fine forged-steel casing dished in the centre to receive the worm wheel, differential, and worm unit, which is mounted on the cover, the latter closing in the dished space in the centre of the axle; at each end of the axle a cast-steel bracket carries the extra large brake shoes and their cams.

Each rear wheel is provided with two separate brake drums of pressed steel, both the rear and front wheels being of the cast-steel hollow-spoke type. The rear wheels are provided with twin solid tires, and each front wheel with a single tire.

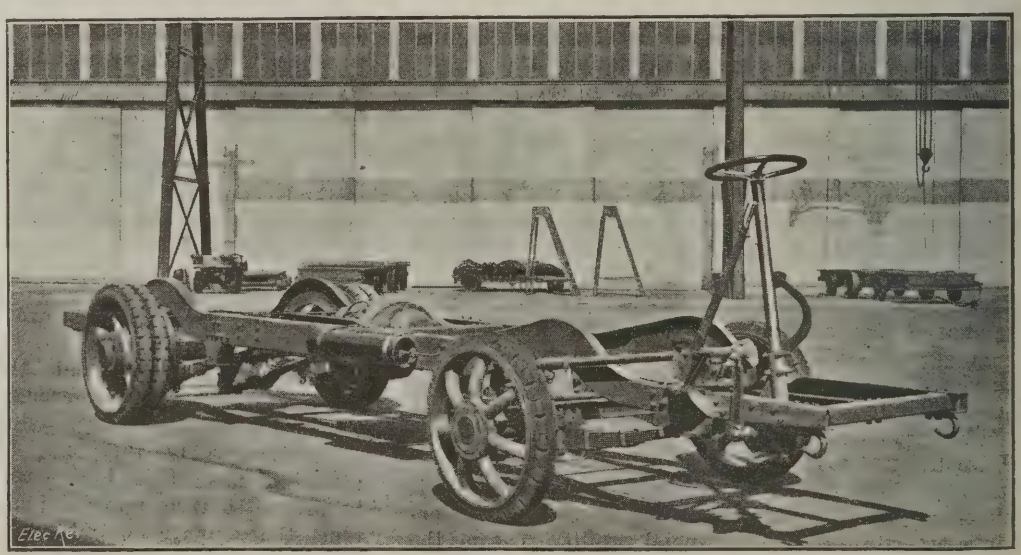


Fig. 2.—Trolley 'Bus Chassis at the Orwell Works.

The brake gear is interesting in so far as the foot brake is operated by compressed air, this equipment having been supplied by the British Air Brake Co. The compressor, and the Ransomes motor which drives it, are mounted on the near side of the main chassis member; the rotary compressor, made by Messrs. Reavell

and Co., is of an entirely new design, and its motor is controlled by an automatic switch in the driver's cab, which is operated by the piston in a cylinder that is controlled in turn by the pressure in the brake reservoir; the working limits of air pressure in the reservoir are 30 lb. and 40 lb. The means of applying the brake is a foot-operated valve on the floor in front of the driver and, in addition, there is a brake operated by a hand lever, which is used in emergency and for holding the vehicle when standing.

The front axle is a drop forging of special steel. The stub axles are so arranged in conjunction with the design of the front wheels that an imaginary projection of the centre line of the swival pin nearly intersects the point of contact of the tire on the roadway, a feature which is characteristic of these new 'buses and assists steering. Specially noteworthy is the excellent springing; each spring is 5 ft. long, and at its forward end is held by a pin passing through a solid eye on the top plate of the spring, and supported in a bracket attached to the main chassis member. Attached to the rear end



Fig. 3.—Interior View of 'Bus.

of the top spring plate is a wearing piece, which bears underneath a roller supported in a bracket attached to the chassis frame, allowing the maximum of freedom for the working of the spring; the vehicles are very smooth riding.

All the bearings throughout the vehicle are of the roller type, including those of the motor. With the exception of the naves of the front wheels and the dished part of the back axle containing the worm gear, where provision is made for oil lubrication, all other points are grease lubricated by means of the "Tecalemit" grease-gun system.

The motor is of Messrs. Ransomes' latest design, and is induced air cooled; the air enters at the forward end of the motor through a special hood and protected opening, and it leaves at the rear end where somewhat different hooding is provided to prevent splashed water (for example, when washing the 'bus) getting into the motor. The motor is so attached to the pressed supporting members that by taking out 8 bolts it can be entirely dropped from the chassis frame for overhaul or replacement; it is equally easy to remove the armature from the motor without detaching the carcase of the latter from the chassis framing.

The bodies of these new vehicles are of somewhat special design, doors being provided for ordinary use at both the front and rear. The front door is in front of the near side wheel, which enables part of the space usually taken up by the driver's cab to be utilised, and when operated as a one-man 'bus enables the driver to receive passengers' fares and issue tickets with greater facility. The intention of the Corporation is to operate the 'buses as one-man vehicles during the slacker periods of the day, but during traffic rush hours to place a conductor on each 'bus, when passengers will use the rear entrance, which is fitted with a pair of folding doors on the near side; they are mechanically connected with the steps, so that when the doors are closed and bolted the steps are folded in the upright position. The front door folds up, and is operated by a lever by the driver.

The interior seating capacity is thirty passengers, with the maximum of standing capacity during rush hours. The floor level of the 'bus when fully loaded is 29 in. at the front-door entrance and 33 in. at the rear-door entrance. The exterior is painted green and the interior decoration is fumed oak and white enamel; the seats are upholstered in green leather cloth, and space is provided between the near side longitudinal seat and the front door for a small quantity of passengers' luggage. The driver is completely screened off from the passengers and has a separate entrance door to his cabin from the front offside.

The interior of the 'bus is illuminated by no fewer than 11 ceiling bulk-head fittings. The destination indicators have been patented by Mr. Clarke, of the Corporation Tramway Department, and one of the accompanying illustrations shows the neat arrangement of the front head-lights, which are so housed that they do not project beyond the surface of the front dash.

The weight of the complete chassis is 3½ tons, and that of the complete 'bus ready for the road is 5 tons 19 cwt. The maximum speed with a full load, on the level, is about 22 m.p.h., and up Bishop's Hill (of which the steepest gradient is 1 in 11) it is about 12 miles per hour. One of the tests is to stop and start when fully laden on the steepest point of the hill, and either brake will stop the 'bus when going at 20 m.p.h. fully laden in from 16 to 20 yards on the level.

In conclusion, it may be remarked that the Company's five works cover 40 acres, the Electric Vehicle Department being accommodated in the factory erected during the war for the manufacture of aeroplanes. Our thanks are due to the directors of the Company for allowing us to see the 'buses in production in the extensive Orwell works and to take part in a demonstration run in the historic old town of Ipswich.

Earth Losses in Radio Sets.

How to Secure a High Efficiency.

By PAUL D. TYERS.

The necessity of a good aerial has recently been emphasized in these columns. It must not be imagined, however, that the aerial is the only important factor determining the performance of a set, however good it may be. The aerial system includes the earth connection, and a really efficient earth connection is again a vital necessity. In the writer's opinion it is no exaggeration to suggest that at least fifty per cent. of the earth connections in use at the present time are not efficient. Let us then briefly consider the most important points which should be observed when making an earth connection.

The lead between the set and the actual point of connection to the earth should be as short as possible. Too fine a size of wire should not be used for the earth lead, nothing smaller than about 16 or 18 gauge really being suitable. It is further advantageous to use an insulated wire for the earth lead, particularly when the set is to be used on the shorter wave lengths.

There are really two ways of making connection to the earth; the first is by burying a conductor of an

appreciable area, and taking a lead from it, while the second is that of making connection to some conductor which is already buried, such as a water pipe. Neither method is more efficient than the other, nor are they equally efficient. The efficiency depends upon the actual conditions of each specific example. If a water pipe is employed, only a main lead pipe should be used, and the wire should preferably be soldered to it, rather than connected by some form of earth clip. Pipes containing screwed joints, such as a gas barrel, should not be employed. If it is found that the water pipe to which an earth connection is to be made travels round the house before going into the ground, it will probably give worse results than a connection consisting of a plate buried directly under the aerial, or near the receiver.

If an efficient connection is to be made, it is essential that the ground should be fairly moist. This necessitates burying the earth plate as deeply as possible. The area of the plate should be at least several square feet, fairly thick copper foil being very useful for the purpose. Where the earth lead is connected to the plate, it is preferable to employ a soldered joint, taking care to remove any traces of flux used in the soldering operation, and finally covering the joint with paint or some form of fairly soft wax, to exclude any moisture from the contact between the two dissimilar metals, which might give rise to electrolytic action from moisture in the ground. Other earthing devices are now on the market in the form of earth plates or mats, or earth tubes. The writer infinitely prefers, as a result of measurements taken, the use of an earth plate to the use of an earth tube or spike simply driven into the ground. The writer has recently examined a number of receivers fitted with earth tubes, which were giving very poor results, the trouble being due to the fact that the earth connection was totally inefficient. It must not be imagined, however, that the earth tube itself is inefficient, the success depending upon the manner in which it is employed. If the tube is simply driven into the ground, it follows that only approximately the lower half of it is in moist surroundings, and accordingly its effective area is halved. The dry earth over the surface of the earth is of little use in making a connection. If the ground happens to be permanently very moist almost to the surface, then substantially the whole area of the tube is useful, but this is seldom the case. When an earth tube is driven in level with the earth, it should be knocked in at least a few more feet with a piece of metal rod of some description, so that the whole area of the tube is completely surrounded with moist ground several feet below the surface. The writer recently found an earth tube driven into a gravel path. Needless to say, the results were very poor indeed.

The effect of a bad earth on a receiver is not only to weaken the signal strength; it also tends to flatten the tuning, and makes the set difficult to manage. It is not at all unusual to be able to increase the signal strength by more than 50 per cent. simply by substituting a good earth connection for one indifferently installed. By paying attention to small points of this nature, the trader will do much to gain the confidence of his clients.

The Settlement of Technical Disputes.

(From our Legal Correspondent.)

It sometimes occurs to those who have the misfortune to be involved in litigation which concerns machinery, or the discussion of highly technical matters, that our recognised tribunals are not best fitted to settle the rights of the parties. Indeed, one might almost put it higher than this, and say that technical people generally are so averse to the risk of being concerned in a lawsuit in the strict sense of the term that they almost invariably have recourse to arbitration. It is not too much to say that hundreds of disputes are settled by this means in the course of a year; and, apart from all else, courts of arbitration are a dire necessity. In the time at their disposal, His Majesty's judges would be wholly unable to cope with the large volume of litigation which is disposed of by these domestic tribunals.

But there remains the question—Is a reference to arbitration best obtained by the clause which is now customarily inserted in technical agreements? Take, for example, that which provides for a reference to two arbitrators—one to be chosen by each party, and an umpire appointed by them in case of difference.

This form of clause necessitates the appointment, in the first place, of two arbitrators who, in the nature of things, are generally partisans from the outset. Failing agreement between them, they appoint an umpire. In the vast majority of cases they "agree to differ" at once and appoint an umpire, who presides at the hearing. The hearing may take a long time. The arbitrators and the umpire are generally busy men, who must be adequately compensated for their services. When the award is made, it need not be published or given up to the parties until the arbitrators' fees are paid; and those fees may be, and often are, wholly out of proportion to the amount in dispute. True, the unsuccessful party will generally be ordered to pay them; but they must be paid, in the first instance, by the party who takes up the award. Having taken it up, he may find that his opponent is directed to pay the fees of the arbitrators and all the costs of the reference. But it is one thing to get an order for John Brown to pay a certain sum of money; it is another and a wholly different thing to get the money. John Brown may "have no wool on his back."

We start, then, with the initial difficulty that he who goes to arbitration may have to pay not only his own lawyer, but the tribunal itself. In a suit at law he may have to pay certain judicature fees; but he is not called upon to pay for the services of a judge.

The curious and cumbersome practice of selecting an expensive tribunal, consisting of two arbitrators and an umpire, may have had its origin in the fact that the parties cannot be certain that, when trouble arises, they will be able to agree upon a single arbitrator; but whatever the origin of the procedure, contracts involving what is, from some points of view, a needless waste of money, have come to be common form. They are signed without either party inquiring, or even pausing to consider, whether there is any alternative; whether disputes, if they arise, cannot be settled in some other way. Least of all does it seem to occur to those who sign such documents that the law of the land may provide for the determination of disputes in a manner which is just as satisfactory and rather less expensive than an ordinary reference to arbitration.

Can those who wish any disputes in which they may be concerned to be settled by arbitration, secure that form of trial before one independent arbitrator? They frequently do so by providing that the reference shall be to an arbitrator appointed (say) by the President of the Institution of Electrical Engineers. That is one satisfactory method. But there is another provided by law. It is to be found in the Arbitration Act, 1889, which states (by S. 5) that where a submission provides that a reference shall be to a single arbitrator and the parties do not concur in the selection of an arbitrator, the Court may make the appointment.

In view of this state of the law, it is sufficient to so frame the arbitration clause as to require the services of a single arbitrator. Failing agreement as to a particular person, either party may apply by what is called an originating summons to a Master in Chambers, who will make a suitable appointment. His discretion

in the matter is entirely unfettered. If it is an engineering case he may appoint an engineer; or if it is a building case he may appoint an architect; but he will generally select some person whom he knows to be skilled not only in his own profession, but in the settlement of disputes. His fees must, of course, be paid by the parties—and will generally have to be paid by the unsuccessful party.

Nor (it is submitted) should those who are involved in a technical dispute adhere too strictly to the view that it will best be adjusted by a technical expert.

It is the general experience of mankind that the best tribunal for determining a question of fact is one presided over by a lawyer accustomed to hear and weigh the value of evidence. He can hear the testimony of experts on one side and experts on the other on a purely technical point and form an opinion as to who are most likely to be correct. He will not always be right; but that is not the point. Is he not *more likely* to be right than a man who has never been trained to sit in judgment? Your expert who takes a biased view on a particular scientific theory or problem would not be the proper person to decide a case which involved the application or consideration of that theory or problem. He would be *ex hypothesi* prejudiced. One recalls a case in which the point for decision was whether a certain picture was or was not the genuine work of an old master. The parties assembled with their witnesses—artists of great eminence—to have the matter determined. The judge, however, intimated that he would prefer to call in an artist of his acquaintance to examine the picture and report to him as to whether the picture was genuine or not. The parties agreed to this course. The story goes that the artist reported that the picture was genuine. Straightway the successful litigant took a taxi and brought this genuine "old master" to a well-known dealer who could find him a customer amongst the millionaires of America. But alas! the dealer refused to hang the picture—pronouncing it a fake!

Again, it should not be forgotten that there are many amongst the lawyers of the present day—to be found within a radius of a few hundred yards from Temple Bar—who are well qualified to sit in judgment in a technical case. The bar of England always has within its ranks men who have spent part of their professional youth in other professions; and even where he has had but a smattering of a technical education, it is marvellous how the man with a legal mind can bring himself to understand the scientific questions which arise in a case. Even lawyers with no technical experience at all have been known to shine in scientific cases. One of the great judges of the past—Lord Parker—was called upon to decide a case in which the whole subject of wireless telegraphy had to be inquired into. His court assumed the aspect of a physical laboratory for about a month. All the greatest experts were summoned before him, and he gave a decision so masterly that it was never appealed from! One of the experts told the writer at the end of the case that of all those who were present in court, there was no one who knew more of the subject than the Judge on the Bench!

A genius like Lord Parker does not make his appearance more than once in a lifetime; but it is hoped that enough has been said to show that in selecting a tribunal for the settlement of technical disputes, the technical man should not wholly ignore the possibility of submitting his case to the decision of a lawyer.

Investigations in Commercial Testing.

Some Noteworthy Applications of the Megger Testing Set.

By G. TAGG, B.Sc.

THE testing of the insulation of electrical equipment, whether it be cables, generators, switchgear, transmission line insulators or house wiring, is of very great importance, and it is the practice of well organised supply authorities to keep card records of the value of the insulation of the various components of their plant. The purpose of these records is to make apparent any deterioration of the insulation, since it is not so much a high value of insulation that is necessary, as constancy during the course of time. All electrical engineers are familiar with the ordinary use of the Megger testing set, but in view of modern requirements, the higher standards demanded, and the necessity of keeping records which should be comparable over a number of years, a few notes on the extended use of the Megger are desirable.

Many years ago telegraph engineers, especially those connected with submarine cables, experienced considerable trouble due to extraneous current affecting their testing instruments; and although the instruments were very highly insulated, it was not found possible to overcome the trouble until Price introduced his guard wire, which had the effect of by-passing the leakage currents so that they did not affect the instruments.

When Mr. S. Evershed designed the Megger testing set some 25 years ago, he took advantage of Price's simple but ingenious arrangement to guard the sensitive indicating movement of the Megger testing set from leakage currents, and thus to secure that the Megger would only indicate the insulation of the object connected to its terminals. The diagram fig. 1 shows how the Price guard system was applied. In this diagram it will be seen that any leakage current passing between the line and earth terminals is trapped by the guard ring and goes back to the generator by a direct path and not through the instrument movement.

For ordinary insulation tests up to 100 megohms, such an instrument is quite satisfactory, but for higher values and special conditions the guard system is connected to an additional terminal marked "Guard" as shown dotted in fig. 1. This enables the operator to guard the apparatus he is testing and also to determine the individual values of several parallel paths by the application of a few simple formulæ. Before deducing these formulæ it is necessary to make the following assumptions:—

(1) The resistances concerned can be treated as separate resistances not in any way interconnected with one another.
(2) The values of these resistances are constant.
(3) The resistances are not altered by the change in direction of the current passing through them.

Consider what happens when three resistances represented by x, y and z are connected, x between the line and earth terminals, y between the line and guard terminals, and z between the guard and earth terminals, as shown in fig. 2. Suppose k equals the total internal resistance of the current circuit, that is equals CR + C. Let the instrument reading be a.

The current circuit is shunted by the resistance y, and hence the proportion of the current through x which passes through C is $y/(y+k)$. But the instrument reading is inversely proportional to the current through the current circuit, as when x is nothing the current is a maximum, and when x is infinity the current is zero. Therefore the instrument reading is increased in the ratio $(y+k)/y$, and so

$$a = x.(y+k)/y \quad \ldots\ldots\ldots\

current circuit as it will pass from the guard terminal straight back to the negative side of the generator. Also the pressure circuit has no effect as none of the current through it passes through the current circuit.

Now reverse the line and earth terminal connections and let the instrument reading be b. This reversal has the effect of changing the positions of y and z relative to the instrument and so by a similar reasoning to the above

$$b = x.(z+k)/z \quad \ldots\ldots(2)$$

Return the line and earth terminal connections to their original positions and reverse the line and guard terminal connections. This has the effect of changing the positions of x and z relative to the instrument, and so if c is the reading

$$c = z.(y+k)/y \quad \ldots\ldots(3)$$

Equations (1), (2), and (3) can now be completely solved for x, y and z, and give

$$x = (bc-ak)/c \quad \ldots\ldots(4)$$
$$y = k(bc-ak)/(ac-bc-ak) \quad \ldots\ldots(5)$$
$$z = (bc-ak)/a \quad \ldots\ldots(6)$$

The above equations involve the total resistance of the current circuit of the Megger testing set being used, which can always be obtained from the makers for any particular instrument if the serial number is mentioned. As an example a 500-volt Megger reading up to 1,000 megohms has a value of k of .3 megohm, while the 1,000-volt instrument has a resistance of .6 megohm.

These equations have been tested not only by using constant wire resistances, but also by experiments on porcelain insulators where the resistances of the paths have been fairly accurately known, and it has been found that the results obtained from these equations are well within the accuracy with which the instrument can be read.

We will now consider the practical application of these formulæ.

Insulators when wet or dirty possess a considerable leakage path over the surface, and there is accordingly a leakage resistance in parallel with the true resistance of the insulator. This has the effect of reducing the apparent resistance of the insulator, and it is difficult to differentiate between a faulty insulator and one which has a low insulation value due to the presence of moisture or other matter forming a leakage path. The result of a test on an insulator would depend not only on its own condition but also on the presence of these leakage paths if a test were taken in the usual manner. In fig. 4 let A represent the overhead line, and B the insulator support.

Then suppose a guard ring were placed round the insulator in some such position as C. This will divide the leakage path over the surface between A and B into two portions. The resistance of that part between A and C may be represented by y, and the resistance of that part between B and C by z. Then if the true resistance of the insulator is represented by x, and A is connected to the line, B to the earth, and C to the guard terminals of a Megger testing set, the diagram of connections will be similar to that in fig. 2.

If the procedure outlined above is then followed, the three equations (4), (5), and (6) will give the values of the true resistance of the insulator and of the two portions of the leakage path. In testing an insulator it is probable that the resistance k will be negligible compared with x, y and z, and so the amount of current which is shunted from the current circuit will be too small to have an appreciable effect on the instrument reading. If this is the case, when the connections are as shown in fig. 2, the instrument will read directly the value of x, the true resistance of the insulator.

This enables faulty insulators to be differentiated from those with considerable leakage paths.

The above method may also be applied to the testing of two-core cables. In the cable shown in fig. 5 there are three resistances concerned, namely, the resistance between the two conductors and the resistance between each conductor and the sheath. Let the resistance between the two conductors A and B be represented by x, that between A and the sheath S be represented by y, and that between B and S by z. Then if A is connected to the line, B to the earth, and S to the guard terminals of a Megger testing set, the diagram of connections will again be similar to that shown in fig. 2, and the above method may be applied. The three equations will then give the values of the resistance between the two conductors and the resistance between each and the sheath as separate values.

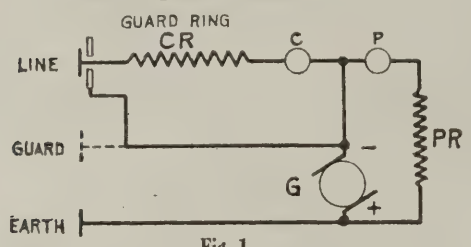


Fig. 1.

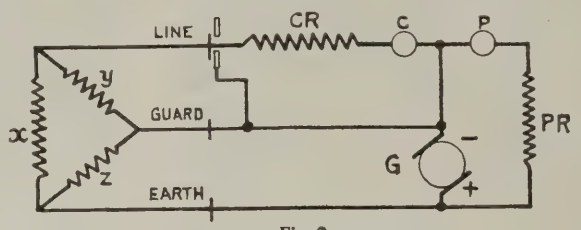


Fig. 2.

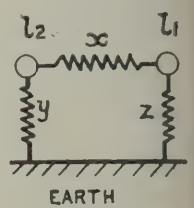


Fig. 3.

The testing of multi-core cables is rather more complicated, due to the presence of more than two conductors. The resistance between any two conductors may, however, be determined by connecting one to the line, the other to the earth terminals, and all the remaining conductors and the sheath to the guard terminal. Using the above method, equation (4) then gives the resistance required. The values obtained from equations (5) and (6) are of little use as they represent the resultant of a number of resistances in parallel.

To determine the resistance between any conductor and the sheath, connect the conductor to the line and the sheath to the earth terminals, and all the remaining conductors to the guard terminal. If the method is again applied equation (4) will give the value required.

House wiring may also be tested by the above method. Consider two wires l_1 and l_2 in fig. 3. Then there is a resistance between them which may be represented by x, and also resistances between each and earth which may be represented by y and z respectively. Then if l_1 is connected to the line terminal, l_2, to the earth terminal, and the earth to the guard terminal of a Megger testing set, the connections will be similar to those shown in fig. 2. The equations (4), (5) and (6) will then give the resistances required.

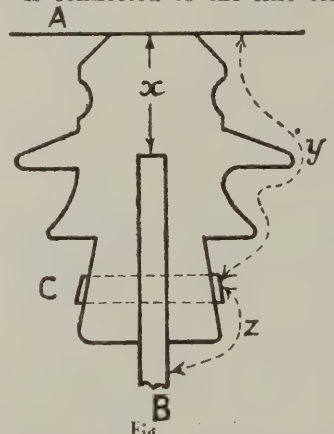


Fig.

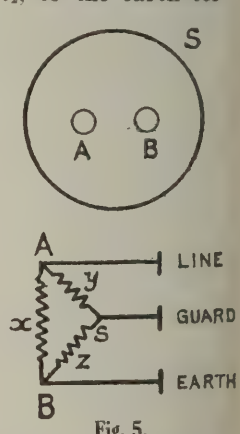


Fig. 5.

The instruments which are generally used for testing house wiring do not possess a separate guard terminal, but connection can be made to the guard ring by pushing a thin piece of metal or the flattened end of a piece of wire in between the guard ring and the line terminal insulator. It is advisable to apply the testing pressure for a few moments before taking the readings to allow for the effect of electrical osmosis.

From the above it will be seen that the use of the guard terminal, and it may be, of a guard ring, simpli-

fies the testing of many portions of electrical equipment, which, if tested in the ordinary way, are likely to give erroneous results. In most cases the instrument will be direct reading because the resistance of the current circuit of the Megger testing set will be negligible compared with the resistance under test, thus making the current shunted from the current circuit extremely small. The above method is particularly useful when testing insulators, as leakage resistance may be separated from the true resistance. It should be noted that the method will only show up faulty insulators if the faults are in such a state that they will reduce the resistance of the insulator.

If the insulator were cracked, for example, a test in very dry weather would not show up the fault, as the crack would be filled with dry air which is itself a good insulator. The fault would only show up if the crack were filled with moisture or dirt.

Testing without using a guarded system is rather unsatisfactory, as resistances are introduced of which it is not easy to take account, and it is accordingly advisable always to use a guarded circuit where possible.

Modern Electric Lifts.

The New Department-Store Control Installation at Harrods's Stores.

A CONSIDERABLE and important advance on what had previously been done in the production and operation of electrically-driven lifts is represented in the development, by Messrs. Waygood Otis, Ltd., of the department-store control system of electric-lift operation, by



Fig. 1.—Lift Bank, Top Floor.

which, it is claimed, a service increase of 50 per cent. is obtained above that by lifts employing the ordinary resistance car-switch control. The principal feature of this new method of control is multi-voltage supply regulation of the driving motor. This machine is supplied with energy from a motor-generator and the elevator movement is governed by automatically regulating the pressure of the generating unit, which is directly supplied to the armature of the driving motor.

Some particulars of a recent installation of electric lifts employing this new control system will probably prove of interest to most electrical engineers. The equipment referred to may be seen at the Brompton Road stores of Messrs. Harrods, Ltd., and has been working since Christmas last with satisfactory results. The installation consists of a bank of four identical lifts arranged side by side, fig. 1. Each is operated by a 25-h.p. motor, fig. 2, driven from a motor-generator of the same capacity. A feature of the apparatus is the employment of a traction sheave for the lift drive. The driving portion of the sheave is mounted directly on the armature shaft, and, its diameter being only slightly larger than that of the armature, the lift speed closely approximates to the peripheral speed of the driving rotor. As already mentioned, the speed regulation of the motor, and in consequence the lift car, is effected by variation of the supply pressure from the generator, which ranges from 200 V to 12-15 V, representing the maximum and minimum motor speeds of 102 and about 7 r.p.m. The brake drum is an integral part of the armature cylinder and the spring-controlled brake shoes are held in the off position by brake magnet coils mounted on the motor frame. The motor bearings are provided with chain lubrication.

The main control medium between the car and the generator consists of a pawl-coil unit mounted on, and free to move along, a screwed, vertical, steel rod which is tape driven from the car, and as the rod revolves the pawl device travels up or down the thread of the rod, according to the direction of rotation of the rod, the limits of travel representing those of the actual car between its top and bottom stages. Two pawls are employed, one at each end of the coil, and each works in co-operation with a separate selector rod. Each rod is equipped with four collars which are spaced out, in relation to the travel of the pawl unit, so as to represent the floor stages of the lift, four up on one rod and four down on the other. The pawls are controlled from the car to engage or disengage with the necessary collars when required. The rods each actuate four selector switches controlling four of the five governing relays for the pressure regulation. As the car, and with it the pawl unit, rises or falls, the pawl corresponding to the direction of the lift travel is operated to engage the collar representing the next floor to be reached when the coil arrives at the necessary position. The coil continues to travel on engaging with the collar and lifts or lowers the rod according to the direction of

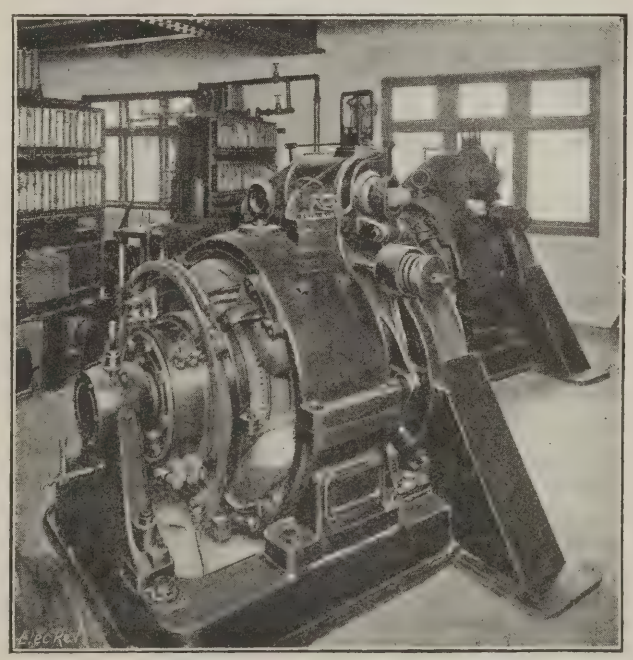


Fig. 2.—Light-Driving Motor.

motion of the lift. The rod movement actuates the selector switches and the car is stopped. The reverse operation takes place when it is required to start the

elevator, the pawl being disengaged from the collar. Normally the car reverses only at the top and bottom stages, but an emergency direction-changing device is installed for operation at the intermediate stages, should that be necessary.

The fifth pressure-varying relay is only called into service when the load on the lift is severe, and it is automatically and electrically operated. The relays are controlled by reactance coils to give them the correct working sequence. They are mounted on the control board, fig. 3, which also accommodates the main relay equipment, directly controlling the motor-generator switchgear and field-reversing relays for the necessary direction control of the motor. A small auxiliary relay is operated from the car, and in turn controls the main relay and a d.p. switch which excites an automatic rheostat, interlocking relay, and the main control devices.

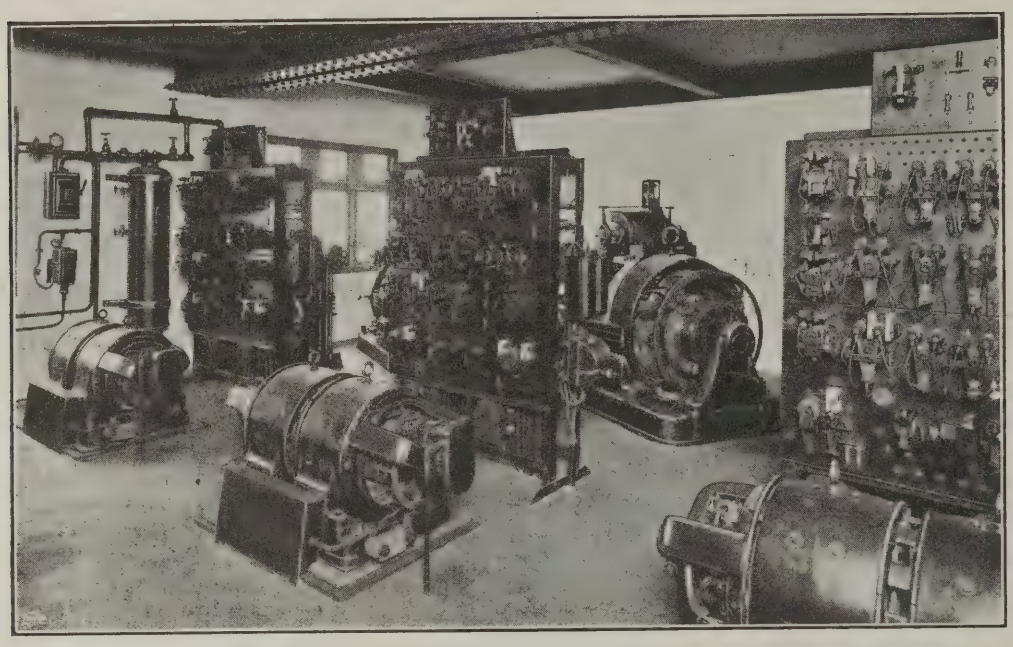


Fig. 3.—Lift-Control Room.

An operating panel is installed in a convenient position in the car and contains the operating handles and the emergency and safety control switches. The auxiliary relay on the control board is operated by a Yale-key switch, a small lamp indicating when this is on. A lever switch operates the pawl unit, thus starting or stopping the car. In the normal position this is arranged with a dead-man action. A safety switch under a glass face can be operated to cut the whole supply off in the case of failure.

Both the car and hatchway doors are operated by means of air pressure which is electrically controlled by a small motor situated on the roof of the car. The motor opens a valve governing the air supply and is brought into operation at the half-way position of the lever switch. The air supply is maintained between the required limits of pressure by means of an electrically-driven pump, a piston switch that automatically operates the motor being actuated under the air pressure. The driving and controlling machinery for the four lifts is installed in a special 2-storey room located on the roof immediately above the lifts. The motor generators, motors, control boards, selector-switch equipment and the air-pump gear are located in the top storey, fig. 3, and the lower floor accommodates the lower part of the traction sheave, the lift governor apparatus and the tape-driving equipment for the pawl-unit spindle.

The elevators are self-levelling, and maintain the car floor at the hatchway level during the loading operations. As the loads increase the self-levelling device compensates for the tension on the cables. A particular feature of the lifts, due to the multi-voltage control, is the rapid and smooth movement of the car. The usual "up" and "down" hall lanterns above the car doors signal to waiting passengers the approach of the car and indicate when it is stopped at the landing. If desired an annunciator may be installed in one or more cars and signal buttons in the halls for night service.

In conclusion, we are indebted to Messrs. Waygood-Otis, Ltd., and Messrs. Harrods, Ltd., for their courtesy in giving us facilities to inspect the installation.

A Swiss Hydro-Electric Installation.

Some Details of the Lake Tremorgio Plant.

Although the hydro-electric station which was completed last year near Rodi, in Southern Switzerland, for the Società Officine Elettriche Ticinese, and some particulars of which were recently given in the Electrical Review, only so far comprises a single 15,000-h.p. set, the installation is interesting owing to the many engineering difficulties which have had to be overcome. The power is derived from Lake Tremorgio, which lies up in the snow at an altitude of 6,000 ft. above sea level, and which is mainly fed by the Lagasca stream, a tributary of the River Tessin. When carefully measured, the lake was found to cover an area of about 670 acres, to have a maximum depth of roundly 180 ft., and an approximate capacity of 2,420 million gallons of water. Following the preliminary surveys, it was decided to reduce the depth of the lake by about half and its capacity to about 1,687 million gallons.

Owing to the steep sides of the lake being usually covered with snow, and the fact that avalanches have to be contended with, it was decided to draw the water from the lake by a tunnel, which commences at a point about 85 ft. below the lake level, and extends through



Fig. 1.—Rodi Hydro-Electric Station.

the mountain for a distance of 783 ft. The first 205 ft. of the tunnel practically forms an extension of the lake, for at that point, at the bottom of a vertical shaft 120 ft. deep, sluice gates have been interposed. The lake end

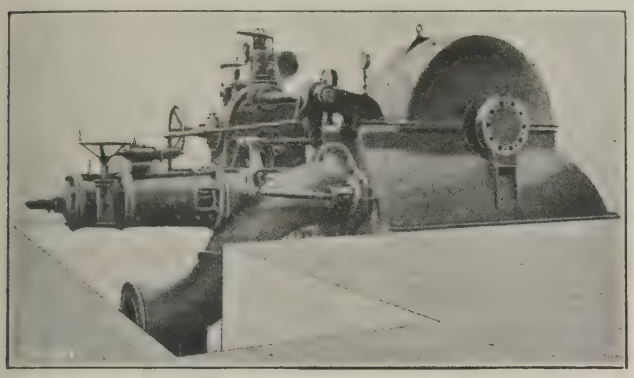


Fig. 2.—Pelton-Type Turbine.

of the first portion of the tunnel is oblong in section, this being followed by a part which has straight sides and bottom with a rounded top, the width varying from 3 ft. 11 in. to 4 ft. 6 in., and the height from 4 ft. 6 in. to 5 ft. 2 in. The portion of the tunnel behind the sluice gates is circular in section, the diameter ranging from 4 ft. 11 in. to 5 ft. 11 in.; part of it is lined to prevent leakage, with cement, and part with "Gunite."

At a point on the mountain side where the tunnel ends, 5,877 ft. above the sea, the water will be diverted into two conduits, only one of which, however, is at present installed. At this point a water-inlet control house has been established, provision being made both for hand and remote—from the power station—control. The conduits are of welded steel, and are partly laid in tunnel and partly in the open, although in many places, owing to the risk of avalanches, a protective covering for the pipes has had to be provided. The head between the control house and the power station is 2,775 ft. The conduit pipe is, however, 5,179 ft. in length owing to various turns in its direction being necessary. The average angle of slope of the pipes is 68 per cent., while in some portions the angle reaches 230 per cent. It will thus be readily realised that the work of construction was extremely arduous, necessitating the construction of both a temporary cable railway and a cable ropeway. Indeed, even for Switzerland, the steep angle of 230 per cent. is regarded as unusual.

The conduit is divided into four sections, the diameter ranging from 27.5 in. at the top down to 21.6 in. at the bottom, the thickness of the pipes increasing proportionately from 7 to 29 mm., while, in order to prevent rust, the pipes throughout their entire length were given a coating both internally and externally of asphaltic tar.

The power station is located near the village of Rodi; the building, fig. 1, which has been designed for easy extension, is in the Roman style, and of stone from the local quarries. At present the floor area is 64 ft. by 24½ ft., amply sufficient to contain a 15,000-h.p. Pelton-type turbine, fig. 2, constructed by Escher Wyss and Co., of Zurich, driving at 750 r.p.m., a 10,000-kVA, three-phase alternator built by the Brown, Boveri Co., of Baden, the current being generated at 8,400 V, 50 periods. The plant also includes a Brown, Boveri transformer, which steps up the current for transmission purposes to 50,000 V.

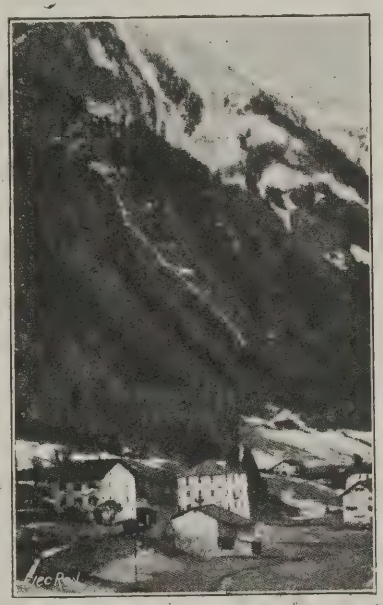


Fig. 3.—Bottom Conduit Section.



Fig. 4.—Conduit Erection.

Figs. 3 and 4 show, respectively, the bottom section of the conduit, and the conduit being fixed at an angle of 230 per cent.

Women and Home Lighting.

Successful Convention in London.

On Thursday and Friday last week, April 29th and 30th, London was the centre for ladies connected with various electrical undertakings, companies, and firms in various parts of the United Kingdom. By invitation of the Electric Lamp Manufacturers' Association they came from far and near—some from electricity showrooms, others from the showrooms of manufacturers, wholesalers and contractors, and yet others by invitation of the Electrical Association for Women, to attend the First Home Lighting Course for Women at the E.L.M.A. Lighting Service Bureau in Savoy Street.

The proceedings were divided each day into a morning and afternoon session, and under the chairmanship of Mr. W. E. Bush, the manager of the Bureau, and the experienced lecturing of members of E.L.M.A.'s expert staff, some sixty ladies were initiated into some of the problems of illumination. Such matters as lighting progress down the ages culminating in the modern electric lamp, the control of light, modern wiring systems, lighting fundamentals, light as a decorative medium, comparisons of good and bad lighting, selling light (showroom, window, and other demonstration), and the possibilities of better lighting in the home and the need for campaigning to secure it, were all parts of the theme. The "students" had excellent opportunities for asking questions which had arisen in the course of their own business occupations, and no doubt they are all back in their places this week far better equipped for rendering efficient electrical service, having at command many new talking points with which to persuade existing and potential consumers.

How well-conceived was the whole scheme will be recognised when we mention that the Bureau under-

took, through its staff, the reserving of hotel accommodation for such of the visiting students as required it for the period of their stay in London. How appreciative they all were of the efforts that had been made for their comfort and instruction, for the facilities that their employing undertakings, &c., had afforded them to be absent from their ordinary duties so as to attend the course, was amply demonstrated by the most excellent spirit which characterised an informal dinner which took place at the Florence Restaurant last Friday evening, as the concluding function in the programme.

Mr. C. W. Sully, Director of E.L.M.A., presided at the dinner. He proposed a toast including all kinds of guests who were present. The speeches were few and brief. Miss Holm returned thanks on behalf of the visitors from the provinces, and Mrs. Hollis on behalf of those from London and its suburbs, while Miss Haslett spoke appropriately concerning the work of the Electrical Association for Women. Mr. J. W. Beauchamp, Director of E.D.A., followed, and Mr. A. H. Bridge (Electrical Review) responded for the Press.

The musical programme delighted the audience immensely, and it was obvious that the dinner formed a very popular means for winding up a thoroughly popular course; perhaps the most homely and human touch of all was the presentation of a box of chocolates to Miss Hodge, who had been so charming a Fairy Godmother to all the women during their stay.



"Students" at the E.L.M.A. Home Lighting Course for Women.

As the occasion was one of a quite exceptional character, and in order to indicate how representative it was, we give below the names of most of the "students"; a few others who attended were members of the Electrical Association for Women, but their names were not registered. We also reproduce a group photograph taken on the steps of the I.E.E. building during the course.

Miss M. de Gruchy, Croydon Electricity Department.
Miss M. F. McDonald, G.E.C., Birmingham.
Miss Veda Brice, Beckenham U.D.C. Electrical Department.
Mrs. V. K. Shepherd, member of Electrical Assn. for Women.
Miss A. Jackson, Lighting Service Bureau, Newcastle.
Miss K. S. Lindsey, Lighting Service Bureau, Glasgow.
Miss F. M. Ridley, G.E.C., Newcastle.
Miss R. F. Kennedy, Corp. Electricity Dept., Glasgow.
Miss Crane, Chingford Electricity Supply Co.
Miss Winterbottom, Metro-Vick Supplies, Ltd.
Miss U. O'Connor, J. W. Russel, Watford.
Miss F. Swire, Hackney Electric Supply Dept.
Mrs. Hollis, West Ham Electricity Dept.
Miss D. Bentley and Miss O. Bull, Stoke-on-Trent Electricity Dept.
Mrs. Boysons, Electricity Works, Epsom.
Miss H. W. Forbes, North Metropolitan Electric Power Supply Co., Enfield.
Miss C. Carter, Sevenoaks and District Electricity Co.
Miss I. Clements, Stoke Newington Borough Electricity Dept.
Miss M. Selbey, member Electrical Association for Women.
Mrs. E. A. Clement and Mrs. J. Tyler, South Wales Electric Power Co., Cardiff.
Miss G. C. Senior, G.E.C., Cardiff.
Mrs. Peel and Miss Lee, G.E.C., London.
Misses F. M. Upchurch and D. M. Geddes, North Metropolitan Electric Power Supply Co., Palmer's Green.
Miss Mioprio, North Metropolitan Electric Power Supply Co.
Miss O. Holt and Miss Green, Edison Swan Electric Co., London.
Miss J. Dent, J. C. White, Manchester.
Miss Davies, Wolverhampton Electricity Dept.
Miss Pedler, B.T.-H. Co., Birmingham.
Miss E. Kerswill and Miss R. Pecken, Bristol Corporation Electricity Department.
Miss A. A. Stemp, Cheltenham Corporation Electricity Dept.
Miss G. Busby, North Met. Electric Power Supply Co., Edmonton.
Miss E. Dickinson, Bermondsey Borough Council.
Miss F. M. Simpson, North Met. Electric Power Supply Co., Edgware.
Miss J. Clayton, North Met. Electric Power Supply Co., Tottenham.
Miss A. Holm, Newcastle Electricity Supply Co.
Mrs. Arnold and Miss M. Fox, City of Bradford Electricity Dept.
Miss J. Lees, Siemens & English Electric Lamp Co., Ltd., London.
Mrs. Cross, Westminster Electric Supply Corporation.
Miss Hansell, North Met. Electric Power Supply Co., St. Albans.
Miss J. P. Lewis, member of Electrical Assn. for Women.
Miss E. M. Sheret, North Met. Electric Power Supply Co., Wembley.
Miss A. B. Watson and Miss M. Greenhill, representatives of "Good Housekeeping."
Mrs. C. Taylor, representative of "E.D.A."
Mrs. O. Fletcher and Mrs. A. L. Walker, North Met. Electric Power Supply Co., Barnet.
Miss Haslett, director, Electrical Assn. for Women.
Miss B. Moss, Tottenham Light, Heat and Power Co.

Loud-speakers in Bath Abbey.—As in many other historical buildings in the United Kingdom, the acoustics of Bath Abbey are unfortunately bad. Services conducted from the pulpit and lectern are inaudible to half the congregation, and loud-speakers have accordingly been installed in order to overcome the various difficulties. A Marconiphone No. 1 "Public Address" equipment has been used for the purpose with a microphone on the pulpit and lectern and two loud-speakers suitably mounted in the organ loft. The amplifier and control outfit is housed in a cellar-like compartment leading to the transept, and comprises a charging board, amplifier, and a sub-control. From this point a microphone can be switched in and out of circuit as required. It was found that one of the loud-speakers required less volume than the other, and suitable damping apparatus was incorporated in order that proper acoustic balance should be maintained.

Electricity Supply in Great Britain.—XV.

North Wales.

The counties of Anglesey, Carnarvon, Denbigh, Flint, Merioneth and Montgomery comprise the greater part of the area of the North Wales and South Cheshire Electricity District, as approved by Parliament.

The map of these six counties has not been reproduced, but copies of the map are available if required.

The 1921 Census gives the following particulars for these Administrative Counties:—

Administrative County.	Acres.	Persons.	Resident families.	Buildings not containing dwellings.
Anglesey ...	176,630	51,744	12,847	1,020
Carnarvon ...	366,005	130,975	31,537	2,446
Denbigh ...	426,080	154,842	33,975	2,472
Flint ...	163,707	106,617	23,002	1,914
Merioneth ...	422,372	45,087	10,758	1,238
Montgomery	510,110	51,263	12,064	1,092
Total ...	2,064,904	540,528	124,183	10,182

The number of kWh generated in Area No. 6 (which includes the output of the generating stations owned by the Chester and Crewe Corporations and those owned by companies at Aberystwyth and Oswestry, as well as the output of the generating stations in the above six counties) is given in Table 8 of the Electricity Commissioners' publication, "Generation of Electricity in Great Britain."

Year ending March 31st.	kWh generated. Area No. 6.
1922	38.990,369
1923	41,753,834
1924	52,407,347
1925	59,834,945

Table 8 also gives the following figures for kWh generated by water power:—

Year ending March 31st.	kWh generated by water power. Area No. 6.	Great Britain.*
1922 ...	27,035,496 ...	29,107,036
1923 ...	29,074,884 ...	31.823,031
1924 ...	40,704,029 ...	44,094,796
1925 ...	46,768,001 ...	51,093,237

*In Appendix I to the Weir Report, the available water power in Great Britain is estimated to be capable of giving an output of 2,120,000,000 kWh per annum.

The following is a list of the existing authorised undertakers:—

Local Authorities.

Abergele and Pensarn Urban District Council.
Bangor Corporation.
Bethesda Urban District Council.
Bettws-y-Coed Urban District Council.
Carnarvon Corporation.
Colwyn Bay Urban District Council.
Connah's Quay Urban District Council.
Conway Corporation.
Hawarden Rural District Council.
Holyhead Urban District Council.
Llandudno Urban District Council.
Llanfairfechan Urban District Council.
Llangollen Urban District Council.
Menai Bridge Urban District Council.
Mold Urban District Council.
Penmaenmawr Urban District Council.
Prestatyn Urban District Council.
Pwllheli Corporation.
Rhyl Urban District Council.
Wrexham Corporation.

Companies.

Llanrwst Electricity Supply Co., Ltd.
North Wales Power Co., Ltd.
North-Western Electricity and Power Gas Co.
Ruthin Electric Supply Co., Ltd.

Authorised Persons.

Assheton Smith, G.W.D., Esq., and Successors.

Applications for Special Orders under Section 26 of the Electricity (Supply) Act, 1919, have been lodged by the following:—

Wrexham Corporation (Extension).
Colwyn Bay Urban District Council (Extension).
Wrexham Rural District Council.
Portmadoc Urban District Council.
Gwynedd Trust, Ltd.
Executors of Mrs. M. A. Owen.

Further particulars of these applications are given in the Fifth Annual Report of the Electricity Commissioners and also in the Report of the North Wales and South Cheshire Joint Electricity Authority for the year ended March 31st, 1925.

In this connection it is stated (on page 12, paragraphs 35 and 36, of the Electricity Commissioners' Fifth Annual Report) that:—

"Since the coming into force of the District Order, the North Wales Power Company has pressed forward actively with the establishment of the transmission scheme, and the marked progress already made has not only resulted in the supersession of local generation at a number of centres owing to the availability of bulk supplies, but has also stimulated a number of applications for Special Orders for distribution powers in new areas capable of being developed by means of supplies from the transmission system."

"The practical results of the steps already taken to improve the organisation for the supply of electricity in this District provide an informative indication of the manner in which re-organisation and further development is accelerated as a consequence of the establishment of a comprehensive transmission system over a wide area."

Marine Life-Saving Services.—In April, 1923, the control of H.M. Coastguard passed from the Admiralty to the Board of Trade, the force being reconstituted primarily for life-saving duties, and in December, 1925, the Coastguard Act, 1925, was passed. The shore signal stations maintained by the Admiralty for Naval purposes and on behalf of Lloyd's (19 in number) participate in the life-saving organisation, the Board of Trade making an annual payment to the Admiralty in respect of such services.

Electrical communication naturally takes a prominent place in a life-saving organisation. Consequently, wherever possible, every coastguard station, look-out position, volunteer-in-charge and watchman-in-charge is connected to the exchange telephone system of the country. Certain lifeboat authorities are also provided with telephone facilities at the charge of the Board of Trade. In localities where the exchange system is not sufficiently developed, private circuits connecting two or more coastguard stations are provided with the necessary extensions to the look-out positions and lifeboat authorities in the neighbourhood. Provision of telephone facilities for life-saving purposes is also made to selected lighthouses and light-vessels, but in the case of lightvessels telephone cables are being gradually superseded by wireless telephony. Under this system a group of lightvessels are in communication by wireless telephone with a centrally situated coastguard station. In the United Kingdom wireless communication with vessels at sea, other than those of His Majesty's Navy, is conducted by a number of coast wireless stations under the control of the Postmaster-General. For each of these stations and also for each of the Admiralty wireless stations, there is a liaison coastguard station situated adjacent to, and in close telephonic touch with, the coast wireless station, to which the wireless station reports immediately any S.O.S. signal is received from a vessel within a certain defined area, including the British Isles. It is then the duty of the liaison coastguard station to plot the position given in the S.O.S. signal on a chart and then dispatch it to the officer of coastguard off whose district the vessel in distress is situated. This officer initiates the necessary steps for the dispatch of appropriate assistance, informing the liaison station of the action taken, which in turn passes on the information to the wireless station in order that the vessel in distress may be acquainted that assistance is forthcoming. Special priority is afforded by the Postmaster-General to all messages transmitted on life-saving service by telephone or telegraph.

The I.E.C. Meeting in America.—II.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

The subjects dealt with at the Conference were as follows:—

Nomenclature.
Symbols.
Rules and Regulations for Transmission Lines.
Rating of Electrical Machinery.
Standard Pressures.
Transformer Oils.
Prime Movers, Steam Turbines.
Prime Movers, Hydraulic Turbines.
Traction Motors.
Terminal Markings.
Lamp Caps and Holders.

The opening technical session of the Conference, presided over by Signor Semenza, was occupied by the reading and discussion of papers by experts on different aspects of the question of machinery rating. The authors and titles were as follows:—

Dr. A. E. Kennelly:—"Can the Thermal Capacity of Electrical Machines be made a Simple and Practical Element of Rating?"

Prof. E. Morelli:—"The true meaning of Ambient Temperature, Limits of Temperature, and Temperature Rise."

Mr. Roger T. Smith.—"Ambient Temperature as a Testing Temperature of Reference, and as a Climatic Entity."

Papers were read by Mr. A. Huber Ruf and Dr. H. Behn-Eschenberg, Mr. C. Rodgers, Mr. Frans Dupont, Dr. M. Kloss, and Mr. R. Liljeblod, on the question: "What is the Importance of Overload Requirements, and what are the Main Reasons for the Same?"

The papers emphasised the fact that a motor was usually called on to give an average output plus an intermittent overload, and then discussed how this was looked after in different countries. The British practice is to limit the temperature rise for the average load to such a figure, 40 deg. C., that the usual over-loads are automatically cared for, while on the Continent the practice is to adopt a continuous maximum rating with a 50-deg. rise, known as the I.E.C. standard rating. With the latter system of rating there is obviously no demand for over-load. In this country all difficulty in the use of the two systems has been overcome by showing when desired both ratings on the name plate. As regards the question of ambient temperature of reference, the British delegation favoured the retention of a standard of reference. At the conclusion of a long and interesting discussion, it was decided to advise the Rating Committee that there was no general demand for an over-load on the I.E.C. 50 deg. C. continuous maximum rating. The British 40 deg. C. rating would, of course, remain the standard for Great Britain.

Transmission Line Difficulties in Morocco.—In a recent issue of the house organ of the Compagnie Francaise Thomson-Houston, of Paris, reference is made to the difficulties which have been experienced in Morocco in connection with the 60,000-V transmission line between Casablanca and Rabat, owing to the large number of storks in that country. These large birds quickly discovered that the masts provided a means of building more stable nests than was possible in trees and chimneys. Although the nests have not caused any difficulties in connection either with the transmission line or the masts, considerable trouble has been experienced with the insulators, which have been much soiled by the excreta of the birds, but the difficulty has been overcome by the provision of smooth surface shields on which the storks cannot get a footing and by the construction of stork-perches in the vicinity of the lines.

Chilean Trade and Development.

More Propaganda Needed.

Mr. W. F. Vaughan Scott (British Commercial Secretary at Santiago) has forwarded a report on the industrial and economic situation in Chile (dated September, 1925) to the Department of Overseas Trade.* In his introduction and general review of the situation, Mr. Vaughan Scott says that the British Empire was the principal supplier of goods to Chile during 1924, providing 26 per cent. of the total as compared with 23 per cent. supplied by the United States. Germany's share was 13 per cent. As regarded Chilean exports, the United States was the principal customer, with 41 per cent., while Great Britain occupied second place with 34 per cent.

It is considered that Chile has awakened from the static *regimé* of ultra-conservatism of many generations, and this has brought into play new energies which, if left unhindered, spell great expansion in trade. Among the many enterprises which are in prospect are a number of hydro-electric developments of importance.

Trading Methods.

Mr. Vaughan Scott deals very fully with the trading conditions in Chile. He says that our manufacturers must recognise the fact that practically every civilised nation has to-day entered into competition and is manufacturing every conceivable class of goods, at the same time jealously protecting and fostering these new industries. The fact that these nations have attained such rapid industrial development in a very few years makes it necessary for us to exert every effort if we are to maintain our relative position in, say, 20 years' time. The traditional individualism of the British manufacturer, which in the past has often stood him in such good stead, is to-day a source of disadvantage, and there is still a great deal too much fear of the man on the other side of the road knowing what the man on this side is doing. Success can only be maintained by co-operation, and, generally speaking, by specialisation. The handicap of high prices which is so evident in the bulk of foreign markets, can be greatly lessened by efficient salesmanship and propaganda, and frequently can be overcome altogether by these means. United States manufacturers, in particular, have realised this, and though their propaganda costs them a great deal of money, they are reaping the benefit. It is time that our "Buy British goods" campaign was extended in appropriate form beyond Great Britain and the Dominions. British manufacturers already have abroad the finest network for distribution that any nation could desire. Trading conditions are also dealt with in a sub-report by Mr. S. H. Gudgeon (Vice-Consul at Iquique), who says that one effect of the keener competition of the last few years has been to bring the producer into closer touch with the consumer. To-day many manufacturers are represented by a travelling agent, or perhaps by a small firm which places its orders direct with its principals, on a purely commercial basis.

With regard to the investment of capital, Mr. Vaughan Scott says that American capital is eagerly welcomed in Chile, and fresh British capital would be equally welcomed. In the interests of our future trade in this country it is most important that our investments should be increased and not decreased, as is the present case. An important and growing market exists in Chile for mining equipment, including steam boilers and engines, gas engines, water turbines, electric motors, converters, and other machinery.

Copper Production.

During the year under review the copper mining industry satisfactorily progressed in spite of a shortage of water power, which reduced the output. Exports of bar copper during the years 1923 and 1924 and the first 10 months of 1925 were 162,419 tons, 181,442 tons and 130,362 tons respectively. Chile already ranks second, after the United States, as a copper-producing country, and during the next few years she will increase her production by a further 190,000,000 lb. per annum, as a result of the decision of the Anaconda Copper Co. to complete the installation of the Andes Copper Co.'s mine at Potrerillos. The Chile Exploration Co. (New York) at Chuquicamata, near Antofagasta, has continued to produce and export very pure copper in bars.

Railway Electrification.

Among the railway developments which are in hand is the electrification of the Transandine Railways. The locomotives for this system have been ordered from Switzerland, as it is stated that British and United States manufacturers have less experience in rack railway equipment. Power will be supplied by the Maitenes power station, belonging to the Compania Chilena de Electricidad, which supplies Santiago and the first section of the State Railway to Valparaiso. The completion of the electrification of the line from Santiago has resulted in greatly accelerated service for goods and passengers. The improvements being carried out are the installation of automatic brakes and couplings, a feeder line for electrical energy for lighting stations, improvements in signals and points, &c. The administration of the First Zone has drawn up a plan of improvements, and estimates the cost at £5,000,000, for which a loan will have to be raised.

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*H.M. Stationery Office. 2s. 6d. net.

The Nitrate Railway Co., in order to counteract the accumulative deterioration of its property, submitted a scheme to the Government involving an expenditure of £1,250,000, which provided for the introduction of several general improvements, and in particular the electrification of the heavy-grade section. Owing, however, to the failure of the company to secure an extension of its concession, the electrification scheme was abandoned.

Radio Telephony and Telegraphy.

Radio-telephony continues to make progress in Chile, but the trade is still in the hands of foreign competitors, the bulk of it being done by United States manufacturers, followed by Germany. Probably all the business done by Great Britain only amounts to 10 per cent. The number of broadcasting receiving sets at present in use is about 45,000, as compared with 12,500 a year ago. During 1924 the only broadcasting station in operation was that of the Radio Chilena Corporation, but since then four large stations have been installed—three at Santiago and one at Concepçion. Beyond these there are nearly 24 stations erected by newspapers, business firms, and others. The first law dealing with broadcasting was passed in 1925. Under this decree the Republic is divided into seven zones, in each of which only two broadcasting stations of the first category may be installed, *i.e.*, with power of 1 kW or more, which must use wave-lengths between 350 and 425 metres or 475 and 545 metres. The wave-lengths of the stations situated in the same zone must have a minimum difference of 100 metres, and there must be a difference of 50 metres between contiguous zones. A radio transmission station cannot be installed at less than 28 km. from permanent Government stations. The Government has stations at Valparaiso, Talcahuano, Frutillar, Punta Arenas, and will shortly have one at Arica. The naval wireless station near Antofagasta, constructed under the supervision of Messrs. Marconi, was finished and opened in January, 1925. The station is in existence primarily for naval purposes, but commercial and ordinary messages can also be transmitted and received. The service, however, is apt to be dilatory, and so has proved of little value commercially.

Trade in Electrical Goods.

Mr. V. V. Cusden (Vice-Consul at Valparaiso) says that the market in that district for electrical apparatus and accessories is held principally by German and American firms, there being a comparatively small sale of British-made goods. This is probably partly accounted for by the fact that British goods are more expensive, being of a superior quality, and therefore not so attractive to the Chilean market. In the Concepçion, Coronel, and Lota district, according to Mr. E. Cooper (British Consul at Concepçion), practically all of the electrical goods are supplied by Germany.

General.

The large construction programme undertaken by the Compania de Electricidad de Valparaiso, after it acquired the properties about two years ago, has been practically completed; the company is giving a more efficient service and is able to extend the use of electricity. A number of factories have changed over their plants to the more economical electric power, and others will shortly do the same. As a consequence, the power consumption has doubled during the last year, the number of users has increased by about 2,000, and the total sale of energy by about 3,000,000 kWh. The tramway system at Valparaiso and suburbs is efficient, but it is not at present a paying concern. The new cars on the Viña del Mar route are giving excellent service, and are well patronised, but motor-'bus competition is very keen.

A proposal is on foot to hold an international industrial exhibition at Viña del Mar in September, 1927.

The revision of the import duties has remained in abeyance, but will probably be dealt with during the current year.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Advertisement Correction.—We regret to find that in the advertisement of the WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., appearing in our issue of April 30th, a printers' error occurred in the type relating to one of the forms of switch made by the company—the last of all. For "*Imported* Quick-Make and Break," &c., read *Improved*.

The London Chamber of Commerce.—Among the matters dealt with in the Chamber's 44th annual report (1925), are electricity supply in the City, merchandise marks, national and local economy, rating and valuation, &c. With regard to the first subject, mention is made of the joint action taken by the Chamber and the City Corporation, as a result of which the charges for electricity were slightly reduced. The report states that the Committee appointed for the purpose will consider it its duty to carefully watch the working of the new London Electricity Acts. The "standard prices" are not necessarily permanent and, apart from the general financial result, attention will be directed to several other features of the Acts, for instance, that which permits the companies to charge different rates to large and small consumers.

In presenting the report, the Council says that, as was pointed out last year, new factories in the war zones are being equipped with the most up-to-date appliances, and it is essential that a forward policy in this matter should be followed by manufacturers here and that the trade unions should abandon their opposition to all things new.

Cable Contract.—MESSRS. W. F. DENNIS & Co. inform us that the telephone cable about to be laid between England and Holland (ELEC. REV., April 23rd, p. 664, note entitled "The Telephone Service"), was manufactured by Felten and Guilleaume Carlswerk A.G. at Coln-Mulheim.

Industrial Retrospect and Prospect.—The Federation of British Industries says that there was a moderate increase in trade during the past quarter which was widely diffused, *i.e.*, not confined to the major industries. This is said to be due to a seasonal improvement and to the effects of the coal subsidy. The price curves show that a period of readjustment was in progress and the same conditions prevailed in other countries. American observers report a feeling of uncertainty and a probable slackening of activity. In Germany a state of serious trade depression still persisted, a condition which was partly due to the need for some further relative downward adjustment of the German cost of living and wages in order to bring them more into line with those in other countries. All indications point to the confirmation of the Federation's forecast that the current year was likely to be one of readjustment and consolidation rather than expansion.

Unemployment.—The total of registered unemployed fell to below a million during the week ended April 19th. The actual figure was 996,600, as compared with 1,024,389 on April 12th, and 1,202,670 on April 20th, 1928.

Municipal Trading at Sydney.—At a meeting in March, at which the Sydney City Council reaffirmed its intention of commencing the sale of electrical appliances, the acting general manager of the Electricity Department (Mr. Maling) said that he had received a demand from the Electrical Traders' Association, of which the Council was a member, for £15 15s. subscription and levy. In view of the fact that the Association is strenuously opposing the Council's trading proposals, it was decided to pay the amount demanded and withdraw from the Association.

Modified Mexican Import Duties.—The *Board of Trade Journal* for April 29th contained a list of articles which, by a recent Presidential Decree, are to be subject to modified duties upon importation into Mexico. Among these are electric stoves and heaters of all kinds. The new duties upon these are:—Weighing more than 20 kg. net each, 0.15 peso per kg.; weighing up to 20 kg. each, 0.30 peso per kg.

A Contractor's Hire-purchase System.—During the hearing of evidence by Parliamentary Committees upon clauses giving municipal supply authorities powers to wire houses and sell appliances by hire-purchase systems, a great deal has been said regarding the inability or unwillingness of contractors to do work by this method. Some contractors, on the other hand, have expressed their willingness to wire houses upon the deferred-payment plan, and a concrete case of the kind came under our notice when Mr. Harry Moss sent us the card which is reproduced herewith. We think the card is self-explanatory, but it will be noticed that it does not get over the difficulty of persuading those who are mere tenants to have their houses wired.



A Contractor's Hire-Purchase System.

Municipal Trading.—At the annual meeting of the Association of British Chambers of Commerce on April 22nd and 23rd, a resolution was passed strongly protesting against powers being granted to municipal authorities to trade in commodities in competition with ratepayers.

New Businesses Registered.—The following businesses have recently been registered under the Business Names Act:—

B. C. Palmer & Co. (electrical engineers), Cromwell House, High Holborn, W.C.

Victor Engineering & Supply Co. (electrical engineering), 118, Oxford Road, All Saints', Manchester.

"Isca" Electrical Engineering Co. (general electrical contracting and sales), 177, Sidwell Street, Exeter.

Eastern Wireless Co. (manufacturers of radio sets and accessories), 90, Three Colt Street, E.14.

James V. Coonan Co. (consulting mechanical and electrical and structural engineers), 8-9, Northwalls, Queen's Dock, Hull.

C. W. H. Electrical Co. (electrical, wireless, and general engineers), 53a, Standishgate, Wigan.

Peach, Martin & Co. (dealers in radio components and sets), 11, Carysfort Road, Stoke Newington, N.16.

Stockport Battery Service (accumulator makers and factors), Wellington Grove, Stockport.

Ludgate Radio Co. (dealers in radio and electrical goods), 56, Ludgate Hill, E.C.4.

Engineering Employés' Wages.—A conference of delegates of trade unions in the engineering industry was held in London on April 29th, when it was decided to recommend the members of the unions to vote in favour of a strike as a means of enforcing the demand for increased wages. It was also decided to approach the executive councils of unions with members engaged in power stations and other public utility undertakings to decide what action should be taken. A joint committee was instructed to set up a strike organisation, as it was considered certain that the ballot would result in a majority in favour of a stoppage of work.

Key Industry Duties.—As we briefly stated last week, carbons and scientific instruments are affected by the alterations proposed in the Key Industry Duties. The existing *ad valorem* duty on arc lamp carbons is to be replaced by a flat rate of 1s. per lb., while amorphous carbon electrodes are added to the list of protected goods with a duty of 33⅓ per cent. *ad valorem*. Galvanometers, electroscopes, gauges and measuring instruments of precision of the types used in engineering shops and viewing rooms, whether used in such or not, together with certain other instruments and their component parts, are still to be subject to a duty of 33⅓ per cent. *ad valorem*.

The duties are to remain in force until August 19th, 1936.

These regulations have been made as a result of the recommendations of the Board of Trade Committee, under the chairmanship of Sir Burton Chadwick, which was appointed to consider the matter.

Halifax Corporation and Contractors.—The Corporation Electricity Committee recommends that, as from May 1st, sales to customers of over £1 shall be invoiced, wherever possible, to the customer's electrical contractor, so that the contractor may be allowed the usual trade discount, provided that the Corporation retains a profit of not less than 10 per cent. If the customer has no contractor, or the contractor fails to send the order accompanied by cash, if cash is asked for, the sale will be direct to the customer at retail list price without deduction. In view of the above concession to contractors, the Committee says that it is unable to comply with a request for reduced rates for electricity used by contractors for demonstrative purposes, especially as the Corporation showrooms are available for demonstrations.

Trade Announcements.—The SCOTT INSULATED WIRE CO., LTD., has secured larger premises at 44, Queensland Road, Holloway, London, N.7 Telephone No.: "North 1706." All correspondence for the works should be addressed there. The head office remains at 69, Fleet Street, E.C.4, for the present.

MR. CLAUDE G. NAPP has acquired the business of the Wireless Instruments Co., of Harpur Street, Bedford.

After May 17th the address of MR. T. A. NUNWICH, representative of the Midland Electric Manufacturing Co., Ltd., for Lancashire will be 21, Clinning Road, Birkdale, Southport.

Catalogues and Lists.—THE METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Special Publication 7200/6 containing particulars of the company's fabrics, papers, mica, bakelite, fibre and other insulating materials.

MESSRS. JOSHUA JONES & CO., LTD., 76, Worship Street, Finsbury, E.C.2.—A list of charges for varnishing paper.

THE I.L.G. ELECTRIC VENTILATING CO., 2850, N. Crawford Avenue, Chicago, Ill.—A booklet and leaflets advertising the company's electric fans and heaters.

THE ELECTRIC CONSTRUCTION CO., LTD., Ingersoll House, 9, Kingsway, W.C.2.—A brochure entitled "Modern Electrical Plant," containing over 60 pages of illustrations of the company's products, as well as data relating to cables, mechanical power transmission, &c.

MR. W. H. PETTIFOR, 11, Victoria Street, S.W.1.—A price list of electrical aids for the deaf, with pamphlets illustrating and describing various microphonic appliances.

THE STEAM FITTINGS CO., LTD., West Drayton, Middlesex.—An illustrated and priced pamphlet dealing with the company's dial thermometers.

THE BEKO LAMP CO., 5, Pocock Street, Blackfriars, S.E.1.—A price list of electric lamps.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Leeds.—Price lists of 25-cycle, three-phase induction motors including special crane patterns.

MESSRS. BAXENDALE & CO., LTD., Miller Street, Manchester.—A pocket catalogue of conduits and fittings, fuse boards, lampholders, switches, cables, and other electrical accessories and tools. Illustrated and priced.

THE RELAY AUTOMATIC TELEPHONE CO., LTD., Marconi House, Strand, W.C.—The "Relay Recorder" for May, advertising the company's automatic telephone system.

THE WESTMINSTER ELECTRICAL CO., 2, Tanswell Street, Lambeth, S.E.1.—A trade price list of electrical and radio materials and fittings.

MESSRS. J. J. EASTICK & SONS, Eelex House, 118, Bunhill Row, E.C.1.—An illustrated and priced pamphlet of radio apparatus.

Bankruptcy Proceedings.—CHARLES HUBBARD, 13, Magdalen Street, Norwich, electrician and wireless dealer.—The first meeting of creditors was held on April 23rd at the Official Receiver's Office, Norwich. The statement of affairs showed gross liabilities of £514, of which £472 was expected to rank against assets of £677, leaving a surplus of £205. Debtor did not admit that he was insolvent. It appeared that he commenced business on his own account in October, 1923, with about £300, his savings and stock which he had created in his spare time. The matter was left in the hands of the Official Receiver as trustee of the estate. The following are creditors:

	£		£
Bankers	105	Newbold & Co.	21
Hirst Bros. & Co., Ltd. ...	33	Siemens Bros. & Co., Ltd. ...	29
Houghtons, Ltd.	65	Stamp, S.	20

PETER JENNINGS, commercial traveller, Bury Road, Breightmet.—This debtor appeared at Bolton Bankruptcy Court on April 21st to undergo his first examination. His deficiency was £266. It was stated that since 1921 he had been employed as traveller for a firm specialising in electrical fittings and wireless goods. In 1924 he went to Ireland on behalf of a firm, and whilst there he was sent wireless goods of the value of £1,000. On leaving the service of the firm he was sued for an alleged deficiency of £35 in stock. Judgment was given against him, and with costs he had to pay £53. Debtor attributed failure to heavy business and domestic expenses. The examination was closed.

GASTON O. BONNET-PIERROT, electrical contractor and engineer, 2a, Camden Road, N.W.—This debtor attended before Mr. Registrar Mellor at the London Bankruptcy Court last week, in custody, for public examination upon accounts showing liabilities of £2,796 and assets of £5, apart from bad book debts, £485. Questioned by the Official Receiver, debtor said he commenced business in February, 1923, with a capital of £200, and a year later he began to deal in radio accessories, but owing to trade depression the business was not successful. In January last he was sentenced at the London Sessions to 15 months' imprisonment for obtaining wireless headphones with intent to defraud. The examination was concluded. The following are the principal creditors (unsecured):—

	£		£
Lee, Albert, & Co. (1923), Ltd.	278	Brown, S. G., Ltd	350
Stokes, C.	170	Fellows Magneto, Ltd.	80
Renaults, Ltd.	145	Brown Bros., Ltd.	36
Stevens, A. J., & Co. (1914), Ltd.	729	Bransome, Kent & Co., Ltd. ...	42
Burndept, Ltd.	130	Electrical Supplies, Ltd.	20
Clarke, N., & Co., Ltd.	168	Hunt, A. H., Ltd.	93
Formo Co., Ltd.	179	Edison Swan Electric Co., Ltd.	104
Metropolitan-Vickers Electrical Co., Ltd.	39	Radio Instruments, Ltd. ...	21
Coleman Bros. & Stone, Ltd. ...	45	Dew, A. J., & Co., Ltd. ...	50
		North Met. E.P.S. Co.	20

D. E. DAVIES, wireless engineer, 19, Poulton Street, Kirkham.—Receiving order made April 27th on debtor's own petition.

F. V. LAMBERT (Lambert & Curley), electrical contractor, 27, Parrock Street, Gravesend.—Receiving order made April 26th on debtor's own petition. First meeting, May 7th, at the Official Receiver's office, 280a, High Street, Rochester. Public examination, May 10th, at the County Court House, Rochester.

G. TURNER (Radio Supply Co.), electrician and wireless dealer, 34, Mesnes Street, Wigan.—Receiving order made April 27th on debtor's own petition.

W. G. HEAD, electrical engineer, late of 30a, High Street, Ashford.—Trustee, Mr. A. H. Ward, Official Receiver, 10, Burgate Street, Canterbury, released April 23rd.

A. WOOD, electrical agent, 67, Bradford Avenue, Cleethorpes.—Trustee, Mr J. F. Wintringham, Official Receiver, St. Mary's Chambers, Great Grimsby, released April 23rd.

J. A. REFOY (Varley Radio Co.), dealer in wireless apparatus, 178, Ancona Road, Plumstead, S.E.—First and final dividend of 5¾d. in the £, payable May 17th at the Official Receiver's office, 29, Russell Square, W.C.

F. F. GREGORY, electrical engineer, 2a, Westbourne Road, Luton.—Receiving order made April 24th, on debtor's own petition.

J. A. TREND, electrician, 31, Chapel Street, Luton.—Receiving order made April 24th, on debtor's own petition.

J. REGG and F. STEAD (Regg & Stead), radio engineers, 17, Old Chapel Street, Blackburn.—Last day for proofs for dividend, May 11th. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

Company Liquidations.—H. E. DAVIS, LTD., 4, South Street, E.C., wireless and electrical manufacturers and agents.—Winding up voluntarily. Liquidator, Mr. R. S. Yates, Abbey House, 2, Victoria Street, S.W.1. A meeting of creditors was held on April 29th, at the Institute of Chartered Accountants, E.C., when the chair was occupied by the liquidator. A statement of affairs was presented which disclosed liabilities of £3,718, all due to unsecured creditors. There were debentures for £2,000, and it was stated that there was a further claim for £1,020 in respect of which an action was pending and against which the company was counterclaiming for a greater sum by way of damages. The liquidator said that the action was in respect of a number of dry batteries which had become unsaleable. The net assets were valued at £2,614, but from that amount had to be deducted £2,000 due to the debenture holder, which left £614, or a deficiency of £3,104. The company held £500 in debentures and £300 in shares in another company. The goodwill was put at £585. Those items had been shown on the statement of affairs, but were considered of no value. The company was incorporated in November, 1924, to take over as a going concern the business of electrical engineers which had been carried on by Mr. H. E. Davis. The consideration was £3,000 to be satisfied by £1,000 worth of shares and £2,000 worth of debentures. The liquidator said that the debenture holder had appointed Mr. William Osborne, of Balfour House, Finsbury Pavement, E.C., as receiver, and he was at the present time in possession of the whole of the assets. Mr. Yates said that he had seen the receiver and had obtained from him an undertaking that in realising the assets he would have due regard to the creditors' rights in the matter. He said that from the time of the incorporation there had been a loss on trading of £1,853. There was a petition on the file for compulsory liquidation. Mr. Baker (Wholesale Traders' Association) said that he considered that Mr. Davis, the debenture holder, should come forward and make the creditors some offer of composition. The meeting was then adjourned for that purpose. The following are creditors:—

	£		£
Igranic Electric Co., Ltd.	39	Hirst Bros. & Co., Ltd.	76
Discamusements, Ltd.	472	Duiker, J.	38
Wireless Components Co.	52	S.D.H. Manufacturing Co.	43
Rothermel Radio Corporation, Ltd.	132	Phillips Lamp Co., Ltd.	41
Crypto Electrical Co., Ltd.	44	Empire Electric Co.	32
Scott Insulated Wire Co.	30	Beaver Electric Co.	196
Trelleborge Ebonite Works, Ltd.	13	Redfern & Co.	41
Hardwareman and Builders' Merchant	33	Albert Lee & Co.	256
Autoveyors, Ltd.	46	Marcure, —.	32
Acme Show Card Co.	80	Burton, F. & H.	48
Lee & Churchill	53	Radio Equipment Co.	40
Hurley Machine Co.	65	Radi-arc Electric Co., Ltd.	37
Spiller, S. H.	98	Bretwood, Ltd.	106
Collinson Precision Co.	40	Buckinson Manufacturing Co.	54
Burndept, Ltd.	118	Cochrane & Cripwell	200
		Bankers	203

R. MCKELLEN & CO., LTD., wireless, &c., dealers, 58, High Street, W.C.—The first meetings of the creditors and shareholders were held on April 23rd, at Carey Street, a compulsory winding up order having been made on March 30th. The Official Receiver reported that the company was registered as a private company on May 7th, 1925, with a nominal capital of £10,000, to carry on a business which had previously been conducted by R. McKellen. The liabilities were said to amount to about £7,200, of which nearly £7,000 was owing to a Mr. Matthews. The assets comprised cash £15, stock, fittings and furniture £200, and book debts payable by instalments, £7,000. A difference of opinion arose regarding the appointment of a liquidator and it was intimated that the matter would be referred to the Court.

DUBLIN AND LUCAN ELECTRIC RAILWAY CO.—Mr. David McDowall Grosart, Conyngham Road, Dublin, has been appointed by Mr. Justice Johnston to be Official Liquidator of the company.

REFLEX RADIO CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Watson Jones, Ltd., electrical and wireless factors, 235a, Blackfriars Road, S.E., and will be heard in London on May 11th.

FULLER'S UNITED ELECTRIC WORKS, LTD.—A petition for the winding up of this company has been presented to the High Court by Mr. R. H. Symonds, iron and steel merchant, of Albany Buildings, 39, Victoria Street, S.W., creditor, and will be heard in London on May 11th.

WESTERN ANGLO-SWEDISH ELECTRIC WELDING CO., LTD.—A meeting of creditors was called for May 1st at 24, Wood Wharf, Greenwich. Liquidator, Mr. W. N. Tomkinson.

MORGAN & TAYLOR'S RADIO ELECTRIC CO., LTD.—A meeting of members is called for May 31st at 31, Queen Street, Cardiff, to hear an account of the winding up from the liquidator, Mr. S. E. Clutterbuck.

BRITISH ELECTRIC VEHICLES, LTD.—Winding up order made by the High Court on April 27th.

BURY ELECTRICAL PLANT CO., LTD.—A meeting of members is called for May 28th at the offices of Messrs. C. R. Scholes and Co., Silver Street Chambers, Bury, to hear an account of the winding up from the Liquidator, Mr. T. S. Smith.

CHASE ELECTRICAL MFG. CO., LTD.—A meeting of members is called for May 28th, at the offices of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the Liquidator, Mr. W. A. J. Osborne.

Dissolutions of Partnership.—PRATT & CO., electrical engineers and magneto specialists, 26, Little Clarendon Street, Oxford.—Messrs. H. B. Pratt and A. E. Malins have dissolved partnership so far as concerns Mr. H. B. Pratt.

FARROWOOD ACCUMULATOR CO., electrical and radio engineers, 69, Mumps, Oldham.—Mr. C. H. Wood and Mr. J. C. Farrow have dissolved partnership. Mr. Wood will attend to debts.

ELECTRIC REGULATOR & HEATING CO., manufacturing electrical engineers, Mikado Works, 8, Whittall Street, Birmingham.—Mr. J. E. Horsburgh and Mr. R. Roberts have dissolved partnership.

WORSTER & HOUNSLOW, electrical and wireless engineers, 40, Lowlands Road, Harrow, and 12, Albany Street, N.W.—Mr. A. E. Hounslow and Mr. G. H. Worster have dissolved partnership. Mr. Worster will attend to debts and continue the business.

ROYAL ACCUMULATOR CO., electrical accumulator manufacturers, 18, Atkinson Street, Deansgate, Manchester.—Mr. W. E. Beardsall and Mr. W. Johnson have dissolved partnership.

Copper and Lead Prices.—Messrs. F. Smith & Co. report May 4th:—Copper (electrolytic) bars, £65, 10s. decrease; do. do. sheets, no change; do. do. wire rods, £75, 10s. decrease; do. do. h.c. wire, 9 7/16d., 1/16d. decrease.

Messrs. James & Shakespeare report May 4th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £29 15s., 10s. decrease.

Messrs. Edward Till & Co. report May 4th:—India-rubber, Para fine, 2s., 1d. increase.

New Italian Companies.—Among the concerns recently organised in connection with the Italian electrical engineering industry are the Società F.A.U.S.T., Fabbrica Apparechi Utilita Speciali Termoelettrica, Milan, capital 30,000 lire; La Società Elettrotermica, Milan, capital 50,000 lire; and La Società Costruzioni Elettriche Telefoniche, Milan, capital 50,000 lire.

Chinese Notes.—The *Chinese Economic Bulletin* says that the Ta Yu Li Electric Light Co., Hangchow, has become one of the most prosperous industrial concerns in the Chekiang Province, and its growth has been accompanied by the establishment of about a dozen companies to supply fittings, &c. These companies have organised an association to fix prices and prevent unfair competition, and they supply goods to a number of neighbouring districts.

The Industrial Commissioner of Kiangsu is taking steps to establish connections between the Nanking Electric Light Co. and the Pukow Electric Power Co.

Through telephone communication was established in January between the Shanghai Chinese City and the foreign settlements.

It is reported that tests of the new radio station at Paotow, for communication with Peking, have been quite successful.

Hostilities in the district have held up the installation of the telephone system between Tientsin and Shanghai, a contract for which was secured by a French firm last year.

Local Exhibitions.—MORECAMBE.—In connection with the extensive exhibition promoted by the Morecambe Chamber of Trade which closed on April 28th, a big display was organised by Mr. J. Boyce, the borough electrical engineer. During the progress of the exhibition, lectures, demonstrations and kinema films all appertaining to the use of electricity in the home were given. A notable feature of the exhibition was that it was a traders' exhibition and a large portion of the space was taken up by the Corporation electricity and gas departments, which work quite amicably together, and, as far as possible, act in unison in carrying out extensions and distribution work. The supply system has recently been changed over to a.c., 3-phase, and new reduced rates were instituted on April 1st. Over 2,000 consumers have been connected since the introduction of the new supply, most of whom have taken up the rateable value scale—20 per cent. rateable value plus 1d. per kWh. In organising the display Mr. Boyce had the assistance of several well-known firms.

DEWSBURY.—A British and Empire Goods Shopping Week commenced at Dewsbury on May 1st. The Corporation Electricity Department established a temporary showroom for the week in the Market Place, making an attractive display of British-made electrical appliances for domestic cooking, heating, washing, &c.

New Australian Companies.—Electric Home Lighting, Ltd., has been formed in Sydney with a capital of £10,000, to carry on an existing business of manufacturers and vendors of power plant, electrical appliances, and machinery.

The State Electric Lighting, Ltd., was recently registered in Sydney, with a capital of £25,000, to carry on the business indicated by its title.

United States Electrical Exports.—*Commerce Reports* states that exports of electrical goods from the United States during February last were valued at $6,862,910, an increase of $1,862,597 over the February, 1925, total, but a decline of about $280,000 as compared with the January figure. Upon the whole, there was an increase in the shipments of generating equipment, the most notable rise occurring in the case of a.c. generators of 2,000 kVA or over. There was a decrease in the exports of d.c. generators owing to a heavy decline in the smaller sizes. There was an increase in the transmission and distribution apparatus class and in motors, except for a slight decrease in the case of railway motors. Other

classes which recorded increases were radio apparatus, domestic appliances, batteries, fans, and wiring accessories. On the other hand, insulated copper wire and cable exports showed a decrease.

Book Notices.—Two recently revised publications of "Technical Pamphlets for Workmen," issued by the Post Office Engineering Department, "Telephone Testing Equipment" and "Automatic Telephony: Step by Step Systems," are on sale at H.M. Stationery Office, price 6d. each net.

The Macintosh Cable Co., Ltd., has sent us an instructional book which it has issued for the assistance of wiremen when employed on the Macintosh surface-wiring system. It is fully illustrated and contains notes of a practical nature which should prove of value to the wireman. A feature is a cloth sheet of wiring diagrams. A cloth cover of suitable dimensions will allow rough pocket usage. The company has also issued a brochure describing the wiring system.

"The Annual Report and Accounts of the British Legion, 1925." (103 pp.). London: The British Legion.—This report records the continuance of the good work carried out by the organisation for ex-Servicemen for a number of years, and shows that there is still ample scope for its benevolent and social activities.

"Signal Wiring," by T. Croft. Pp. xii + 349; 463 figs. Price 15s.; "Introductory Electrodynamics for Engineers," by E. Bennett and H. M. Crothers. Pp. ix + 665; figs. 306. Price, 22s. 6d. London: McGraw-Hill Publishing Co., Ltd.

"Dictionary of Costing," by R. J. H. Ryall. Pp. xi + 377. London: Sir Isaac Pitman & Son, Ltd. Price 10s. 6d. net.

"Science Abstracts (A and B)." Vol. XXXIX. Part 4. April 25th, 1926. London: E. and F. N. Spon, Ltd. Price 3s. each.

Handbook Series of the U.S.A. Bureau of Standards, No. 6, "Safety Rules for the Installation and Maintenance of Electrical Supply Stations." Price 10 cents.—The contents of this publication comprise Part I and the "grounding" rules of the 4th edition of the "National Electrical Safety Code." The American protection recommendations for all classes of electrical machinery and apparatus used on supply undertakings are given.

Germany's Foreign Electrical Trade.—An American Trade Commissioner at Berlin informs *Commerce Reports* that important German electrical manufacturers report an increase of 30 per cent. in orders on hand at January 1st, 1926, as compared with a year ago, and admit an increase in workers of 150 per cent. during 1925 as compared with 1924. All large companies paid 6 per cent. or 7 per cent. dividends, and undoubtedly placed considerable earnings to reserves. The tonnage of imports increased 270 per cent., and the value at practically the same rate. A comparison of the import and export figures shows that Germany shipped 19½ times as many tons of electrical equipment as it imported, and that the equipment exported was 16 times as valuable as the equipment imported.

For Sale.—The Chief Superintendent, Southern Railway, invites offers for surplus machinery, including fans, lathe, oil separator, &c. (See our advertisement pages to-day.)

The Institute of Patentees.—The address of the Institute of Patentees (Inc.) has been changed to 39, Victoria Street, London, S.W.1.

Lighting and Power Notes.

Argentina.—Hydro-Electric Development.—A new hydro-electric station is to be erected at Andalgala, in the Province of Catamarca, to supply electricity to the government-operated mines and smelter and for domestic and industrial use.—*Reuter's Trade Service* (Catamarca)

The extensions at the Sorrento power station of the Société d'Electricité de Rosario have now been practically completed. The new plant comprises four boilers and a 15,000-kW turbo generator. During the past year the sales of electricity increased from 37,636,131 to 39,243,905 kWh.

Bury (Lancs.).—Electricity Charges.—The Corporation Electricity Committee has fixed the following charges for electricity:—Domestic tariff: 14 per cent., on the rateable value, plus 1½d. per kWh for the first 200 kWh per annum, and ¾d. for the remainder, with a minimum standing charge of 30s. per annum and a maximum standing charge of £4 5s. House lighting: 4½d. per kWh. Heating: 1d. per kWh. Shop lighting: 5d. per kWh. Shops with occupied houses, first 200 kWh, 4½d. per kWh, beyond, 5d.

Blagdon.—Electricity Supply.—At a recent meeting of residents a resolution in favour of the introduction of electric light was adopted. The North Somerset Electric Supply Co., will erect h.p. mains through the centre of the village and supply a ¾-mile radius. The price to be charged is 9d. per kWh.

Canada.—Hydro-Electric Development.—During the next eight months approximately $2,000,000 will be expended by the Winnipeg Electric Railway Co. and its subsidiaries in making the necessary provision to obtain and utilise additional power from the hydro-electric plant at Great Falls. In connection with the development at Grand Falls, tenders are now being prepared and contracts will shortly be awarded.

One of the principal proposals in the Ontario Government estimates is an item for $3,000,000 for the construction of a 110,000-V transmission line through the eastern district.

It is stated that the Shawinigan Water and Power Co. group and the Aluminium Corporation of America interests have purchased from the Duke and Price estates respectively their interests in the Duke-Price Power Co. This company installed plant at Maligne, on the Saguenay River, and brought into operation 360,000 h.p. last year. An extension to 480,000 h.p. is proceeding, and is expected to be completed shortly. The Aluminium Corporation of America at Caron Chute has plans for an ultimate development of 800,000 h.p.

Continental.—Italy.—The estimated electrical energy available at the end of 1925 was 3,200,000 h.p., being more than double that of pre-war years and an increase of 300,000 h.p. for each of the past two years.—*Reuter's Trade Service* (Milan).

Sicily.—In a recent issue of *Energia Elettrica*, details are given of the hydro-electric plant which has lately been completed in Sicily to utilise the water power of the River Belice. About 7½ miles from Palermo, at a height above sea level of nearly 2,000 ft., a dam 128 ft. high and 850 ft. in length has been constructed to form an artificial lake with a storage capacity of 16,720 million gallons. From the lake, the water is led along a 7½-mile canal to an 11-million gallon storage reservoir. From this the water is conveyed to the generating station by means of a pipe 265 ft. in length. The water reaches the power station under a head of 1,550 ft. The plant comprises four Riva-Monneret turbines, each developing 3,500 h.p. at 750 r.p.m., these being coupled to 10,500-V alternators. The output is expected to amount to 25 million kWh per annum.

Belgium.—Work has recently been commenced by the Société d'Electricité de la Région de Malmedy on the erection of three hydro-electric stations to utilise the water power of the River Warchi.

France.—Work is well in hand on the construction of a new central power station which will have a capacity of 28,000 h.p. at Monistrol d'Allier for the Compagnie Electrique de la Loire et du Centre. The plant is expected to be ready for operation before the end of the current year.

Bulgaria.—Although it is estimated that water power to the extent of over one million h.p. is available in Bulgaria, very few hydro-electric plants have so far been erected in the country. The most important plants at present in course of construction are those on the Rivers Rila and Kritschin. The Rila installation will comprise three power stations at Rila, Pastra and Ilina. So far the only station to be completed is that at Pastra, where eight 3,300-h.p. turbo generators have been installed. The energy is stepped up to 35,000 V for transmission to Rila, Crerka, Pernik and Batanova.

Coventry.—Loan.—The Corporation is making application for sanction to a loan of £14,321 in connection with the supply of electricity to the Radford housing estate.

Deal and Walmer.—Electricity Supply.—The local authorities have been informed that in order to meet with the demand for a supply of electricity in the two towns, the South-East Kent Electric Power Co., Ltd., is arranging with Messrs. Pearson & Dorman Long, Ltd., for a bulk supply from Betteshanger Colliery, and it is proposed that electricity shall be transmitted by means of overhead cables to sub-stations, from which it will be distributed by underground cables in Deal and Walmer.

Eastbourne. — Loan Sanctioned. — The Electricity Committee has received sanction to a loan of £16,000 for mains and services.

Glasgow.—Progress during March.—The Corporation electricity manager reports that during March 159 houses were wired bringing the total to date to 2,122. There were 164 applications for hire of appliances, making the total since the scheme commenced 10,281. He has suggested that arrangements might be made for occupiers of small houses to pay the cost of the more expensive domestic appliances by monthly instalments, and the Sub-Committee on Propaganda has recommended that the proposal be adopted.

Hitchin.—Electricity Supply.—The Rural District Council has decided to raise no objection to the Stevenage Electric Light and Power Co., Ltd., extending the mains to supply Council houses at Knebworth and Mile End. The company will provide services and fittings for two lighting points per house at 1s. per week if all the tenants are prepared to take a supply, three points at 1s. 6d. per week, and any additional point at 2d. each per week, plus the charge for electricity consumed.

Huddersfield.—Loans.—The Electricity Committee has decided to apply for sanction to borrow £10,000 for transformers and £20,000 for mains.

Ilford.—Electricity in Bulk.—The Electricity Committee has approved the draft provisional agreement between the County of London Electric Supply Co., Ltd., and the Council regarding the proposed bulk supply of electricity by the Company to the Council.

Loan Sanctioned.—The Committee has received sanction to the borrowing of £5,000 for domestic apparatus to be let on hire.

Sub-Stations.—The Committee has recommended that three sub-stations be converted into automatic sub-stations and tenders for the necessary apparatus are to be obtained.

India.—RANGOON (BURMA).—Owing to the increased demand for electricity the Rangoon Electric Tramway and Supply Co., Ltd., has recently installed additional plant. A 3,000-kW set has been erected and a new 6,600-V switchboard has been completed. Two 500-kW rotary converters have been installed in Turtle Tanks sub-station to take the tramway load in the east part of the city, and a considerable portion of the h.p. transmission system in the city and the suburbs has been changed over from 2,300 V to 6,600 V.

ELECTRICAL DEVELOPMENT.—Messrs. Martin & Co., of Calcutta, are promoting two new electrical enterprises, known as the Jubbulpore Electric Supply Co. and the Muttra Electric Supply Co., for the purpose of supplying electrical energy to the cities of Jubbulpore and Muttra respectively. Arrangements have been made with the military authorities, municipalities, and the railway companies at these places for the supply of electricity. The plant required for the Jubbulpore company consists of two 175-kW and one 300-kW alternators, with switchgear, &c., 7¼ miles of h.p. feeders, and 15 miles of distributing mains, with street lighting, at a cost of Rs. 7 lacs. Additional plant will be also provided in the second and third year. For the Muttra Electric Supply Co. the initial plant consists of two 175-kW and one 50-kW alternators, with accessories, three miles of h.p. feeders, and 10 miles of distributing cables, with street lighting, &c., at a cost of about Rs. 5 lacs.

The Government of Madras states that hydro-electric schemes to be undertaken during the next five years are as follows:—(1) The Pykara scheme, with a capacity of 37,200 kW, which may ultimately be connected with the Moyar scheme, which will yield another 10,500 kW. (2) The Pinjikavi scheme, with a Kumbar connection, to develop about 18,000 kW. (3) The Papanasam scheme to develop about 21,000 kW. The estimated cost for the Pykara Fall development, which is expected to be completed in 2½ years, is Rs. 238 lacs.

Leek.—INAUGURATION OF EXTENSIONS.—Plant extensions, including a 400-kW gas-driven generating set, were formally inaugurated at the Urban District Council's electricity works on April 28th.

Lichfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,200 for the provision of an overhead line to Whittington Barracks.

Manchester.—NEW PLANT.—The Electricity Committee is to ask the City Council at an early meeting to approve a scheme for works extensions, at a cost of £600,000, and for equipment at £234,000. The engineer, Mr. H. C. Lamb, states that unless arrangements are made to meet the demand for the winter 1928-29, there will be a serious danger of shortage of plant. He proposes a second power house containing two sets of 40,000 kW each. Only one set is required for the present extension. The boilers will be fitted for the use of coal or coke breeze, although the new boiler-house will be designed for the use of pulverised fuel if the plant on order is a success.

Morecambe.—ELECTRICITY CHARGES.—The Town Council has introduced a new scale of electricity charges, which includes as alternatives to the flat rate, a rateable value charge, maximum demand charge, two-rate scale, and a shop-window rate.

North Wales and South Cheshire Joint Electricity Authority.—Details were given at the annual meeting of the North Wales and South Cheshire Joint Electricity Authority held recently at Llandudno of the progress made in connection with the supply of electricity in bulk in the authority's area. The bulk supply of electricity has increased from 8,500,000 kWh in 1922 to 19,500,000 kWh in 1925. In October, 1923, the lines constructed were 111 miles in length, and since that time 260 miles of line has been constructed. The lines extend from Pwllheli in the west to Runcorn in the east. Lines are being constructed to the engineering works at Sandbach and to the borders of Staffordshire. Since 1923 the plant has been increased by 10,000 kW. A comprehensive report of the progress of the erection of the transmission lines was presented by the North Wales Power Company, which shows that nearly 105 lines have been erected and the new dam at Maentwrog is almost completed. It is reported that owing to the nature of some of the foundations exposed for the Gyfynys Hendre, Mur and Trawsfynydd Dams, the designs have had to be modified. The work is now proceeding and good progress is being made.

Preston-Blackpool.—TRANSMISSION LINE.—Owing to the Preston-Blackpool transmission line having to cross the River Ribble opposite the Preston power station, it will be necessary to lay the cables underground, at an increased cost of about £2,000. The Electricity Commissioners have advised the Preston Electricity Committee that, in order to provide for eventual duplication of this line, it should arrange for the towers, which are to be erected under the first part of the scheme, to be so designed as to enable a second set of three conductors to be added later.

South Africa.—WITBANK POWER STATION.—According to the Johannesburg correspondent of the *Financial Times*, the first 20,000 kWh set at the new Witbank station of the Victoria Falls and Transvaal Power Supply Co., has recently been started up This is the only one at present installed of the three sets proposed. The electricity is being transmitted at 132,000 V to Brakpan, where it will be transformed down to 20,000 V for distribution along the Rand. The transmission line, 65 miles in length, is supported by 100 ft. towers, with spans of 1,000 ft. between them.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Silsden Urban District Council, for the supply of electricity in the urban district; and the Cark and District Electricity Co., Ltd., to supply in parts of the rural district of Ulverston. The Gwynedd Trust, Ltd., has applied for the amendment of the Whitchurch, Ellesmere and District Electricity Order so as to include the rural district of Malpas in addition to the areas already mentioned in the Order.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Gainsborough Urban District Council to supply electricity in the urban district, and the Millom Urban District Council in the urban district of Millom.

Stirling. — LOANS. — The Town Council has applied for sanction to a loan of £4,000 for mains extensions to supply the Bannockburn Road Housing site, and £3,000 for laying cable for houses, of the Scottish Oil Agency, Ltd., and the London & North-Eastern Railway Co.

Turkey.—ELECTRICAL DEVELOPMENT.—The report of the Société Turque d'Electricité shows that the output of the power station during the past year amounted to 45,825,860 kWh, an increase of 14½ per cent. over 1924. An agreement has been concluded with the Société du Gaz de Kadikeny, to supply electricity to the Asiatic side of the Bosphorus, and in order to provide the additional supply an order has been placed for a new turbo-generator with a capacity of 15,000 kW.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical World*, Col. H. L. Cooper has presented to the New York State Water Power Commission an amended application of the St. Lawrence Valley Power Corporation, in which the Frontier Corporation is interested, for a permit to develop 2,400,000 h.p. at Hawkins Point at the foot of Barnhart Island in the St. Lawrence River, 43 miles north-east of Ogdensburg. Detailed plans filed with the Commission show that the Company contemplates the erection of a generating plant of 24 units, each capable of developing 50,000 h.p., on both the American and Canadian sides of the river. It is proposed to build a dam, which would be 130 ft. in height, giving a head of 83 ft. It is proposed to maintain the water level at 246 ft. above sea level, which is virtually the level of Lake Ontario. The total cost of the scheme is estimated at $238,000,000.

Yorkshire.—COLLIERY LINKING-UP SCHEME.—A 33,000-V cable is being laid, to link up the collieries included in the Doncaster Collieries Association. By this means these collieries will be able to pool their surplus electricity, which is mainly generated from waste heat. The laying of the cable is well advanced, and the collieries will be linked up in the course of a month or two.

Tramway and Railway Notes.

Birmingham.—TRAMWAY EXTENSIONS.—Important extensions are to be made to the Corporation tramway system. The chief extensions are from the suburb of Hall Green to Shirley, at the city boundary; and on the Tyburn Road, Erdington, along a new road to be constructed, near to Pype Hayes Park.

Glasgow.—NEW TRAMCAR DESIGN.—In its efforts to compete with the motor-'buses, the Corporation is building a Pullman tramcar, which will be a single decker and practically all steel. It will be capable of a speed of from 20 to 30 miles an hour, and will have upholstered seats, small foyers for "straphangers," and a seat for the driver. If the experiment is successful 50 more cars will be built.

Kilmarnock.—ABANDONMENT OF TRAMWAY.—The Corporation has applied for an Order authorising it to abandon its tramway as, owing to the increased working costs, it is not now possible for the undertaking to be worked remuneratively.

London.—METROPOLITAN ELECTRIC TRAMWAYS.—As the result of an inspection of the whole of the Metropolitan Electric Tramways, made recently by the Ministry of Transport, the Company has now received official authority for an increase in the maximum speed of the tramcars from 16 m.p.h. to 20 m.p.h. In certain parts of the system the present authorised speed is lower than the maximum of 16 m.p.h., and in these instances also some further increase will be permitted.

"OVAL" TUBE STATION.—Good progress is being made with the construction of escalators at the tube station at Kennington Oval, and it was hoped to put them into operation on May 8th. The scheme of reconstruction at this station also provides for a new and more commodious booking hall and a new entrance leading to Harleyford Road.

BREAKDOWN.—There was delay on the Underground railway on the morning of April 27th, owing to an electrical defect on the north-bound tube between Waterloo and Charing Cross, which caused a diversion of the traffic during rush hours. Between Charing Cross and Piccadilly services had to be suspended, but were restored after a delay of about two hours.

Worcester.—Tramway Improvements.—In connection with the tramway undertaking which was recently purchased by the Corporation, a recommendation in favour of railless cars has been approved, and the following works are to be carried out:—Fourteen new cars, £22,400; taking up tramway track and repairing roadways, £12,000; adaptation of overhead work, £3,000.

Telegraph and Telephone Notes.

Cuba.—New Radio Station.—Cuba will shortly possess another radio-telegraph and telephone station, permission having been given by the Government for the construction of the buildings. The station will be sufficiently powerful to communicate with stations belonging to the United Fruit Co. Communication will also be possible with North, South, and Central America and the West Indies; the contract calls for the station being opened in any case by the end of 1930.—*Reuter's Trade Service* (Habana).

Danzig.—New Radio Station.—A new radio station is being built by the Deutsche Telefunken Gesellschaft at Glettkau, in the Free City of Danzig, for the Danzig Government. It is expected to furnish communication with the rest of Europe.

Germany.—New Cable Steamer.—A new cable-laying steamer was recently launched by the Blohm & Voss Co., of Hamburg, for the North German Sea Cable Works, of Nordenheim, Germany. The vessel, which is 459 ft. in length, has been designed for use both as a cable-laying and freight-carrying steamer, it having a displacement of 14,550 tons and a cable-carrying capacity of 8,000 tons. It is being used for the laying of the final portion of the new telephone cable between Holland and England, and when this is completed it will lay a new telegraph cable between Emden and the Azores.

Honduras.—Radio Letter Service.—The Tropical Radio-Telegraph Co., of Honduras, recently introduced a service of week-end wireless letters between Tegucigalpa and the United States and Canada. The rate per word is 0.15 peso (gold), with a minimum of 20 words. Wireless letters are accepted at the main office up to midnight on Saturday and delivered at their destination on the following Monday morning. The minimum price is 3 pesos, and the language employed must be either that of the country of origin (Spanish) or destination. Code telegrams are not accepted.—*Reuter's Trade Service* (Tegucigalpa).

Haiti.—New Radio Station.—The Government of Haiti has granted permission and the necessary funds for the construction of a new radio-telegraph station at some point not yet chosen.—*Reuter's Trade Service* (Port-au-Prince).

Spain.—Telephone Developments.—The National Telephone Co. of Spain is laying underground cables throughout the country and introducing the automatic service and other improvements. Among the main features of the programme are a number of trunk lines between the larger towns. The automatic service has been completed at Santander, a new telephone exchange erected, and a school established for the training of the telephone staff. The new cables in most of the northern and north-western districts will in all probability be completed before the end of the year.

Transatlantic Telephony.—Rugby Experiments.—It is understood that interesting transatlantic radio-telephony tests are to be carried out at the Rugby station shortly. According to the *T. & T. Age*, speech is to be transmitted in an extremely distorted form, in which state it will be completely unintelligible to the ordinary listener. The receiving apparatus in America will filter out the distortion and restore the speech to its original clarity. The filtering device is too costly and complicated to allow of its general use for interception of the messages. Reception could be made still further difficult for unauthorised persons by rapidly varying the distortion, say several times per second, in order to compel the use of perfect synchronisation which is not too easy.

Costa Rica.—New Radio-Telegraph Station.—The new wireless station belonging to the International Radiograph Co., which has just been erected half way between Cartago and Paraiso high above sea level, has three steel towers 440 ft. high on cement foundations and 1,050 ft. apart; the receiving station has two towers 140 ft. high standing 183 ft. apart. There is a separate electric plant, a residence for the employés, insulated oil storage, and very full general equipment. Messages are received from the United States, Europe, South America, other parts of the world, and ships at sea.—*Reuter's Trade Service* (San Jose).

Radio Notes.

Australia.—Government Control of Broadcasting.—It is reported that the Commonwealth Government is likely to take over the whole of the broadcasting operations in Australia shortly.—*Reuter* (Melbourne).

Belgium.—Wave-length.—From April 30th Radio Belgique's new wave-length will be 487 metres, and not 508 as was at first reported. The new station at Antwerp radiated a special concert on April 30th on a 265-m. wave.

Bolivia.—New Station.—The recently-organised Radio Club of La Paz has met with much success. According to the terms of its charter, the members will be asked to pay a small initial sum fixed by the directors, collectively sufficient to cover the original cost of the transmitting station. Within a few weeks broadcasting will commence.—*Reuter's Trade Service* (La Paz).

Broadcasting in England and America.—A Contrast.—Captain P. P. Eckersley (chief engineer of the British Broadcasting Co., Ltd.), speaking at the annual meeting of the British Science Guild in London, contrasted the system of joint ownership and management as applied by the B.B.C., with private enterprise in America. By amalgamation, he said, the B.B.C. had been able to build up a reputation greater than that of any other broadcasting concern in the world. More people listened to wireless programmes in this country, in relation to the population, than in any other country in the world, and more of the poor people were able to listen; in fact, the B.B.C. fulfilled a public service, and 90 per cent. of the people of the British Isles could listen to programmes on a set which need not cost more than two or three pounds. In America, however, those who found broadcasting of the greatest value (*i.e.*, those living in rural areas) had to reply on expensive sets, because it was only in the cities and towns, where the broadcasting companies were able to broadcast advertisements and so obtain revenue, that real service was given. In Great Britain the stations were erected primarily for the public, but in America the man who erected a broadcasting station did so, in the first place, in his own interests (in order to advertise goods) and afterwards for the public. The B.B.C. was not a trust, but a public service. He did not see why, because the principle of trade directorship of the organisation was to be discontinued and seven men who were absolutely independent of the Press, the trade, or any commercial enterprise, were to be appointed to the board, it should be said that broadcasting would be subject to Government control. If the report of the Broadcasting Committee were adopted by the Government, the B.B.C. would continue its activities in the same way as it had done hitherto. Unified control, and the application of scientific methods, had enabled the B.B.C. not only to serve all the country, but to put into operation methods which competitive organisations would never have been able to apply. For example, any great man's speech could be broadcast to every part of the British Isles, but that could not be done under the American system, because of disagreement between competitive organisations.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—Melbourne.—June 16th. City Council. Turbo-alternator, exciter, and condensing plant.*

Brisbane.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Adwick-le-Street.—May 19th. Urban District Council H.p. switchgear and cables, step-down transformers, l.p. distribution gear, pillars, cables, joint boxes, &c. (April 16th.)

Belgium.—May 12th. Municipal authorities of Schaerbeek, Brussels. 600 armoured circuit breakers. Particulars (Cahier des Charges) from the Service de l'Electricité, Hotel de Ville, Schaerbeek.

Bristol.—May 13th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (April 30th.)

Canada.—June 2nd. Department of Public Works. One 25-ton electrically-operated portal crane for Esquimalt Dry Dock.*

Cairo.—Egyptian State Railways, Telegraphs and Telephones. Underground cables. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.—*Reuter's Trade Service* (Cairo).

Cheadle and Gatley.—May 10th. Urban District Council Electricity Department. Single-phase alternating-current meters required during year ending March 31st, 1927. Form of tender from Mr. R. W. Willis, engineer and manager, 37, High Street, Cheadle.

Dundee.—May 20th. Electricity Department. A.c. and d.c. house-service meters for 12 months. (See this issue.)

Farnworth. — May 14th. Electricity Department. cables, street-lighting pillars, pillars and boxes, cut-outs and meter boards, and meters. (April 30th.)

Hull.—May 20th. Electricity Department. Underground cables. (April 30th.)

Telephone Committee. Copper jointing sleeves. (See this issue.)

Ilford.—May 11th. Electricity Department. One 1,000-kW La Cour motor converter. (April 30th.)

India.—India Store Department. May 11th. One 200-kW La Cour-type motor converter. (April 23rd.)
May 14th. Three 5-kW oil engine-driven generator sets, one switchboard, and two pumping sets.*
May 15th. Madras and Southern Mahratta Railway Co., Ltd. Telephone line material (comprising porcelain insulators, galvanised terminal irons, &c.), copper line wire (1,302 miles), copper binders, tapes, &c. (April 23rd.)
May 18th. Porcelain insulator cups. (April 30th.)
June 15th. 70,000 copper bonds for track rails.*

Leeds.—May 15th. Library and Arts Committee. Electric lighting at Public Library, Hough Lane, Bramley. Particulars from Messrs. Foggitt & Addison, architects, 3, Park Place, Leeds.

London.—METROPOLITAN ASYLUMS BOARD.—May 19th. Installation of electric cable, &c., for arc-light treatment apparatus. (April 30th.)
PADDINGTON.—May 21st. Great Western Railway. Electric wire and cables. Specification from the Stores Superintendent, Swindon.

Manchester.—May 11th. Tramways Committee. Electric tramcar bodies, trucks, motors and controllers. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.
May 20th. Electricity Committee. Potential and current transformers, cable supplies, electric kettles, and electrical meters for 12 months. (See this issue.)

May 11th. Board of Guardians. Electric cables for the Crumpsall Institution. Particulars from E. Hargreaves, Superintendent of Works, Union Offices, All Saints, Manchester.

Middlesbrough.—Electricity Department. Extension of electricity supply distributors, total length approx. 1,000 yd. (April 30th.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*
WELLINGTON.—May 12th. Post and Telegraph Department. 18 switchboards.*
Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*
New Zealand Railway Department. June 16th. Electric motors.*
DUNEDIN.—May 28th. Otago Harbour Board. One portable electrically-driven cargo stacker.*

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

South Africa.—JOHANNESBURG.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*
CAPE TOWN.—June 3rd. South African Railways and Harbours. One motor-starting panel.*
June 10th. D.c. electric generating plant (suction gas).*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (April 23rd.)

Stockton-on-Tees.—May 10th. Electricity Department. Paper-insulated cables, a.c. meters, and house-service cut-outs. (April 30th.)

Walthamstow.—May 12th. Electricity Department. One 1,500-kW motor converter. (April 23rd.)

Warrington.—May 10th. Electricity Department. E.h.p. sub-station truck-type switchgear. (April 23rd.)

Waterford.—May 12th. Electricity Department. Two 250-kVA, 3-phase alternators direct coupled to heavy oil engines, e.h.p. mains and l.p. underground distribution system, transformer kiosks, pillars, street lighting services, l.p. overhead distribution system, &c. (April 9th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Electricity Committee. Accepted:—
10,000-kW turbo-alternator, with condensing plant (£38,000).—English Electric Co., Ltd.

Australia.—SYDNEY.—The following is the list published by the Sydney *Daily Telegraph* of the tenders submitted for the turbo-alternators for the Bunnerong station of the Sydney Municipal Council:—

Tenderer.	Total price after deducting spare parts.	Australian manufacture.
English Electric Co. of Australia, Ltd. ...	£492,351	—
Metropolitan-Vickers Electrical Co., Ltd. ...	502,500	—
Allgemeine Elektricitats Gesellschaft ...	503,550	—
C. A. Parsons & Co., Ltd.	552,307	—
Australian General Electric Co., Ltd. ...	565,117	35 per cent.
Ditto, alternative (recommended by the acting chief electrical engineer) ...	606,778	33 per cent.
English Electric Co. of Australia, Ltd. ...	619,173	96 per cent.
British General Electric Co., Ltd.	636,333	?
Commonwealth Shipping Board (with Metropolitan-Vickers). Accepted ...	**661,224**	**55 per cent.**
Ditto, alternative	685,386	63 per cent.
Schneider & Co.	682,656	—
Brown Boveri & Co., Ltd.	721,161	?
Sir W. G. Armstrong, Whitworth & Co., Ltd.	764,260	—

The figure of £666,605, at which the Commonwealth Shipping Board's tender has been accepted, includes a few extras that have been omitted in this schedule, in order to make the tenders comparable. Only machines running at 1,500 r.p.m. (the recommended speed) have been included.
At a special meeting of the Council held on March 22nd, the Town Clerk stated that the following cable message had been received from Mr. Mackay (general manager):—
"Yours eighteenth Bunnerong turbines: Council's decision obviously not based on commercial or technical considerations; therefore comment by me difficult. Commercially and technically 'B.T.-H.' (British Thomson-Houston) tender better. Even allowing for Council's desire to place order with local publicly-owned works, I think it imprudent order six turbines Cockatoo, because order too big for inexperienced establishment to complete in time. Failure to put Bunnerong into operation early 1928 would be a catastrophe. Dividing order between Cockatoo and 'B.T.-H.' would secure completion of some plant by 1928."

A later message from Mr. Mackay was as follows:—
"Further by cable to-day: Situation discussed with Payne, manager Cockatoo, and as result I recommend if six turbines ordered Cockatoo that special arrangement be made for early completion first two. Suggest Council agree to importation by Cockatoo increased percentage parts first two turbines on condition that percentage imported parts reduced last two."
After considerable discussion the Council, on a vote, declined to reconsider the decision to give the contract for turbo-alternators to the Commonwealth Shipping Board for construction at the Cockatoo Dockyard.
A further resolution was passed giving the city electrical engineer power to "negotiate" with the Commonwealth Shipping Board for the additional variation of the tender, on the lines indicated in the cablegrams of Mr. Forbes Mackay, to permit of additional units being imported from Britain, so as to ensure the delivery of the plant from Cockatoo in the time specified under the contract conditions.

Brighton.—Lighting Committee. Accepted:—
Switchboard (£848); duplicate cell regulating switches (£625).—Bertram Thomas.
Booster (£654).—Bruce Peebles & Co., Ltd.
Steam turbine-driven rotary feed pump (£355).—G. & J. Weir, Ltd.
3,000 yd. .1-in. cable (£570).—Standard Telephones & Cables, Ltd.

Chester.—Corporation. Accepted:—
New battery at the Crone Street electricity works (£13,660, less £1,466 for the scrap lead).—Tudor Accumulator Co., Ltd.

Coulsdon.—Housing Committee. Accepted:—
Wiring on housing estate (12s. 6d. per point).—G. S. Hawker, Ltd.

Croydon.—Electricity Committee. Recommended:—
Switchgear at Drummond Road sub-station (£761).—A. Reyrolle and Co., Ltd.
Two transformers for Drummond Road sub-station (£810).—British Electric Transformer Co., Ltd.

Dover.—Electricity Committee. Folkestone-Dover cable. Supply of 6,250 yd. .1 sq. in. 3-core paper-insulated cable, including laying, jointing, testing, &c., and the provision of all necessary boxes:—

Macintosh Cable Co., Ltd.	£4,755
Hackbridge Cable Co., Ltd. (Recommended.)	**4,413**
Watshams, Ltd.	4,290
Enfield Cable Works, Ltd.	4,782
W. T. Henley's Telegraph Works Co., Ltd.	4,804
Johnson & Phillips, Ltd.	4,825
Standard Telephones & Cables, Ltd.	4,803
Pirelli-General Cable Works, Ltd.	4,764
W. T. Glover & Co., Ltd.	4,815
Siemens Bros. & Co., Ltd.	4,684
British Insulated Cables, Ltd.	4,810
Callender's Cable & Construction Co., Ltd.	4,889

The Committee ruled out the third of the above tenders, which was for cable of Belgian manufacture.

Durham.—County Education Committee. Accepted:—
Electric light installations at Station Town School (£128), Simm and Richardson; at West Cornforth New School (£376), F. Reid Ferens and Co.

Erith.—Urban District Council. Accepted:—
Cable (£1,388).—Callender's Cable & Construction Co., Ltd.
Switch cubicle (£182).—Fraser & Chalmers Engineering Works.

Folkestone.—Town Council. Accepted:—
Electric light fittings for the Leas Cliff Hall (£540).—Metro-Vick Supplies, Ltd.

Halifax.—
Electrical work in connection with 40 Corporation houses at Nursery Lane and 40 houses at Booth Town.—A. Higginbotham & Sons.

Hornsey.—Electricity Committee. Recommended:—
Wiring 108 Council houses (£874).—E. Wright & Co.

London.—ISLINGTON.—Board of Guardians. Electric lighting installation (mains and power) for the Guardians' schools, Andover Row, Hornsey Road, N. Mr. Edmund J. Harrison, architect:—

Simplex Electric Lamp Co., Ltd.	£4,750
J. M. Jamieson	2,300
Dalziel Engineering Co.	2,020
Smethurst & Co.	1,818
McHow & Haynes	1,797
W. C. Clutton	1,600
Electrical Installations, Ltd.	1,567
E. H. Finn	1,427
Higginbotham & Co.	1,400
Ridout & Ratcliff	1,392
P. M. Braidwood	1,385
Ellis & Ward	1,349
Locke & Soares	1,310
G. A. Weston	1,308
Morris Electrical Co., Ltd. (Accepted.)	**1,225**

Lancaster.—Corporation. Accepted:—
E.h.p. cables.—British Insulated Cables, Ltd.

Lichfield.—Town Council. Accepted:—
Electricity meters for one year.—Measurement, Ltd.

Peterborough.—We are informed that the statement appearing in our last issue to the effect that the Town Council had accepted a tender of International Combustion, Ltd., for boiler plant at £34,190 is incorrect; that company did not tender.

Reigate.—Electricity Committee. Accepted:—
Supply and erection of a fly-wheel alternator for the new six-crank engine (£2,535).—Electric Construction Co., Ltd.

Rothesay.—Electricity Works. Accepted:—
One battery of 268 13-plate S.T.C.-type cells, capacity 600 amp.-hr.—Hart Accumulator Co., Ltd.

Salford.—Education Committee. Accepted:—
Electric lighting installation (£169).—County Electrical Co.

Tramways Committee. Accepted:—

Stores for 12 months:—
Commutator segments.—Manchester Armature Repair Co., Ltd.
Insulating tapes.—L. Andrew & Co.
Gear and pinion wheels.—British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Hadfields, Ltd.; Brown Bayley's Steel Works, Ltd.
Brake blocks.—Pease & Partners, Ltd.

Wanstead.—Essex Education Committee. Accepted:—
Installing electric light at Wanstead County High School (£699).—H. A. Neale & Co.

York.—Electricity Committee. Accepted:—
Cable (£8,050).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, May 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Distortion in Wireless Reception," by Mr. A. V. Balihatchet.
Friday, May 14th. Paper on "Static Transformer Testing and Test Plant Requirements," by Mr. L. Smith.

Electrical Association for Women.—Friday, May 7th. At the Criterion Restaurant, Piccadilly, W. At 1 p.m. Luncheon.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, May 8th. At Brecon. Annual meeting.

London Association of Foremen Engineers.—Saturday, May 8th. At the Cannon Street Hotel, E.C. At 6 p.m. 73rd Anniversary Festival.

Institute of Physics.—Tuesday, May 11th. At the Royal College of Science, South Kensington, S.W. At 5.30 p.m. Lecture on "The Relationship of Physics to Aeronautical Research," by Mr. E. H. Wimperis.

Royal Society of Arts.—Wednesday, May 12th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "Industrial Welfare in Practice," by Mr. W. S. Bradley.

Radio Society of Great Britain.—Wednesday, May 12th. At the Institution of Electrical Engineers. At 6 p.m. Informal meeting.

Institution of Electrical Engineers (North-Western Centre and Mersey and North Wales (Liverpool) Centre).—Wednesday, May 12th. Reunion at Chester.

Institution of Production Engineers.—Wednesday, May 12th. At 83, Pall Mall, S.W. At 7.30 p.m. Paper on "Inspection Methods," by Mr. A. Butler.

Royal Institution.—Thursday, May 13th. At 21, Albemarle Street, W. At 5.15 p.m. Lecture on "The Imperfect Crystallisation of Common Things," by Sir William Bragg.
Saturday, May 15th. At 3 p.m. Lecture on "Atmospheric Electricity," by Dr. G. C. Simpson.

Faraday Society.—Thursday, May 13th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. From 2.30 to 4.30 and 5 to 6.30 p.m. Discussion on "Explosive Reactions in Gaseous Media."

Birmingham Electric Club.—Friday, May 14th. Visit to the works of the English Electric Co., Ltd., and Siemens & English Electric Lamp Co., Ltd., at Preston.

Physical Society of London.—Friday, May 14th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Notes.

School Lighting.—A paper on this subject was read by Dr. James Kerr, late School Medical Officer for London, at the meeting of the Illuminating Engineering Society on April 29th. He pointed out the special needs of children with regard to light; to them letters were unfamiliar and good illumination was even more needful than to the adult. Statistics showed that about a third of the children in schools failed to retain normal vision. The lecturer attached great importance to proper shading of light sources, especially in view of the general use of gasfilled lamps. He was disposed to recommend that no sources within the direct range of vision should have a greater brightness than 3 c.p. per sq. inch. Reference was made to interesting results obtained in the schools of Cleveland, U.S.A., where an average illumination of a little over 5 foot-candles is provided, and diffusing glass units with a brightness not exceeding 3 candles per sq. in. are used. Referring to the question of the colour of light, Dr. Kerr reported favourably on personal experience with a portable lamp equipped with Lamplough glass, and suggested that the question of the colour of light deserved attention in schools occupied by myopic children. During an interesting discussion which followed the lecture, Mr. C. Hughes exhibited a pleasing form of totally enclosed unit and several examples of modern reflectors equipped with half-frosted lamps, which were recommended for school lighting. Capt. Halsted Hanby showed examples of units equipped with tinted glass, of the type mentioned by Dr. Kerr, and Mr. L. Gaster referred to the work being done by the Committee on the Ideal Classroom and to the various American Codes of School Lighting, which advocated methods substantially in agreement with those recommended by the Society. Dr. Nash dealt with the subject from the standpoint of the medical officer.

The Electrical Trades Benevolent Institution.—Annual General Meeting.—On April 29th the annual general meeting of the E.T.B.I. was held at the Institution of Electrical Engineers. Mr. R. A. Chattock, president I.E.E., presided, and moved the adoption of the annual report of the Committee of Management and the accounts.

The report stated that the income from contributions for the year was £1,953, making with other receipts a total income of £3,128. After the payment of grants and expenses, £1,894 had been carried to the capital account. In respect of the year £773 had been invested, bringing the total invested funds at cost to £24,606. The number of grants had increased from 70 to 81; every qualified applicant received assistance. The Local Advisory Committees had increased the contributions and made the Institution better known, and the Committee hoped that further Committees would be created, for which purpose the co-operation of leading persons in the large towns was invited.

The annual festival was held on November 4th; Mr. E. S. Barralet presided, and his appeal brought in £1,389. The attendance was the largest recorded.

A new set of rules was under consideration, with a view to enrolling more contributing members and to simplifying the granting of assistance.

Commenting on the report, the Chairman compared the income for the year, £3,128, with that of the previous year, £3,810; the expenditure amounted to £299, compared with £292 in 1924, and included an item for travelling expenses of the hon. secretary in attending meetings in the provinces, from which good results were anticipated. The grants for temporary aid had increased in number from 70 to 81, and in amount from £899 to £935, figures previously unapproached; the cause was, first, the unsatisfactory state of trade, and secondly, the fact that the Institution was becoming more widely known. It had been more difficult to find employment for those who sought assistance than in any previous year. The invested funds cost £24,606, and their market value at the end of the year was £24,541, from which it was seen that the money had been well invested. The funds did not benefit so much by legacies as those of other institutions did. The E.T.B.I. and the Benevolent Fund of the I.E.E. kept closely in touch to avoid overlapping, and in some cases shared the cost of the grants. The Committee had been revising the Rules of the Institution, and when the work was completed, a special general meeting would be held to bring them into force.

Mr. J. Y. Fletcher having seconded the motion, the report and accounts were unanimously adopted.

Members of the Committee retiring by rotation were re-elected, and new members, Messrs. A. G. Beaver and J. E. Edgecombe, were elected. The hon. auditors, Messrs. Price, Waterhouse & Co., and the hon. solicitors, Messrs. Sugden, Bextall & Beal, were re-elected, and votes of thanks were passed to them, to the Press, and to the I.E.E. for the use of the room.

The Chairman referred to the presence of Mr. E. S. Barralet, president at the last Festival, and moved a vote of thanks to him for the services he had rendered to the Institution, which was warmly accorded; and the proceedings concluded with a vote of thanks to Mr. Chattock for presiding, moved by Mr. J. Y. Fletcher.

Appointments Vacant.—Electrical engineer, for the Aldershot Gas, Water and District Lighting Co.; telephone engineer for Singapore (£46 per month approx.), for the Oriental Telephone & Electric Co., Ltd.; Principal, for the Stafford County Technical School (£600); assistant electrical engineer ($400 per month+dollar=2s. 4d.), for the Government of the Federated Malay States; assistant electrical foreman, for the Gun Carriage Factory, Jubbulpore. (See our advertisement pages to-day.)

Urban Tramways.—That the tramway undertakings throughout Great Britain now carry more than 4,000 million passengers during the year and that their annual revenue exceeds £29,000,000 are facts which Mr. A. A. Jackson made evident in his recent paper before the Midland Section of the Institute of Transport. He dealt mainly with passenger fares, remarking that by certain recently promoted special Acts of Parliament, authority had been obtained to charge at a rate not exceeding 1½d. per mile per passenger. It had not been found practicable, or advisable, to introduce overlapping fare-stage points much less than half-a-mile apart. In a few towns contract or season tickets for periods of a week, month, or quarter had been issued. They were good for any number of rides and irrespective of the inidividual user, as it had proved to be practically impossible to make them non-transferable. Their general use was open to serious abuse on account of the multiplicity of fare stages and the difficulties of inspection and check. The price of all-day shilling tickets, usually issued on any day and available for any number of trips, was too high to permit of serious misuse. Transporta-

tion service could not be sold at a fixed price, but the price must vary from time to time with the cost of producing such service. Local conditions played a most important part in the fixing of fares. An adequate revenue must be secured and the ride must be paid for fully by the rider.

The Volta Centenary Celebrations.—The Committee which is organising the Volta Centenary celebrations which are to be held in Como, Italy, from May to October, 1927, has just commenced the publication of a monthly magazine with the title "Voltiana" dealing with the life work of the famous scientist and giving full particulars of the celebration preparations that are being made. Copies can be obtained from 11, Via Unione, Como, Italy.

London Electrical Engineers.—27TH (LONDON) ANTI-AIRCRAFT BATTALION, R.E. (T.A.).—Officer Commanding: Lieut.-Colonel C. H. S. Evans, O.B.E. The following orders have been issued for May:—304th Company, Major P. F. Foulger; 305th Company, Major A. W. M. Mawby, O.B.E., Tuesdays, 7 p.m. to 9.30 p.m. 306th Company, Major F. C. Clarke, Mondays, 7 p.m. to 9.30 p.m. Technical training is being dealt with very fully up to the annual training, which is being held this year from July 25th to August 8th at Manston (near Margate). A selected detachment of the unit will take part in training at Whitsuntide. Efforts are being made for an extensive recruiting campaign from May 10th to May 12th, when it is hoped with the generous assistance of employers to materially raise the strength of the unit.

Canadian Water Power.—The Toronto correspondent of *The Times* says that the Premiers of Ontario and Quebec have agreed to unite to defend their constitutional rights against any encroachment upon the power of the Provinces to control the generation and distribution of hydro-electric power.

The same correspondent reports that a provincial charter has been granted to the Spruce Falls Power and Paper Company authorising the construction of a hydro-electric power plant, and pulp and paper mills near Kapuskaing on the water courses to Hudson Bay. The New York *Times* is jointly interested in the new company. The enterprise involves the investment of $25,000,000, and the estimated daily production of the plant is 500 tons of paper and upwards of 120 tons of sulphite, also electric power for industrial purposes.

Social Event. — On April 24th, the staff of the Reigate Corporation electricity works celebrated the undertaking's 25th anniversary by a supper and social, presided over by Mr. T. W. Reed. The Mayor attended, accompanied by members of the Electricity Committee, and representatives of several electrical firms were present. During the evening Mr. W. S. Ross, the borough electrical engineer, who has been with the undertaking since its inception, was presented with an inscribed silver watch and a handbag for Mrs. Ross. The toasts included "The Mayor and Corporation," "The Borough Electrical Engineer and Staff," "The Contractors," and "The Visitors." A musical entertainment was provided.

Electric Milking Plant.—Mr. F. Swarbrick, borough electrical engineer, Basingstoke, has supplied particulars of cow-milking by electricity in practice, on the farm of Mr. Tom Bowden, Sherborne St. John, where some 64 dairy cattle are milked by equipment that was installed in August, 1925. According to the *Daily Telegraph*, tests showed that the cows were milked in 1¼ hours, and the consumption of the electric motor was 2.475 kWh, at 3d. per kWh, or 7.425d. Therefore the cost of electricity per day for milking 64 cows is 1s. 3d., and one man and two lads were required to do the whole work, whereas under the hand-milking system three men and three lads were necessary. This alone constitutes a saving of £5 10s. per week. Spread over a year, under the old system, the wages of three men at £6 per week, were £312 and three lads at £4 10s. per week £234, a total of £546. Under the new method the full cost is £332 5s., or a total saving of £213 15s. per year. The costs of the new method are: One man at £2 a week, £104; two lads at £3, £156; interest on capital expenditure at 5 per cent., £16 10s.; depreciation at 10 per cent., £33; and cost of electricity at 1s. 3d. per day, £22 15s. Although depreciation is taken at 10 per cent., it is very unlikely, contends Mr. Swarbrick, that this figure would be reached, as the whole installation is so well designed and constructed. The milk supplied at this farm is Grade A, T. T., and the official yield for last year was 900 gallons per cow.

Barrow Hydro-electric Scheme.—Last week, at Barrow Town Hall, Colonel T. C. Ekin, M.Inst.C.E., on behalf of the Electricity Commissioners, inquired into the application of the Barrow Corporation for consent to establish an hydro-electric station at Backbarrow, on the River Leven, and for sanction to borrow £90,000 for the purpose, this being £78,000 for the proposed station and £12,000 for transmission lines. The Town Clerk (Mr. L. Hewlett) was in charge of the case for the Corporation and opposition to the scheme came from four sources The Kent, Bela, Minster, Leven and Duddon Fishery Conservators, and Lord Richard Cavendish, owner of the salmon fishery of the river, represented by Mr. S. Hart Jackson, junr.; Ulverston Rural District Council, represented by Mr. N. E. Barnes; Barrow Property Owners' Association and Barrow Chamber of Trade, represented by Mr. J. Pickavance; and Barrow Ratepayers' Defence Association, represented by Mr. John Jackson. The Town Clerk submitted that the proposed scheme was a sound, practical one, and in support he called Alderman W. Fairbairn, J.P., chairman of the Corporation's Negotiating Committee, to explain the need for the scheme. Mr. H. R. Burnett, borough electrical engineer, explained the position at the Corporation's works in Buccleuch Street, Barrow, where the load factor was very high, and he gave statistics showing the necessity for the proposed station. The revised estimated cost of construction, based on Messrs. Vickers's tenders, plus the estimated cost of fish passes, was £90,000. A flow of 750 cu. ft. per sec. at 33 ft. effective head had been taken as representing the maximum output of the proposed plant (1,500 kW) and the output available for a year would be approximately 5,760,000 kWh generated. The total estimated annual cost of production would be £10,020 (£7,658) or 0.534d. (0.408d.) per kWh on an average anticipated output of 5 million kWh. The figures in parenthesis represented the estimated costs in the event of a Government grant being obtained, amounting to 50 per cent. of the interest on the capital expenditure (*i.e.*, £2,362 per year).

Mr. Burnett said the Corporation was prepared to make certain fish passes, and to meet some of the needs of the Ulverston Rural Council; he pointed out that only once in 27 years had the electricity department had a loss, and that was a very small one. He agreed that Messrs. Vickers had "a super-power station" at Barrow, but it was better, in his opinion, to have the Backbarrow station.

Mr. R. W. Hogarth, M.Inst.C.E., of Messrs. Buchan and Partners, Westminster, an expert on hydro-electric stations, gave evidence in support of the scheme. After full inquiry into all the circumstances and data he estimated that on the basis of 1925, which was a dry year, there would have been six million kWh generated, and after deducting 800,000 kWh for compensation and 56,000 kWh for works and losses, he arrived at 5,144,000 kWh. The supply would be the cheapest obtainable, and the scheme was excellently laid out. The opposition with regard to fishing in the river was met by arrangement.

The Ulverston Rural District Council's opposition related to certain water supplies for works and domestic purposes; eventually there was an agreement with the Rural Council, subject to the decisions of the Electricity Commissioners.

The contention of the Barrow Property Owners' Association and the Barrow Chamber of Trade was that owing to the bad financial position of the town the scheme should be postponed and that a further arrangement should be made with Messrs. Vickers, Ltd., for any extra electricity necessary.

Mr. John Jackson, of the Barrow Ratepayers' Defence Association, handed in a petition bearing 10,157 signatures demanding that a referendum be taken in the town on the scheme.

Colonel Ekin pointed out that it was addressed to the Mayor, Aldermen and Councillors. Why was it presented to him? On the first sheet were two signatures which appeared to be those of a ratepayer and his wife. It seemed to him incredible that in a town of 15,000 ratepayers there should be over 10,000 signing the petition.

The Town Clerk, in completing the inquiry, submitted that he had proved by evidence that the scheme was a sound one, which would overcome the Corporation's difficulties for some years to come. There was not the slightest chance of the scheme being a charge on the rates, and he stressed the point that a supply authority should not be dependent for its electricity upon a private firm.

A New Alloy Steel.—Sir Robert Hadfield last week, announced at Sheffield the discovery of a new alloy steel capable of withstanding abnormally high temperatures. A gas turbine wheel made of the new steel had been tested at 55,000 revolutions a minute, so that it was working at a temperature of 800 to 900 deg. C., being brought to a very bright red heat without its efficiency being impaired. The new steel, he said, would no doubt help to solve many industrial problems in the application of high-temperature gases.

The British Association.—As has been previously announced, the 1927 meeting of the British Association for the Advancement of Science is to be held in Leeds. Last week the period was fixed as from August 31st to September 7th.

Electrical Association for Women.—A lecture on "Lighting" was given in the Medical Theatre, Birmingham University, on April 28th, to the Birmingham and Midland Branch of the Electrical Association for Women by Mr. C. McDonald, chief electrical engineer of the Birmingham Post Office. He traced the growth of artificial lighting and gave practical demonstrations of the developments in electric lamps, illustrating by means of slides the various systems of lighting—direct, indirect and semi-indirect. In discussing household illumination he emphasised the importance of decoration in relation to light.

Institution of Engineers-in-Charge (Inc.). — ANNUAL DINNER.—On Friday last the annual dinner of the Institution of Engineers-in-Charge was held at the Holborn Restaurant, London; the president, Engineer-Vice-Admiral Sir Geo. G. Goodwin, K.C.B., was in the chair, and covers were laid for about 270 members and guests.

After the loyal toasts, Mr. L. Pendred, M.I.Mech.E., vice-president, proposed "The Lord Mayor, the Sheriffs, and the Corporation of the City of London," remarking that it was 16 years since the Institution had been honoured by the presence of the Lord Mayor; it was the only engineering institu-

tion domiciled in the City. He referred to the educational engineering work accomplished by the Guilds of London, which had done much to raise the status of engineers, and expressed a hope that the Lord Mayor would use his influence towards rectifying the Fleet order by which naval engineers had suffered injury.

In reply, the Lord Mayor, Col. Sir W. R. Pryke, acknowledged the indebtedness of the community to the work of engineers and engineering institutions, and said that the Livery Companies were all glad to do what they could for the public welfare. Proposing "The Institution," Eng.-Vice-Admiral Sir Robert B. Dixon, K.C.B., remarked that the Institution was now 25 years old, and complimented it on the high standard of its papers and discussions; there were many institutions, he said, some of which overlapped, but the Institution of Engineers-in-Charge poached on no-one's preserve. He congratulated the Social Committee on its excellent work, and was glad to see that the benevolent fund was in a very satisfactory position. At sea, he said, they watched closely the progress of engineering on land, and recently a ship was launched whose boilers would work at 500 lb. pressure. Responding, the President pointed out the unique circumstance that the toast was proposed by the Engineer-in-Chief of the Fleet, and responded to by the previous holder of that position —with whom he had always worked most harmoniously. The Institution, he said, was very particular regarding the qualifications of candidates for membership, a regular works training being an indispensable requirement. The proceedings contained many valuable papers. The formation of a Students' Section was in contemplation.

Mr. W. Edwards, vice-chairman, proposed "Our Guests and Friends," expressing the gratitude of the Institution for their help and guidance, and Mr. R. A. Chattock, president I.E.E., responding, remarked that his old friend, Mr. Frank Bailey, who gave him his first job as an engineer-in-charge, was present. There were three institutions catering for engineers-in-charge, the others being the E.P.E.A. and the S.T.E. Could they not amalgamate, with advantage, and thus strengthen the position of the young engineer? He cordially agreed with Mr. Pendred regarding the Admiralty order; the I.E.E. would do all that was possible to further the interests of engineers in the Navy and to maintain their status. The engineers-in-charge of small central stations were concerned as to their future under the new Bill, but the electricity supply industry was growing so fast that there would be plenty of outlets for their energies in connection with distribution.

Mr. J. M. Dawson proposed "Our President" in felicitous terms; the toast was accorded musical honours, and the President, in response, paid a tribute to the work of the hon. secretary, Capt. A. E. Penn, and the Chairmen of Committees. The normal membership was 500; but 50 new members were being enrolled in one year. With regard to naval engineers, the officers serving could not speak, but it was a fact that the loss of the purple stripe took a great deal away from the engineer officers, though it did not greatly affect the executive officers. He was glad that action was being taken by the Institutions in this matter.

Amongst the guests not mentioned above were Dr. Alex. Russell, F.R.S., past-president I.E.E., Sir Joseph Petavel, K.B.E., F.R.S., and Mr. W. McClelland, C.B., O.B.E.

A very good entertainment added to the pleasures of the evening.

Junior Institution of Engineers' Dinner.—The annual dinner of the above-named Institution was held at the Café Monico, London, on April 27th, the forty-seventh anniversary of its foundation. The president (Mr. J. S. Highfield) occupied the chair, and was kept busy with a host of unofficial toasts called for by Mr. Tookey with the aid of a business-like spanner. The principal guests included Sir Frank Dyson (Astronomer Royal), Mr. W. Reavell (president of the Institution of Mechanical Engineers), Air Vice-Marshal Sir W. Sefton Brancker (Director of Civil Aviation), Air Vice-Marshal Sir Vyell Vyvyan, Col. The Master of Sempill, and Mr. J. P. Rowen (chief engineer, Trinity House Corporation). Sir W. Sefton Brancker, who has accepted a vice-presidency of the Institution, prompted other speakers to make references to the speed of travel, while both Mr. W. J. Tennant and Mr. W. Reavell made a plea for a greater appreciation amongst engineers of the commercial side of engineering, the former remarking that if ever he should make a million he would found a Chair of Engineering Economics; meanwhile, perhaps someone who had a million would take the hint. During the evening Miss Bessie Kerr sang well, and Mr. L. Hamilton "entertained," Mr. R. Cooper being at the piano.

Institution Notes.

Institution of Electrical Engineers. — North-Eastern Centre.—The annual general meeting of the above Centre was held on April 26th, when the annual report of the Committee was presented. The membership of the Centre at the end of the session 1925-26 was 509, as compared with 512 at the end of the previous period. The new officers and Committee for the next session were appointed. The chairman will be Mr. J. Rosen, M.I.E.E.; vice-chairmen, Messrs. Hugh Paterson, A.M.I.E.E., and E. Fawssett, M.I.E.E.; hon. sec., Mr. P. F. Allan, M.I.E.E.

Institution of Public Lighting Engineers.—The third annual meeting and conference of the above Institution will be held at Newcastle-upon-Tyne in September. Application has been made to the Ministry of Health in respect of the expenses of the delegates attending the meeting, and a reply has been received to the effect that the Minister of Health will be prepared to consider applications from local authorities whose accounts are subject to Government audit for sanction to the payment of the expenses of the attendance at the meeting and conference of not more than two delegates, one of whom should be the engineer or superintendent for public lighting in the district.

The Röntgen Society.—A general meeting will take place on Thursday, May 20th, at 8.15 p.m., in the Barnes Hall of the Royal Society of Medicine, London, when the seventh Mackenzie Davidson Memorial Lecture will be delivered by Dr. A. Dauvillier, Paris, the subject being "The Measurement of X-ray Dosage."

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The *Journal* of the Associated Chambers of Commerce in China and Hong Kong reports that Mr. P. B. Critchley, who has been associated with the Shanghai Municipal Electricity Department for 25 years, has retired. He was to return to England by the *Empress of Scotland*.

At a recent meeting of officials and staff of the Lincoln electricity undertaking, Mr. Stanley Clegg was presented with a travelling case to mark his completion of 25 years' service as chief engineer. Mrs. Clegg received a scent spray.

Mr. A. Hewitt and Col. Cortez Leigh have been re-elected chairman and vice-chairman respectively of the North Wales and South Cheshire Joint Electricity Authority for a further period of three years.

We are pleased to learn that Mr. Guy Burney, who recently underwent a serious operation to his ear, is making satisfactory progress.

The Times states that the Carnegie Hero Fund Trustees have awarded the bronze medallion, their highest award, and an allowance of £200 per annum to Dr. George Alexander Pirie, Dundee, who has become permanently incapacitated as the result of injuries received through engaging in X-ray work.

The French Académie des Sciences has awarded the Gaston Planté prize for 1925 to M. Joseph Bethenod, of the Ecole Supérieure d'Electricité, Paris, for his work on the generation and utilisation of high-frequency alternating currents. The Hebert prize has been awarded to M. Edouard Roth, of the Société Alsacienne de Constructions Mécaniques, Belfort, for his work on alternators and synchronous motors.

The *Central News* reports that Dr. Lobligeois, of Paris, has had to have an arm amputated consequent upon injuries due to the effect of radium. This is the fourth operation which the doctor has sustained from the same cause.

Mr. Robert Millar, electrician at Bowhill Colliery, Fife, received parting gifts at a recent social meeting at which Mr. John Kerr, head electrician at the colliery, presided. The presentation was made by Mr. T. Lister, of the electrical shop.

The *Sydney Morning Herald* states that the Sydney City Council at a recent meeting decided that the acting general manager of the electricity department (Mr. Maling) should be paid an allowance at the rate of £1,500 per annum additional to his present salary of £2,000 per annum. This allowance will be paid during the absence in London of the general manager of the department (Mr. Forbes Mackay). Mr. Mackay's fixed salary is £2,000 per annum, and he is paid an allowance at the rate of £1,500 per annum whilst absent from Sydney, in addition to travelling and other expenses. Reform aldermen objected to the allowance being paid to Mr. Maling in view of the fact that he was already being paid a salary equal to that of the general manager. The Labour party, on a party vote, decided that the allowance should be paid, and by a similar vote, defeated an amendment moved by Alderman Cole that Mr. Maling should receive an allowance of £1,000.

It is announced that Mr. W. M. Furniss, manager of the company's works at Wolverhampton, has been elected to the seat on the board of the Electric Construction Co., Ltd., rendered vacant by the death of Sir Henry C. Mance.

Obituary.—Mr. A. M. Conway.—It is reported in the Australian Press that Mr. Arthur M. Conway, chief electrical engineer for Orange, passed away in March at the age of 38 years. Mr. Conway, after training at the Sydney Technical College, went to America and held a position with the General Electric Co. of Schenectady. In the San Francisco earthquake he lost all his belongings, and after returning to Sydney he became, for a time, assistant general manager of the Australian General Electric Co., which position he resigned to take up his post at Orange.

Mr. T. Ferguson.—The death has occurred, at the age of 28 years, of Mr. Thomas Ferguson, an electrical engineer with the Sunderland Forge Co., at Birkenhead.

PROF. L. A. HERDT.—The *Engineer* records the death, which occurred on April 11th, of Prof. Louis Anthyme Herdt, Macdonald Professor of Electrical Engineering at McGill University. Prof. Herdt, who was born in France 53 years ago, is described as one of the leading electrical engineers of Canada, and one who had a part in many great electrical enterprises.

MR. M. KEATING.—The death occurred in London, on April 28th, of Mr. Maurice Keating, Superintendent of the Eastern Telegraph Co., Ltd., at Carcavelos Station, Portugal (late of Cahirciveen, Co. Kerry).

MR. H. BJERKE.—The *Anglo-Norwegian Trade Journal* records the death, last month, of Mr. Harald Bjerke, who was, until recently, director-general of the Norsk Hydro-Elektrisk Kvælstofaktieselskab. Prior to taking this position, Mr. Bjerke had been managing director of a number of industrial concerns in Norway.

Wills.—The late Sir THOMAS BROOKE-HITCHING, who was a director of the Chiswick Electric Supply Corporation, Ltd., and the West London and Provincial Electric Supply Co., Ltd., left £79,245 gross and £57,633 net personalty.

The late Mr. J. BROWNE MARTIN left £560,685 gross and £399,763 net personalty.

New Companies Registered.

Norton Wireless Co., Ltd. ((213,504).—Private company. Registered March 28th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in radio sets, &c. The subscribers (each with one share) are:—Jessie M. Kelly and T. Kelly, 13-14, Broadway, Deptford, S.E., radio dealers. The subscribers are to appoint the first directors. Qualification, 1 share. Remuneration, £100 each per annum. Solicitor: E. L. L. Foakes, 221, Bishopsgate, E.C.2.

C. A. C. Valve Distributing Co., Ltd. (213,497).—Private company. Registered April 28th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical and motor engineers and contractors, suppliers of electricity, manufacturers, importers and exporters of and wholesale and retail dealers in railway and tramway appliances, telegraphic, telephonic, and radio apparatus, &c. The first directors are:—G. E. Ward, 10, Rangoon Street, E.C.3, managing director of a company; E. G. Brett, 10, Rangoon Street, E.C.3, secretary. Qualification, 1 share. Solicitors: Bateman & Co., 5, John Street, Bedford Row, W.C.1. Registered office: 10, Rangoon Street, E.C.3.

Sun Signs, Ltd. (213,460).—Private company. Registered April 26th. Capital, £1,000 in 500 10 per cent. cumulative preference shares of £1 each and 10,000 deferred shares of 1s. each. Objects: To acquire the whole or any part of the right, title, and interest in or appertaining to the provisionally protected invention comprised in or covered by provisional patent specification No. 22,936/1925, concerning "improvements in or relating to displayed signs," and to carry on the business of designers and manufacturers of and dealers in all kinds of signs, and displayed advertisements of all kinds, but more particularly in relation to the invention known as the "Sun-Sign" for affixing or applying to electric glow lamps or any other form of artificial lighting, &c. The directors are:—R. C. Spurin (permanent managing director), 12, Oakley Square, N.W.1; F. Hinde, 28, Adelaide Road, N.W.; C. Pedgrift, 12, Oakley Square, N.W.1. Qualification, 100 shares. Remuneration as fixed by the company. Registered office: 8, Red Lion Square, W.C.1.

Wico Electric Co. (F.2530).—Particulars of this company (incorporated outside the United Kingdom) were filed on April 22nd pursuant to Section 274 of the Companies (Consolidation) Act. The capital is $400,000 in $100 shares (2,000 shares preferred stock and 2,000 shares common stock). The company was incorporated in Massachusetts, U.S.A., on March 23rd, 1920, to manufacture and sell magnetos, storage batteries, electric ignition equipment, and electrical and mechanical specialities of all kinds. The British address is Chase Estates, Willesden Lane, North Acton, N.W.10. H. G. Brown, solicitor, of 2, Bond Court, Walbrook, E.C.4, is authorised to accept service of process and notices on behalf of the company. No list of directors has yet been filed.

Great Western Ignition Co,, Ltd. (213,517).—Private company. Registered April 29th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical materials, goods and appliances, and also electrical and other automobile accessories and fittings, accumulators, batteries, dynamos, &c. The directors are:—R. C. Jackson, 52, Ashley Road, Bristol; A. R. Matthews, 7, Guinea Street, Redcliff Hill, Bristol. Qualification, 100 shares. Solicitors: Plummer, Parry & Patchett, 16, John Street, Bristol.

Norwich Wireless Co., Ltd. (213,526).—Private company. Registered April 29th. Capital, £1,000 in £1 shares. Objects: To carry on the business of radio engineers and manufacturers of and dealers in radio apparatus, consulting wireless experts, &c. The directors are:—S. Sacker and Mrs. S. Sacker, 19, Honeywood Road, Colchester.

Turkin, Ltd. (213,479).—Private company. Registered April 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, radio experts, &c. The subscribers are:—C. R. Turner, 2, Clovelly Gardens, Upper Tulse Hill, S.W., merchant; M. Moses, 119, Finsbury Pavement, E.C.2, solicitor's clerk. The first directors are not named. Solicitors: Cochrane & Cripwell, Balfour House, 119, Finsbury Pavement, E.C.2. Registered office: 32, West Street, Weston-super-Mare.

J. W. Peacock & Co. (1926), Ltd. (213,386).—Private company. Registered April 23rd. Capital, £500 in £1 shares. Objects: To acquire an electrical device known as "Walker's Patent Counter Sign," to adopt an agreement with J. W. Peacock and D. D. Walker, trading as "J. W. Peacock & Co.," and to carry on the business of manufacturers of and dealers in furniture, fancy and sports goods, jewellery, watches, clocks, chronometers, and optical and scientific instruments and appliances, electricians, &c. The permanent directors are:—E. R. Mountstephen, 797, London Road, Westcliff-on-Sea, ironmonger; J. W. Peacock, 26, Hamlet Road, Southend-on-Sea, furniture dealer; M. St. J. C. Shepherd, Eastwoodbury, Southend-on-Sea, electrical engineer; D. D. Walker, Ravensknowle, Springfield Drive, Westcliff, Southend-on-Sea, engineer. Qualification, £50. Remuneration, £100 per annum, divided between them. Secretary: J. W. Peacock. Solicitor: F. T. Fisher, 44, Alexandra Street, Southend-on-Sea.

Stanley Cox, Ltd. (213,425).—Private company. Registered April 24th. Capital, £1,200 in £1 shares (500 8 per cent., tax free, cumulative preference and 700 ordinary). Objects: To carry on the business now carried on by S. Cox at 30, Percy Street, Tottenham Court Road, W.C., and to carry on the business of manufacturers, commission agents, and merchants of electrical or other apparatus, &c. The directors are:—S. Cox (permanent managing director), "Ravensthorpe," Beltinge Road, Herne Bay, Kent, electro-medical engineer; R. H. Stevens, address not stated.

Official Returns of Electrical Companies.

Twiss Electric Transmission, Ltd.—R. H. Stevens, C.A., of 37, Walbrook, E.C.4, was appointed receiver and manager on April 19th, 1926, under powers contained in debenture dated September 28th, 1921.

Radio Equipment Co., Ltd. — C. Latham, of 78, New Oxford Street, W., was appointed receiver on April 22nd, under powers contained in debenture dated February 10th 1926.

Thornley & Co., Ltd.—Debenture dated April 19th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Nettlefold & Sons, Ltd., 54, High Holborn, W.C.

India Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Particulars filed of £400,000 debentures authorised January 28th, and covered by trust deed dated March 29th, 1926, charged on certain properties at West Ham and Liverpool, and the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: J. S. Cockburn, Sir John Ferguson, K.B.E., Sir Henry C. Mance, C.I.E., and the Hon. S. E. Marsham.

Nelson Electric Co., Ltd.—Particulars filed of £1,000 debentures authorised March 26th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £600.

Melbourne Electric Supply Co., Ltd.—Mortgage or charge executed out of the U.K., and comprising solely property situate outside the U.K., dated February 9th, 1926, to secure £100 and further moneys due to the sent and future including uncalled capital, the whole amount being now and future. Holder: Sir Alexander J. Peacock, K.C.M.G., Treasurer of the State of Victoria.

R. & T. Patents, Ltd.—A. A. Whittingham-Jones, of 41, Castle Street, Liverpool, ceased to act as receiver or manager on April 23rd, 1926.

Thornley & Co., Ltd.—Satisfaction in full on April 8th, 1926 of debenture dated April 12th, 1923, securing £500.

Lewis Thomas & Sons, Ltd.—Debenture dated April 1st, 1926, to secure £1,500, charged on the company's undertaking and property, including uncalled capital. Holder: J. D. Williams, Boulevard, North Parade, Aberystwyth.

W. Robson & Sons, Ltd.—First charge on the company's property, present and future, including uncalled capital, dated March 31st, 1926, to secure £600. Holder: T. W. Robson, 226, Westminster Road, Liverpool.

Neutron, Ltd.—Particulars filed of £1,300 debentures authorised April 12th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £250.

Electric Fires, Ltd.—Mortgage dated April 8th, 1926, to secure £6,000, charged on certain properties, &c., in Norwich. Holder: Miss M. S. Reeve, 29, Thorpe Road, Norwich; and N. J. Adams, Stratton House, Cirencester.

"Ego" Engineering Co., Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C.2, accountant, ceased to act as receiver or manager on April 9th, 1926.

London Power Co., Ltd.—A trust deed dated April 15th, 1926, securing £3,000,000 5 per cent. redeemable debenture stock has been registered, constituting a floating charge on the undertaking, property, assets, and revenues of the company, present and future. The trustees are: The Law Debenture Corporation, Ltd., 24, Old Broad Street, E.C.2. The debenture stock was issued at a discount of 4 per cent.

Radio Communication Co., Ltd.—Mortgage or charge on the company's undertaking and property, present and future, including uncalled capital, dated April 14th, 1926, to secure £81,500. Holder: R. Sweeny, 20, Copthall Avenue, E.C.2.

Cooke & Whitfield Wireless, Ltd.—E. P. Q. Carter, of 33, Waterloo Street, Birmingham, C.A., was appointed receiver and manager by order of Court dated April 16th, 1926.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Urban Electric Supply Co., Ltd.

The annual meeting was held on April 29th, Mr. P. D. Tuckett presiding. In moving the adoption of the report (*vide* our last issue, p. 711), the chairman said that it was eminently satisfactory. There was an 18 per cent. increase in the balance carried to net profit and loss account and a 26 per cent. increase in the net profit. Such a marked improvement in the Company's earning capacity was very gratifying; the shareholders had at last reached the stage of receiving a more adequate return on their investment and he hoped that they would be able to maintain it. The improved result had been brought about by the general expansion of the business and by a further reduction in the ratio of working expenses, the largest individual contribution coming from the Cornwall Power Company. The connections for the year showed a 6 per cent. increase and the output increased by 11 per cent., of which nearly two-thirds was attributable to the Cornwall Power Company. The outlook in Cornwall continued to improve, all the mines being actively engaged on extensive developments and looking forward confidently to the future if the price of tin remained at anything like its present figure, as it was considered likely to do for some years to come. To meet the growing load they were considering the extension of their power station at Hayle with the expectation of largely increasing its efficiency, and the stability and profit-earning capacity of the business. In

spite of the improved position which the balance sheet disclosed, he would not like them to infer that the reserves were in any degree over-adequate, with £100,000 of their capital sunk in unremunerative tramways, with their liability to write off the cost of their stations in the event of bulk supplies becoming available, and with the possibility of loss on purchase of their undertakings by the local authorities. Last year he had addressed the bulk of his remarks to the disquieting result of the inquiry which had recently been held into their prices at Stamford. They had since had another inquiry in connection with their Twickenham undertaking, the outcome of which had very much reassured them, for it had established the principle that they were entitled to earn the necessary minimum to enable them to form adequate reserves and provide a reasonable return on capital, whilst they on their part, in proof of their *bona-fides*, had undertaken to pass on to their consumers during the next three years any surplus profits over and above that necessary minimum. A number of substantial reductions had been made and further decreases were contemplated when they were in a position to make them. In view of the possibility of a general stoppage in the coal industry with all the disastrous consequences which it would have on the industries of the country, it was impossible to forecast at the moment what were their prospects for the present year. Apart, however, from any untoward development of that nature, they had no reason to anticipate anything but a period of steady and continuous progress; they had ample stocks of coal at all their stations. At the moment they were devoting their attention to the Government's Electricity (Supply) Bill now before Parliament in an endeavour to protect their interests. He did not propose to discuss its provisions in any detail, because many of them were so manifestly unfair and unworkable that they felt they were bound to be drastically amended in committee. With the avowed objects of the Bill, to cheapen electricity and stimulate its use, they were all in hearty accord, but with the proposed method of realising them they were most of them in entire disagreement, since they thought it was calculated to hamper existing undertakers by costly and unnecessary bureaucratic interference and to discourage private enterprise by impairing its ability to attract fresh capital. So far as their small undertakings were concerned, they would welcome the opportunity of availing themselves of cheap bulk supplies, provided that, in the event of their purchase by the local authority, they were not prejudiced by the shutting down of their stations. In their Twickenham and Cornwall areas they had already taken advantage of the bulk supply facilities available, but in most of their other isolated undertakings it was difficult to believe that for a good many years to come it would be commercially possible for any centralised organisation to afford them a cheaper supply than they could themselves generate locally owing to the excessive cost of transmission. Mr. Edmund Charrington seconded the motion and it was carried unanimously.

Johnson and Phillips, Ltd.

The company's annual meeting was held on April 29th. Mr. W. Claude Johnson (chairman), who presided, in moving the adoption of the report and accounts (*vide* our last issue, p. 710), said that the available balance was £152,133. The interest on the debenture stock was over £4,000 less than last year, largely owing to the reduction of the interest from 8 to 6 per cent. for the last six months of the year; the item would be reduced by about another £4,000 in the current year. The share capital had been increased from £500,000 to £600,000 by the issue of 100,000 new shares at 40s. per share on December 1st last. The premium of 20s. per share, amounting to £100,000, together with the premium of 2s. per share on the previous issue, amounting to £6,250, had been transferred to reserve account which with the £43,750 transferred from the profit and loss account, increased the reserve to £250,000. Over £63,000 had been spent on additions to the company's property. That was necessary in order to cope with the great increase in the amount of business which was continuing. Stock in trade and work in progress at about £479,800 and sundry debtors at just over £400,000, showed an increase of nearly £120,000, owing to the very large increase in the amount of business in hand at the end of the year, the profits from which would go to the benefit of the current year. It was fitting that the firm's jubilee year should have provided such record figures. The record turnover had been rendered possible by the greatly increased output capacity of the shops and the efficiency of the selling organisation. The extensions which they had carried out during the last two or three years had proved of inestimable value, enabling them not only to increase the turnover but to do so in a most efficient and economical manner, consistent with the maintenance of their high reputation for quality. The programme of extensions which they had in hand was well advanced. Attention had been paid to the question of selling and distributing the further increased output; the directors had always regarded productive capacity and selling capacity as contemporaneous—the one could not develop without the other. They had strengthened their sales and distribution organisation both at home and abroad. In conclusion, Mr. Johnson said that he was confident that the current year's results would be even better. Mr. J. McGregor (managing director), in seconding the motion, said that the work in all departments had increased, and there was every prospect of still greater business in the ensuing year. The Electricity Bill now before Parliament, if carried through successfully, would be of great national benefit. It would give the manufacturers of the whole country cheap power for production, lighting and transport, and, incidentally, it would bring the company large orders for most of its manufactures. Their finances would enable them to take full advantage of that increase in business, and they would be fully equipped with up-to-date machinery and working facilities, to deal with all requirements. The prospects were very bright and there appeared to be nothing to prevent their progressing, provided always that there was labour peace. During the last 21 years the capital had risen from £175,000 in ordinary shares with £175,000 of debentures, to £600,000 in ordinary shares with £300,000 of debentures, and the assets had risen from £362,832 to £1,376,934. The directors had been able to pay an interim dividend last year and they hoped to continue the practice. He believed that they would be able to increase the dividend next year.

Indo-European Telegraph Co., Ltd.

Presiding at the annual meeting on April 29th, the chairman (Mr. H. L. M. Tritton) said that the company's relations with the various Governments from which it enjoyed concessions remained satisfactory. He regretted that the Black Sea cable was still out of operation, but hoped that a way would soon be found out of the difficulties which surrounded that matter. Great strides had been made recently in cable communication, and there was ample room for that system of communication, as well as for land lines and radio-telegraphy. Mr. Tritton outlined the company's system, and said that it only transmitted messages directly; there was no delay at intermediate stations. They had a very efficient maintenance system which reduced interruptions to the minimum, and transmission errors were a very small proportion indeed in their large traffic. Dealing with the accounts, the chairman said that the expenditure on the reconstruction of the line in Russia and Poland, which was still in hand, showed an increase. That item and the one relating to the Persian section had been further reduced by sums set aside out of revenue. They had been able to maintain the dividend at 7 per cent., free of tax, and to increase the bonus from 1½ to 3 per cent., free of tax.

Telephone Manufacturing Co., Ltd.

In a recent announcement, the directors point out that the company's bank loan, which has to be met by annual instalments of £40,000, together with the interest on the 8 per cent. income bonds, is a great strain upon the revenue, exceeding the total profit. Accordingly, a reorganisation scheme has been drawn up. Under this, the 410,000 issued shares of £1 each would each be divided into two 10s. shares, half of which would be retained by the present shareholders, while the other half would be issued to those who subscribe the additional capital which it is proposed to raise. In addition, the unissued shares (590,000) would be divided. A provisional agreement has been entered into with the Rock Investment Co., by which that company agrees to buy all the shares which would thus remain to be issued (1,590,000) for £590,000 in cash (less a commission of £88,500). By this means the company would obtain sufficient capital to pay off the 8 per cent. bonds and the bank loan, and £65,000 would remain as additional working capital. The arrangements with the Rock Investment Co. include an option to existing shareholders to purchase not fewer than 1,000,000 new shares at 7s. 6d. each.

By order of the High Court, a meeting of members will be held at Cannon Street Hotel, E.C., on May 12th, for the purpose of considering and, if thought fit, approving this scheme of arrangement proposed to be made. A copy of the scheme can be seen at the offices of the company, Hollingsworth Works, Martello Road, West Dulwich, S.E.

Swansea Improvement and Tramways Co., Ltd.

The meeting of this company, whose report was reviewed in our last issue (p. 711), was held on April 28th. Mr. C. G. Tegetmeier, who presided, said that the reduction in the revenue was disappointing in view of the facts that increased facilities had been provided and that the number of passengers had risen. The decrease was due to an increased proportion of workpeople carried. This heavily handicapped the company and it was impossible to reduce fares if they were to make proper provision for maintenance and renewals, and provide a reasonable return upon the capital. It had been said that motor 'buses had rendered tramways obsolete. That was certainly not the case in Swansea, where proper co-ordination had allowed an efficient tramway system to flourish side by side with an efficient omnibus undertaking. The Swansea Corporation had realised that unlimited competition in transport was not in the interest of efficiency or of advantage to the travelling public.

German Companies.

The directors of the *Hartmann and Braun Company*, Frankfort-on-Main, recommend a dividend at the rate of 5 per cent. for 1925, as in the previous year.

The *Emag Electricity Company*, Frankfort-on-Main, proposes to pay a dividend of 5 per cent. for 1925; there was a small loss in the preceding year.

The *Mix and Genest Telephone and Telegraph Works Company* proposes a dividend at the rate of 8 per cent. for 1925, as against 6 per cent.

The *Wolfram Lamp Company*, Augsburg, which is under the influence of the German Osram Company, reports net profits

of 62,000 marks for 1925, as compared with 50,000 marks in the previous year. It is intended to pay a dividend at the rate of 10 per cent., against 6 per cent.

The *German Cable Works Company*, Lichtenberg, Berlin, states that the business was removed from the old to the new works during 1925, the new copper rolling mill was completed, and additions were made to the machinery. After providing for depreciation the accounts show net profits of 376,000 marks, as against 395,000 marks in 1924, the dividend remaining at 6 per cent. The directors state that success attended the resumption of the export of cables, especially in the English market. The current year has so far been favourable.

French Companies.

The *North-South Electric Railway Company*, Paris, records net profits of 5,505,000 fr. for 1925, and is distributing a dividend at the rate of 12.76 fr. net per registered share and 10.44 fr. per bearer share. The City Council has asked the company whether it would be willing to transfer its undertaking before the pre-determined date. The company is said to be prepared to submit an acceptable scheme for the consideration of the shareholders.

The *Société Electro-Chimie, Electro-Metallurgie Ugines*, Paris, is increasing its capital from 80 to 120 million francs.

The *Compagnie Radio-Maritime* again proposes to pay a dividend at the rate of 22 fr. per share for 1925.

The *Compagnie Radio-Orient* intends to increase the rate of distribution from 4 per cent. to 6 per cent. for 1925.

Belgian Companies.

The *Société de la Fabrication des Câbles et Fils Electriques*, Brussels, reports a net profit of one million francs for the last financial year, as compared with 825,000 fr. in 1924.

The *Société Générale Belge d'Entreprises Electriques*, which is an investment company, reports an increase in the revenue from 7,390,000 fr. in 1924 to 8,853,000 fr. last year. The net profits were 4,783,000 fr., as against 3,502,000 fr. in 1924, and it is intended again to pay a dividend of 55 fr. gross on the old shares and 18.75 fr. on the shares issued during 1925. The directors express satisfaction with the progress made by the different undertakings, principally the works concerned with the supply of electricity.

Dutch Company.—*Philips Glowlamp Works.*—The Amsterdam correspondent of the *Financial Times* says that the gross earnings of this company during 1925 were 7,947,000 florins, as compared with 6,211,000 florins in 1924. After providing for depreciation, there is a balance of 4,000,000 florins, sufficient to pay 16 per cent. on the ordinary shares and 8 per cent. on the preferred. The extension reserve is increased from 7,414,000 to 9,410,000 florins.

Latin-American Company. — The *Compania Hispano-Americana de Electricidad*, Madrid, which a few years ago took over the electrical undertakings of the German Transmarine Electricity Company, reports gross profits of 72,457,000 pesetas for 1925, of which the sum of 34,079,000 pesetas has been applied to depreciation. It is proposed to pay a dividend at the rate of 14 per cent. as in 1924, although the share capital has been increased to 180,000,000 pesetas.

Madras Electric Tramways (1904), Ltd.—The directors' report for 1925 shows a gross profit of £35,190, and after meeting expenses and interest, and providing for depreciation and renewals, there remains a balance of £14,392, to which is added £7,124 brought forward, making £21,516. The preference and interim ordinary dividends absorbed £8,250, and it is proposed to pay a final dividend at the rate of 6 per cent. on the ordinary shares (making 6 per cent. for the year), to write £3,500 off the cost of the debenture issue, and to carry forward £7,516. The report says that a motor omnibus service was inaugurated during the year, and the tramway service is being accelerated. Although the cost of operating motor omnibuses is appreciably greater than the tramway expenses, the expenditure in Madras was reduced by 1.7 per cent. Meeting: May 11th.

Melbourne Electric Supply Co., Ltd.—The annual meeting was held in Melbourne in March. Mr. Agar Wynne, who presided, said that owing to the smaller amount of building which had been carried out in the city during the period under review there was a decline in the number of consumers connected; nevertheless the business was satisfactory. The results which had been obtained had justified the company's policy of keeping its distribution system well ahead of building developments in new areas. The valuation of the company's property was proceeding, and the directors hoped to be in a position soon to make a definite announcement of the exact purchase price which was to be agreed with the State Electricity Commission.

Pernambuco Tramways and Power Co., Ltd.—The report for the past year records net receipts of £170,270, as compared with £153,462 in 1924. After paying interest, &c., and putting £10,230 to capital reserve, £10,000 to reserve for contingencies, and £1,500 to the amortisation fund, the net profit is £35,515, as against £28,745. A dividend of 7 per cent. is to be paid on the preference shares. This is the first distribution since 1919, when 3½ per cent. was paid; £7,000 is transferred to general reserve; and a balance of £5,379 is to be carried forward. The number of passengers carried increased by six millions to 49,710,333, and the number of electricity consumers rose from 9,431 to 10,914.

Electrical Finance and Securities Co., Ltd.—After providing for debenture interest, office expenses, &c., amounting in all to £10,893, there remains a balance of £6,488 from 1925. To this is added £1,966 brought forward, making £8,454, out of which it is proposed to pay a dividend of 10 per cent., leaving £2,408 to be carried forward. The company is interested in the following undertakings, which all recorded progress:—The Northwood Electric Light and Power Co., Ltd.; the Foots Cray Electricity Supply Co., Ltd.; the Colne Valley Electric Supply Co., Ltd.; the Boston and District Electricity Supply Co., Ltd.; and the Lothians Electric Power Co. The report refers to the death of Mr. A. L. Radford, a director of the company since its inception. The meeting was to be held yesterday (Thursday).

Winnipeg Electric Railway Co.—The operating expenses declined and the gross earnings increased during 1925, raising the net income to $821,604. After allocating $374,050 to depreciation, a balance of $447,554 is carried forward to surplus account, making $1,042,343, and after paying dividends of 7 per cent. on the preferred stock and 2 per cent. on the common stock, there remains a balance of $612,343. The assets have been written down, and $73,100 has been transferred to bond sinking fund, leaving a balance of $380,287 to be carried forward.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Northampton Electric Light and Power Co., Ltd.—70,000 new ordinary "B" shares of £1 each, fully paid, Nos. 342,123 to 342,389 and 350,001 to 419,733.

Northern General Transport Co., Ltd.—118,750 new ordinary shares of £1 each, issued at par, 2s. 6d. paid, Nos. 475,001 to 593,750.

Application have been made to the Committee to allow the following to be officially quoted:—

Calcutta Electric Supply Corporation, Ltd.—150,000 five per cent. cumulative preference shares of £1 each, fully paid, Nos. 2,375,001 to 2,525,000.

North Metropolitan Electric Power Supply Co.—300,020 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 599,891 to 900,000.

Ever Ready Co. (Great Britain), Ltd.—The accounts for the year ended March 31st last show (subject to audit) a net profit of £140,000, as compared with £96,000 in 1924-25. It is proposed to transfer £49,800 to reserve (against £35,000) and to carry forward £23,800 after paying the following dividends:—5 per cent. on the preference shares, making 10 per cent. for the year; and 5 per cent., plus a bonus of 15 per cent., on both the old and new ordinary shares, making 25 per cent. for the year in the case of the old ordinary shares. Meeting: June 1st.

Bogota Telephone Co., Ltd.—By order of the High Court, meetings of the holders of preferential and deferred shares of the above company will be held on May 19th at Magnet House, Kingsway, W.C., for the purpose of considering and, if thought fit, approving a scheme of arrangement proposed to be made. Copies of the scheme of arrangement can be seen at the offices of the company, Magnet House, or at the office of Messrs. Wild, Collins & Crosse, Kenman's House, Crown Court, Cheapside, E.C.

National Electric Construction Co., Ltd.—Mr. G. H. Nisbett, presiding at the annual meeting on April 29th, said that the company's profit had increased and a dividend of 10 per cent. was being paid. The dividend equalisation and general reserves had been increased. While the outlook for the future was promising, he was apprehensive of the effect of the Government's Electricity Bill which, unless it was drastically modified, would inflict immediate and lasting injury upon the electricity supply industry.

Callender's Cable and Construction Co., Ltd.—The directors recommend a final dividend of 2s. per share on the old and new ordinary shares, making in the case of the old shares 3s. per share for the year.

They also propose to increase the authorised ordinary share capital from £700,000 to £1,000,000, and to capitalise £200,000 of the reserves and issue it in the form of £1 ordinary shares to present holders in the proportion of one to three.

Rothesay Tramways Co., Ltd.—The directors report a net profit of £4,454 for 1925. To this is added £1,171 brought forward, making £5,625, and after meeting debenture interest and allocating £1,707 to renewals, it is proposed to pay a dividend of 3 per cent. on the ordinary shares, to transfer £2,000 to reserve, and carry forward £672.

International General Electric Co.—The value of the orders received in 1925 was $25,710,000, as against $17,590,000 in the preceding year. The net income amounted to $2,641,063 and, after paying dividends and interest, a balance of $1,917,204 is added to the accumulated surplus, bringing it up to $11,860,270.

Bengal Telephone Corporation, Ltd.—The *Financial News* states that the report for the year ended June 30th, 1925, showed a net profit of Rs. 3,24,313. A dividend of 2 per cent. was declared on the ordinary shares and Rs. 30,137 was carried forward.

Richardsons, Westgarth & Co., Ltd.—A dividend of 3 per cent. has been declared on the ordinary shares, as compared with 5 per cent. for 1924.

Mirrlees, Bickerton & Day, Ltd.—Under the terms of the amalgamation scheme with the Mirrlees-Watson Co., Ltd., a payment of 2s. 6d. per ordinary share is being made.

Western Union Telegraph Co.—The gross operating revenue for 1925 increased by 12 per cent. to $127,078,023, and after adding other receipts and deducting expenses, interest, &c., including an appropriation of $1,000,000 for the development of ocean cables, a surplus of $15,186,259 remained. To this was added $56,980,028 accumulated surplus and $4,514,192 profit from sale of securities, making $76,680,479. From this were deducted a further $4,200,000 for ocean cable development, dividends totalling $7,232,457, and adjustments of surplus $279,911, leaving a surplus at December 31st, 1925, of $64,968,111. The report states that about one-third of the net income is now set aside annually for taxes.

City of Buenos Ayres Tramways (1904), Ltd.—A dividend of 1s. 3d. per share has been declared in respect of the quarter ended March 31st.

Burma Electric Supply Co., Ltd.—An interim dividend of 4 per cent. has been declared on the ordinary shares, as compared with 3 per cent. in 1925.

Stocks and Shares.

Monday Evening.

On the eve of what may, or may not be, a General Strike, it is only natural that Stock Exchange markets should be in an extremely sensitive state. Prices gave way in all departments. There was no trace of excitement or of panic. Brokers and jobbers found themselves with little to do, for the public did not come in with selling orders. Much of the decline in prices had no origin in sales; it came about as a measure of precaution lest people should want to turn out stock without there being any support to take what came on offer. Some prices became practically nominal; to buy shares was as difficult as it was to sell them. On this Monday evening, the markets separated with foreboding mingled with resignation. The principal complaint was that no newspapers had appeared since the middle of the day.

Falls in the Electricity Supply section are few and unimportant. The London group is steady. Amongst provincial shares, Newcastle-on-Tyne and Yorkshire Electrics are easier. In the manufacturing market, Johnson and Phillips have been changing hands up to £3, the increased dividend, making 17½ per cent. for the year, being attractive to investors. Electric Constructions are better at 31s. English Electrics, which touched 14s. 3d. on the passing of the dividend, are now up to 16s. 3d. Callender's preference have strengthened. The ordinary were unaffected in price by the announcement of a scrip bonus to be distributed from the company's reserves. It is proposed to capitalise £200,000 and to give to present proprietors one new share for every three shares held. The dividend is again 3s. per share, for the seventh successive year. The bonus forms a substantial present, and the expectation is not unjustified which hopes for a continuance of the 15 per cent. dividend upon the increased capital.

The Ever-Ready Company issued a remarkably good statement, net profits for last year being £44,000 higher than those of 1924. The company declares a dividend and bonus making 25 per cent. in all, against 15 per cent. in the previous twelve months. On this, the price of the shares jumped from 48s. 9d. to 56s. 3d., to react to 51s. 3d. in the malaise of Monday. At the latter price, the yield is over 10 per cent. on the money, allowing for the accrued dividend in the price.

Home Railway stocks are, of course, very flat. Metropolitans, Districts, and the Underground Electric Railways issues gave way sharply. In the last named, a somewhat extensive bull account had become built up during the past fortnight, the £10 and the shilling shares being a popular tip for capital appreciation. The temporary bulls hastened to snatch thin profits, for fear of a general strike, and the prices accordingly came down under the pressure of real selling. The London traction stocks have not changed. The L.C.C. anticipates a net deficiency of £192,500 upon its tramways for the year 1925-1926. Rearrangement of traffic conditions is the only lasting remedy which the L.C.C. Highways Committee can see for meeting the present lamentable state of affairs. National Omnibus shares have declined to 22s. 6d.

The Victoria Falls and Transvaal Power Company announces the starting-up of its new giant power station, 65 miles above Johannesburg. The new plant has a capacity of 20,000 kilowatts, and the company looks to multiply this by three when the whole of the section is completed. Mexican Utilities have strengthened, the gains ranging from 1 to 3 points, upon more cheerful news from the country. It is said, unofficially, that the Mexican Light and Power Company has a scheme under consideration for dealing with the arrears of interest upon its second mortgage bonds, and the unpaid dividends upon its preferred shares.

Automatic Telephones are 1/16 up to 2 7/16. Siemens new shares, 18s. paid, are quoted a little lower at 5s. premium. Babcock and Wilcox gave way to 49s. in sympathy with a general fall amongst iron, coal and steel shares. Radio Corporations had a jump of 15s. to 8¼ on New York buying. The preference remained at 9½. Cable stocks and shares show no variations on the week. A rise in rubber shares became checked by the strike crisis, but the statistical position of the rubber industry has taken a turn for the better, from the viewpoint of the holder of rubber shares, and the market would improve were there to be any public encouragement afforded to it.

Share List of Electrical Companies.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price May 3 1926.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	55/9 x all	—	4 16 0
Brompton Ordinary	1	10	10	1⅛	—	*6 8 1
Charing Cross Ordinary	1	15	15	44/6	—⅛	6 14 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	45/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	27/-	—6d.	5 18 6
County of London	1	15	15	56/-	—	5 7 2
do. do. 6 % Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	28/6	+6d.	5 19 2
do. 7% Pref.	1	6	7	22/-	—	6 7 8
Elec. Supply Corporation	1	10	10	32/6	—	6 8 0
Kensington Ordinary	5	15	15	13⅜	—	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	35/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—	6 0 0
Newcastle-on-Tyne Ordinary	1	7	7	21/3	- 9d.	6 11 9
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—6d.	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16⅜	—	5 8 6
South London	1	15	15	2⅜	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	4	22/6	+6d.	3 11 1
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/3	—	6 18 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—6d.	7 13 10
Yorkshire Elec.	1	8	8	26/6	—1/-	6 0 9
Home Rails.						
Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	64½	—2	7 15 0
do. District	,,	3½	3½	£11½	—½	6 16 0
Underground Electric Ordinary	10	Nil	Nil	3½	—⅜	Nil
do. do. "A"	1/-	Nil	Nil	10/-	—2/-	Nil
do. do. Income	Bonds	6	6	99	—1	*6 1 3
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	1	8	6	2 7/16	+ 1/16	4 2 1
Chili Telephone	5	6	5	6⅞	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	17½	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 12 8
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	22	22	29	—	7 11 8
Indo-European	25	8½	10	47½	—	*5 5 3
Marconi	1	10	10	1 3/16	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/-	—	*5 14 3
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17¼	—	*5 15 11
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 1/16	+6d.	8 19 6
do. do. 2nd Pref.	5	6	6	2 1/16	—	11 3 4
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	127½	—	4 14 0
do. do. 6% Pref.	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	4	93	+1½	5 7 6
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	96/-	96/-	105½	—	*4 9 4
do. do. Deferred	,,	129/5	129/5	126	—	*5 3 2
do. do. Deb.	,,	4½	4½	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	63⅛	—½	7 17 6
Mexican Light Common	100	Nil	Nil	90½	+1	Nil
do. Pref.	100	Nil	Nil	75½	+3	Nil
do. 1st Bonds	—	5	5	70½	+1	7 1 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10
Manufacturing Companies.						
Babcock & Wilcox	1	12	13	49/-	—	*5 6 1
British Aluminium Ord.	1	5	10	2 1/16	+9d	4 17 0
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅜	—	4 16 0
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3⅜	—	4 0 0
do. 6½% Pref.	1	6½	6½	2⁹/9	+1/3	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	+6d.	4 17 0
do. 5% Deb.	Stock	5	5	82½	—½	6 1 3
Electric Construction	1	10	10	31/-	+1/-	6 9 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	+6d.	6 7 0
do. do. Pref.	1	6	6	18/3	—	6 11 0
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	29/-	+9d.	5 3 5
Henley	1	15	16	3¾	—	4 5 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	2 1/16	—	5 18 9
Met.-Vickers Ord.	1	8	8	23/-	—	6 19 2
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	30/6	—d.	4 18 4
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

The Rugby Radio Station.

An All-British £400,000 High-power Telegraph Station.

By E. H. SHAUGHNESSY, O.B.E., M.I.E.E.

(*Abstract of Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page* 719.)

Control Table.—The position of the control table can be seen from fig. 4. The slate panel contains all the essential controls and the most important meters of the wireless transmitter.

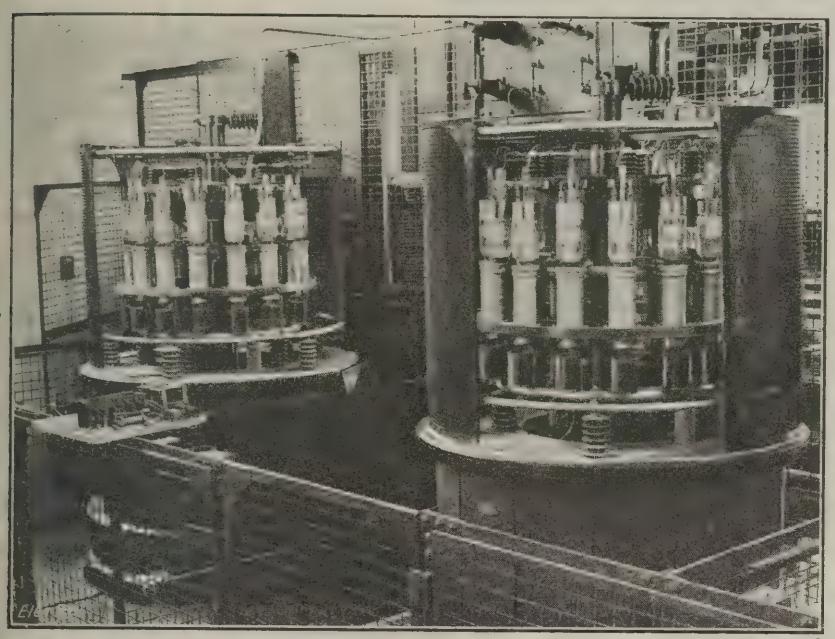


Fig. 10.—Third Stage of Amplification.

The apparatus terminating the land line from the Central Telegraph Office, London, which controls the transmission from the station, is fitted on the right-hand side of the panel, fig. 12, so that the duty engineer can check the signals passing through the transmitter and also speak to the controlling telegraph office as may be necessary. On the table on the left-hand side of the panel is an "engine-room telegraph" operated by push-buttons to enable the power requirements to be signalled to the power house. A loud-speaker and wireless recorder are provided for checking the actual signals transmitted from the aerial. In addition two press-buttons control a motor-driven variometer in the aerial circuit to compensate for any changes in the aerial constants due to weather, &c. The duty engineer, therefore, has full control of the entire station in detail from his position at the control table.

The high-frequency and other electrical measuring instruments fitted in the valve transmitting plant were supplied by Messrs. Everett, Edgcumbe & Co., Ltd.

Coupled Aerial Circuit.—Any large valve transmitter should be provided with a coupled circuit, since the use of a valve transmitter at reasonably high efficiencies necessitates the production of a certain proportion of harmonics which should be filtered from the aerial. For an "anode tap" the use of capacity rather than inductance brings with it a reduction of the harmonics in the aerial in the ratio of $1/m^2$ for the mth harmonic; that is, types B and D are m^2 times better than types A and C respectively, fig. 13.* For preliminary tuning, the use of capacity rather than inductance brings with it the disadvantage of having to be tapped in relatively big steps instead of being continuously variable as with an inductance; but, within these steps, variations of coupling between the primary circuit and the antenna circuit will produce equivalent changes in the adjustment of the complete circuit. Similar arguments apply to the method of coupling the primary circuit to the antenna circuit; that is, as regards the undesirable emission of harmonics, type E circuit is m^2 times better than type D, and therefore m^4 times better than type C. The ideal circuit, therefore, from the point of view of harmonic emissions is that shown as type E with capacitative coupling to both anode and aerial. In practice, however, it would be expensive to provide a range of condenser values for both anode and aerial couplings which would cover all the large and small adjustments required during the experimental period of tuning up the plant. If, however, a type D circuit is used with a condenser having a relatively coarse adjustment for the anode coupling and a continuously variable inductive coupling for the aerial, all necessary adjustments for the preliminary testing can be made with facility; then when the constants of the aerial circuit are known and the preliminary tuning has been completed, if necessary the change to type E can readily be made. It has, however, been found unnecessary to depart from the type D circuit installed.

The mica condensers, fig. 9, immersed in oil, were made by Messrs. Dubilier to meet the Post Office specification. They have a power factor of 0.00025 at the working frequency; the primary circuit is designed to carry 630 amperes, and at this current the value of the r.m.s. voltage applied to the condenser would be 33,000 volts (peak value 46,500 volts) and the kVA 20,800. Actually at present the value of the working primary current is about 300 amperes.

At the time the designs were being prepared the practical manufacturing limit as regards number of strands in a cable was 6,561 ($=3^8$) and calculations indicated that the diameter of the coil should be great and the diameter of the wire used should be very small. It was, therefore, decided to use a cable of 6,561 strands of No. 36 S.W.G. wire for both the primary and aerial inductances, each strand being insulated by enamel and one covering of cotton or silk. The cables were made to the Post Office specification by Henley's Telegraph Works, Ltd.,* and Messrs. Connollys, Ltd. The maximum current-carrying capacity of this cable when wound into an inductance is probably of the order of 1,000 amperes. The cable is mounted on a framework of American whitewood,† wound in slots on movable wooden spiders which are supported by rollers on a wooden framework, so that changes

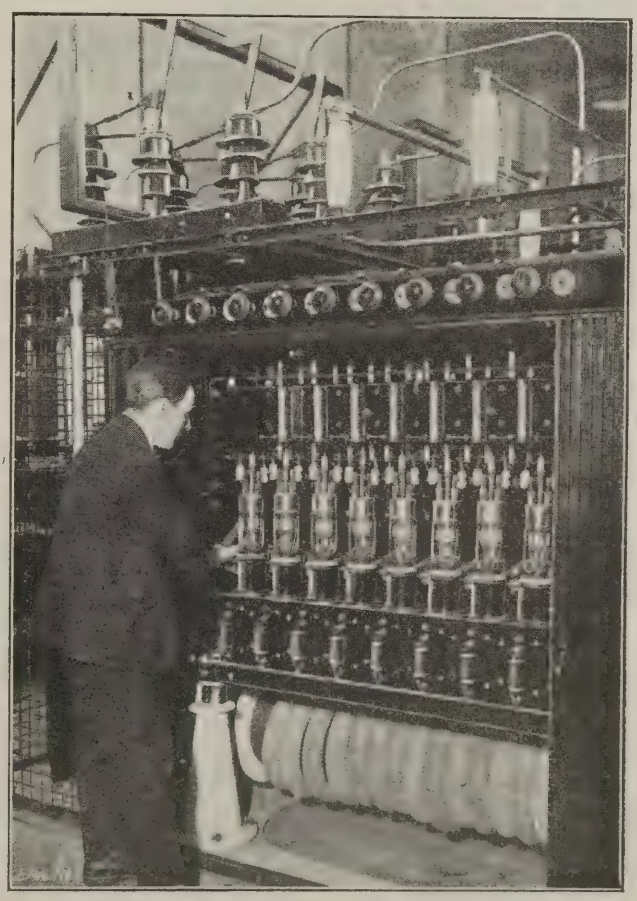


Fig 11.—One of the Power Valve Units (Gates open).

* Taken from a paper being prepared by Mr. R. V. Hansford and Mr. H. Faulkner for presentation to the Institution.

* See ELEC. REV., November 20th, 1925; p. 831.
† See ELEC. REV., July 10th, 1925; p. 61.

of inductance can be obtained by the relative movement of the spiders without the awkward mechanical construction of "tapping points" and the disadvantages of "overhanging" end-turns. The maximum width of the largest inductance coil is 14 ft. 6 in.

One outside spider can be moved by a screw in order to get a fine adjustment of tuning. The method of making a joint in the stranded wire between the spiders is to splay out the strands on a number of insulated flat copper plates and semi-conical copper fittings so as to ensure proper circulation of current through all the strands and to keep a cool joint.

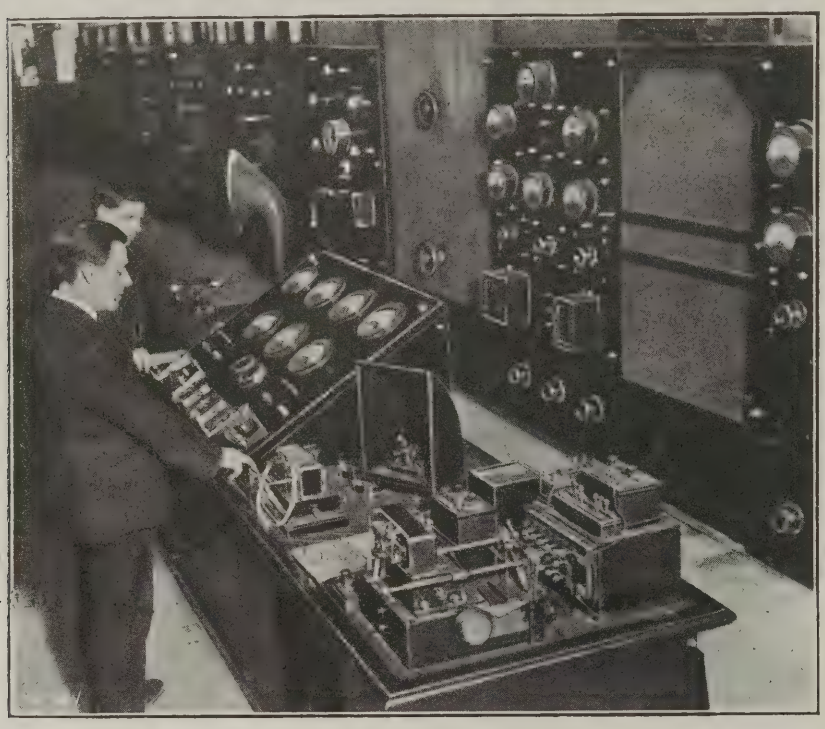


Fig. 12.—Telegraph Control Desk ; Land-line Terminal on Right.

The actual measured resistance at 16,000 cycles of the entire primary circuit as erected was 0.088 ohm, giving a decrement of 0.0053. The measured resistance of the aerial tuning inductance and coupling coil (2,500 μH) at 16,000 cycles was 0.11 ohm, giving a decrement of 0.00137 for the coils, and the author has not noticed details of any transmitting inductance which is as efficient as these have proved to be.

Keying and Shape of Signals.—One of the greatest difficulties is that of successful keying; as a result of experiments it was decided to provide for the simultaneous operation of a simple "make and break" key at each of the three points in the circuit marked x in fig. 7. The system has proved to be eminently satisfactory and Creed pneumatic keys are used at points *a* and *b* and a magnetic relay at point c. There is no oscillation in the aerial when the key is "up" and this result is obtained by breaking the feed to the grid from one stage of amplification to the next, as shown in fig. 15, which is a skeleton diagram of the last inter-stage circuit. Two points of particular interest in the arrangement are, first, that the key splits the coupling condenser to the grid and leaves the condenser E between the grid and filament when the key is up; this condenser is of sufficient value to make the impedance from grid to filament capacitative, and this counteracts any tendency that this stage may have to self-oscillate. The second point of interest is the series circuit A B C from grid to filament; A is merely a high-frequency choke, B is an adjustable resistance (grid leak) and C is a d.c. (grid bias) generator. When the key is down the mean negative grid potential is the sum of that due to the grid leak and the generator; when the key is "up" the only bias is that due to the generator. By adjusting the proportions of the bias due to grid leak and generator respectively when oscillating, it can be arranged that the generator voltage is sufficient to allow a suitable d.c. current to pass through the valves when the key is up. The advantages of this are that (1) the d.c. load with "key up" reduces the voltage "kick" on the generator with keying, and (2) the conductive path through the valve (due to the small grid bias) increases the damping of the aerial when the key is "up," with a corresponding improvement in the shape of the signals.

From oscillograms of the aerial current the decrement of the aerial circuit for the rise of current has been calculated as 0.0086, whilst for the decay it is as high as 0.024; for higher speeds, advantage will be taken of the quick decay by decreasing the length of the "space" relatively to the "mark" and means for doing this are being developed. This method of keying is due to Messrs. Hansford and Faulkner, whilst the whole of the work of erecting and assembling the internal wireless plant was done by Post Office workmen under the supervision of, and to the detailed designs of, Post Office engineers. The tuning-fork units were made in the Post Office experimental workshop at Dollis Hill.

Masts.—The masts are 820 ft. in height from ground-level to the top of the antennæ aerial sheave and are of the stayed and pivoted type. The pivot is about 17 ft. above ground-level; below this are columns of porcelain insulators and a granite cube (5 ft. 6 in. sides), the whole being supported by a steel columr The total weight of steelwork in a mast is 170 tons and the weight of the 15 stays is 28 tons, and stay anchorages, &c., 12 tons. Under maximum wind load the resultant vertical load on the base of the mast is 400 tons.

The insulation is primarily provided by 12 columns of porcelain insulators arranged three in each column between steel castings immediately below the pivoted joint. The insulators will withstand a high-frequency voltage of 25,000 (r.m.s.) at 50,000 cycles per sec. for 6 hours without overheating or breaking, having first been immersed in water for 2 hours. They were tested mechanically to a compression load of 270 tons; each is 9 in. in diameter and 3¼ in. thick, with a recessed hole in each face 2½ in. dia. and 1 in. deep.* Their arrangement permits of the insertion of 3 hydraulic jacks to raise the mast and replace faulty insulators as required.

The stays are insulated at the base only, and a hydraulic press is incorporated in the stay-rope attachment which can be used to measure directly the tension of the stay.

The stays are of parallel strand construction and were made

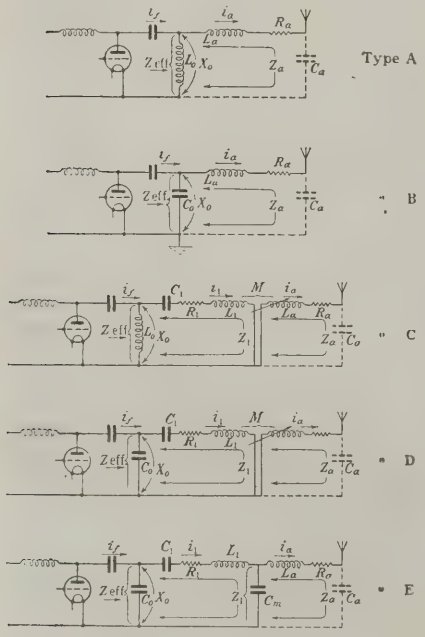


Fig. 13.—Types of Output Circuits.

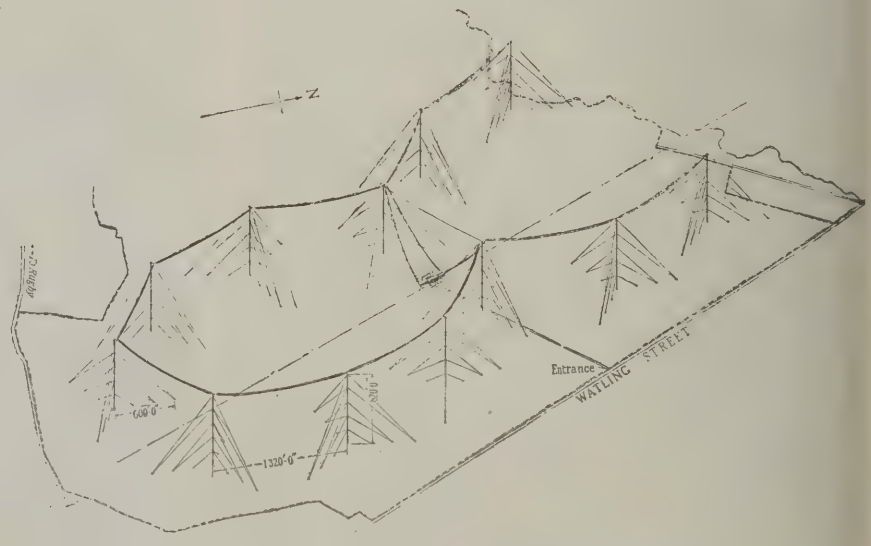


Fig. 14.—Isometric View of the Station.

* See ELEC. REV., July 10th, 1925; p. 60.

on the site. The larger is composed of 151 wires of No. 10 S.W.G., having an area of 1.918 sq. in. and a circumference of 5½ in., and this type of stay has a great advantage over the usual small wire stranded variety in possessing a smaller extension under load.

The masts were manufactured and erected by Messrs. Head Wrightson and Co., and switches are provided for earthing the masts when access to them is required and also for enabling transmission to be carried out at full power with the masts earthed. A spark-gap is also associated with the switch as a protective device against abnormal voltages on the masts or aerial.

Aerial System.—Two separate aerials of different capacities may be used, or the two combined to form one larger aerial

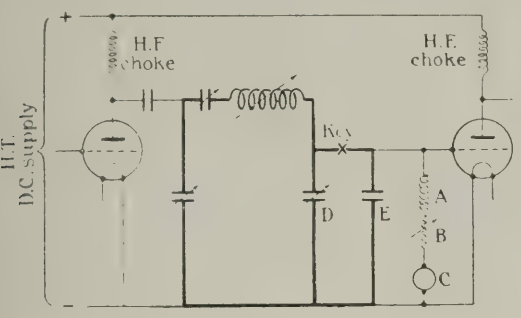


Fig. 15.—Inter-stage Circuit.

(fig. 14). The larger of the two is the telegraph aerial and forms an elongated octagonal figure in plan, with sides of 1,320 ft., but with opposite sides on axes at right angles at distances apart of 880 and 1,200 yards. The smaller aerial open arms arrangement is designed to permit of the addition of four more masts if necessary. The aerial insulators are of the porcelain-rod tension type, weighing 6½ cwt. and each will withstand a pull of over 20 tons and 200,000 volts at 50,000 cycles per second across the ends without damage. They were made by Messrs. Bullers, Ltd. Spider spreaders of tubular steel, 12 ft. in diameter and spaced 140 ft. apart, support the eight 7/14 S.W.G. silicon-bronze wires that form the cage aerial. The split hubs of each spreader are tightly clamped to a central steel supporting cable. The tension of the lead-up wires is taken by 6 porcelain tubes, similar to those used in the main aerial insulators, suspended on a steel structure near to the building, fig. 16, the steel rope supporting the aerial insulators passes down the centre of the mast and is attached to a drum fitted with a slipping friction brake so adjusted that the rope is slackened when the load exceeds 10 tons.

The earth system on the telegraph site consists of copper wire, 100 lb. per mile, buried a few inches below ground, and follows the plain of the aerial and extends 800 ft. on either side. Near the buildings the wires leave the ground and converge upon the transmitting room in a fan arrangement (fig. 17).

An insulated counterpoise has been erected under the smaller aerial at an average distance of about 16 ft. from the ground, following generally the earth system in arrangement.* The ratio of the effective height of the aerial with the masts earthed is 1.22. At 19,000 m. wave-length the aerial resistance with masts insulated is 0.7 ohm, and with the masts earthed it is 0.55 ohm. The use of inefficient insulators for masts practically doubles the aerial resistance, *i.e.*, when the porcelain insulators are short-circuited and the granite blocks alone are used as insulators.

The resistance of the blocks steadily rises as the granite slowly dries out. The effect of the dielectric current in the granite is to drive out moisture gradually from the interior; this action, combined with absorption by the atmosphere in the spring and summer, will raise the insulation to a maximum value, and the granite blocks will then be completely coated with a bitumastic solution to retain them in a dry state.

Results Obtained.—Below are two typical series of measured values of the more important quantities when working on one portion of the aerial only, *viz.*, that having a capacity of 0.33 μF.

Number of power units in use		3	3
Total number of valves in power units		54	54
Aerial circuit	Current	550 amps.	600 amps.
	Power	257 kW.	306 kW.
Primary circuit current		275 amps.	300 amps.
Coefficient of coupling to aerial		0·015	0·015
Efficiency of coupled circuit		97½%	97½%
D.C. input	Voltage	5,820 volts.	6,780 volts.
	Current	61 amps.	64 amps.
	Power	355 kW.	434 kW.
Filament power		48 kW.	48 kW.
Efficiency of transmitter	Excluding filament	72%	71%
	Including filament	64%	64%
Voltage on antenna		165,000 volts.	180,000 volts.

The above figures are for about two-thirds power of the station, and the present limitation is the fact that only a portion of the main aerial is available, which is already being used at antenna voltages in excess of 165,000 volts. With this power, however, the station has been proved to have a world-wide range and only the collection and scrutiny of data over a long period will show to what extent, if any, an increase of power is necessary for a *continuous* world-wide service. From the experience already gained it can be predicted that, if it is proved to be necessary, 3-power units using a d.c. supply of about 9,000 volts will give an antenna current of the order of 750 amperes in the larger antenna of 0.045 μF, with an increased overall efficiency.

During the several months that the station has now been testing and working commercially with type D circuit, not a single complaint has been received with regard to interference with broadcast or other reception by harmonics from the telegraph transmissions.

Experimental Telephony.—The experimental telephony installation works with the smaller aerial, and the American Telephone and Telegraph Co.'s "single-side band" system described by the late Dr. H. W. Nichols.* The modulating and filtering circuits and the valve amplifying panels were made and installed by the Western Electric Co., Ltd., in co-operation with the American Telephone and Telegraph Co.

Experimental tests show that good speech is received in New York during most hours of the day when using an aerial current of about 185 amperes. This installation may form the subject of a separate paper when reliable data has been collected over the period of bad atmospheric conditions. In addition, two other installations to work with smaller aerials supported on the existing masts are being provided. One will be a medium-wave 50-kW valve set and the other a short-wave 15-kW valve set.

Discussion in London.

Mr. L. B. TURNER presided and opened the discussion by reading a communication from Dr. W. H. ECCLES, who commended the excellent team work of the Post Office engineering staff; they had been responsible for the design and development of unusual forms of plant and circuits and the best testimonial to their work was the station's magnificent performance. Its erection had been completed without failure, fault, or accident, and the estimates were very close to the final expenditure.

SIR GUY WRIGHTSON, of Messrs. Head, Wrightson & Co., who supplied and erected the masts (which have formed the subject of an Institution of Civil Engineers' paper) said that their erection had been carried out in one of the wettest and windiest seasons that he remembered without accident.

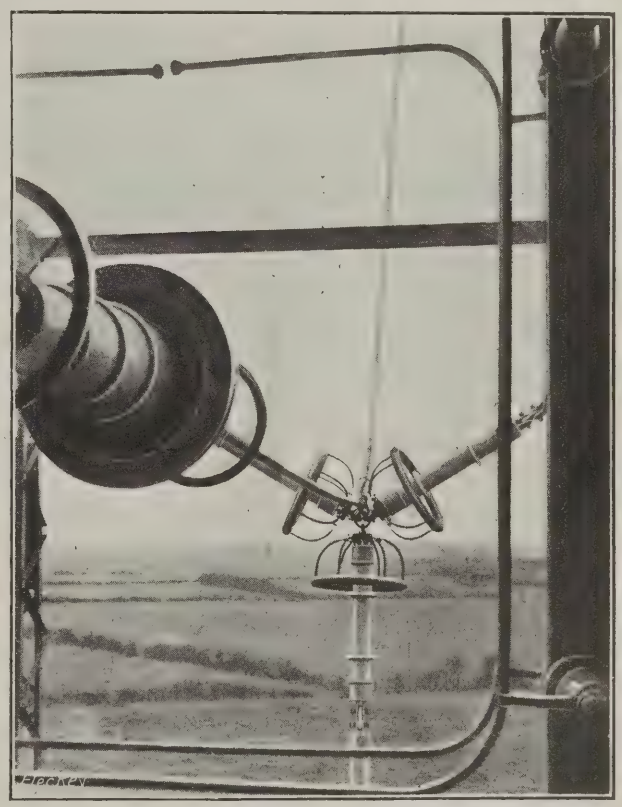


Fig. 16.—Aerial Lead-in.

Mr. C. ELWELL wanted to know whether it was necessary to provide so many masts. No engineering difficulty would be encountered in erecting even higher masts than those at Rugby, nor in providing for a much greater aerial pull, say, 30 tons, in which case the masts could be double the distance apart. With regard to valves, personally, he favoured the use of a smaller number of larger size, because the maintenance factor of many small ones was unknown. Large valves could have their filaments renewed.

Capt. P. P. ECKERSLEY envied the Post Office engineers' ability to erect a station of that size wherever they liked without the consent of anybody, but his envy was changed to admiration when it was realised that the telegraphic plant operated without seriously interfering with the broadcast wave-

*The counterpoise has since been buried.—EDS.

Journal, I.E.E., 1923, vol. 61, p. 812.

band; telephony was another matter. He congratulated those concerned on having built the station on a solid engineering bases, and admired the manner in which the Meissner patent had been overcome. The application of a tuning fork represented a unique advance in methods of maintaining wavelength constancy; the British Broadcasting Co. had experimented in that direction and had used tuning forks for independent drives; starting with 890 cycles it had been possible to drive a relay station at a frequency of nearly one million cycles. Many valves made for safety, but would it not have been more economical to have used less expensive mast insulation and a little more power?

Mr. H. N. Vivian felt that the Rugby station was the last word in two respects; it was the best of its type ever built and he believed it would be the last. In a short time the "beam" stations would prove whether that opinion was sound or not.

Mr. E. H. Shaughnessy, in reply, remarked that the long-wave stations in Germany and France were still doing very well and there was no indication that they would be scrapped. The Post Office knew something about short waves, including the fact that they did not behave the same from day to day and a telegraph service was of little value if it were not reliable. If manufacturers would not repair large valves, the Post Office would have to do it.

Radio Measuring Instruments.

However casually the average engineer may be inclined to regard "wireless," contemplation of the Rugby station can hardly fail to arouse enthusiasm for the achievements of the radio engineer, and especially is the General Post Office staff to be congratulated on having built a station costing about £400,000 and containing only £1,000 worth of foreign apparatus. Even the heaviest of heavy-current engineers must be impressed by the provision of 1,000-ampere radio ammeters with which to measure the flow of the high-frequency current to the oscillatory system. The electrical measuring instruments for the valve transmitting plant were supplied by Messrs. Everett, Edgcumbe & Co., Ltd., and a brief survey of the more interesting types employed may not be without interest as indicating the care that has been taken to meter the energy needed to operate the station. The switchboards controlling the supplies of a.c. at 100 cycles for filament lighting, and the high-voltage d.c. for the anodes, in addition to the low-pressure d.c. for various auxiliary purposes, are equipped with "Superscale" instruments.

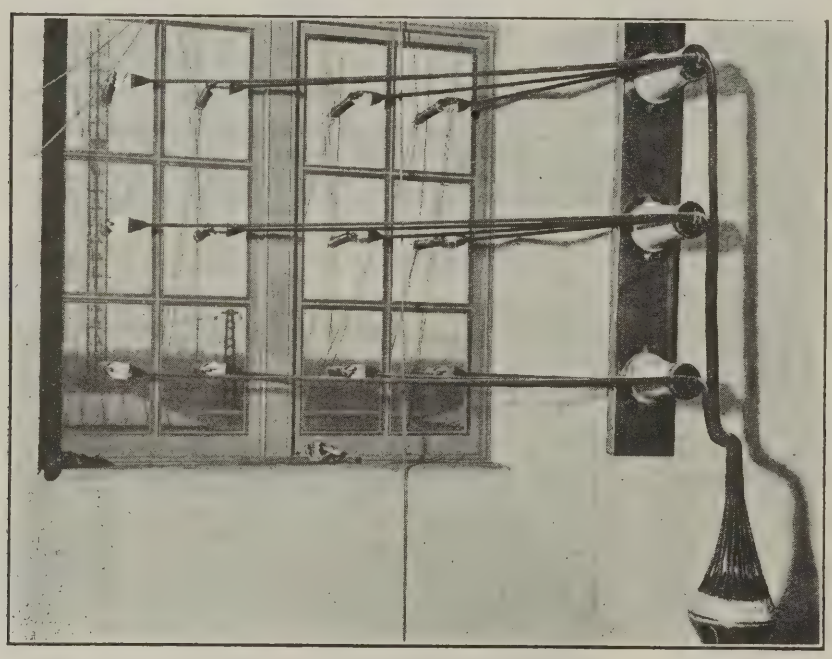


Fig. 17.—One of the Earth Leads-in.

An interesting feature is the mounting of a specially designed electrostatic voltmeter on each pair of motor-driven main generators; each instrument is mounted on an insulating pillar on the top of its machine, and is calibrated, with both poles insulated, to read the total voltage of each pair of generators, *i.e.*, 6,000 volts. When the generators are in series a specially developed tank type of voltmeter is used for measuring the full anode voltage of 18,000 volts. It consists of a "Superscale" milliammeter of the moving-coil pattern connected in series with a high resistance contained in an oil-filled porcelain tank, and arranged to pass milliamps. per thousand volts across the terminals, the milliammeter being calibrated in kilo-volts to correspond. The resistance tank is placed high up in a place of safety, since it necessarily has the full potential across it and the instrument may be seen in the centre of the bottom row on the control desk (fig. 12). The filament current of the valves is continuously recorded on "Inkwell" ammeters; the total valve hours worked by each bank can thus be readily ascertained by integrating the chart readings and information as to constancy of supply is easily obtainable. In addition to the cooling-water flow-meter, d.c. "Superscale" instruments indicate the grid and anode filament currents and a third ammeter (designed to carry both d.c. and a.c.) indicates the oscillatory component of the anode filament current. The last-mentioned instrument, a considerable number of which pattern is in use in the station, is worthy of description: The indicating portion of the instrument consists of a thermal-expansion ammeter designed to ensure accuracy at any frequency. An important factor in this respect is the actual current passed through the indicator, and being transformer operated, the latter can be adjusted to work with any current value considered desirable. A figure of 2 amperes was chosen to allow the use of a working element sufficiently thin to be negligibly affected by skin effect, even up to several million cycles per second, and yet sufficiently robust. A current of 2 amperes, further, is sufficiently large to render any parasitic currents induced in the connecting leads negligibly small by comparison. Another consideration is the importance of avoiding the formation of an inductive loop of any size, by the disposition of the internal wiring and terminals; this possible source of error has been avoided by the use of tubular concentric terminals which project from the back of the instrument, and to which the connecting leads from the transformer secondary are joined. The latter are constructed of separately enamelled copper flex, similar to that used in the tuning inductances of the station, the twin insulated conductors being parallel to one another in an external braided covering; both the impedance and the tendency to collect induced parasitic currents are less with this arrangement than with the more usual type of twisted lead. At Rugby, the radio-current transformers are connected directly between the various sections of the oscillatory circuits, the instruments themselves being placed on the control panels and main control desk, sometimes as much as 80 ft. away from their respective transformers. The advantages of this method of measuring large high-frequency currents, as compared with the usual type of directly connected thermal instruments, can readily be appreciated and the transformers themselves have a transformation accuracy well within 0.5 per cent.; although they involve the use of iron cores, thereby greatly reducing their bulk, they have been supplied to work in circuits operating at frequencies as high as 5,000,000 cycles per second. The cores are built up of thin laminated silicon steel, overwound with the secondary winding, the size of wire being so chosen that the required turns exactly fill either one, two, or three complete layers. No gap or uneven winding is permissible, since any variation of the secondary linkage will inevitably cause local leakage of magnetic flux, and thus local heating of the iron. At the higher radio frequencies, even a dozen stray lines will cause sufficient heating of the iron to damage the insulation, the normal working flux density, in such a case, ranging from 0.5 down to 5 gauss at the lower frequencies.

The core and secondary winding (which is of toroidal form, to secure immunity from stray fields) are housed inside the primary winding, which consists of a spun-brass or copper sheath, thus further protecting the secondary from the effect of external fields. The primary current enters by a tubular conductor, passing through the centre of the wound core; it then returns, first, by way of the copper sheath, flowing radially in all directions, and finally through a second tubular conductor, concentric with the first; the whole, in fact, corresponding with a "one turn" current transformer. At high frequencies, however, the use of the iron core makes one turn adequate for currents as low as 10 amperes, such a transformer being only a few inches in diameter and weighing under 1 lb., whilst a 1,000-ampere transformer weighs about 10 lb.

A number of transformer-operated instruments may be seen both on the panels in the valve room, and in the top row of the main control desk (figs. 4 and 12), the capacity of the latter instruments being from 500 to 1,000 amperes of radio-frequency current.

Another instrument of an unusual nature is installed close to the main control desk. It is an electrostatic voltmeter of the attracted-disk pattern, adapted for use as a peak voltmeter; by comparing this reading with the r.m.s. voltage, some idea of the crest factor can be obtained. The peak voltage is measured by connecting a highly insulated condenser in series with a two-electrode valve across the lines. Owing to the non-return action of the valve, the condenser becomes charged to a pressure equal to the maximum value impressed on it, *i.e.*, the peak of the pressure wave. This voltage across the condenser is measured by the electrostatic voltmeter, which thus indicates the peak voltage. An important proviso is that the leakage across the voltmeter and condenser must be very small. It is, of course, the peak of the wave which tends to leak away, and a leakage amounting to, say, 0.2 per cent. of the half wave would represent about 2 per cent. off the peak. Long porcelain supports are used for this voltmeter which has ranges of 10, 20 and 40 kV.

In conclusion, our indebtedness to Mr. F. E. J. Ockenden, who made a special study of the problems involved, for the above details must be recorded.

A Steam-Electric Cotton Mill.

The Rishton Victoria Spinning Co.'s Modernised Plant.

THE ceremonious inauguration of the modernised cotton mill of the Rishton Victoria Spinning Co., Ltd., near Blackburn, took place recently. The installation is of an interesting kind, consisting of a steam turbine driving the spinning mill direct by ropes and the weaving shed electrically; it has been specially designed so that the stopping and re-starting operations at meal times can be effected in the shortest time without difficulty.

It is believed to be the first plant of its type to be commissioned in that district and is an example of what can be done to bring the power plant of old mills up to date in order to meet modern conditions, without having to shut down the mill for a long period.

The original plant consisted of a double beam engine of 900 i.h.p., built in 1860, which drove the spinning mill by spur gearing and an upright shaft; also a horizontal engine for driving the weaving shed through bevel gears. Various schemes for conversion to modern driving were considered, including reciprocating engines and electric driving, but eventually it was decided to install a geared steam turbine and condensing plant with combined rope and electric drive, as shown in fig. 1, the order for the plant being placed with Messrs. W. H. Allen, Sons & Co., Ltd., of Bedford. An important factor was the necessity of keeping the machinery running during the change-over; this was effected by, first, installing the turbine and rope pulley in a small space between the mill chimney and the mill and alongside the existing beam engine house, and the spinning portion of the mill was driven by ropes from the turbine.

The old beam engine and upright shaft were then dismantled and the alternator for driving the weaving shed was erected and coupled to the turbine. Motors were installed in the weaving shed, commencing at the far end, one motor driving three cross shafts, the reduction in speed being effected by double helical wheels. When the last cross shaft was coupled up, the old weaving-shed engine was dismantled. The plant drives 40,000 spindles direct by ropes and the electric motors drive 852 narrow looms and 268 sheet looms; an unusual feature of the drive is that the motors have been arranged to start with the alternator, thus eliminating individual starting and loss of time as referred to above. The alternator and motors were supplied by the Electric Construction Co., Ltd., of Wolverhampton, and the wiring was carried out by Messrs. Adams and Co., of Manchester.

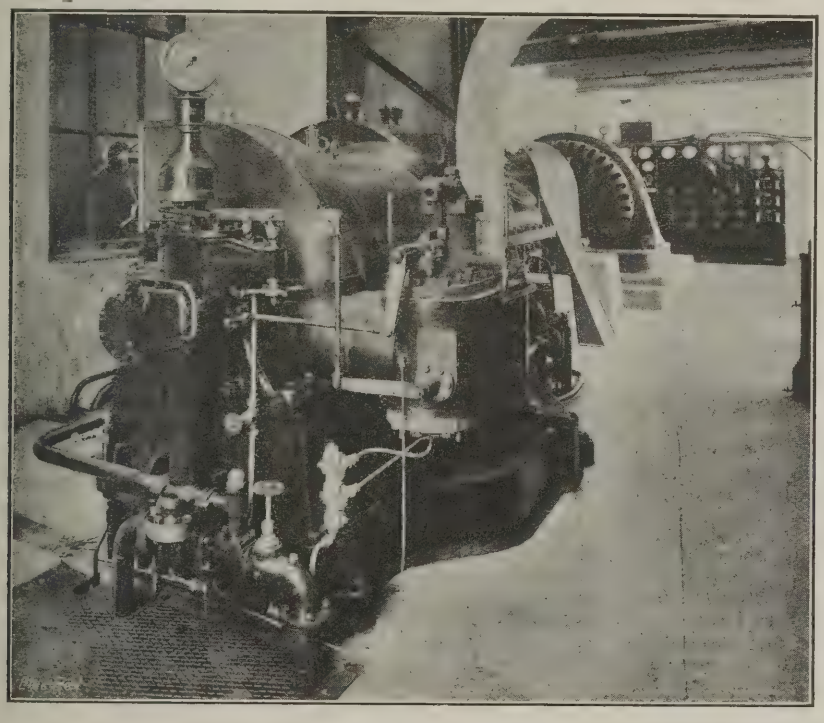


Fig. 1.—Cotton-Mill Steam-Electric Plant.

Provision has been made for the turbine to drive an additional load, if required for future extension, the total available power being 1,750 b.h.p. The boiler pressure is 160 lb. per sq. inch with steam superheated to 65 deg. F. The turbine runs at 4,800 r.p.m. and is geared down to 500 revolutions, while provision has been made for a portion of the steam to be utilised for heating purposes after it has developed power in the turbine. The exhaust steam from the condenser air pump is utilised for heating the boiler feed water before it enters the economisers. Arrangements have been made to enable the turbine to start quickly under vacuum; it requires only two minutes to attain full speed. Apart from the increase in production that the new plant yields, the cost consumption is much lower than that of the old plant.

In conclusion, we are indebted to Messrs. W. H. Allen, Sons and Co., Ltd., for placing the above particulars at our disposal.

A Meter-Testing Laboratory.

A Visit to the Outside Department's Premises of the North Metropolitan Electric Power Supply Co.

ON Thursday of last week Sir James Devonshire, K.B.E., the chairman and managing director of the North Metropolitan Electric Power Supply Co., received and welcomed a number of engineering representatives of manufacturers and other electricity supply undertakings at an inspection of the premises of the outside department of the company at New Southgate.

The company carries out with direct labour the whole of the necessary underground extensions to its super-extra-high, high and low-pressure systems, requiring the laying of some two hundred miles of cable per annum. The work is carried out under the supervision of a mains superintendent and an assistant engineer, and a permanent staff of 37 men, including three foremen, 10 jointers and jointers' mates, and 14 labourers. Owing to the extensive area in which the company operates, it is not practicable to carry a larger staff of permanent labourers, but an average of 200 casual labourers are employed, these being drawn, as far as is possible, from the districts in which extensions are carried out. A fleet of five motor lorries and a 12-ton six-wheel cable carriage provide for the transport of materials for the four gangs normally employed.

The maintenance of the super and extra-high-pressure mains is carried out by the permanent staff of the mains department, the maintenance of the overhead lines being dealt with by a linesman and a mate. The pressure testing of the low- and high-pressure mains is carried out by means of suitable portable step-up transformers. The super- and extra-high-pressure mains are tested by means of a portable 2-tube Kenotron apparatus, made by Messrs. Watson & Sons, and designed for a maximum pressure of 200 kV. The recording of all the mains extensions is carried out in the outside department drawing office, a senior and four junior draughtsmen being employed on this work.

The department was formed in 1921 to control the stores, mains and meter departments of the company, the accommodation consisting of a three-storey private house (No. 15, Friern Barnet Road). The rapid increase in the company's activities had rendered the original accommodation inadequate, and separate buildings have been erected at the rear of the house, which now provides office accommodation only for the stores and mains departments.

All materials required by the company's district undertakings are stocked in a two-storey building, 72 ft. by 33 ft. A third but independent floor above this building accommodates the central offices, where the accounts for the whole of the company's consumers, about 24,000, are dealt with. The feature of the premises, at least from the technical point of view, is the meter department's building which has recently been erected. This consists of a single-storey building divided into four sections, receipt and dispatch room, workshop, testing laboratory, battery and motor generator room. Immediately on delivery all meters are permanently marked with a serial number in the first-mentioned portion, to which they are returned after being dealt with in the laboratory. The workshop contains the necessary bench accommodation and apparatus for the complete overhaul of all types of meters, separate benches being devoted to each type. The battery and motor-generator room contains a 4-cell 800-Ah Tudor battery and a 3-unit motor generator, consisting of a 2½-h.p., 3-phase motor driving a 600-V, 1-A, d.c. generator and one of 10-V, 100-A rating.

The laboratory is perhaps the reverse of what has been conceived as the up-to-date test room, and its conspicuousness lies in the absence of complicated and elaborate instruments. Those responsible for the lay-out of the department have obviously gone out for simplicity throughout—and with it efficiency. Methods of testing have been adopted which ensure, without loss of accuracy, the necessary speed to cope with over 10,000 meters per annum. If permissible, the term "testing by mass production," might be applied. The bulk of the meters are tested against rotating sub-standard meters which, with other standard and sub-standard instruments, are accommodated on a separate standards bench. Test racks and benches for dealing with the different types of meters are placed in the usual manner throughout the room, and all connections between the benches and racks are run in ducts below the floor.

Two methods of testing single-phase Wh meters are employed, one, in which a tapping key controls both the current and potential of the testing circuit and the standard meter, is allowed to rotate x revolutions; the angular displacement from zero of each test meter disc is then read on a gauge, which gives direct readings of the percentage inaccuracy. In the second method the tapping key controls the sub-standard meter only; this is run during x revolutions of each meter under test,

the percentage error being calculated from the sub-standard disk reading. The polyphase meters are tested against a standard double-element dynamometer-type wattmeter. Other types of meters are tested by modifications of the usual testing methods.

For collecting data concerning different types and makes of meters, samples are tested at various temperatures in a small electrically-heated oven with a glass front and suitable terminal arrangements. This oven is also used for the desiccation of transformer oil and dielectric samples. An important branch of the work done in the test room is in connection with breakdown tests on transformer oils. A special panel is provided for this work at one end of the laboratory. A h.p. supply is obtained from four 100/10,000-V potential transformers connected in series, and the control is effected by means of a phase shifter, one secondary of which is connected in opposition to the corresponding phase of the supply. This phase shifting apparatus is also used in connection with the testing meters on unbalanced circuits.

The supply of energy for the premises is taken from a sub-station adjacent to the stores building which supplies the company's local networks in New Southgate and Friern Barnet. This sub-station is fed through two feeders from the company's 11,000-volt system, terminating in B.T.-H. compound-filled truck-type switches.

In supporting Sir James Devonshire at the reception, Captain Donaldson, the company's chief engineer, paid a tribute to Mr. G. F. Shotter, the meter superintendent, who is responsible for the entire lay-out of the apparatus in the testing laboratory.

Tramways and Light Railways in 1924-25.

Annual Return.

As we have reported, the annual return of tramways and light railways (street and road) and railless trolley undertakings for 1924-25 has been published,* somewhat later in the year than the previous one.

The return covers the year 1924 in the case of company undertakings and the twelve months ended usually in March, 1925, in the case of municipal undertakings.

The statistics relate to 242 tramway undertakings, 170 owned by local authorities. During the period covered, the system of the Keighley Corporation was wholly converted to railless traction; and the Dearne District Light Railways Joint Committee commenced operations. Out of a total of 2,792 route miles authorised, 2,605 miles was open for traffic; 1,859 miles was worked by local authorities and 746 miles by companies. The total length of track in operation amounted to 4,381 miles.

The number of passengers carried during the period was 4,620,501,521, equivalent to 1,772,711 journeys per mile of route open. The car-mileage amounted to 378,239,229; of this 99.59 per cent. was worked electrically. The figures show that, as compared with the preceding period, the number of passengers carried increased by about 177,000,000, and the car-mileage by approximately 15,000,000. There was a slight decline in the efficiency of use of electrical energy; the total consumption was 707,038,431 kWh, giving an equivalent of 1.88 kWh per car-mile, as compared with 1.87 kWh in 1923-24. The average fare paid per passenger fell from 1.53d. to 1.47d.

The traffic receipts and expenditure of the undertakings is analysed in a table. From this it is seen that the gross receipts per car-mile declined from 19.46d. to 18.23d.; and the gross working expenses from 15.13d. to 14.43d., leaving net receipts of 3.80d. as compared with 4.33d. in 1923-24. The alterations were particularly marked in the case of company undertakings in which the receipts fell from 20.87d. per car-mile to 17.70d., and the expenses from 16.10d. to 14.20d., reducing the net receipts from 4.77d. to 3.50d. per car mile. The municipalities' net receipts were 3.87d. per car-mile, as compared with 4.23d. in 1923-24.

The amalgamated capital accounts show that the amount invested in municipal undertakings at the end of the period was £75,737,982 and that the companies' capital expenditure was £20,211,615, giving a total investment of £95,949,597.

In comparing the revenue statistics it is necessary to eliminate the amounts paid by lessee to lessor undertakings. With this adjustment the gross receipts amounted to £23,957,179 in the case of local authorities, and £4,780,460 in the case of companies, giving a total of £28,737,639. The working expenses were as follows:—Local authorities, £18,896,573; companies, £3,836,582; total £22,733,155. The 1923-24 totals were:—Receipts, £29,433,647; working expenses, £22,847,032. From these figures it will be seen that the ratio of working expenses to receipts rose from 77.74 per cent. to 79.10 per cent. As a further comparison it may be mentioned that this ratio was 76.23 per cent. in 1922-23, and only 64.51 per cent. in 1913-14. The net receipts for 1924-5 were £6,004,484 and sundry additions brought this up to £7,368,080; these additions included aid from rates amounting to £521,801. On the other hand, the allocations included £281,732 to the relief of rates; £2,057,442 to interest and dividends; £1,644,816 to debt repayment; £536,144 to income tax; £1,916,485 to reserves; £130,724 to capital works charged to revenue; and other charges making the total £7,173,412, and leaving a balance of £194,668 to be carried forward.

In accordance with the usual practice the 176 undertakings have been grouped into six classes according to their financial results. In Class I, comprising undertakings which showed a credit balance for the year, after meeting all charges in full, there were 99 undertakings—one more than in 1923-24—showing a combined balance of £419,708 as against £404,101 in the preceding year. Undertakings in Class II, after meeting all charges, made reserves in excess of the amount available; there were 6 of these as compared with 9 in 1923-24, but the combined debtor balance increased from £42,600 to £108,824. In Class III—undertakings which met interest and capital redemption but failed to cover income tax and other charges in full—there were 15 undertakings, against 11, and the aggregate adverse balance was £38,342, as compared with £17,056. Twenty undertakings (Class IV) were unable to meet their capital redemption charges (as against 22) and their total deficiency was £46,394, as against £46,435. In Class V, comprising systems that were unable to pay interest charges in full, there were eight undertakings, as against 5, the total debtor balance rising from £87,789 to £296,437. Eight undertakings (Class VI) were unable to meet their working expenses by an aggregate of £212,618 (as against £136,067). The total result was an overall debtor balance of £282,907, comparing unfavourably with a credit balance of £74,154 in 1923-24, and even more so with a balance of £223,103 in 1922-23.

The statistics of railless trolley undertakings are given in separate form. During the period reviewed 13 local authorities and one company actually carried passengers; 20 local authorities did not exercise their powers. Six undertakings appear in the return for the first time, *viz.*, Ashton-under-Lyne, Croydon, Lowestoft, Manchester, Oldham, and St. Helens Corporations. The total route-mileage in operation was 57.48 (local authorities 54.57 miles). The number of passengers carried was 24,261,748 and the number of car-miles run 2,670,562. The operating ratio was 84.40 per cent. in the case of the municipalities, 95.09 per cent. for the company (Mexborough and Swinton), and 84.43 per cent. overall. A table giving the results of the undertakings in pence per car-mile for five years shows that a remarkable improvement occurred during the year under review. While the income rose from 14.09d. to 14.27d., the expenses were reduced from 12.96d. to 12.10d., raising the net receipts from 1.13d. to 2.17d. per car-mile. The net receipts of the municipal undertakings averaged 2.23d. per car-mile, while those of the company undertaking were 0.67d. The detailed statistics show that the amount expended upon railless trolley systems at the close of their respective periods was £365,829 in the case of municipal authorities and £16,911 in the case of the company.

The revenue during the year was £152,335 for municipal undertakings and £6,411 for the company, and the expenditure was £128,567 and £6,096 respectively, giving balances of £23,768 and £315. Four local-authority undertakings were unable to meet their working expenses, incurring an aggregate deficit of £3,571. The total available in the case of municipal undertakings was £27,189. Against this were charged interest, taxation, &c., totalling £28,055, leaving an adverse balance of £866. The largest of the undertakings—the Teesside Railless Traction Board, with a capital expenditure of £85,269—not only met all charges but was able to contribute £4,695 to the relief of rates and to put £1,500 to reserve. It must be stated, however, that the undertaking made no provision for loan repayment or interest. The combined municipal undertakings carried 23,267,561 passengers at an average fare of 1.56d., and operated 2,557,172 car-miles.

*Stationery Office, 15s. net.

Scientific and Industrial Research Report.—We have received a copy of the Second Report of the Adhesives Research Committee of the Department of Scientific and Industrial Research, price 3s. net, postage extra. It covers the period of three years since the Committee's first report appeared in 1922, and contains an interesting account of the work of that body. A clear step forward in the study of the chemistry of gelatin has been made by the production of a gelatin of very high purity. The product differs very little in this respect from ordinary high-quality glues. A method has been elaborated for the extraction of high-grade gelatin from bones in a far shorter time than has hitherto been possible, and should prove of practical value. But an achievement which should have important economic results is the development of a method of extracting an *odourless* and *tasteless* gelatin of high adhesive value by simple treatment from fish skins. Investigations designed to throw light on the fundamental nature of adhesion have been undertaken, and have already enabled some tentative conclusions to be drawn as well as indicating the uses to which particular adhesives are specially suitable. It has also been demonstrated that, provided a small amount of heavy loading material, such as lead sulphate, is incorporated in the glue, which does not materially affect the strength of the joint, X-rays may form a valuable means of detecting flaws in joints in finished structures. Finally, research has been continued on the utilisation of castor bean residues, together with colouring substances and fillers such as sawdust, in the manufacture of plastic materials. Tiles taking a high polish and suitable for flooring have been produced, and use has been found for the adhesive in the manufacture of water paints and distempers.

The Electricity (Supply) Bill.

The Proceedings in Committee.

STANDING Committee C of the House of Commons began consideration of the Electricity (Supply) Bill on April 27th. Sir Robert Sanders was in the chair.

On Clause 1, which proposes to set up a Central Electricity Board, consisting of a chairman and seven other members appointed by the Minister of Transport, Mr. Attlee (Limehouse, Lab.) moved an amendment which, he said, would pave the way for a further amendment which stood in his name, and which had as its object the substitution of the Electricity Commissioners for the proposed members of the Board. He said that in the Bill, the Electricity Commissioners were to be in a *quasi*-judicial position. In a number of cases disputes would have to be decided eventually by the Commissioners, and the feeling had been expressed in various quarters that under the Bill, the Electricity Board and the Electricity Commissioners were not sufficiently distinct to allow of the Commisioners acting in a judicial manner towards the operations of the Board. The two were regarded, in fact, as semi-detached, and not wholly detached. The Labour Party thought that, as the Bill was drafted, it was impossible to disconnect the Board and the Commissioners, and in a later amendment the Labour Party would propose another tribunal altogether. If it were accepted that some other tribunal should be set up, it appeared to be unnecessary to continue to have two distinct bodies, the Electricity Board and the Electricity Commissioners. Therefore his first amendment would make the Commissioners and the Board one body. The Labour Party held that if their view were adopted, the whole of the Bill would be enormously simplified and a clumsy duplication of authorities would be got rid of.

SIR DOUGLAS HOGG, the Attorney-General, said that although the Government were most anxious to accept any amendments that would tend to improve and simplify the Bill, they could not accept Mr. Attlee's amendment. In the first place, the Electricity Commissioners already had, under the Act of 1919, very complicated and responsible duties to perform, which demanded a body mainly technical in character. All the Commissioners but one, who was a man of great financial experience, were electrical experts. That did not, in the view of the Government, constitute the sort of body which they desired or thought suitable for performing the functions entrusted to this Board. The Government view was that the Board ought mainly to be a Board of wide financial and business capacity, although, no doubt, some knowledge of electrical matters might be of assistance. If the Government were to seek to put on the Commissioners all the duties imposed on the Board under the Bill, they would be imposing on them a task far greater than they could adequately perform.

Mr. A. GREENWOOD (Nelson and Colne, Lab.) expressed the perturbation which the proposed Board gave rise to in the minds of the members of the Labour Party. So far as he knew, this would be the first time in history that a nondescript body of business men would have very direct control over local authorities.

Mr. G. BALFOUR (Hampstead, U.) pressed the Attorney-General to give his views on a number of amendments of the same type which appeared on the Order Paper, as did also Sir F. Hall and Mr. Hartshorn.

SIR D. HOGG said if it was the wish of the Committee that they should have a discussion on the composition of the Board, he was quite willing to make a general statement. The functions of the Central Electricity Board would be to carry out the main scheme of the Bill, which was to lay down main transmission lines, and to determine where electricity could most suitably and most economically be generated. Under the clause, as drawn, the Government had deliberately left the composition of the Board not too precisely defined. It was not too much to say that the successful constitution of the Board would be almost the decisive factor in the operation of the scheme. The Board was entrusted with wide powers and with very responsible duties, and it was essential to get the most suitable men, whoever they might be and wherever they might be found. If the Committee desired it, the Government would have no objection to providing in the Bill what certainly would be done whether it was provided in the Bill or not, that before the Board was actually nominated the Minister would consult representatives of the various interests affected. The Government recognised that the Board ought, of course, to avail itself of any assistance which the Electricity Commissioners could render. Under the Bill as drawn the Board had power itself, when once it was functioning, not only to delegate to committees certain powers—which he hoped it would exercise freely towards the general electricity authorities and bodies of that kind—but to set up consultative expert committees which would advise it on technical matters. On Clause 4 the Government would be prepared, if the Committee thought it right, to suggest that, instead of the Board's framing a scheme and submitting it to the Electricity Commissioners for their approval, the Board should frame a scheme in consultation with the Commissioners. That would probably accelerate the preparation of a scheme. If the Commissioners were to sit as an appellate tribunal on the scheme, it would be difficult to advise on its framing. The Government hoped that the relations between the Board and the Commissioners would be friendly, but they did not intend that the Board should cease to exist and that the Commissioners should be put in its place. The Government did not propose to accept a series of amendments designed to destroy the Board as an executive body and to turn it into a purely judicial tribunal. Such a proposal cut at the whole framework of the Bill. It would be a mistake for the Board to be an elected body, but it should be, as the Commissioners were, a nominated body.

Mr. Attlee pointed out that Clause 4 provided for the hearing of parties to a scheme, but before whom would they be heard if the Commissioners were to be also responsible for the scheme?

SIR D. HOGG said that the Government proposed to substitute an appeal to the Minister of Transport from the scheme as constituted by the Board in consultation with the Commissioners. The Government thought that a tenure of office of five years was the minimum for a member of the Board, and there would be power to re-appoint any member at the end of that period. He felt that not less than five years and not more than ten years, would be a workable compromise. The Government was not prepared to debar a member of the House of Commons from sitting on the Board. Debates showed that there were members of the House who would be eminently desirable members of the Board. The Government had decided that there should not be representatives of various interests on the Board. It was not intended that each interest should nominate an individual for membership of the Board. He did not think it would be desirable to exclude a person from membership on the ground that he was directly or indirectly interested in the supply of electricity. For instance, if they were able to get Mr. Samuel Insull, of Chicago, to sit, he would be very sorry to find him disqualified because of his interest in electricity.

SIR JOSEPH NALL (Manchester, Hulme, U.) pressed the Attorney-General for further information as to the appeal which he had suggested from the Board. It now appeared that after the Commissioners and the Board had initiated a scheme, the parties interested would have a right of being heard, but by whom? By the Commissioners who initiated the scheme. They could then appeal to the Minister of Transport, who, presumably, when he heard the case, would have the Commissioners present with him. Could it be seriously contended that that was an appeal within the ordinary common practice adopted in this country?

SIR J. MARRIOTT took the same view, and SIR C. WILSON urged that the Board and the Commissioners should be consolidated, as there was not the slightest necessity for the two bodies. One competent body should be appointed which would have a fair chance from the State of being successful in its object.

After further debate, in which Mr. HARMSWORTH (Isle of Thanet, U.) and Mr. GROTRIAN (Hull, U.) urged the creation of an impartial appeal tribunal, Sir D. HOGG said that he did not think it was intended to lay down by Clause 1 that the Electricity Commissioners were to become a judicial body, or anything like it. It certainly never had been the intention of the Government, or of anybody connected with the scheme, that there should not be an effective appeal, and, of course, the suggestion that the Minister, after the Board had consulted with the Commissioners and prepared a scheme, should then consult the Commissioners as to whether the scheme should be approved would be a travesty of an appeal, and would also be a travesty of what he was going to propose on reaching Clause 4. He deliberately did not elaborate the appeal, but the suggestion would be that, just as under the 1919 Act, when the Commissioners had prepared a scheme it went up to the Minister for confirmation and the Minister decided, not in consultation with the Commissioners, because, if there was an appeal from their decision, they could not be consulted as to the hearing of the appeal, so, when there was an appeal under Clause 4 in regard to any scheme, there should be appointed by the Minister some appropriate person to hear everyone's objections. But every time one multiplied the hearing of the appeals, with expert witnesses, learned counsel, and the other paraphernalia of a judicial hearing, one added enormously to the costs which so far as the Board was concerned, would have to be borne by the consumers in the long run. A multiplicity of hearings and re-hearings, too great a delay, and too great an expenditure, would kill the scheme. With those qualifications, he was perfectly content to consider, when Clause 4 was reached, what was the best and most practicable way of creating an appeal in which the Committee would have full confidence. On the present amendment of Mr. Attlee's, the Government must adhere to the view that it was essential that there should be a Central Board, as well as the Commissioners.

The Committee then adjourned.

When the proceedings were resumed on April 29th, Mr. R. S. HUDSON, the Unionist member for Whitehaven, said that since the previous meeting of the Committee a number of members had been trying to find a way out of their present difficulties with regard to an appeal. There was a general feeling that there ought to be some form of an appeal tribunal. Discussion in the Committee would be simplified if it could

be borne in mind that there were two stages in the life of the Board. The first was the forming of the scheme, and the second was the administering of the scheme, and the relations between the Board and the Commissioners were not necessarily the same at both stages. It would shorten discussion if the Committee would regard the first four clauses of the Bill as forming a whole, and discuss on them the relations of the Board and the Commissioners during the first stage, and leave the relations between the Board and the Commissioners in the administrative life of the Board to a subsequent discussion. If that met with the approval of the Committee and the Government he would suggest that the Government should undertake, when Clause 4 was reached, to agree to the positions of the Board and the Commissioners being reversed—that the Commissioners, the technical people, should form the embryo schemes and that they should publish them, and that the Board should then hold a hearing and become a Court of first instance, giving an opportunity for all the interested parties to put forward any objection to the schemes. The Board, after hearing all parties, would then make such alterations in the scheme as it thought fit, and would publish the scheme. There should also be some kind of small appeal tribunal, which would hear only appeals from persons who considered that their interests had been prejudicially and unreasonably affected by the scheme adopted by the Board. It should not be allowed to consider anything that would have the effect of destroying any fundamental principle of the scheme, because it could not be expected that men of the eminence of those who would compose the Board, would, after drawing up a scheme, submit to the over-riding of that scheme by some appeal tribunal.

Sir D. Hogg agreed that the functions of the Board could be properly looked at in two different stages. He had had communications from more than one member of the Committee making suggestions with a view to meeting the difficulties which some members had indicated last time, and he was grateful to them and to Mr. Hudson for trying to discover some amendment which would not render the Bill unworkable, and which, at the same time, would meet the difficulties of getting some kind of appeal which would be speedy and cheap. He thought that in Mr. Hudson's suggestion there was at any rate hope of a successful solution. If Mr. Hudson and those associated with him would be good enough to frame the precise amendment which they suggested, he would be prepared to consider it favourably when Clause 4 was reached. As for Mr. Attlee's amendment, if Mr. Hudson's plan were to be adopted it would be necessary to reject that amendment, which, indeed, would pave the way towards the nationalisation of the industry, which the Labour Party desired.

In the discussion which followed, Sir C. Wilson (Leeds, Central, U.), announced his intention of supporting Mr. Attlee's amendment, as he was opposed to Mr. Hudson's suggestion, and Sir J. Marriott (York, U.) declared that he declined to be frightened by the bogey of Socialism, and, in the absence of a definite assurance from the Government that a judicial appeal tribunal should be set up, he would also support the amendment.

Lt.-Col. Ashley, the Minister of Transport, agreed that it would be better for the Board to have the final say in the scheme, and not the technical experts. The Government was perfectly willing to consider favourably the suggestion that the Bill should be turned round, that the Electricity Commissioners should frame the scheme—which they were eminently suited to do with their long experience and distinguished service—and that the Board should then consider the scheme and receive representations from those people who thought that they were adversely affected by it. Previous to that, the Board would, of course, have published the scheme. Then, those who considered themselves adversely affected financially by the scheme should have that the right of appeal from the Board to an independent tribunal. Such a proposal would, he thought, meet all the legitimate objections of those who wanted the Bill to go through. All that the Government desired was that there should be an independent appeal tribunal which would inspire confidence.

Mr. A. Greenwood (Nelson and Colne, Lab.) accused the Government of capitulating to those very interests which it had declared it would stand up against, and of letting down the local authorities.

Mr. G. Balfour (Hampstead, U.) regarded with favour the Government's new suggestion as to appeals.

Mr. Mardy Jones (Pontypridd, Lab.), in supporting Mr. Attlee's amendment, declared that the Commissioners, with their large technical knowledge, should remain as the nucleus of any Board that might be set up. He agreed that there should certainly be some form of appeal tribunal.

Mr. Hardie (Glasgow, Springburn, Lab.), asked some some assurance that the Board should not get into the hands of the business "sharks."

In view of the concessions which had been made by the Government, Sir C. Wilson intimated that he would withdraw his support from the amendment.

Mr. Attlee's amendment was defeated by 50 votes to 17.

Mr. Grant (Derby, S., U.) moved an amendment to provide that the Chairman of the Board should be "an experienced lawyer." Sir D. Hogg resisted the amendment, in view of the fact that the Board was to be entrusted with very important business functions. After discussion, the amendment was withdrawn. The Committee then adjourned until Tuesday, May 4th.

(To be continued.)

Czecho-Slovakian Imports and Exports.

The December issue of the monthly foreign trade returns of Czecho-Slovakia contains in a summarised form certain details of the imports and exports of the country for the twelve months of 1925. From these, the following figures relating to electrical material have been extracted, the corresponding statistics for 1924 having been added and notes of increases and decreases given. It will be noticed that imports of heavy apparatus are considerably greater than exports.

Imports.

	1924. Quintals.*	1925. Quintals.	Inc. or dec.
Dynamos and motors and apparatus permanently combined with them, also transformers—			
Total	12,668	17,563	+4,895
From Germany	5,411	8,343	+2,932
„ Austria	6,032	7,444	+1,412
„ United States	20	121	+ 101
Telegraph apparatus, &c.—			
Total	234	250	+ 16
From Germany	54	89	+ 35
„ Austria	150	150	—
Measuring and calculating apparatus—			
Total	1,437	1,680	+ 243
From Germany	934	1,127	+ 193
„ Switzerland	322	425	+ 103
Lamps, arc, incandescent, &c.—			
Total	1,363	1,780	+ 417
From Germany	466	552	+ 86
„ Hungary	338	457	+ 119
„ Austria	260	313	+ 53
„ Holland	263	406	+ 143
Electrical apparatus and electro-technical devices—			
Total	4,126	6,629	+2,503
From Germany	2,344	4,136	+1,792
„ Austria	1,295	1,459	+ 164
„ Switzerland	135	174	+ 39
„ France	65	392	+ 327
„ Hungary	15	42	+ 27
Cables and insulated wire—			
Total	382	231	− 151
From Germany	98	63	− 35
„ Austria	249	112	− 137
Carbons—			
Total	6,415	8,664	+2,249
From Germany	4,691	4,546	− 145
„ Austria	202	644	+ 442
„ Jugo-Slavia	1,365	2,364	+ 999

Exports.

	1924. Quintals.	1925. Quintals.	Inc. or dec.
Dynamos and motors and apparatus permanently combined with them, also transformers—			
Total	8,998	7,440	−1,558
To Austria	2,858	1,312	−1,546
„ Jugo-Slavia	385	702	+ 317
„ Germany	1,387	1,082	− 305
„ Poland	727	777	+ 50
„ Hungary	516	1,510	+ 994
Telegraph apparatus, &c.—			
Total	981	1,308	+ 327
To Austria	786	489	− 297
„ Germany	157	540	+ 383
Lamps, arc, incandescent, &c.—			
Total	2,687	3,254	+ 567
To United States	1,106	629	− 477
„ Austria	141	298	+ 157
„ Hamburg	317	742	+ 425
Electrical apparatus and electro-technical devices—			
Total	1,675	2,631	+ 956
To Austria	470	357	− 113
„ Germany	378	313	− 65
„ Poland	109	213	+ 104
Cables and insulated wire—			
Total	2,023	2,383	+ 360
To Rumania	578	577	− 1
„ Jugo-Slavia	490	538	− 48
„ Great Britain	244	461	+ 217
Electric carbons—			
Total	37	171	+ 134
To Jugo-Slavia	10	74	+ 64
„ Austria	8	43	+ 35

(* Quintal = 2 cwt.)

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

The "Heatrae" Electric Water Heater.

Figs. 1 and 2 show a domestic hot-water supply tank and a bath-water heater which have recently been introduced by MESSRS. ELECTRIC FIRES, LTD., King Street, Norwich. The domestic tank is fitted with a ball valve, operating in an entirely independent valve chamber. The water chamber is well lagged and enclosed in an outer casing, and a suitable overflow pipe and draw-off tap are provided. The heating apparatus consists of a small constant heater and a separate booster heater, the latter being of the combined switch and immersion-heater type, if desired, so that the whole is self-contained. The tank is made in capacities of from 10 to 30 gals., with constant and booster loadings of from 200 and 2,000 W to 300 and 4,000 W respectively. The bath-water heater consists of a



Fig. 1.—Domestic Hot-Water Tank.



Fig. 2.—Bath-Water Heater.

specially designed, unlagged, cylindrical copper tank. The cold-water inlet is taken to the top of the tank, the inlet pipe being fitted with a water control valve. The feed-water arrangement is such, it is claimed, as not to allow the water to syphon back in the event of the water supply failing, and provision is made on the outlet pipe to prevent dripping whilst the water is heating up. The loading is 4 kW and the capacity is from 5 to 15 gals. Both heaters are finished in white sprayed enamel.

A New Design of Tumbler Switch.

We have received from MESSRS. "M.K." ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, a sample of a new tumbler switch, fig. 3 ,which they have recently placed on the market. The design is on the general lines of the makers' foot-press switch, used in connection with electric fires, and can be supplied in the surface, sunk and semi-sunk types. The rated

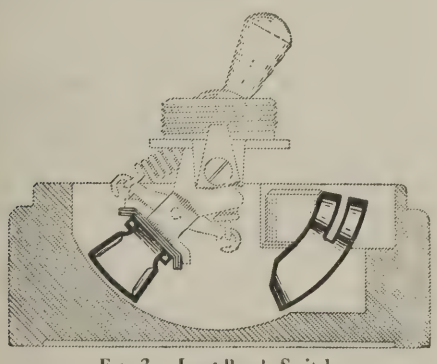


Fig. 3. Long-Break Switch.

capacity of the switch is 5-7 A and its special design and exceedingly long break renders it capable, it is claimed, of making and breaking four times that capacity Two tripping links, actuated by the dolly irrespective of the spring movement, give the contact arm a positive action throughout its entire stroke. A quick-make and-break action is transmitted by a strong flexible spring. The contacts are of phosphor bronze and the insulation is of pure mica which is specially treated to prevent surface leakage when installed in damp places.

The "Domestic" Electric Water Heater.

The accompanying illustration, fig. 4, the "Domestic" cistern, is one of a range of such apparatus which has been placed on the market by MESSRS. INVENTUM ELECTRICAL APPLI-

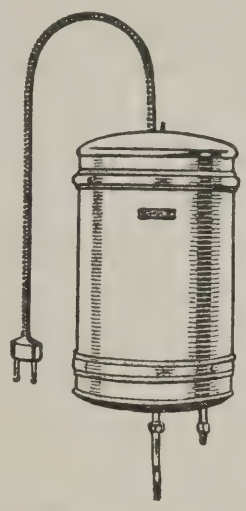


Fig. 4.—"Domestic" Water Heater.

ANCES, 124, Chancery Lane, London, W.C.2. The elements are of the electric-iron type encased in a tinned-copper sheath from which they can be withdrawn without emptying the tanks. The outer casing is of galvanised iron, while the inner casing or tank is constructed of tinned copper and is lagged with shredded cork. The apparatus is fitted with the "Inventum" bi-metallic thermostat (for use on a.c. only) which, it is claimed, can be adjusted to operate at any temperature up to 202 deg. F., the usual "temperature drop" allowed between "cutting" out and in being 10 deg. F. The capacity of the cistern is 1.5 gal., and the loading is 500 W. The range includes apparatus with capacities up to 22 gal. at loadings up to 500 W. A feature of the appliances is that the whole of the working parts can be removed, it is claimed, in 5 min., and the interior easily cleaned of scale and deposits, this possibility enabling a higher water temperature to be maintained.

A Non-Metallic Electric-Heating Element.

We have received from THE BRITISH RESISTOR CO., LTD., 32, Clare Road, Halifax, some particulars of a non-metallic element, "Globar," which they are introducing into this country. "Globar" resembles in appearance silicon carbide and the elements are usually manufactured in the form of round rods, ranging from 3 to 60 in. long, and from ¼ to 1 in. in diameter. The material is claimed to be unaffected by gas and chemical fumes and to have practically no coefficient of expansion, enabling liquids to be poured over the elements when operating at high temperatures. It is also claimed that the material does not decompose under temperatures of 3,000 deg. F. and that the material is being commercially used in electric furnaces for working temperatures up to 1,350 deg. C. The terminal portions of the elements are specially treated for increasing their conductivity. A variable characteristic of the material is its change in resistance through use, but it is claimed that this can be made negligible or entirely compensated for by the correct design of the apparatus.

A Car-Lighting Fitting.

THE LODGE FITTINGS CO., LTD., 57, Albert Road, Aston, Birmingham, has sent us a sample of its "Classic" car-lighting fitting, fig. 5, which has recently been put on

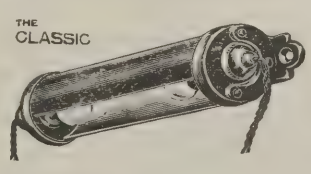


Fig. 5.—Car-Lighting Fitting.

sale. The device is designed as a trough lighting unit and accommodates a small b.c. lamp at each end. The trough is arranged as a revolving shutter so that the light can be focused to the most convenient position. The shutter is held at any position in the two end "caps" by virtue of its own spring, and it can be revolved by slightly pressing its centre at the edge. The device is contained in a suitable bracket which is fixed in the desired position by means of two screws. The inside of the shutter acts as the reflector and is silver-plated. The other parts are oxidised.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

Damage by Electric Wires.—On April 27th, Major Ruggles-Brise asked the Minister of Transport whether he was aware of certain contingencies which might arise, causing injury to persons, buildings, fences, crops, or stock during or after the erection of above-ground transmission lines or other electric lines.

Colonel Ashley said that owners and tenants of private land were safeguarded by the existing provisions contained in Section 22 of the Electricity (Supply) Act, 1919, and he did not consider that further provisions were necessary.

Fuel Economy.—On April 27th, in reply to questions by Mr. Hannon, Lord Eustace Percy said that research on the economical utilisation of fuel was being carried out under the Fuel Research Board of the Department of Scientific and Industrial Research. An account of the work in progress was given in the Report of the Royal Commission on the Coal Industry (Chapter IV), and fuller information would be found in the annual reports of the Fuel Research Board and of the Department of Scientific and Industrial Research.

P.O. Power Station at Taunton.—On April 27th, Lieut.-Colonel Gault asked the Postmaster-General whether he was aware that an independent power plant was being installed by his department at Taunton, where there was already an efficient and cheap public supply of electricity available with an adjacent main from the Taunton Corporation; and whether, in the interests of national economy, he would reconsider the erection of this plant and make use of the power generated from the existing system.

Sir Wm. Mitchell-Thomson said he was aware that arrangements were being made to install an independent electric generating plant in the new telephone repeater station at Taunton. It was essential to equip repeater stations with a complete electrical power unit, for use in emergency. At the smaller stations, such as that at Taunton, it was more economical to provide a second power unit and thus make the station self-contained, than to install the special plant which would be necessary to utilise energy from the public supply.

Wireless Experiments with America.—On April 27th, Sir A. Sinclair asked the Postmaster-General whether His Majesty's Government refused to conduct experiments in wireless telephony with either Australia or Canada on account of its commitments in the United States of America; and if so, whether he would explain the nature of these commitments and how long they would last.

Sir W. Mitchell-Thomson said that the only reason why the experiments had so far been confined to the United States was that the United States was the only country equipped with suitable transmitting and receiving apparatus for the purpose of reciprocal experiments. The Government was under no obligations to the United States which would preclude its undertaking experiments with Canada or Australia in the event of stations equipped for the purpose being provided in those Dominions.

Electricity Meters.—On April 29th, Viscount Sandon asked the Minister of Transport whether he would consider the desirability of taking power to safeguard the consumer by inflicting penalties on electricity companies where the meters were faulty and recorded excessive readings, and by inspection of these meters.

Colonel Ashley said he did not propose to suggest an alteration in the existing law on this subject, which, in his opinion, already adequately safeguarded the interests of the consumer.

The Doncaster Corporation Bill.—This Bill, which includes a clause giving the Corporation certain powers with regard to the wiring of houses and the supply of electrical fittings, was to come before a House of Lords Committee on May 3rd, but was adjourned *sine die*. We are informed that there is no opposition on the part of the Electrical Contractors' Association.

Legal.

Alleged Mercurial Poisoning.

At the Birmingham County Court, on April 28th, before His Honour Judge Ruegg, Lucy E. Goffe, Gravelly Hill, claimed for compensation, under the Workmen's Compensation Act, against the Birmingham Corporation, in respect of the death of her husband, Richard Goffe, on February 24th. He was employed as a meter repairer in the Electric Supply Department, and the applicant's contention was that his death was due to an industrial disease, namely, mercurial poisoning. Respondents contended that death was due to natural causes. Mr. Ward (counsel for applicant) said Goffe was 22 when he died, and his dependants were a widow and one child. He was in the employ of the Corporation for seven years, and it was in respect of the last two years that it was alleged mercurial poisoning was set up. During that time he was employed to inspect electricity meters in houses and factories, and possibly to clean them when it was required. These meters contained mercury, and before he was engaged on this work Goffe was strong and robust, but afterwards he complained of headaches, depression and internal pains. A local practitioner was called in, and he came to the conclusion that Goffe was suffering from poisoning in some form. Counsel described Goffe's symptoms as time went on, and said his wife had seen him remove small pellets from his hair and clothing. Paralysis and death ensued. A post-mortem examination was made by Professor Haswell Wilson, two days after the death, but no traces of mercury were found in the body at that time. Certain of the organs were sent to Mr. Rigby, an analyst, who then found traces of mercury in the liver, the kidney and the spleen. In the other parts of the body he found no traces. Counsel's submission was that although the final cause of death was myelitis, that myelitis was brought about by mercurial poisoning. Professor Morrison said death was due to myelitis, and no mercurial poisoning was present, his reason for saying this being that there was no change in any organ such as would be produced by chronic mercurial poisoning. Professor Haswell Wilson, Professor of Pathology at Birmingham University, who made the post-mortem examination, said he found no evidence of mercurial poisoning. His Honour, after consulting the medical referee, said that the matter would require careful consideration, and judgment would be reserved.

Marconi's Wireless Telegraph Co., Ltd., v. Pearl's Bargain Stores.

In the Chancery Division, before Mr. Justice Astbury, on April 28th, Mr. Trevor Watson moved for judgment in the case of Marconi's Wireless Telegraph Co., Ltd., against Pearl's Bargain Stores. Counsel said that this was a patent action. A defence was delivered, but it contained no particulars, and an order was made for particulars which had not been complied with and in consequence there was no defence. He therefore asked for judgment in the ordinary form—an injunction delivery-up, and an inquiry as to damages.

His Lordship gave judgment accordingly.

British Electric Vehicles, Ltd.

Mr. Justice Romer, in the Companies' Winding-Up Court, on April 27th, made an order for the compulsory liquidation of British Electric Vehicles, Ltd., on the petition of Batteries, Ltd.

Counsel for the petitioners said that they were creditors for £429 for goods supplied. There was no appearance for the respondent company, and no opposition.

Correspondence.

Correspondents should forward their communications at the earliest possible moment. ***No letter can be published unless we have the writer's name and address in our possession.***

British Goods Handicapped in Australia.

Being a comparative newcomer to Australia, there are one or two points I would like to bring to the notice of your readers. I have been in the electrical industry in London, Birmingham, and Manchester, and am naturally an enthusiast for British goods, and have found no difficulty in selling them against foreign makes. The majority of native Australians are not enthusiastic, and I think these are some of the reasons. There is a general feeling that America leads on manufactured goods, due to the advantage gained during the "drugged and doubting years" 1914-1917; the American representative is not slow to take advantage of this. Even worse, a representative of the B.E.A.M.A., writing in one of this week's trade journals, talks of unrelieved gloom in the electrical industry at "home." Would you give an order to a traveller who said his company was nearly bankrupt? Another point: Why do reputable English manufacturers give their agencies to men who have no sympathy with British trade? Very often a good agency is run in conjunction with Japanese goods, or even Belgian dolls. The agent very often does not know anything about the goods, and will show an English cast article against an American stamping; when asked to explain the difference in price, "one is English and one American" is all he knows. Does the average manufacturer know how large Australia is and what it can take in electrical goods?

Wake up! Cheer up!

Salesman.

March 25th, 1926.

Three-phase, 4-wire Distribution.

Referring to "Inquirer's" question in your issue of the 23rd ult., perhaps the following remarks may be of assistance to him. I am presuming that his letter referred to a group of three single-phase transformers, and that the actual text, as printed, is in error when it states that "three THREE-phase core-type transformers" were to be connected star/star.

If unbalanced single-phase loads are connected between phase lines and secondary neutral, the star/star-connected bank will not operate successfully unless the primary neutral is connected to the neutral of the generator.

Assuming that a single-phase load be connected between one phase line and the secondary neutral, and that the other

two phases are not loaded, then the current for the load will flow through the neutral line, through the secondary of one phase of the transformer, and through the phase line connected to the loaded phase of the transformer. A load of this kind draws current from only one secondary of the transformer. A corresponding current must flow in the primary winding of the loaded phase. But, when the primary is star-connected, and its neutral is not connected to the neutral of the generator, then the current for the loaded phase must pass through one or both of the other phases. Similar results are produced when the three phases are unequally loaded by connecting single-phase loads of different values between phase lines and neutral. The voltages induced in the phases due to unbalanced load are in addition to the impressed voltages. The resultant voltages produce extra voltage stresses on the insulation, and may produce a high iron loss, which may increase the temperature of the transformer. If the primary neutral (of the transformers, or transformer, if it is three-phase) be connected to the generator neutral, the transformers should operate satisfactorily, provided they are of good design.

W. G. Stuart.

Trethomas, *May 1st*, 1926.

[The wording was published as received by us.—EDS. ELEC. REV.]

Propeller-type Runners for Hydraulic Turbines.

We have read with interest the article in your issue of April 23rd pointing out the advantages of the Kaplan runner. But are its advantages over other propeller runners worth its high cost, and greater liability to breakdown, due to the necessity of installing a large amount of mechanism in a most inaccessible part of the turbine?

It is true that owing to its higher speed the alternator should be cheaper, but then other factors arise which tend to neutralise this advantage.

It is also true that high efficiencies at low gate openings are obtained, but in practice all large stations have two or more units, and it is therefore not necessary to operate the turbines at their low gate openings.

When considering the Lilla Edet scheme, the Swedish Government engineers thoroughly investigated and tested the relative advantages of the Kaplan and Lawaczeck runners, and the result of their investigations was that one Kaplan and two Lawaczecks were ordered. We believe their main reason in coming to this decision was greater assurance of reliability with the latter.

The first trial run of the Lawaczeck turbine has already taken place, and when tested on a net head of 6.2 metres, this turbine gave 11,000 b.h.p. against a guaranteed output of 9,350 b.h.p. on that head.

James Gordon & Co., Ltd.
JAMES GORDON, *Director.*

London, *May 1st*, 1926.

The Heating of Buried Cables—Report No. 2.

We are much indebted to Major Taylor for calling attention, in his letter published in your issue of April 30th, to the discrepancy in the formulæ for calculating "K" as between the earlier report in 1921 and the later one as published in the *Journal* of the Institution of Electrical Engineers, Vol. 61, p. 517 *et seq.* In the first report the quantity "Q" was used to represent the heat developed in the whole cable, and was correctly employed in the corresponding formulæ. In revising the symbols for the larger report it was the wish of the Sub-Committee to employ the quantity "H" to represent the total heat in watts developed in each centimetre length of each conductor as set out on p. 534 in the *Journal*. Owing to a regrettable slip the formulæ as previously given for "Q" were not corrected for this different meaning of "H," so that, while formula (23) is correct, "H" should read "2H" in formula (24), and "nH" in formula (25). None of the values of the thermal resistivity given in the report are affected by this *lapsus calami*.

Major Taylor's comments hardly serve to make the matter clear, and his description of a 3 : 1 error as an error of 300 per cent. needs revision, but in view of his letter referring specifically to Mr. Melsom's work and his present absence in America, I, as joint author of the report, beg to offer the above explanation with the approval of the Director of Research.

Printer's errors which escaped correction in the *Journal* occur in equation (58) where "r" should be "R_1," and in equation (37) where "I_2" should be "I^2."

E. Fawssett.

Westminster, *May 3rd*, 1926.

Science Congress in France.—The annual congress of the French Association for the Advancement of Science is this year to be held in Lyons from July 24th to August 1st next. For the last ten years an exhibition of scientific apparatus has been held in connection with the Congress, but as this year's is the fiftieth of the Congress it has been decided to give the display of scientific and technical apparatus a much more comprehensive character. Interested firms can obtain particulars of the exhibition from the offices of the Foire de Lyon, 1, Rue Blanche, Paris.

Reviews.

Junior Technical Electricity. By R. W. HUTCHINSON, M.Sc. Pp. viii + 382; figs. 327. London: University Tutorial Press, Ltd., and W. B. Clive. Price, 4s. 6d. net.

A fair idea of the scope of this book may be obtained from the fact that the first diagram is of a piece of magnetite with iron filings adhering to it and the last is of a three-valve wireless receiving set. The book is issued as a First Year Course in Electrical Engineering for students in Technical Schools and Colleges, and, in view of the fact that no previous knowledge of electricity is assumed, we are inclined to regard the author's estimate of the time taken to cover the course as a trifle optimistic. However, admitting the truth of the adage, "A man's aim should exceed his grasp," and allowing Mr. Hutchinson a certain latitude in his measurement of time and human capacity, we would say at once that he has covered much ground with thoroughness and has struck a good balance in his treatment of the theory and practice of electricity.

There are twenty chapters in the book and the subjects are taken in the usual order, the first five chapters treat of Magnetism and the two next of Electrostatics, while the latter part of the book treats in succession the properties of currents and the phenomena of electromagnetic induction and its application to generators, motors, instruments and telegraphy.

While realising the importance of good electrical conductors few students of electrical engineering gain sound conceptions concerning the properties of magnetic materials and often fail to appreciate the value of low hysteresis losses. It is satisfactory to note that some stress is laid by the author on magnetic properties and the practical applications of magnetism.

We must confess to finding the chapters on Electrostatics a little *dry*, an impression that is intensified rather than diminished by the very free use of *italics* and the frequent changes of type.

The chapters on the magnetic, chemical and heating effects of the electric current are sound and practical. We rather doubt the wisdom of devoting so much space nowadays to arc-lamps, and would suggest that, in view of the greater use of the arc for welding and furnaces, brief reference to these applications would have been preferable to details of arc-lamp mechanisms. Generators and motors are treated in an elementary but useful manner, and there is quite a good concluding chapter on radio communication.

A useful feature of the book is the number of worked examples, and there are also exercises appended to each chapter. Viewing this book side by side with its elder brother "Technical Electricity," we are somehow reminded of a now famous poster in which an emaciated bather contemplates his corpulent reflection in the convex surface of a familiar bottle. But while the addition of the word "Junior" to the title has produced some emaciation it does not seem to have impaired the soundness of constitution of this last addition to Mr. Hutchinson's literary family.

P.H.S.K.

Telephone Communication Systems. By ROYCE GERALD KLOEFFLER, Kansas State Agricultural College. Pp. vii + 284; figs. 213. London: Macmillan Company. Price, 17s. net.

This, the latest manual of the Engineering Science Series, has for its object the presentation of the subject of telephony in a general manner suitable for short college courses in that particular field. In the twenty-two chapters into which the work is divided, the author deals with the transmitter and receiver, magneto and signalling systems; non-multiple, multiple and universal switchboards, intercommunication systems, automatic telephony—Strowger and panel-type—lines, testing, repeaters and multiplex telephony, and radio-telephony.

Detailed descriptions of apparatus and circuits are avoided by selecting typical items illustrative of fundamental principles. Realising the difficulty which many students experience in tracing out complicated circuit diagrams, the author, by the use of partial circuits, leads up to the more complicated complete ones; and although unable, within the limits to which he has restricted himself, to go into too much detail, succeeds in giving the reader sufficient to enable him to obtain a fair grasp of the subject. The volume is fully equal to the other members of the series in the excellence of its illustrations and letterpress, and although written from the American standpoint, will prove a useful book to those whom the author describes as "having to explain communication problems to the public and others."

Turbo Blowers and Compressors. By W. J. KEARTON. Pp. xv + 333, with 152 illustrations, including 7 folding plates. 8½ in. by 5½ in. by 1¼ in. London: Sir Isaac Pitman & Sons, Ltd. Price, 21s. net.

The development of the high-speed electric motor has led to the introduction of many entirely new types of machines for all manner of industrial processes. Instead of being driven either directly by low-speed reciprocating engines or through belts or toothed gearing, the machine can be direct-coupled to the motor, and owing to the high speed of the latter a light, compact, and therefore less costly, unit is obtained. A very good example of this new type of machine is to be found in the turbo-blower and centrifugal compressor—the author does not deal with the reciprocating compressor—and it is this new type of machine which forms the subject of this book. These machines have been developed to take the place of the low-

speed reciprocating blowers, compressors, gas pumps and exhausters, and it is indicative of their recent introduction that this is the first text-book published in this country dealing exclusively with their design, construction and regulation.

The theory of the centrifugal pump is familiar to every engineering student and can be easily understood, but the theory of the centrifugal blower or compressor, which is in reality a centrifugal pump dealing with compressible fluids such as air, coal gas, &c., instead of incompressible fluids such as water and oil, is not so easily explained. The author, however, deals with this part of his subject in his opening chapters in a very direct and concise manner, giving first of all a chapter on the compression of air in which he discusses the usual theories of isothermal and adiabatic compression, entropy, specific heat, and work, all of which are equally applicable to rotary as to reciprocating machines. The problems of the losses inseparable from the centrifugal compressor, the necessity of interstage cooling and the various cooling systems employed, and the efficiency of this type of machine are then discussed, the more theoretical part of the book being closed with a chapter on regulation.

What we may term the second part of the book deals with the more practical problems of design, testing, and operation. In this part the author has described in detail, illustrating his remarks with a number of folding plate drawings as well as smaller detail drawings, of actual machines, these including blowers for blast furnace and cupola work, compressors having eleven or twelve stages, and capable of delivering air up to pressures of 100 lb. per sq. in. and suitable for pneumatic plant as well as exhausters for operating ash suction, and grain suction plants. A useful chapter on the critical speed of shafts is included in this section and while one could suggest that it might rather find a place in a text book on strength of materials, its inclusion is justified by the application of the theories given to the case of high-speed blower and compressor shafts. Another very interesting chapter is that dealing with the turbo-blower as an auxiliary to the internal combustion engine. For the two-stroke engine this type of machine is used for scavenging the cylinder, while for the four-stroke engine it finds its application for supercharging, which is, of course, equally applicable to the engine working on the two-stroke cycle. An interesting application of this is to be found in the aero engine, where blowers driven by exhaust gas turbines are employed to overcome the effects of reduction in the atmospheric pressure with altitude.

It will be realised, therefore, that this book deals very fully with the subject from the point of view of the student and the designer. We would have wished that the author had in one of his preliminary chapters given a brief *résumé* of the various purposes to which the rotary blower for pressures up to, say, 10 lb. per sq. in. and the centrifugal compressor for pressures above this figure have been put, and of their advantages and disadvantages as compared with the reciprocating types. It might also have been of interest if some suggestions could have been made as to the possibilities of further applications and developments of the rotary machines. From the electrical engineer's point of view these have the advantage of requiring the electric motor to drive them—unless, indeed, they are so large that they are direct coupled to the steam turbine itself, as is already being frequently done. But with these reservations we can heartily recommend this book to all those who are interested in this newer and more economical method of compressing gases.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 28th :—

H.G., Horace Green & Co., Ltd., Cononley, Keighley, Eng. (lettering and design). No. 455,001. Class 6. Electric motors and dynamos.—Horace Green and Co., Ltd., Cononley, Keighley.

Permatector. No. 467,806. Class 8. Rectifiers for radio receiving sets.—Brownlie Wireless Co. of Great Britain, Ltd., 310a and 312a, Euston Road, N.W.1.

Miniloss. No. 468,211. All goods in Class 8.—Sterling Telephone and Electric Co., Ltd.

Ceag (lettering and design). No. 453,217. Class 13. Electric lamps, contacts and terminals, fittings, fusible cut-outs, switches, &c., all for use in connection with miners' electric safety lamps.—"Ceag" Miners' Supply Co., Ltd.

Harelda (lettering and design). No. 465,583. Class 13. Electric lamps (ordinary).—Harelda, Ltd., 5, Suffolk Street, Pall Mall, S.W.1.

The L.C.C. Tramways and Street Improvements.—Since the London County Council commenced to operate tramways, in 1899 the undertaking has been called upon to make contributions towards the cost of the widening of streets through which the tramways run, and the annual charge has been in the neighbourhood of £30,000. The Highways Committee considers that the time has arrived when the undertaking should be relieved of a burden which is not shared by other transport systems, except in such cases where the cost of improvement is increased by the special requirements of the tramways. Where improvements are carried out solely on account of the tramways, the cost should be charged wholly or partly to the tramway accounts. A resolution embodying recommendations on these lines was to be submitted to the London County Council on Tuesday last.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

6,510. "Methods of protecting electric transformer oils against oxidation." British Thomson-Houston Co., Ltd. March 13th, 1923. (212,928.)

21,639. "Receiving sets for wireless telephony." R. B. Matthews and W. H. R. Pike. July 13th, 1925. (250,278.)

23,874. "Inductance coils, variometers, transformers, and the like applicable for use in high-frequency circuits." W. J. Rickets and J. W. Dunthorne. October 9th, 1924. (250,282.)

26,650. "Waterproof electric fittings." M. Sieverts Fabriks Aktiebolag. November 7th, 1923. (224,553.)

31,256. "Electrical control systems." Metropolitan-Vickers Electrical Co., Ltd. January 2nd, 1924. (227,114.)

31,262. "Electric gasfilled discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 11th, 1924. (Addition to 236,155.) (239,826.)

1925.

59. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (C. R. H. Arntzenius). January 1st, 1925. (250,304.)

393. "Loud-speaking telephone apparatus." A. E. J. Vlug. January 6th, 1925. (250,308.)

833. "Impulse transmitters, particularly for use in automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 10th, 1925. (Cognate application 834/25.) (250,332.)

836. "Sparking plugs." E. Von Lepel. April 4th, 1924. (231,834.)

848. "Electrode supports for secondary batteries." J. Stone & Co., Ltd. (P. Butchart). January 10th, 1925. (250,333.)

1150, "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 14th, 1925. (250,342.)

1,252. "Thermionic valves or electron-discharge tubes." Mullard Radio Valve Co., Ltd., L. S. Harley, and O. S. Pratt. January 15th, 1925. (250,343.)

1,601. "Electrically-heated toaster." B.-A.-G. Broncewarenfabrik Akt.-Ges. Turgi. February 1st, 1924. (228,522.)

1,760. "Electric illuminated advertising device." C. Gleerup-Moller. January 20th, 1925. (250,347.)

4,416. "Ferro-concrete foundations." W. Eccles, T. G. Williams, and Metropolitan-Vickers Electrical Co., Ltd. February 17th, 1925. (250,363.)

6,223. "Non-slipping and cushioning attachment for use with the metal straps or bands of wireless and other headphones." A. P. R. Willis. March 7th, 1925. (250,374.)

6,256. "High-tension batteries for wireless signalling apparatus." L. Kremner. March 7th, 1925. (250,375.)

6,938. "Methods of remote control for reversible electric motors." Smith, Major & Stevens, Ltd., and P. H. Stevens. March 14th, 1925. (250,377.)

6,984. "Independently-excited thermionic valve radio transmitters." Telefunken Ges. für Drahtlose Telegraphie. March 15th, 1924. (230,853.)

7,950. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), R. A. More, and G. C. Hartley. March 24th, 1925. (250,381.)

8,187. "Electric time switches." G. E. Tate, F. O. Monkhouse, and A. F. Walters. March 26th, 1925. (250,386.)

8,564. "Arrester device for protecting wireless or other electrical apparatus from atmospheric electricity." S. E. Needham. March 31st, 1925. (250,388.)

14,577. "Voltametric measuring devices." Siemens Schuckertwerke Ges. June 18th, 1924. (235,865.)

14,767. "Diaphragms for acoustical instruments." L. Lumiere. June 7th, 1924. (235,222.)

14,891. "Electric batteries for clocks." B. Newth and O. Newth. July 7th, 1924. (236,531.)

15,303. "Pipes or conduits for electric cables." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. June 12th, 1925. (250,424.)

16,428. "Microphones." E. Reisz. June 25th, 1925. (Patent of addition not granted.) (250,430.)

16,849. "Shock-absorbing mounts for thermionic valves or other electrical devices." Benjamin Electric, Ltd., and G. Campbell. June 30th, 1925. (250,431.)

18,172. "Electric lamp pivot." A. Lederer. July 16th, 1925. (Convention date not granted.) (237,891.)

18,457. "Electrically-operated surgical or dental instruments." W. J. Cameron. July 20th, 1925. (250,442.)

18,595. "Shock-absorbing sockets or holders for thermionic valves or other electrical devices liable to be injured or affected by shocks or vibrations." Benjamin Electric, Ltd. July 21st, 1924. (237,296.)

18,726. "Combined head-lamp, dimming switch, and horn switch for motor vehicles." N. B. Moss. July 22nd, 1925. (250,445.)

18,879. "Electrolytes for secondary batteries." L. F. Ducker. July 24th, 1925. (250,448.)

19,291. "Electric fuses." W. Whitehead. July 30th, 1925. (250,451.)

20,984. "Electromagnetic device producing a sustained intermittent movement." Soc. Anon. des Etablissements Tecalemit. September 2nd, 1924. (239,503.)

21,500. "Electromagnetic loud speakers." O. Bothe. September 26th, 1924. 240,425.)

21,701. "Thermionic valve holder." B. Nicholitch. August 29th, 1925. (250,460.)

22,533. "Regulating apparatus for electric supply systems." British Thomson-Houston Co., Ltd. September 23rd, 1924. (240,437.)

23,109. "Arc-welding apparatus." British Thomson-Houston Co., Ltd. September 16th, 1924. (240,159.)

24,047. "Holder for thermionic valves." B. Nicholitch. September 26th, 1925. (250,471.)

24,503. "Device for regulating electric voltages." Naamlooze Vennootschap Machinerieen-en Apparaten Fabrieken. October 9th, 1924. (241,187.)

25,402. "Electrical testing apparatus." G. A. Iler. October 12th, 1925. (250,476.)

25,418. "Loaded electrical conductors." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Bell Telephone Laboratories, Inc.). October 12th, 1925. (250,477.)

25,459. "Electric flue-gas testing apparatus." G. Sokolow-Wichnevsky. October 12th, 1925. (250,478.)

27,596. "Electrical condensers." H. Seurat. November 4th, 1924. (242,642.)

28,331. "Electron discharge devices." Standard Telephones & Cables, Ltd. (Bell Telephone Laboratories, Inc.). November 10th, 1925. (250,485.)

29,369. "Electrodes of vacuum apparatus." W. Dallenbach. November 20th, 1924. (243,378.)

29,844. "Protective arrangements for electric distribution or supply systems." Switchgear & Cowans, Ltd., and G. H. Neep. November 26th, 1925. (250,494.)

30,580. "Methods of making insulators." D. H. Rowland. December 9th, 1924. (244,455.)

31,882. "Method of and apparatus for continuously cleaning insulators used in electrical gas-cleaning and dust-precipitating installations." Lodge-Cottrell, Ltd. (Metallbank und Metallurgische Ges. Akt.-Ges.). December 17th, 1925. (250,499.)

1926.

723. "Manufacture of lead-sheathed telephone cable." W. T. Henley's Telephone Works Co., Ltd., and W. Bone. January 9th, 1926. (250,507.)

1,314. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and F. Tench. January 6th, 1925. (Divided application on 249,248.) (250,510.)

The

Electrical Review

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LIST OF FOREIGN AGENTS (see first page "Official Notices").

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Ourselves and the Emergency.

IN consequence of the General Strike, which lasted from midnight on May 3rd until midnight on May 12th, the weekly trade and technical papers, in common with practically all other publications, were prevented from making their appearance. The ELECTRICAL REVIEW for May 7th had been passed for press, and in that form it was obliged to remain until the Strike was called off and subsequent negotiations between the Newspaper Proprietors, the Master Printers, and the various unions —which extended over nearly four days—were concluded.

Immediately it was known that the issue of May 7th would be delayed, arrangements were made for the preparation of a special Electrical News Summary of four pages to be issued weekly so long as the emergency should last. Accordingly one such Summary was circulated by letter post to regular subscribers, advertisers, and others whose addresses were on our lists, on May 7th, and a second was dispatched on May 14th. It was, of course, impossible for us similarly to meet the requirements of regular readers who purchase their copies through newsagents.

In the present supplementary issue, dated May 14th and 21st, we have endeavoured to cover the principal electrical news that has reached us up to the time of dispatch, and we wish to announce that the full normal issue of the ELECTRICAL REVIEW will make its appearance at the usual time on Friday, May 28th.

The Strike and its Results.

THE passing of the great General Strike, which had been held up before the eyes of the British public as a menace from time to time, was hailed with relief not only by the nation but by the whole civilised world. Its prospective terrors proved, when put to the test, to exist only in imagination, and its ignominious failure to achieve its objects has for ever laid the spectre which haunted the thoughts of our statesmen. It failed simply because the great majority of the British people declined to accept the dictation of a minority, and quietly but with unshakeable resolution determined to "carry on." Perhaps the most noteworthy features of the struggle were the orderly manner in which it was conducted by both sides, and the short duration of the conflict; it was brought to an end before any section of the community had incurred serious suffering and before temper had been aroused—hence it leaves little bitterness behind.

Unfortunately, it cannot be denied that the trade and industry of the country have been severely dislocated, and the ill-effects of the strike will be felt for many months to come; the rising tide of returning prosperity has been stayed for a time, but we hope and believe that the magnificent demonstration of British stability and sanity which has been afforded by the recent events will secure and enhance the confidence of foreign customers. The prestige of Great Britain never stood higher than it does to-day. Despite the loss and inconvenience to which we have all been put, we think the nation will feel that it was a good thing to "get it over" and to be done with the general-strike bogey once for all.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Electricity (Supply) Bill.—Owing to the crisis the consideration in committee of this Bill was postponed. On May 14th the House of Commons in Committee considered the following resolution:—"That it is expedient to charge on the Consolidated Fund any sums required by the Treasury for fulfilling any guarantees or payment of interest or principal on any loans raised under any Act of the present Session to amend the law with respect to the supply of electricity which may be given by the Treasury under the Act."

Several Unionist members criticised the resolution, and Major KINDERSLEY objected to the Committee's being asked to pass a guarantee for £33,500,000. He moved to limit that resolution to a sum not exceeding £10,000.

Mr. RADFORD thought the guarantee unnecessary, and contended that a well-drawn up prospectus, pointing out that the Electricity Board would have a potential monopoly of electricity, would raise the money required at 5½ or 6 per cent., without any Government guarantee.

Mr. G. BALFOUR was convinced that if the Bill emerged from the Committee in its present form the only result of the resolution would be to raise the price of the money which from this time forward had to be employed in the private development of electricity.

Sir D. HOGG, the Attorney-General, said that it was not correct to say that when the Board required £33,500,000 it would be in a position to raise the money on commercial terms on the Stock Exchange. The Board was by its constitution precluded from making any profit, and when it raised money for building its main transmission lines it would have no assets in its possession. There was no question of a monopoly as a money-making concern, but merely a question of a Board formed to discharge a great public function. It was an essential part of the scheme that this guarantee should be given. The Committee by the resolution was only authorising the discussion of the corresponding clause of the Bill when it was reached by the Standing Committee.

The amendment was rejected and the resolution agreed to.

The consideration of the Bill in Standing Committee C was resumed on Tuesday, May 18th.

Imperial Radio-Telephony.—On May 4th, Lord WOLMER, the Assistant Postmaster-General, informed Sir H. Brittain that he had seen a statement that there were stations in Australia capable of radio-telephonic communication with this country, and he had asked the Australian authorities for particulars, stating that, if suitable stations were available, the British Post Office would welcome the opportunity of conducting experiments in radio-telephony between Great Britain and Australia.

Broadcasting.—On May 4th, Lord WOLMER informed Lt.-Commander Kenworthy that the Government had decided to accept in general the recommendations of the Broadcasting Committee as to the constitution of a new authority to control the broadcasting services, and was now considering the method to be adopted to give effect to them.

Electrical Artificers.—On May 6th, Mr. BRIDGEMAN, in reply to questions by Mr. Hore-Belisha, said that over 30 chief and other electrical artificers were at present fully qualified for promotion to warrant electrician and on the roster for promotion. Promotion to the rank was being made as vacancies occurred, but as the number on the roster was amply sufficient to cover any vacancies which were likely to occur in the near future, it had been thought desirable, as a temporary measure, to suspend the examination for promotion until the number on the roster was reduced.

Legal.

Fuller's United Electric Works, Ltd.

IN the Companies Winding Up Court on May 11th, Mr. Justice Romer ordered an adjournment of the petition of Mr. R. H. Symonds, of Albany Buildings, Victoria Street, S.W., for the compulsory liquidation of this company to allow negotiations to proceed for the drafting of a scheme which Mr. Whinney, for the company, said would enable the company to restart business. It was hoped to make arrangements with the debenture holders. Under the scheme further capital would be needed and there was no doubt that that would be obtained.

His LORDSHIP said it sounded as if the scheme might be worth considering.

Theft of Valves.

AT the West London Police Court, on May 7th, before Mr. Ratcliffe Cousins, Ernest Sydney Hunt (35), machine operator, of Richmond, appeared on remand charged with stealing eight valves, valued at £5, belonging to his employers, the M.O. Valve Co., Ltd., Osram Works, Hammersmith. He was arrested a week previously, and 30 other valves were found in his house. The defendant was sentenced to one month's imprisonment with hard labour.—*Richmond and Twickenham Times*

Magneta Time Co., Ltd., v. Stonebridge Electrical Co., Ltd.

IN the Chancery Division, before Mr. Justice Russell, on May 7th, Mr. Bray, for the defendants in this action, said that he had a motion for rectification of the register, and the question was how it should be heard. The Stonebridge Co. were the distributors in this country of electric clocks made by a firm at Zurich. They had not been selling these clocks as "Magneta," except that in one of their catalogues was a photograph of one of the Swiss clocks, on which, if one looked through a magnifying glass, the word "Magneta" could be read. Plaintiffs had commenced an action for infringement in respect of that and for trade libel. The defendants were now applying to meet that by rectification of register. "Magneta" was registered in 1908 by plaintiffs' predecessors, and renewed in 1922, when the original company had been dissolved for five years, the application for renewal being apparently by the agent of the plaintiffs. Invalidity of the renewal would be urged.

Sir DUNCAN KERLY, K.C., explained, for plaintiffs, that the agent did not know of the assignment of the trade mark to the plaintiffs at the time, and omitted to register. A change of address had to be made. The goodwill was sold to plaintiffs and the trade mark assigned to a Mr. X, and then by Mr. X to the plaintiff company. That had been registered, and he (Sir Duncan) was to apply to the Controller of Patents to renew the mark to the plaintiffs, as he had power to do, and that renewal would no doubt be made retrospective.

Subject to Sir Duncan doing that without delay Mr. Justice RUSSELL said he would give him the opportunity of doing it and of giving notice to the other side for the second motion day of next sittings.

Sequel to False Pretences Charge.

AT Old Street, on May 5th, Anatole Ivan Zaitzeff, merchant, Victoria, S.W., was charged on remand "that you, a person against whom a bill of indictment was found by the grand jury at the Central Criminal Court on September 8th for having conspired with other persons to defraud such persons as should be induced to part with goods to N. A. Ludwin and Co. and Importex, Ltd., by false representations, did fail to appear or plead to the said indictment." Mr. Clarke Hall made a committal to the Central Criminal Court, and Zaitzeff appeared before Judge Atherley Jones, K.C., on Monday last.

Lissen, Ltd., v. Pullen.

IN the Chancery Division, on May 7th, by consent Mr. Justice Russell granted an injunction to Lissen, Ltd., restraining Mr. Pullen, Fulham, from infringing its trade mark "Lissenstat" in connection with wireless goods. The defendant had agreed to submit to a perpetual injunction and to deliver up infringing goods.

Reflex Radio Co., Ltd.

MR. JUSTICE ROMER, in the Companies' Winding Up Court, on May 11th, made an order for the compulsory liquidation of this company on the petition of Watson Jones, Ltd., of 235A, Blackfriars Road, S.E., wireless and electrical engineers, creditors for £191 for goods supplied. There was no opposition.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Sports.—We are informed that Messrs. Wm. Geipel's Sports Club Association Football XI had a highly successful season, finishing up champions of the Premier Division of the Harrow and District Football League.

German Cable Works Development.—It is proposed to establish a community of interests between the Isola Works Company of Duren-Birkesdorf and the firm of Karl Heinz and Company of Rodenkirchen. Both works produce similar articles and complement each other in their equipment, while at the same time the Rodenkirchen company has recently brought into operation a modern factory for the manufacture of lead-covered cables.

For Sale.—Southampton Corporation Electricity Works has for disposal one Cole, Marchent & Morley triple-expansion engine with surface condenser, pumps, &c., direct coupled to a 1,000-kW Dick, Kerr d.c. generator. Mr. H. J. Shaw will sell by auction, on June 1st and following day, at the Westmoreland Petrol Station and Garage, Norwood Road, Herne Hill, S.E., 150 1-kW electric rotary converters, 25 electric motors and dynamos, a quantity of electric lamps, 1,000 inert cells, wireless sets, &c. (See our advertisement pages to-day.)

Low-Temperature Carbonisation Developments. — *The Times* reports that a scheme for the reorganisation of Low Temperature Carbonisation, Ltd., and Gas and Fuel Plants, Ltd., and amalgamation with the Barnsley Smokeless Fuel Company has been approved by shareholders and creditors. Under the scheme £150,000 fresh capital is provided by the issue of that amount of 8 per cent. prior lien debenture stock.

Electrical Work for New Buildings : Architect or Building Contractor?—Writing under the title "Are We Barking Up the Wrong Tree?" *Electrical Merchandising* says:—"For some time the electrical industry has been concerned with establishing a working connection with the architect, on the theory that through this avenue approach can be made to the better class of homes. Now comes an analysis of the record of buildings erected in one western community, which suggests that the architect has perhaps been given too prominent a place in the picture and that time may more profitably be spent in educating the man who is handling the far greater part of the home construction in the average city—namely, the contractor and builder. On a single day, the city of Oakland, California, issued permits for the building of 105 homes. Of these, but two passed through the hands of architects. Berkeley allowed 29 homes to be erected, of which five had architects. Alameda issued five permits, with but one architect involved. This was a typical day and typical not of this community alone, but of conditions in all parts of the country. The buildings handled by general contractors through their own organisations without outside counsel is enormous. Only in a few sections of the country is the electrical industry doing anything constructive toward reaching this important group."

Fuller's United Electric Works, Ltd.—On April 29th, Sir John Mann, 8, Frederick's Place, Old Jewry, E.C.2, was appointed as receiver and manager of this company at the instance of the holders of the prior lien debenture. That appointment was subsequently confirmed by the Court, who also constituted him receiver and manager on behalf of the holders of first mortgage debenture stock. In a circular to the unsecured creditors Sir John Mann states that the business is now being carried on under his control. The board recently conferred with some of the principal unsecured creditors, who have appointed a committee of six of their number, who are inquiring into the position, and it is understood that they hope to make proposals for continuing the business. Meanwhile steps are being taken to conserve the position in the interests of all concerned. With this object one of the unsecured creditors, who is a member of the Committee, has filed a petition for the liquidation of the company, but by arrangement with the Committee and with Sir John Mann this petition is being held over.

Electrical Exhibition.—DUBLIN.—The Dublin Municipal Electricity Department recently held an exhibition of electric cooking and domestic appliances in the Mansion House, and it proved highly popular and successful. Demonstrations of the uses of electricity to the housekeeper proved to be of great interest.

Trade Announcements.—THE ISCA ELECTRICAL ENGINEERING COMPANY has opened new showrooms at 177, Sidwell Street, Exeter.

MESSRS. PHILIPS LAMPS, LTD., have opened a new branch and distributing centre at 34, Marsh Street, Bristol (Telephone: Bristol 2746), where they will carry larger stocks of all their products to meet the West of England demand.

MR. WALTER BLENKARN has been appointed North of England representative of Electrical Utilities, Ltd.

Catalogues and Lists.—MESSRS. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester.—A series of illustrated pamphlets dealing with 11,000-V and 88,000-V oil-immersed circuit-breakers, rocking-type isolating switches, metal-clad switchgear, and cubicle gear.

THE EVER-READY CO. (GREAT BRITAIN), LTD., Hercules Place, Holloway, N.7.—A pamphlet advertising the "Super 1" h.p. battery for radio work.

MESSRS. MICKELWRIGHT, LTD., Alperton, Wembley.—12-page illustrated booklet and price list of resistances, dimmers, battery charging boards, &c.

MR. J. H. HEATHMAN, Parson's Green, Fulham, S.W.6.—Illustrated and priced leaflets advertising ladders of various patterns.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—May blotter advertising the company's new open-type boiling plate

THE GREGSON MANUFACTURING CO., LTD., 31, Tenby Street, Birmingham.—An illustrated catalogue of wood fittings for electric lighting, with a price list.

MESSRS. NASH & HULL, LTD., 87, New Oxford Street, London, W.C.1.—Fully illustrated and priced catalogue (72 pp.) of various electric signs, sign letters, plates, tablets, &c.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI.—May list of motors and dynamos in stock at Charleroi.

Bankruptcy Proceedings.—A. F. KINGDOM, 86, Old Town Street, Plymouth, late Tavistock Street, Devonport, electrical and wireless engineer.—The adjourned public examination of this debtor was to be held on April 30th, at Plymouth, but debtor did not appear, and the examination was adjourned *sine die*.

ALFRED NORTH and FRED NORTH, trading as A. & F. North, 38, Bradford Road, and Market Place, both Dewsbury, wireless and electrical engineers.—The public examination of these debtors was held recently at the County Court House, Dewsbury. The statement of affairs showed gross liabilities of £2,735, of which £2,700 was expected to rank, while the assets were estimated to realise £746, from which preferential claims of £35 had to be deducted, leaving a deficiency of £1,989. Debtor A. North said that they did not call their creditors together earlier because they were hoping to obtain more capital and form the concern into a limited company. Debtor F. North was also questioned, and debtors were ordered to complete their cash and goods accounts and to prepare a trading account and an amended deficiency account from the commencement of their business to the date of the receiving order, and the examination was adjourned.

R. H. W. PARTON, electrical installation engineer, late of 353, Richmond Road, East Twickenham, now residing at 18, Bristol Road, Sheffield.—Receiving order made May 3rd on debtor's own petition. First meeting, May 21st, at the Official Receiver's office, Figtree Lane, Sheffield. Public examination, June 3rd, at the County Court Hall, Sheffield.

D. E. DAVIES, wireless engineer, 19, Poulton Street, Kirkham.—First meeting, May 14th, at the Official Receiver's offices, 11, Winckley Street, Preston.

A. J. REFOY (Varley Radio Co.), dealers in wireless apparatus, 178, Ancona Road, Plumstead, S.E.—First and final dividend of 5½d. in the £, payable May 17th, at the Official Receiver's office, 29, Russell Square, W.C.1. (Amended notice.)

A. M. WILLMORE, electrical and radio engineer, 45, King Street, Brighton.—Receiving order made May 7th, on debtor's own petition.

W. H. GREENALL (Hampton Electric Co.), electrician, Newerne Street, Lydney.—Receiving order made May 4th, on debtor's own petition.

Company Liquidations.—H. E. DAVIS, LTD., 4, South Street, E.C., radio and electrical manufacturers and agents.—An adjourned meeting of creditors was held on May 3rd, at the Institute of Chartered Accountants. Mr. Baker (Wholesale Traders' Association) asked if Mr. Davis was prepared to make any offer. Mr. Davis replied that the stock could be realised for about £2,000. It was not his idea to put the company into liquidation or to appoint a receiver, but he was forced into that position owing to a writ being issued which could not be met. He was confident that if the matter was left in the hands of the present liquidator to deal with, some dividend would be paid to the creditors. Mr. Baker asked if Mr. Davis was prepared to agree that one half of the amount realised from the assets should go as part payment for the debentures and the other half towards a dividend for the unsecured creditors. Mr. Davis said that he could not agree to that suggestion. It was stated that there was an order on the file for compulsory liquidation and the creditors passed a resolution agreeing to support the winding-up petition.

T. W. JEFFERSON, LTD., Liverpool, electrical engineers, &c.—A meeting of creditors was held recently, when the statement of affairs presented showed liabilities of £4,239. The net assets were £4,448, leaving a surplus so far as the unsecured creditors were concerned of £209. Debentures (£4,776) were held by the bank, which had appointed a receiver. The company was registered in September, 1919, with a nominal capital of £10,000, which was subsequently increased to £50,000. There had been a substantial turnover, but losses had been incurred during recent years. It was decided to confirm the voluntary liquidation of the company, with a committee of six of the creditors. The following are creditors:—

	£		£
Baxendale Bros., Ltd.	230	Macintosh & Co., Ltd.	30
Downes & Davies	1,695	Middlesbrough Electric Tube Co.	20
Dodd & Oulton	218	Price's Patent Candle Co. ...	181
Edison Swan Electric Co., Ltd.	60	Porter Bros., Ltd.	25
Electrical Conduits, Ltd. ...	177	Porter, A. S., & Co.	20
General Electric Co., Ltd. ...	154	Quiggin & Co., Ltd.	24
Henry & Paris, Ltd.	190	Ross & Alexander	20
Hill, J., & Son	26	Rowe Bros. & Co., Ltd.	230
Johnson, Clapham & Morris ...	33	Simplex Conduits, Ltd.	20
Liverpool Electric Cable Co., Ltd.	50	Stella Electric, Ltd.	107
Mosers, Ltd.	38	Scottish Tube Co.	560
		Whitehouse & Sons	37

H. C. TOFIELD, LTD., wireless accessory dealers, Church Street, Birmingham.—A meeting of creditors was held recently, at the offices of Messrs. Poppleton & Appleby, C.A., 26, Corporation Street, Birmingham. Mr. C. T. Appleby, the liquidator, presented a statement of affairs which disclosed liabilities of £3,164, all of which was due to unsecured creditors. Mr. H. C. Tofield was a creditor for £585 in respect of salary, but that amount was not expected to rank. The net assets were stated to be £1,173, leaving a deficiency, so far as the unsecured creditors were concerned, of £1,991. Some twelve months ago the principal creditors were consulted, and it was then agreed that the company should continue trading under the supervision of two of the principal creditors, and that payment of the liabilities should be made by instalments. An instalment of 2s. 6d. in the £ was paid in March, but when the second instalment became due the company was unable to meet it. The company was registered in July, 1922, with a nominal capital of £2,000. The liquidator stated that the works had been closed, and the plant and machinery had been sold. A resolution was passed confirming the appointment of Mr. Appleby as the liquidator.

WATMEL WIRELESS CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Mr. C. D. Melhuish, shareholder and electrical instrument maker, of 53, Highbury Park, N., and will be heard in London on May 18th.

FULLER'S UNITED ELECTRIC WORKS, LTD.—A petition for the winding up of this company has been presented to the High Court by Messrs. R. Armstrong & Co., 3, Cloak Lane, E.C., and was to be heard in London on May 18th.

BRITISH UNION LAMP WORKS, LTD.—A meeting of creditors was called for May 17th, at 1, Royal Liver Building, Liverpool,

by the liquidator, Mr. A. L. Glencross. (This notice is formal; all creditors will be paid in full.)

L. WEEKES, LTD.—First dividend of 2s. in the £, to unsecured creditors, payable at the office of the liquidator, Mr. B. T. Crew, George Street West, Luton.

SHENTON & Co., LTD.—A meeting of creditors is called for May 26th, at the offices of Messrs. Poppleton, Appleby and Hawkins, 4, Charterhouse Square, E.C. Particulars of claims to the liquidators, Messrs. E. H. Hawkins & W. B. Pearson, 4, Charterhouse Square, E.C., by June 30th.

NADIN & DELL ELECTRIC, LTD.—A meeting of creditors was called for May 12th at the liquidators' offices, 5, Bold Street, Warrington. Particulars of claims to the liquidator, Mr. L. A. Voisey, by June 23rd.

BURWOOD (CONCESSIONAIRES), LTD.—Winding up voluntarily. Liquidator, Mr. G. E. McCaulis, Oxford House, 9-15, Oxford Street, W.1. Meeting of creditors at 50, Gresham Street, on May 26th.

Dissolution of Partnership.—S. E. MYRANS & Co., motor and wireless accessory agents, 16, Atkinson Street, Manchester. —Messrs. S. E. Myrans, H. D. Mackie and E. E. Macdonald, have dissolved partnership. Debts will be attended to by S. E. Myrans & Co., Ltd., of 16, Atkinson Street, Manchester, who are continuing the business.

Book Notices.—The Electrical Association for Women has decided to publish a quarterly paper *The Electrical Age for Women*, edited by Miss C. Haslett, in order to keep members informed of the rapidly increasing activities of the Association.

Electrician Annual Tables of Electricity Undertakings for 1926. London: Benn Bros., Ltd. Price 10s. net.—This, the thirty-ninth, edition has been further expanded, and the tables now contain details of over 2,000 home, Colonial, and foreign electricity undertakings. Among the useful information imparted, in addition to details of plant and prices, are the addresses of showrooms where these exist.

Lighting and Power Notes.

Accrington.—ELECTRICITY CHARGES.—The Corporation Electricity Committee is introducing special charges for all-electric houses in the borough, at the following rates: A charge of 15 per cent. per annum on the rateable value of the dwelling, plus ½d. per kWh for all electricity used, on condition that no coal or other fuel be used, the arrangement to be continued for two years, with an extension beyond that period if it is so desired. The Committee has also decided that, in future, all electrical cookers and boilers shall be installed free if purchased from the Corporation.

Australia. — BRISBANE. — The *Industrial Australian and Mining Standard* states that the City Council has practically decided to erect its own power station, instead of taking over the undertaking of the Brisbane City Electric Light Co. The report of the chief engineer of the Tramways Department, and the manager of the Electricity Supply Department, proposes an initial installation of two 7,500-kW sets, switchgear, boilers, &c., at an estimated cost of £280,216, together with a transmission line to South Brisbane and distribution mains, transformers, &c., at a cost of £182,500. A third 7,500-kW set would be installed in 1928, which with distribution mains in New Farm and Bowen Hills would cost £130,784, making a total expenditure to 1931 of £593,500.

MULLUMBIMBY HYDRO-ELECTRIC SCHEME.—According to the same journal, the supply of power from the Mullumbimby (N.S.W.) hydro-electric scheme was commenced recently. A supply is being provided for Mullumbimby, Byron Bay, Bangalow, Ballina, Murwillumbah, and Burringbar.

Bradford.—LOAN.—The Electricity Committee has authorised the Town Clerk to apply for sanction to borrow a further £150,000 to cover estimated expenditure on mains and services during the next three years. The Committee has approved electricity extensions at a cost of £12,421.

Bridlington.—ELECTRICITY EXTENSIONS.—At a recent meeting of the Town Council, the Electricity Committee introduced a scheme for the extension of the plant, in place of a previous scheme recently approved, to cost £14,000. The borough electrical engineer said he approved the new scheme and the consulting engineers had ascertained that the Electricity Commissioners would sanction it. The scheme was approved.

Cirencester.—OPPOSITION TO ORDER.—The Rural District Council has decided to formally object to the application of the West Gloucestershire Power Co., Ltd., for an Order to supply electricity in the Council's area on the ground that the Council is not in possession of sufficient information and that no compulsory areas are specified in the Order. The Council has also intimated that it would favour a local inquiry into the application.

Clayton.—INQUIRY.—The Electricity Commissioners are to hold an inquiry on May 19th into the applications of the Urban District Council, the Electrical Distribution of Yorkshire, Ltd., and the Bradford Corporation, for Orders to supply and distribute electricity in the district.

Continental.—CZECHO-SLOVAKIA.—According to *Commerce Reports*, the Ministry of Public Works intends to construct a dam in the valley of the river Treblja. The reservoir formed by this dam will have a capacity of 3,000,000 cu. m. and it is estimated that 42,000 h.p. can be developed. The cost of the entire scheme is estimated at 180,000,000 crowns, and the initial development (7,600 h.p.) at 48,000,000 crowns.

Croydon. — STREET LIGHTING. — The Town Council has applied for sanction to a loan of £6,889 for the conversion of 448 street lamps from gas to electric lighting.

Dover.—LOAN.—The Town Council has applied for sanction to a loan of £6,400 for the provision and laying of a cable to connect the electricity works with the system of the Folkestone Electricity Supply Co.

Harwich.—LOAN.—To meet the continued demands under the assisted wiring scheme, the Electricity Committee is to seek sanction to a further loan of £1,000.

Hastings.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £3,500 for a substation and mains on the Grove Estate.

High Wycombe.—STREET LIGHTING.—The Town Council has entered into a new contract with the Wycombe (Borough) Electric Light & Power Co., Ltd., for street lighting for a period of 13½ years, at a fixed charge of £550 per annum, plus 3d. per kWh for electricity consumed up to 40,000 kWh per annum and 2½d. beyond, subject to a reduction when the charge of 10d. per kWh made to consumers in the borough is lowered.

Irish Free State.—THE SHANNON SCHEME.—A letter has been sent out by the Ministry for Industry and Commerce to public authorities within a radius of about 50 miles from Ardnacrusha, Limerick, to the effect that a bulk supply of electricity from the Shannon works will be available in the greater part of the Irish Free State in about three weeks' time.

DUBLIN.—In the Senate recently the promoters of the Dublin Electricity Supply Bill, 1925, were given leave to withdraw it. This has now been done.

Leyton.—LOAN.—The Urban District Council has applied for sanction to a loan of £10,848 for additional plant and a substation.

Linton.—ELECTRICITY SUPPLY.—The Rural District Council has decided to offer no objection to a scheme of electric lighting in the Sawston area by means of overhead and underground cables submitted by the Bedfordshire, Cambridgeshire, and Huntingdonshire Electricity Co.

London.—HAMMERSMITH.—The borough electrical engineer has submitted a report to the Electricity Committee on boiler house extensions in which he recommends the following two alternative schemes: (1) To remove No. 5 boiler, and replace it by a new boiler; (2) to remove Nos. 5, 6 and 7 boilers, and replace them by two new boilers, the estimated cost of the former scheme being £18,800, and the latter £32,201. The Committee has recommended that the larger scheme be carried out. The Committee has also recommended a reduction of approximately 12½ per cent. in the charges for electricity for street lighting.

The Electricity Commissioners have approved the construction of a new 40-inch diameter water discharge pipe line between the generating station and Chancellor's Wharf, and the Committee has decided to proceed with the scheme. The cost is estimated at £16,695.

Manchester.—PROGRESS DURING MARCH.—During the month of March, the Corporation electricity undertaking showed an increase in connections of 2,134 kW, bringing the total to 281,622, and the number of applications received for supply, including consumers for additional supplies, was 904, representing a total of 2,185 kW. The number of hired cookers connected increased by 84, bringing the total actually on circuit to 1,496. Applications for the hire of cookers totalled 132.

Mold.—ELECTRICITY DEADLOCK.—The clerk reported to the Urban District Council recently that a deadlock has been reached in the negotiations between the Council and the North Wales Power Company, the company having declined to amend three clauses in the draft agreement to which the Council would not agree. It was decided to seek the advice of the Council's engineer with the view to placing the matter before the Electricity Commissioners.

Padiham. — ELECTRICITY SUPPLY. — The Urban District Council has decided to operate its Electricity Order, and a Committee has been appointed to ascertain from the Lancashire Electric Power Co. the terms upon which it will be prepared to manage the undertaking for a period of five years, acting on behalf of the Council.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

GILLINGHAM.—Heating: 1½d. per kWh for the first 100 kWh per quarter, and 1d. per kWh beyond.

MAIDENHEAD.—Lighting prepayment meters: 7d. per kWh in the borough and 7½d. per kWh outside the borough.

Sheffield.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £4,500 for the erection of four sub-stations at Botanical Road, Primrose Hill, Denmark Road, and Daniel Hill.

Spalding.—ELECTRICITY IN BULK.—The Urban District Council, on April 28th, decided to accept the offer of the Peterborough Corporation for a supply of electricity in bulk. The cost of the scheme is estimated at £27,000.

Stretford.—LOAN.—The Electricity Committee is to apply for sanction to a loan of £48,000 for sub-stations and cables.

Torquay.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £10,000 for mains.

Uckfield.—ELECTRICITY SCHEME.—At the general meeting of the Uckfield Gas & Electricity Co., Mr. W. O. Hooper, consulting engineer, submitted a report on the proposed electricity

scheme for the district. Two schemes were suggested, one which would only cover the urban district, at an estimated cost of £21,775, and one which would embrace the parishes of Framfield, Buxted, Maresfield, and Newick, besides Uckfield, the cost of this scheme being £34,600. The company has acquired land adjacent to the gas works for a generating station, and it is proposed to install two 300-h.p. oil engines, and one of 70 h.p.

Whitby.—LOANS.—The Urban District Council has applied for sanction to loans of £1,000 for services and mains, and £2,313 for the installation of rectifying equipment and feeders at the Bagdale sub-station.

Tramway and Railway Notes.

Australia.—SYDNEY (N.S.W.).—The *Industrial Australian and Mining Standard* reports that the electrification of the Milson's Point-Hornsby railway, on the northern side of Sydney Harbour, will be commenced at the beginning of next year. In the meantime preparations are being made for the duplication of the line as far as Chatswood, thus providing four sets of rails, instead of the existing double track. It is expected that the Harbour Bridge will be completed at the end of 1930, and it is considered that the duplication of the Hornsby line, at least as far as Chatswood, will by that time have become imperative. It has therefore been decided to advance the work as far as possible in conjunction with the electrification of the existing tracks, and the completion of the whole work will synchronise with the completion of the bridge.

Bolton.—TRACK RENEWALS.—The Tramways Committee has instructed the borough engineer to proceed with the work of relaying the tramway track from Princess Road to Horwich, on the Chorley New Road route, and to obtain tenders for the necessary rails, points, and crossings.

Continental.—SWEDEN.—The electrification of the railway between Gothenburg and Stockholm has now been completed with the exception of a little work on the Stockholm-Soedertaelje section, and on May 11th an electric train service was commenced over the whole of the reconstructed line.—*Reuter's Trade Service* (Stockholm).

Irish Free State.—DUBLIN-LUCAN ELECTRIC RAILWAY.—At a recent public meeting in Dublin a deputation was appointed to wait on the Dublin United (Electric) Tramways Company to ask that a private Bill be introduced in the Free State Parliament to enable the company to proceed with the work of extension and re-opening of the Dublin-Lucan electric railway, joining up and working in conjunction with the city and district system. It is understood that if the Tramways Company proceeds with the Bill its progress will be facilitated by the Government, and the extension and other work may be undertaken very soon.

Japan.—RAILWAY ELECTRIFICATION.—It is reported that the trial running of electric trains between Tokio and Odawara and Tokio and Yokohama has proved successful, and the period of trial will be completed in June or July next. The sections to be electrified under the present project are Kodzu-Numazu, Numazu-Akashi, Ueno-Omiya, and Kokubunji-Hachioji, besides which the Yamanote freight line is to be electrified, the whole scheme being completed by the fiscal year 1931-32.

NEW ELECTRIC RAILWAYS.—Messrs. Y. Yaginuma and S. Ota, of Koriyama propose building an electric railway from Koriyama to Yumoto, Fukushima-ken, and an application for a charter has been presented to the Railway Minister. The building of the Hitohata electric railway of the Hitohata Electric Railway Co., Shimane-ken is to be started shortly, and will be completed by September, 1927.

New Zealand.—RAILWAY ELECTRIFICATION.—According to *Tenders*, the Government has decided to electrify the Lyttelton railway tunnel and the remainder of the Christchurch suburban railways.

Telegraph and Telephone Notes.

New Atlantic Cables.—ITALIAN CONTRACT.—The Government has been authorised definitely to ratify the provisional contract with the (Italian) Italcablo Company for laying cables between the Azores and Cape Verde, between Italy and the Azores, and between Lisbon and Malaga.—*Reuter* (Lisbon).

The Telephone and Telegraph Services.—During the ten days' general strike, which ended on May 12th, the Post Office telegraph and telephone services were maintained in spite of being threatened, and functioned almost normally throughout. On May 10th it was reported that 25 telegraph wires had been cut near Blaydon, in Durham.

Radio Notes.

Australia.—BROADCASTING IN VICTORIA.—According to the Government statist, there are now about 370,000 families in the State of Victoria. There is thus a receiver in use for about every seven families and the effect of the increase in the power of 3LO is reflected in the increase in the number of licences in Victoria in the first three months of 1926. The *Industrial Australian and Mining Standard* says that the reduction of 3LO's wave has been responsible for a marked increase in interest in broadcasting.

The B.B.C.—NATIONAL SERVICE.—During the ten days' general strike, which ended on May 12th, all stations of the British Broadcasting Co., Ltd., functioned uninterruptedly. Apart from the musical programmes, the official news bulletins and notices radiated on behalf of the Government frequently during the day were of much assistance to, and highly appreciated by, the population, especially during the period when all newspapers were forced to suspend publication.

Uruguay.—RADIO REGULATIONS.—A law for the control of radio in Uruguay was proposed by the President in a message to Congress dated March 2nd, 1926. The message contained a draft of the proposed regulations, which are described as being mildly regulatory. According to *Commerce Reports*, broadcasting stations will be required to secure licences, and may not use wavelengths employed by official stations. Amateurs will be restricted to particular hours; transmission of malicious or immoral material is prohibited, and fines and punishment for infractions are provided. There is no mention of any regulation of receivers, either as to licensing or as to types of sets that may be used.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares (B X 2528).*

June 16th. Victorian Government Railways. One heavy-current motor generator set. (B X 2527).*

Belfast.—May 20th. Electricity Committee. D.c. sub-station switchgear and transformer kiosks. (See this issue.)

Belgium.—ANTWERP.—May 27th. Direction de l'Outillage. Three electrically-operated cranes, each 1,000 kilos capacity. (A X 3107).

Bolton.—The Tramways Committee has decided to invite tenders for the supply of 12 bogie tramcars of the 80-seater vestibule type.

Dublin.—June 3rd. Great Northern Railway (Ireland). Six months' supplies of stores, including electrical fittings, lamps, cable, wire, &c. (See this issue.)

Eccles.—May 31st. Electricity Department. Twelve months' supply of single-phase a.c. house service integrating watt-hour meters. (See this issue.)

Edinburgh.—May 21st. Education Authority. Complete electrical installations at several schools. Mr. John Stewart, executive officer.

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine direct coupled to an 80-kW generator, complete with switchboard. (B X 2537).*

Epsom.—June 14th. Electricity Department. Removal of boilers and setting them up as fuel tanks, overhead travelling crane, two 300-kW Diesel engine-driven generators and accessories, oil purifying plant and cooling tower. (See this issue.)

Harrogate.—May 31st. Electricity Department. Electricity meters (British make) for six months. (See this issue.)

India.—June 15th. India Store Department. 70,000 (approx.) copper bonds for track rails. (See this issue.)

Kettering.—June 9th. Electricity Department. Water-softening plant. (See this issue.)

Letterkenny.—May 17th. Electricity Department. Crude oil engine and a.c. sets, switchgear, and a.c. 3-phase overhead distribution system. (See this issue.)

London.—BETHNAL GREEN.—June 4th. Borough Council. Electric lighting and power installation at Bethnal Green Hospital. (See this issue.)

Normanton.—June 1st. Urban District Council. Feeder and distribution cables, feeder pillars, and one 200-kVA transformer. (See this issue.)

South Africa.—June 21st. South African Railways and Harbours. Track bonds for the Cape Town Suburban Railway electrification scheme. (See this issue.)

Stoke-on-Trent.—June 9th. Electricity Department. Two 60,000-lb. per hour water-tube boilers. (See this issue.)

Uruguay. — MONTEVIDEO. — July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B X 2523).*
July 9th. 137,500 metres rubber-insulated wires and cables. (B X 2548).*
40,000 metres of coloured twin conductor cords. (B X 2549).*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Barnes.—Electricity Committee. Accepted:—
Cable (£8,464).—Siemens Bros. & Co., Ltd.
Extension panel (£209).—General Electric Co., Ltd.

Bolton.—Electricity Committee. Accepted:—
Switchgear for Spa Road sub-station.—Park Royal Engineering Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Switchgear for Gresley sub-station (£649).—Ferguson, Pailin, Ltd.

Cardiff.—Tramways Committee. Accepted:—
30 single-deck tramcars (£45,090).—Brush Electrical Engineering Co., Ltd. —*Western Mail.*

Croydon.—Electricity Committee. Accepted:—
500-kVA Scott-connected transformer for Selhurst (£500), and five 200-kVA air-cooled ditto (£998).—British Electric Transformer Co., Ltd.
Alterations to three steam-driven boiler feed pumps to operate at increased pressure (£314).—G. & J. Weir, Ltd.

Dundee.—Education Authority Works Committee. Accepted:—
Electric lighting installation at various schools.—A. Westwood & Co. (£430); J. Smith (£455 and £342); Quirk & Co. (£233).

Gravesend.—Electricity Committee. Recommended:—
Steam pipes (£292).—Aiton & Co.
Assisted wiring.—Mr. Lambert (23s. 6d. per point).

Grimsby.—Electricity Committee. Accepted:—
E.h.p. switchgear (£1,470).—Metropolitan-Vickers Electrical Co., Ltd.
1,000-kW rotary converter (£4,100).—Electric Construction Co., Ltd.
D.c. switchgear (£1,060).—Edison Swan Electric Co., Ltd.

Kettering.—Electricity Department. Accepted:—
1,500-kW rotary converter (£5,372).—English Electric Co., Ltd.
Transformers.—Hackbridge Electric Construction Co., Ltd. (£999); British Electric Transformer Co., Ltd. (£1,385).
E.h.p. and l.p. switchgear (£1,134).—Ferguson, Pailin, Ltd.
E.h.p. and l.p. cables (£3,429).—Union Cable Co., Ltd.

Liverpool.—City Council. Accepted:—
Twenty-four 40-h.p. D.K. 20-A motors and seventy-six 40-h.p. D.K. split-frame motors, £190 per motor (£19,000).—English Electric Co., Ltd.
Steam pipes for Lister Drive electric power station.—Stewarts & Lloyds.

London. — SOUTHWARK. — Electricity Committee. Accepted:—
Oil cooler (£72).—Fraser & Chalmers Engineering Works.

HAMMERSMITH.—Electricity Committee. 2,500 yd. of .15 sq. in. three-core and 1,750 yd. of .075 sq. in. six-core cable:—

Bergmann Electric Co.	£2,676
Enfield Cable Works, Ltd. (Accepted.)	**3,657**
Hackbridge Cable Co., Ltd. (incomplete)	1,488
Edison Swan Electric Co., Ltd.	3,694
Macintosh Cable Co., Ltd.	3,704
British Insulated Cables, Ltd.	3,705
W. T. Glover & Co., Ltd.	3,705
Johnson & Phillips, Ltd.	3,705
Standard Telephones & Cables, Ltd.	3,706
Pirelli-General Cable Co., Ltd.	3,710
Union Cable Co., Ltd.	3,719
W. T. Henley's Telegraph Works Co., Ltd.	3,721
Siemens Bros. & Co., Ltd.	3,731
Callender's Cable & Construction Co., Ltd.	3,792

Switchgear (two stoneware cubicles with switchgear for Bowden-Thompson potential transformers; one four-way three-phase truck-type switchboard; one three-phase truck-type switch; one two-phase do.; and one battery):—

General Electric Co., Ltd. (Accepted.)	**£2,801**
Switchgear & Cowans, Ltd.	2,838
English Electric Co., Ltd.	2,838
Ferguson, Pailin, Ltd.	2,863
Metropolitan-Vickers Electrical Co., Ltd.	2,917
Park Royal Engineering Co., Ltd.	2,949
Johnson & Phillips, Ltd.	2,975
A. Reyrolle & Co., Ltd.	3,007
British Thomson-Houston Co., Ltd.	3,009
Bertram Thomas	3,057
New Switchgear Construction Co., Ltd.	3,067

Transformers:—

	Three 1,000-kVA. (oil-cooled).	Four 250-kVA.	Six 100-kVA. (air-cooled).	Four 50-kVA.
*J. G. Statter & Co.	£1,333	£381	£209	£184
Yorkshire Electric Transformer Co., Ltd.	1,347	—	—	—
*Oerlikon, Ltd.	1,410	720	978	396
Bruce Peebles & Co., Ltd.	1,560	—	—	—
Foster Engineering Co., Ltd.	1,608	—	—	—
English Electric Co., Ltd.	1,661	—	—	—
*Fuller Electrical Co., Ltd.	1,752	674	534	234
General Electric Co., Ltd. (Accepted.)	1,659	1,133	924	418
Hackbridge Electric Construction Co., Ltd.	1,668	855	678	287
Ferranti, Ltd.	1,629	1,013	716	309
Metropolitan-Vickers Electrical Co., Ltd.	1,652	1,013	716	309
Brush Electrical Engineering Co., Ltd.	1,652	1,013	716	309
British Electric Transformer Co., Ltd. (Accepted.)	1,652	**1,020**	**720**	**312**
Johnson & Phillips, Ltd.	1,629	1,377	1,259	554
C. A. Parsons & Co., Ltd.	1,686	—	—	—

*Not in accordance with specification.

40 h.p. switchgear panels (250 amp.):—

Metropolitan-Vickers Electrical Co., Ltd. (Recommended.)	**£656**
J. G. Statter & Co.	679
New Switchgear Construction Co., Ltd.	695
Switchgear & Cowans, Ltd.	750
Park Royal Engineering Co., Ltd.	756
Johnson & Phillips, Ltd.	780
General Electric Co., Ltd.	840
Bertram Thomas	1,034
Ferguson, Pailin, Ltd.	1,080
English Electric Co., Ltd.	1,200
British Thomson-Houston Co., Ltd.	1,510
A. Reyrolle & Co., Ltd.	2,192

Works Cartage and Cemetery Committee.
Renewal of 4 "Exide Ironclad" batteries for the Council's electric vehicles (£620).—Chloride Electrical Storage Co., Ltd.

LONDON COUNTY COUNCIL.—Education Committee. Electrical work at St. Paul's Road School, Limehouse:—

Burdette & Co., Ltd. (Accepted.)	**£415**
Smethurst & Co. (London), Ltd.	498
Commercial Telephone & Electrical Co., Ltd.	516
H. B. Giles	518
A. Hawkins & Sons	569
G. A. Weston	570
W. & G. Firmin	588
Jenner Light & Power Co., Ltd.	590
A. Higginbotham & Sons	600
Eastern Armature Winding Co.	745
Ohms (Proprs. Bovis, Ltd.)	787
Davis, Laurence & Co.	850
P. Braidwood	922

The chief engineer's comparable estimate is £485.

Wiring and fittings for electric lighting and power at St. Martin's School of Art, Westminster:—

Eastern Armature Winding Co. (Accepted.)	**£140**
Commercial Telephone & Electrical Co., Ltd.	150
Jenner Light and Power Co., Ltd.	179
A. Hawkins & Sons	199
H. J. Cash & Co., Ltd.	215
British Electrical Installations Co., Ltd.	259

ST. MARYLEBONE. — Electricity Department. Recommended:—
L.p. cables for 12 months.—Enfield Cable Works. Ltd.
E.h.p. cables for 12 months.—British Insulated Cables, Ltd.
Sixteen tenders were received, six being incomplete.

Manchester.—Education Committee. Accepted:—
Electric lighting installation, Chorlton Central School.—J. A. Somerset and Co.

Electricity Committee. Accepted:—
Three 500-kVA static transformers for Clayton sub-station.—Fuller Electrical and Mfg. Co. One 7,500-kVA ditto, Old Road "B" sub-station, and two 6,000-kVA ditto, Dickinson Street sub-station.—Ferranti, Ltd. Two 3,000-kVA ditto, Moss Side sub-station.—Hackbridge Electric Construction Co., Ltd.
H. and l.p. switchgear for sub-stations.—Metropolitan-Vickers Electrical Co., Ltd.

Tramways Committee. Accepted:—
Copper trolley wire.—British Insulated Cables, Ltd.
Silicum bronze trolley wire.—F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.
Cadmium bronze trolley wire.—R. Johnson & Nephew, Ltd.

Housing Committee. Accepted:—
Electric lighting installation at certain houses on the Openshaw estate.—J. Armstrong & Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Transformers.—Ferranti, Ltd.
Earthenware cable ducts.—Albion Clay Co., Ltd.
Electric lamps.—Z Electric Lamp Co., Ltd.

Rotherham.—Tramways Committee. Recommended:—
150 tons of steel tramway rails (£10 7s. 6d. per ton).—Steel, Peech and Tozer, Ltd.

Salford.—Gas Committee. Accepted:—
One electric passenger lift for Bloom Street gas offices (£335).—Etchells, Congdon & Muir, Ltd.

Sheffield.—Electricity Committee. Accepted:—
Twelve 6-way, 3-phase feeder pillars (£588).—W. T. Henley's Telegraph Works Co., Ltd.
Nineteen 11,000-V sub-station switchgear panels (£3,662).—A. Reyrolle and Co., Ltd.

Tramways Committee. Recommended:—
12 pairs twin movable connected points (£1,452).—Hadfields, Ltd.
6 crossings (leg type) (£250).—Titan Trackwork Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
Supply of cables and laying mains for one year.—Callender's Cable and Construction Co., Ltd.
Static transformers and e.h.p. truck-type switchgear.—Metropolitan-Vickers Electrical Co., Ltd.

Sunderland.—Electricity Department. Accepted:—
Prepayment meters.—A.E.G. Co.

Watford.—Electricity Committee. Recommended:—
Cable supplies for one year.—W. T. Henley's Telegraph Works Co., Ltd.

Weymouth.—Electricity Committee. Accepted:—
Laying new services.—Johnson & Phillips, Ltd.
One 3-phase, 50-cycle turbo-alternator and two 20,000-lb. boilers and auxiliary plant.—English Electric Co., Ltd.

Forthcoming Events.

Association of Teachers in Technical Institutions.—At the Polytechnic, Regent Street, W. May 22nd to 25th. Annual conference.

Radio Society of Great Britain.—Wednesday, May 26th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Ordinary meeting.

Institution of Electrical Engineers.—Thursday, May 27th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Annual general meeting.

Notes.

Low-Temperature Carbonisation.—In a paper read before the South Wales Institute of Engineers by Mr. David Brownlie, B.Sc., the processes for the production of free-burning smokeless fuel, involving the mechanical compression or briquetting of the charge, before or during carbonisation, were considered. The author emphasised that the whole subject of low-temperature carbonisation was of vital importance to the British colliery industry, which should co-operate in the matter and establish a large central organisation for detailed study. The net cost, spread out amongst all the collieries in the country, would be a small matter compared with the advantages to the whole industry.

Appointments Vacant.—Repairs engineer (£403), for the Hammersmith Borough Council electricity department; executive engineer, Electrical Division, Public Works Department, Government of Bengal; assistant mains superintendent, for the Eccles Corporation electricity department; shift charge engineer, for the Borough of Leigh electricity department. (See our advertisement pages to-day.)

Address on Electricity Generation.—According to the *Financial News*, Mr. Samuel Insull, president of the Commonwealth Edison Co., of Chicago, and other electrical organisations in the United States, addressed the members of the Conservative Party Transport Committee at the House of Commons on April 28th, when several members of the Government were present. Mr. Insull dealt with the question of concentrated production.

French Electric Steel Production.—It is stated that the production of steel in electric furnaces in France in 1925 amounted to 75,433 metric tons, of which 64,186 tons were ingots and 11,247 tons were mould castings, and the total only represented about 1 per cent. of the aggregate output of steel in that country last year. The number of furnaces in France at the beginning of 1926 for the production of electric steel was 22, these only turning out the finer qualities of steel. Now, however, the circles interested in the promotion of the use of electric furnaces are said to be making great endeavours to induce the works producing basic Bessemer steel to adopt a process according to which, after leaving the converter, the material would be refined to a quality similar to that of open hearth steel at comparatively small expense.

Chromium for Electrolytic Printing Plates.—According to *Science* experience at the U.S.A. Bureau of Engraving and Printing has shown that by the application of a thin layer, 0.0002 in. of chromium to electrolytic plates used for printing paper currency, the life of the plates is increased to twice that of the case-hardened steel plates and several times that of nickel faced electrolytic plates prior to the application of the chromium upon them. Considerable research was carried out to develop and adapt the metal for this purpose. Subsequent tests have shown that chromium plating is likewise valuable on other types of printing plates, especially those used for long editions. It will probably be useful on dies and gauges where extreme hardness is required, and may obviate case-hardening them.

Radio Direction-finding Errors.—Messrs. R. L. Smith-Rose, Ph.D., M.Sc., A.M.I.E.E., and R. H. Barfield, M.Sc., Student I.E.E., recently read a paper before the Wireless Section of the Institution of Electrical Engineers, on "The Cause and Elimination of Night Errors in Radio Direction-finding." The object of a large proportion of the investigations carried out by the authors for the Radio Research Board during the past few years has been to ascertain definitely the cause of the apparent variations in bearings experienced on closed-coil d.f. apparatus during the "night" periods. Some of the investigations have led to the development of methods of distinguishing between the electric and magnetic components of wireless waves, and of the separate measurement of their intensity and direction. This portion of the work has recently led to a definite proof of the existence of downcoming waves at the earth's surface with components of suitable polarisation and sufficient intensity to account for a large proportion of the night errors experienced. In this manner the theory originally advanced by Mr. T. L. Eckersley in 1921 to account for the apparent variations in the direction of arrival of wireless waves has been adequately confirmed; and it is now evident that these variations are caused by the action of the horizontal components of electric force in the downcoming waves on the horizontal parts of the direction-finding loops. It is generally assumed that the downcoming waves have travelled *via* the upper regions of the earth's atmosphere without deviating laterally from the great circle plane through the transmitter and receiver, an assumption that has, however, not been sufficiently well justified in the past; the presence of the downcoming waves has hitherto made it difficult to prove whether the direct waves travelling along the earth's surface have not also suffered lateral deviation. Another portion of the authors' investigations has therefore been made to ascertain to what extent, if any, such lateral deviation exists. The problem is one of more than pure scientific interest; for it is evident that, if directional receiving apparatus can be devised which shows the absence of lateral deviation, a direction-finder can at once be provided which is free from the variable night errors that place such a serious limitation on closed-coil direction-finders. The present paper describes the experiments which have been carried out with these objects during the past 18 months. In the course of the experiments the Adcock "four-aerial" direction-finder has been developed, and with its aid it has been shown that the actual deviation in azimuth of wireless waves is practically negligible. These experiments thus constitute a proof that the variable errors observed on closed-coil direction-finders at night are caused by downcoming waves arriving from the upper atmosphere and polarised with the electric force in a horizontal plane. The investigation also indicates the possibility of the Adcock system being developed into a practical direction-finder which is free from night errors, and those errors associated with observations on aircraft transmissions made at a ground direction-finding station.

Local Society.—A meeting of the Edinburgh Electrical Society on May 1st took the form of a visit to the foundry of Messrs. Mackenzie & Moncur, Slateford Road, Edinburgh, when the members present were shown through the moulding and casting departments, and all the various processes were fully explained to them. At the conclusion of the visit tea was supplied by the management and an enjoyable afternoon was spent.

Air Transport Services.—On the occasion of the fifth Gustave Canet Memorial Lecture on April 30th Air Vice-Marshal Sir W. Sefton Brancker, K.C.B., delivered an address concerning the air transport services before the Junior Institution of Engineers. He explained the position of Imperial Airways, and outlined the work it was doing with the aid of the Government subsidy. He said that in no case within Europe had air transport paid its way. The British company had complete freedom in its policy, and had been restricted in its activities only by certain international difficulties, which seemed likely to vanish in the near future. The company, and its predecessors, had already carried over 70,000 passengers across the Channel, with only four fatal accidents.

American Electric Truck Show.—How the American Railway Express Co. saved $96,000 worth of floor space by replacing 168 wagons and 300 horses with 84 electric trucks was revealed by a chart exhibited at the sixth annual electric truck show which was opened at New York on April 26th, in the building of the New York Edison Co. Another chart illustrated the extent to which the substitution of electric vehicles for horse-drawn trucks is reducing street traffic congestion, while another display pointed to the day when the milkman on his morning deliveries will need to walk 146 ft. instead of 370 ft. for the average milk delivery, thanks to the rapid replacement of the old-fashioned milk wagon with modern little electrics. Reporting on the results of a series of stop-watch tests, Mr. Arthur Williams (vice-president, commercial relations of the New York Edison Co.) declared that in the typical small-home residential sections of the metropolitan area the average milk delivery as made by the milkman using a horse and wagon required 50 seconds and called for 370 ft. of walking, whereas the average delivery on the same route made by a milkman using an "electric" required only 44 seconds and 146 ft. of walking. The saving in time and energy, Mr. Williams said, was due to the fact that the latter method enabled the milkman to drive from house to house and confined his walking to the short distance between the truck and the house, whereas milkmen using horses and wagons ordinarily walked from house to house and from wagon to house.

"By replacing its horse-drawn wagons with electric trucks the American Railway Express Co. has saved 48,000 sq. ft. of space in a location where a conservative estimate of the value of floor space is $2 per sq. ft. per year," declared Mr. Williams. "This one company has thus not only secured for itself $96,000 worth of floor space through the replacement of electric trucks for horse-drawn vehicles, but has brought about for the community at large a comparable saving in street space. Three hundred horses and 168 wagons would cover 16½ city blocks of streets; the 84 electric vehicles doing the work of these 300 horses would, in the aggregate, cover 7½ blocks of city streets. When it is known that there are still 50,000 horses in New York, one is impressed with the tremendous reduction in traffic congestion which will be possible if the policy of the numerous owners of large fleets of 'electrics' were universally adopted in New York City." More than 20 manufacturers of electric trucks, batteries for such trucks, and other accessories participated in the electric truck show, which closed on May 1st.

Fatality.—The death occurred on May 7th by electric shock of Charles Alfred Moon, who was on volunteer service, acting as guard on a Southern Railway electric train. As he was coming off duty at Charing Cross he came into contact with the conductor rail, receiving a fatal shock.

Educational.—THE POLYTECHNIC, Regent Street, London.—It has been decided to postpone Mr. W. H. Date's special course of lectures on "The Thermionic Valve and its Uses in Wireless Circuits" until Wednesday, June 2nd.

Aircraft Navigational Aids.—An apparatus by means of which aeroplanes can be piloted through the fog without losing their bearings has been installed at Le Bourget. This radio-goniometric post, as it is called, will be operated in conjunction with the wireless telegraph stations at Abbeville and Saint Inglevert, and will enable commercial aeroplanes to pick up their bearings at any time in the thickest fog.—*Reuter* (Paris).

Registration of Engineers.—A Bill has been introduced into the House of Commons to provide for the registration of engineers and for the regulation of their qualifications; it proposes the establishment of a "General Council of Engineering," partly nominated and partly elected, which shall determine the standard of qualification, keep a register, and take steps to protect the title of "engineer" against misuse. The Bill further provides that after two years, official appointments as engineer shall be held only by registered engineers, and that only registered engineers shall be entitled to issue certificates or recover charges. Registered engineers are to be provided with seals for use on plans, tenders, &c., subject to penalties for improper use. After two years it is to be unlawful for any person to describe his business as that of an engineer unless a registered engineer is engaged therein. The Bill has been prepared by the Society of Technical Engineers. Similar measures have been enacted in the United States and elsewhere.

L.C.C. Tramways Finance.—In a recent report to the London County Council, the Highways Committee states what action has been taken to restore the tramway undertaking to financial equilibrium. Mention is made of the suspension of sinking fund payments on the 25-year debt, and some details are given of the economies in working which have been made. It is pointed out, however, that economies alone will not achieve the desired result, and nothing short of a complete co-ordination of passenger transport services and the elimination of unnecessary competition will bring this about. The Committee hopes that the London and Home Counties Traffic Advisory Committee will take the necessary action.

Tientsin (China) Electricity Undertaking.—We have received a copy of the report on the year's (1925) working of the electricity undertaking of the Tientsin British Municipal Council, North China (engineer and manager, Mr. R. A. Williams, M.C., B.Sc.). The revenue for the year amounted to £47,588, and the expenditure to £33,300, leaving a surplus of £14 28s. The kWh generated during the period amounted to 4,747,699, and the generating costs were 1.8d. per kWh. The fuel cost amounted to only 0.291d. per kWh. The return on the capital outlay for the year, after allowing for ample depreciation, was 19.9 per cent., comparing favourably with the results for the Shanghai undertaking in 1924. In view of the difficulties which the undertaking has had to overcome, due to war, civil commotion, poor trade, and at times fuel shortage, the results obtained are very creditable.

French Electric Vehicle Trials.—Trials of electric accumulator vehicles to take place from June 5th to June 20th have been organised by the Union of Electricity Syndicates in agreement with the Ministry for War, the National Office of Scientific and Industrial Research and Inventions, the Automobile Club of France, and the Central Electricity Laboratory. Great advantages are expected from these vehicles. The accumulators are recharged nightly with the surplus energy of the large electricity works; as this electricity can be sold very cheaply the running expenses of lorries, goods vans, and small trucks for interior transport in factories and warehouses of the kind used in the railway stations are very low. The vehicles used in the trials will be parked for part of each day in the Cours la Reine along the Grand Palais, where the public will be able to examine them.—*Reuter's Trade Service* (Paris).

Institution Notes.

Institution of Electrical Engineers.—Scottish Centre.—On April 30th, at Dundee, Capt. P. P. Eckersley delivered a lecture on "The Past, Present, and Future Development of Wireless Telephony." Prof. Magnus MacLean, chairman of the Centre, presided, and there was an enthusiastic audience of considerably over 500 present. On Saturday, May 1st, members of the Centre and their friends left Dundee for an excursion by road to St. Andrews, where luncheon and tea were served in Rusack's Marine Hotel. The excursion was taken part in by a party of about sixty, including ladies, and was greatly enjoyed by all.

The Institution of Railway Signal Engineers.—Annual Report.—Part 2 (August, 1925, to February, 1926) of the *Proceedings*, 1925-26, of the above Institution contains a catalogue of the Institution library and the 13th annual report (1925). The total membership on January 1st, 1926, was 615. The revenue for the year in question amounted to £650 and the expenditure resulted in a balance of £111.

Association of Mining Electrical Engineers.—South Wales Branch.—The South Wales branch of the Association, meeting in Cardiff, elected Mr. Dawson Thomas, A.M.I.E.E., United National Collieries (Risca), chairman for the ensuing year. Messrs. E. I. David, M.I.E.E. (Aberaman) and T. S. Thomas, A.M.I.E.E. (Bedwas) were elected vice-chairmen, and A. C. MacWhirter, A.M.I.E.E., and H. J. Norton, A.M.I.E.E., re-elected hon. treasurer and hon. secretary respectively. Messrs. C. F. Freeborn (Cardiff), R. Illingworth (Ogmore Vale), W. Roberts (Cardiff) and W. Wolfe (Llanbradach) were elected new members of the committee.

Royal Institution.—Annual Meeting.—The annual meeting was held on May 1st, Sir James Crichton-Browne, treasurer and vice-president, in the chair. The annual report of the Committee of Visitors for the year 1925, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. Sixty-two new members were elected in 1925, and 63 lectures and 20 evening discourses were delivered. The following gentlemen were elected as officers for the ensuing year: President, the Duke of Northumberland; treasurer, Sir Arthur Keith; secretary, Sir Robert Robertson. At a general meeting of the members on May 3rd, Sir J. J. Thomson was elected Honorary Professor of Natural Philosophy and Sir Ernest Rutherford was elected Professor of Natural Philosophy.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. Walter T. Young, of Dundee tramways, has been selected by the Halifax Corporation Tramways Committee as tramway manager (subject to formal confirmation by the next Town Council meeting), in succession to Mr. Ben Hall, who was recently appointed tramway manager to Plymouth Corporation. There were 33 applications for the position.

Mr. W. E. Wimhurst, who is retiring from the staff of Callender's Cable & Construction Co., Ltd., Belvedere, after over 31 years' service, has been presented by his colleagues with a 5-valve wireless set. Sir Tom Callender made the presentation on May 7th.

Mr. T. S. Wallis, station superintendent at the Wimbledon power station, has resigned to take up an appointment with the Bristol Corporation.

Mr. Alan Williams, M.I.E.E., has resigned his appointment with British Brown-Boveri, Ltd., and will be pleased to hear from any of his friends, at 16, Messaline Avenue, Acton, London, W.3.

The *East London Observer* states that Sir George Hume, M.P., has resigned his membership of the London and Home Counties Joint Electricity Authority, and Mr. F. Bertram Galer, M.A., F.I.A., has been appointed a representative of the L.C. Council in his place.

Mr. C. Petersen has been appointed Metropolitan-Vickers' London district manager, in succession to Mr. P. F. Crinks, who is now managing director of the Metro-Vick Supplies Co.

The Aylesbury Council has increased the salary of Mr. W. A. Turnbull, borough electrical engineer, to £750 per annum, and has adopted, as the basis of his future remuneration, the minimum salary scale of the Associated Municipal Electrical Engineers (Great Britain and Ireland).

Mr. A. T. Arnall, B.Sc., has been appointed executive engineer, Electrical Project Division, on the Punjab Government's Mandi hydro-electric scheme.

Mr. Henry G. Spencer has been appointed engineer to Standard Telephones & Cables, Ltd., North Woolwich.

Grange-over-Sands Council has appointed Mr. J. Simms as resident electrical engineer, at £250 per annum.

We are pleased to learn that Mr. P. F. Allan has completely recovered from his operation for appendicitis, and all local correspondence in connection with the affairs of the North-Eastern Centre of the Institution of Electrical Engineers and the Summer Meeting, June 7th-11th, should be addressed to him c/o The Macintosh Cable Co., 26, Mosley Street, Newcastle-upon-Tyne.

We are informed that the appointment of electrical engineer for the burgh has been made by Hamilton Town Council. By 11 votes to 3, Mr. W. J. Cooper (at present acting engineer at the Hamilton Corporation Electricity Works) has been appointed.

The Sunderland Corporation has agreed to express its appreciation of the services of the general manager and engineer, Mr. A. S. Blackman, by giving him three months' special leave of absence, with salary, early next year. Mr. Blackman intends to make a tour in America during that period.

Obituary.—Sir Thomas Skinner.—The death occurred last week, at the age of 86 years, of Sir Thomas Skinner, who, in addition to having large Canadian and other financial interests, was a director of the Commercial Cable Co. and chairman of the Halifax and Bermudas Cable Co. and the Direct West India Cable Co.

Mr. H. W. Bowden.—We regret to learn of the death, which occurred on May 9th, at Modwell House, Great Missenden, of Mr. Henry White Bowden, M.I.E.E. He was 58 years of age.

Will.—The late Mr. A. P. Lundberg left £17,919.

New Companies Registered.

Palmers Green Radio Service, Ltd. (213,594).—Private company. Registered May 3rd. Capital, £100 in £1 shares. Objects: To acquire the business of makers of and dealers in wireless apparatus and gramophones and their accessories of all kinds, carried on by A. E. Frost and F. W. Goff, at 15, Melbourne Parade, Palmers Green. The first directors are:—A. E. Frost, 38, Arlow Road, Winchmore Hill, N.21; F. W. Goff, 102, Woodside Road, Bowes Park, N.22. Qualification, £1. Remuneration as fixed by the company. Secretary: F. W. Goff. Solicitors: Simmons and Simmons, 1, Threadneedle Street, E.C.2. Registered office: 15, Melbourne Parade, Palmers Green, Middlesex.

Reilly & Brookes, Ltd. (213,595).—Private company. Registered May 3rd. Capital, £1,500 in £1 shares. Objects: To carry on the business of electrical, automobile and mechanical engineers, &c. The first directors are:—F. Reilly, 1, Tyldesley Road, Atherton; W. Brookes, 83, Castle Street, Tyldesley; T. Bullough, 456, St. Helen's Road, Bolton. Qualification, 200 shares. Secretary: T. Bullough. Registered office: 12a, Church Avenue, Bolton.

Southwold Electricity Supply Co., Ltd. (213,597).—Private company. Registered May 3rd. Capital, £20,000 in £1 shares. Objects: To carry on the business indicated by the title, and to adopt an agreement with Edmundson's Electricity Corporation, Ltd. The directors are:—A. N. Rye, Woodland, Virginia Water, Surrey; C. H. Jones, 67, Hayes Road, Bromley, Kent; A. Anderson, 141, Worple Road, Wimbledon, S.W. Qualification, 50 shares. Remuneration as fixed by the company. Solicitors: Godfrey Warr, Clarkson & Co., 85, Gracechurch Street, E.C. Registered office: Broad Sanctuary Chambers, Westminster, S.W.1.

Chambers & Champion, Ltd. (213,589).—Private company. Registered May 3rd. Capital, £5 in 1s. shares. Objects: To carry on the business of manufacturers of and dealers in electrical, wireless, and other apparatus, builders, manufacturers of and dealers in metal, wooden, vulcanite and other types of articles, motor and aeroplane manufacturers and dealers, &c. The subscribers (each with one share) are:—C. F. Stewart, 7, Alcester Crescent, E.5, clerk; W. F. Palles, 2, Merton Hall Road, Wimbledon, S.W.19, company director. The directors are:—W. F. Palles and C. G. Hofman. No share qualification required. Remuneration as fixed by the company. Secretary: W. F. Palles. Solicitors: Donald McMillan and Mott, Stafford House, 14, King William Street, E.C.4. Registered office: 7a, Victoria House, South Lambeth Road, S.W.8.

Portable Accumulators, Ltd. (213,692).—Private company. Registered May 7th. Capital, £4,400 in 4,000 10 per cent. participating preference shares of £1 each and 8,000 ordinary shares of 1s. each. Objects:—To carry on the business of manufacturers of, and dealers in electric accumulators and generators of all kinds, &c. The subscribers (each with one £1 share) are:—A. W. Slade, 73, Nichols Square, Hackney Road, E.2, clerk; C. Warren, 32, Heathfield North, Twickenham, clerk. The first directors are to be appointed by the subscribers. Solicitors: Mayo, Elder & Co., 10, Drapers' Gardens, E.C.2.

The North Metropolitan Power Station Co., Ltd. (213,642).—Registered as a "public" company on May 5th, with a nominal capital of £100 in £1 shares. Objects:—To construct or equip or enter into agreements for the construction and equipment of a generating station at Brimsdown, Enfield, to grant a lease of the said proposed generating station to the North Metropolitan Electric Power Supply Co. to generate and supply electricity, to construct, fix, and lay down cables and wires, &c. Minimum cash subscription, 7 shares. The first directors are:—Sir James Devonshire, 55, Broadway, Westminster (chairman and managing director, North Metropolitan Electric Power Supply Co.); Emile Garcke, 88, Kingsway, W.C.; Sir Alexander Roger, Norfolk House, Victoria Embankment, W.C.; E. R. Soames, 88, Kingsway, W.C.; C. G. Tegetmeier, 88, Kingsway, W.C. The last four named are all directors of the above-named company. Qualification, £1. Remuneration (except managing directors), £250 per annum, divided between them. Secretary: E. Boys. Solicitors: Stanley & Co., 11, Albemarle Street, W.1. Registered office: 55, Broadway, Westminster, S.W.1.

Mold Accumulators, Ltd. (213,656).—Private company. Registered May 5th. Capital, £1,000 in £1 shares (500 6 per cent. cumulative preference and 500 ordinary). To acquire the business of an accumulator manufacturer now carried on by A. Tunnicliff at Grosevnor Street, Mold, Flint, as "Arthur Tunnicliff." The permanent directors are:—A. Tunnicliff, Bromfield Villa, Mold; E. Tunnicliff, 10, Broncoed Park, Mold. Qualification, 10 shares. Remuneration, £50 per annum, divided between them. Solicitor: W. P. Morris, Church Lane, Mold.

British Glowlamp and Valve Co., Ltd. (213,648).—Private company. Registered May 5th. Capital, £1,000 in £1 shares. Objects:—To acquire the business of an electrical and mechanical engineer and a manufacturer and repairer of wireless valves and parts and electric light globes and parts now carried on by A. Barnes-Thomas at 27, Kirby Street, Hatton Garden, E.C.1, as "The British Glow Lamp and Valve Co.," and to adopt an agreement with the Barnes Land and Trust, Ltd., and Albert Barnes-Thomas. The first directors are:—A. Barnes-Thomas, 64, Louisen Str., Dresden, Germany; S. H. Price, 8, Carew Road, Wallington. Qualification, 50 shares. Remuneration, £50 each per annum. Solicitors: Saml. Price, Sons & Robertson, 3, Bond Court, Walbrook, E.C.4. Registered office: 27, Kirby Street, Hatton Garden, E.C.4.

H. H. Ridley & Co., Ltd. (213,637).—Private company. Registered May 5th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of electrical, mechanical, and motor engineers and contractors, dealers in wireless apparatus, garage proprietors, motor-car dealers, &c. The first directors are:—H. H. Ridley, 30, Lawn Crescent, Kew Gardens, motor engineer; W. A. Rich, 26, Peabody Buildings, Old Pye Street, Westminster, motor engineer. Qualification, 1 share. Solicitors: Bateman and Co., 5, John Street, Bedford Row, W.C.1. Registered office: Orchard Road Motor Works, Orchard Road, Richmond.

Cattley Accumulator Co., Ltd. (213,534).—Private company. Registered April 30th. Capital, £5,000 in £1 shares. Objects:—To acquire the business of L. de M. Cattley and R. E. D. Cattley, trading as the "Cattley Accumulator Co.," and to carry on the business of manufacturers of accumulators and batteries, of which L. de M. Cattley is patentee, &c. The subscribers (each with one share) are:—M. J. Coggins, 46, Charles Street, Cardiff, auctioneer; H. Blake, 106, Plymouth Road, Penarth, engineer. The first directors are:—L. de M. Cattley, R. E. D. Cattley, E. J. Davies, S. A. Smith, and T. B. Humphries, addresses not stated. The first two named shall be permanent so long as they each hold 200 shares. Qualification, 200 shares. Remuneration as fixed by the company. Solicitor: E. J. Davies, 39, Charles Street, Cardiff.

Ormsby & Co., Ltd. (213,554).—Private company. Registered April 30th. Capital, £2,000 in £1 shares. (850 5 per cent. cumulative preference and 1,150 ordinary). Objects:—To acquire the business of manufacturers of, and dealers in wireless receiving and transmitting apparatus carried on at 28, Page Street, Westminster, and at Elstree, Herts., as "Ormsby & Co.," and to adopt an agreement with R. Ormsby Cary, A. Barringer, L. Ormsby, and J. St. C. Bryden. The first directors are:—R. O. Cary, Pomfret House, Sunbury-on-Thames, wireless manufacturer; A. Barringer, "Isca," Boreham Wood, Herts., electrical engineer; L. Ormsby, 77, Page Street, Westminster, wireless manufacturer; J. St. C. Bryden, 5, Shardcroft Avenue, Herne Hill, S.E., wireless manufacturer (all permanent, subject to holding 300 shares each). Solicitors: Oliver Richards & Parker, 1e, King Street, St. James', S.W. Registered office: 21, George Street, Hanover Square, S.W.1.

Official Returns of Electrical Companies.

"M.K." Electric, Ltd.—Issue on May 1st, 1926, of £1,000 debentures, part of a series already registered.

Simmonds & Stokes, Ltd.—Satisfaction to the extent of £2,000 on March 24th, 1926, of debentures dated April 15th, 1924, securing £7,000.

Scammell & Abbott, Ltd.—W. F. Chaundy, of 71, Temple Row, Birmingham, C.A., was appointed receiver and manager on April 24th, 1926, under powers contained in first mortgage debenture dated March 17th, 1926.

Midland Electric Lamp Co., Ltd.—Particulars filed of £500 debentures authorised March 16th, 1926, charged on the company's property, including uncalled capital, the amount of the present issue being £300.

Magnetic Transmission Co., Ltd.—G. T. G. Stevens, of Carlton House, Regent Street, S.W.1, ceased to act as receiver or manager on April 30th, 1926.

Aldeburgh Electric Supply Co., Ltd.—Satisfaction in full on April 13th, 1926, of charge dated August 7th, 1912, securing all moneys due or to become due not exceeding £2,500.

Isaacson & Brown, Ltd.—H. C. Mundy, of 93 and 94, Chancery Lane, W.C.2, ceased to act as receiver or manager on April 22nd, 1926.

H. Haydon & Co., Ltd.—T. F. Birch, of Court Chambers, Friar Lane, Leicester, C.A., ceased to act as receiver or manager on May 3rd, 1926.

Instrument Screw Co., Ltd.—Debenture dated April 22nd, 1926, to secure £3,000 charged on the company's undertaking and property, present and future, including uncalled capital, land at South Harrow, and the company's other freehold, leasehold, and copyhold property. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.

H. T. Boothroyd, Ltd.—Satisfaction in full on May 3rd, 1926, of charges dated February 2nd, 1910, and September 11th and November 26th, 1923, securing all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

Clemson & Smith, Ltd.—Mortgage dated April 30th, 1926, to secure £200 and further advances not exceeding therewith £500 charged on certain freehold land and buildings in Hersham Road, Walton-on-Thames. Holder: Miss E. S. Creed, Jessamine Cottage, High Street, Bampton, Oxford.

Nelson Electric Co., Ltd.—G. S. Hyams, of Salisbury House, London Wall, E.C.2, was appointed receiver on April 23rd, under powers contained in debenture dated April 20th, 1926.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Lancashire Electric Light and Power Co., Ltd.

The trading profit of the Lancashire Electric Power Co. for the year ended March 31st last was £177,470, and to this is added £9,376 brought forward, making £186,846. Of this £60,000 has been allocated to depreciation, £9,000 to income tax reserve and £7,928 has been carried forward, leaving a balance of £109,918 which has been paid over to the Electric Light & Power Co. The balance at credit of the profit and loss account of the latter company is £108,169, plus £8,379 brought forward, making £116,548. After paying the preference dividends and interest on new shares, a dividend at the rate of 7½ per cent. is to be paid on the ordinary shares, leaving £9,826 to be carried forward. It is expected that the new Padiham station will be ready for commercial operation in September next. A 33,000-V main is being laid between that station and the Radcliffe station. The report shows that the Power Company generated or purchased 151,495,964 kWh, as against 130,043,552 kWh in 1924-25. The maximum load rose from 60,930 h.p. to 70,200 h.p. and the connections from 79,900 h.p. to 89,200 h.p.

German Companies.

The *Bergmann Electricity Works Company*, Berlin, records gross profits of 6,257,000 marks for 1925, as against 5,301,000 marks in the previous year, the net profit being 2,599,000 marks, as compared with 2,271,000 marks. It is proposed to increase the rate of distribution from 5 per cent. to 6 per cent.

The *Transradio Company for Oversea Communications*, Berlin, states that the technical equipment at the Nauen and Eilvese wireless stations was further improved during 1925, and a material improvement was obtained in the receiving branch, while new installations were projected at Eilvese as a result of the experience gained at Nauen. The possibilities of short-wave signalling were being studied. Short wave transmitters constructed by the Telefunken Company for experimental purposes had been used by the company for some time past with favourable results, and the establishment of larger transmitters was in contemplation. As compared with 1924 the oversea traffic increased last year by 11 per cent. It was possible in the immediate future that the Nauen-Buenos Ayres connection would be amplified by the establishment of direct communication with Rio de Janeiro, where a large station had been completed. The accounts show net profits of 1,370,000 marks, as compared with 1,420,000 marks in 1924, and the dividend is at the rate of 8 per cent. on the ordinary shares. At the recent annual meeting it was mentioned that preparations were being made for the establishment of communication with South Africa.

Craigpark Electric Cable Co., Ltd.—The accounts for the year ended March 31st last show a net profit of £15,289; to this is added £1,518 brought forward, making £16,807. This is distributed as follows: To depreciation, £3,500; to reserve, £3,000; preference dividends, £2,850; dividend of 12½ per cent. on the ordinary shares, £4,688; carried forward, £2,769. The report records the death of Mr. A. B. Maclean, the founder and managing director of the company and the appointment of Mr. G. Herbert as general manager and a director. Messrs. A. Verdie and D. Todd have also joined the board.

British Thomson-Houston Co., Ltd.—The profit for 1925 was £467,200, and with £211,920 brought forward the amount available is £679,120. After defraying interest charges, &c., it is proposed to pay a dividend of 6 per cent. upon the ordinary shares and to carry forward £220,126. The amount expended upon additions to buildings and plant during the year was £289,066, principally upon extensions at the Rugby and Willesden works. Meeting: May 31st.

Philips Glow Lamp Works.—The report of Philips Gloeilampen Fabrieken, of Eindhoven, states that it was able to work at full capacity in 1925 and successfully meet competition, and many new articles in the wireless branch were placed on the market. All the machines, apparatus, buildings and sites acquired during the year were written off at a total of 3,500,000 fl. After having made provision for depreciation on "participations" the accounts show a working surplus of 7,500,000 fl. as compared with 6,210,000 fl. in 1924, the net profits being 4,000,000 fl. and 3,330,000 fl. in the two years respectively. The rates of dividend, as previously announced, remain at 8 per cent. on the preference shares and 16 per cent. on the ordinary capital as in 1924. The ordinary share capital amounts to 17,500,000 fl. as against 14,000,000 fl. in 1924, and the preference shares represent 5,265,000 fl. as against 4,500,000 fl. The directors have resolved to recommend an increase in the share capital this year for the purpose of financing further works extensions.

Calcutta Electric Supply Corporation, Ltd.—The report for 1925 shows a net profit of £422,469 (as compared with £380,254), to which is added £32,823 brought forward, making £455,292. After providing for depreciation, preference dividends, interest, &c., it is proposed to transfer £50,000 to reserve, £3,000 to insurance fund, and £1,000 to retiring gratuity fund. The final dividend on the ordinary shares is 7 per cent., making 12 per cent. for the year, and £33,048 is carried forward. The sales of energy rose from 85,268,793 kWh to 100,587,227 kWh. Work on the new Southern Station is progressing and an issue of 300,000 shares (half preference and half ordinary) has been made to finance the work. Meeting held May 19th.

Ever Ready Co. (Great Britain), Ltd.—The profit for the year ended March 31st last was £139,488 and to this is added £22,691 brought forward, making £162,179. The profit for 1924-25 was £95,683. After transferring £47,242 to reserve and paying dividends, totalling 25 per cent. in the case of the old shares and 20 per cent. on the new shares, £23,864 is carried forward. The report states that there was a considerable expansion in the company's business which was contributed to by subsidiary undertakings. The expenditure on extensions during the year amounted to £16,594 increasing production facilities. Following the authorisation obtained in March last a bonus issue of 49,800 £1 shares was made in the proportion of one to five. After the general meeting on June 1st meetings will be held to sanction the creation and issue of 250,000 new ordinary shares.

Belgian Company.—The *Compagnie Générale de Railways et d'Electricité*, Brussels, which is an investment undertaking with a combined capital of 60,000,000 fr., reports net profits of 7,945,000 fr. for 1925; the dividend is at the rate of 40 fr. per ordinary share. The directors say that the results were very satisfactory; the transport undertakings continued to yield favourable results, the business of the supply works continued to expand, and the manufacturing companies had adequate orders.

Companies to be Struck off the Register.—The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Aerophones, Ltd.
Bennetts (Electrical Engineers), Ltd.
Beta Light and Heating Co., Ltd.
Hardware and Electrical Co., Ltd.
Lacland Electric Mfg. Co., Ltd.
Residential Wireless, Ltd.
Shaw Electrical Transmission Co., Ltd
Vauxhall Electrical Mfg. Co., Ltd.
Waterloo Electric Co., Ltd.
Wholesale Wireless Co., Ltd.
Wireless Accessories Stores, Ltd.
Wireless Club, Ltd.
Wireless Supplies, Ltd.

Anglo-American Telegraph Co., Ltd.—The report for 1925 states that the dividends paid on the ordinary, preferred and deferred stocks, together with £54,141 for income tax, absorbed £262,500, being the rent paid by the Western Union Co. for the year—equal to 3¾ per cent. on the ordinary, 6 per cent. on the preferred, and 1½ per cent. on the deferred stocks. A balance of £65,625 is available for the payment of dividends for the quarter ended March, 1926. Meeting, May 21st.

Aron Electricity Meter, Ltd.—A final dividend of 3 per cent. is being paid on the preference shares and the ordinary shares are to receive 6 per cent. in respect of the year ended March 31st.

Swedish Company.—The report of the *Svenska Ackumulator A.B. Jungner* states that both orders and output increased during 1925. The net profits rose from 137,000 kr. to 201,000 kr. and the dividend on the ordinary shares is increased from 3 per cent. to 6 per cent.

Luxemburg Company.—The *Societe Luxembourgeoise pour Entreprises Electriques*, of Luxemburg, which is closely associated with the Berlin A.E.G., earned net profits of 411,000 fr. in 1925 and the dividend is at the rate of 11 per cent., as in 1924.

Holsworthy Gas and Electric Supply Co., Ltd.—At the company's annual meeting a dividend of 4 per cent., the first dividend for 10 years, was declared.

British Electric Traction Co., Ltd.—A final dividend of 5 per cent. has been declared on the ordinary shares, making 8 per cent., as against 7 per cent. for 1924.

Western Telegraph Co., Ltd.—The directors have declared the third quarterly dividend of 5s. per share, free of tax.

Guernsey Electric Light and Power Co., Ltd.—After meeting debenture interest, and preference and interim ordinary dividends, a balance of £9,851 remains on account of the past year. It is proposed to transfer £3,500 to general reserve and £500 to employés' benevolent fund; to pay a final dividend of 6 per cent. on the old ordinary shares (making 10 per cent.) and six months' dividend on the new ordinary shares, and to carry forward £776. To meet the growing demand extensions costing about £80,000 are to be carried out. The first portion of the work has been completed and new capital was issued to cover the cost (£17,500). Additional land has been acquired and orders have been placed for 3,000 kW of modern turbo plant.

Potteries Electric Traction Co., Ltd.—The report for 1925 shows a total revenue of £255,985. After meeting all expenses and adding £7,715 brought forward, there remains £19,262. Debenture and loan interest absorbs £13,752 and it has been decided to carry forward the balance of £5,510. Reference is made to excessive omnibus competition, and it is stated that the company's own 'bus services have been considerably extended. Mr. P. M. Rossdale has been appointed to the seat on the board rendered vacant by the death of Mr. J. M. Fells.

Alderley and Wilmslow Electric Supply, Ltd.—After providing for debenture and loan interest, depreciation, &c., and adding £639 brought forward, the balance available from 1925 was £3,426. It was proposed to place £1,000 to general reserve, to pay a final dividend of 5 per cent., free of tax, on the ordinary shares, making 8 per cent., tax free, for the year, and to carry forward £826.

Cuba Submarine Telegraph Co., Ltd.—Final dividend of 5s. tax free, making 5 per cent. for the year.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price May 19th	Inc. or dec. Since April 27th.
a Acid, Oxalic ... ... per lb.	5¾d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£15 15s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£120 to £125	...
b ,, Wire ... ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... ... per ton net.	£245	£5 dec.
Grade II ... ... ,, ,,	£171	£4 dec.
Grade III... ... ... ,, ,,	£93	£2 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅜d.	...
c ,, Tubes (solid drawn) ... ,,	11⅛d. to 1/-	...
c ,, Wire, basis ... ... ,,	9½d.	...
c Copper Tubes (solid drawn) ... ,,	1/0¾	...
c ,, Bars (best selected) ... per ton.	£90	...
c ,, Sheet ... ... ,,	£90	...
c ,, Rod ... ... ,,	£90	...
d ,, (Electrolytic) Bars ... ,,	£65	10/- dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£75	10/- dec.
d ,, ,, H.C. Wire per lb.	9 7/16d.	½d. dec.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/2	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/10	1d. dec.
i Iron Pig (Cleveland Warrants) ... per ton.	nom.	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£30 5s.	...
g Mercury ... ... per bot.	£15 5s.	5/- inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/3½	½d. dec.
o Platinum ... ... per oz.	£23 10s.	...
d Silicium Bronze Wire ... ... per lb.	11¾d.	½d. dec.
r Steel, Magnet, in bars ... ... ,,	7¾d.	...
n Tin, Block (English) ... ... per ton.	£266 10s. to £267	£10 5s. to £10 15s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange refused to believe during the General Strike that the end of such a movement could come in any way except one. The only point in doubt was the length of time over which the trouble could extend. Throughout the period, people were trying to buy sound stocks and shares. So far from there being any desire to sell on the part of investors, the reverse proved to be the case, and good-humoured disappointment was expressed by the would-be purchasers at their failure to find anything that was really cheap.

As already indicated, the jobbers in the various investment markets were quick to notice this tendency, and they promptly issued lists of shares that they wanted to buy for brokers acting on behalf of the public. The net result, so far as Stock Exchange prices are concerned, is that values have suffered scarcely at all, and in some cases stand higher to-day than they did at the beginning of the trouble. Where the Stock Exchange has felt the blow mostly is in the loss of business which the uncertainty and suspense occasioned. It remains to be seen whether the settlement will give that impetus to good business which can fill the gaps caused by the attempted revolution.

In the substantial rises that took place early this week, the Home Railway stocks assumed the lead. The Underground group, first to announce resumption of normal conditions of work, stood out well in the rally. Underground £10 shares gained 7s. 6d., and so reverted to the price at which they stood just prior to the outbreak of the strike. The shilling shares, at 11s. 6d., are 1s. 6d. higher on the fortnight, and the 6 per cent. income bonds remain at 99, from which price they moved but little all the time. Metropolitans are 1½ up at 66, and Districts 1½ at 53. The former yield rather over 7½ per cent. on the money, and Districts 6⅝ per cent. The 6 per cent. tax free return from Underground incomes is equivalent to 7½ per cent., taking tax at 4s. in the pound.

Brazilian Tractions enjoyed a somewhat spectacular spurt to 98. The shares are, of course, of dollar denomination, and the rise in the value of sterling to its parity point, the highest reached since the outbreak of war, had no effect in restraining the strength of the shares. United States utility issues are better as a whole, but the improvement has not extended to Mexicans. Mexican Light preferred are two points lower on the fortnight. Mexico Tramways fives are 1 to the good.

Babcock & Wilcox have made a rapid recovery, being 2s. 3d. up at 5½. There would seem to be a shortage of shares in the market, although Babcocks are so strongly held as to make bear selling a risky operation. Johnson & Phillips at 2¾ are ex dividend. General Electrics are nearly 30s. Siemens hardened to 3⅛; the new shares, 18s. paid, are better at 24s. 3d. Edisons are dull at 8s., but the first debenture hardened to 83. Callender's have put on half a crown at 3⅞. Other shares in this group, after a display of dulness, regained their former figures, and are scarcely changed from the levels that ruled at the beginning of this month.

Aron Meter ordinary are firm at 18s. 9d., upon declaration of a 6 per cent. dividend for last year, this going against 3 per cent. in the corresponding period, when the company paid off all the arrears that remained to be dealt with on the 6 per cent. preference shares. The price of the latter stands at 17s. British Thomson-Houston 7 per cent. preference are unchanged at 23s. 6d.; the ordinary are not quoted in the Stock Exchange lists. The company announces a reduction in net profit, but the dividend on the ordinary is the same as before, though allocations to depreciation and reserve are reduced. Criticism is directed to the general reserve being no more than £220,000, which looks comparatively small for a company of the B.T.H. magnitude.

Charing Cross and County ordinary are better, and a few small advances have occurred in the list of provincial lighting shares. Folkestones, for instance, firmed up to 36s. 3d. The cable group is featureless. Great Northerns continue to be quoted at 29. The report may be regarded as somewhat disappointing. Wireless shares have a better tendency, and Radio Common rose to 8¾.

British Electric Traction has jumped to 130½, showing a gain of 3 points. Beyond this, no alteration occurred in this particular section.

The rubber market holds a fair amount of firmness, although demand is restrained by reason of the sagging nature of the raw material's price. Markets on the whole are bright and cheerful. It is declared that the failure of the general strike is a welcome bull point, as proving that this long-cherished threat need no longer be regarded as a weapon capable of paralysing industry.

Application is invited for 8 per cent. (tax free) preference shares and founders' shares in the Cambrian Electricity Supply Corporation, Ltd. The concern is one of the group associated with the Electric Light and Power Contracts Finance Corporation, Ltd. The directors of the Cambrian Electricity Supply Corporation are Maior James Brigden, L. J. Waring and Capt. E. F. Hill. The solicitor is "W. Thompson, Esq."—we quote from the prospectus—whose address is 43, Cannon Street, London, E.C. The whole scheme is founded upon estimates, and it seems astonishing that anyone should deem it worth while to circulate offers of shares in an undertaking of this nature; apparently there are still to be found some people whose ignorance of financial matters can be played upon by a plausibly-worded prospectus.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	1925.	Price May 18 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	55/9	—	4 16 0
Brompton Ordinary	1	10	10	1⅝	—	*6 3 1
Charing Cross Ordinary	1	15	15	45/9	+1/16	6 11 2
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	45/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/-	—6d.	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	57/-	+1/-	5 5 2
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Edmundson's Ordinary	1	7	7	23/-	—6d.	6 1 9
do. 7% Pref.	1	6	7	22/-	—	6 7 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	26/-	—	5 11 1
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	35/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—	6 0 0
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/-xd	—	5 9 1
St. James' and Pall Mall	5	17½	17½	16⅛	—	5 8 6
South London	1	15	15	2⅜	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	7	1 1/16xd	—	6 11 9
do. 6 % Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/3	—	6 18 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	1	+6d.	7 10 0
Yorkshire Elec.	1	8	8	26/6	—	6 0 9

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68	—	5 17 8
Metropolitan	,,	5	5	66	+1½	7 11 6
do. District	,,	3½	3½	53	+1½	6 12 0
Underground Electric Ordinary	10	Nil	Nil	3⅞	+⅜	Nil
do. do. "A"	1/-	Nil	Nil	11/6	+1/6	Nil
do. do. Income	Bonds	6	6	99	—	*6 1 3

TELEGRAPHS AND TELEPHONES.

		Dividend. 1923.	1924.			
Anglo-Am. Tel. Pref.	Stock	6	6	101½	+½	5 18 3
do. Def.	,,	1½	1½	23¾	—	6 6 4
Automatic Telephone	1	3	6	2 7/16	—	4 2 1
Chili Telephone	5	6	5	6⅞	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6⅜	—	7 8 2
Eastern Extension	10	10	10	17¾	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17¾	—	*5 12 8
do. do. Pref.	10	6	6	10¾	—	5 11 7
Great Northern Tel.	10	22	20	29	—	6 18 0
Indo-European	25	8½	10	45½xd	—	*5 10
Marconi	1	10	10	1 3/16	—	8 8 6
Marconi-Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/-	—	*5 14 3
United R. Plate Tel.	5	8	8	7⅞	—	*5 1 7
Western Telegraph	10	10	10	17¼	—	*5 15 11

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3 1/10	—	8 19 6
do. do. 2nd Pref.	5	6	6	2 11/16	—	11 3 4
do. do. 5% Deb.	Stock	5	5	73½	—	6 16 3
British Electric Traction Ord.	,,	6	6	130½	+3	4 12 4
do. do. 6% Pref.	,,	6	6	107	—	5 12 2
Brazil Traction	100	4	5	98	+5	5 2 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	85½	—	5 17 0
do. do. Preferred	,,	96/-	96/-	106½	+1	*4 10 4
do. do. Deferred	,,	129/5	129/5	127	+1	*5 1 9
do. do. Deb.	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	48	—	8 6 8
Mexico Trams, 5% Bonds	—	5	5	64½	+1	7 15 0
Mexican Light Common	100	Nil	Nil	30½	—	Nil
do. Pref.	100	Nil	Nil	73½	—2	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	2 9/16	+2/3	*5 1 4
British Aluminium Ord.	1	5	10	2 1/16	—	4 17 0
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅜	—	4 16 0
Brush Ord.	1	10	10	25/9	—	7 15 4
Callenders	1	15	15	3⅞	+⅛	3 17 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/-	—3d.	5 0 0
do. 5% Deb.	Stock	5	5	83	+½	6 0 6
Electric Construction	1	10	10	31/-	—	6 9 0
Enfield Cable Pref.	1	7½	7½	1¼	—	6 0 0
English Electric	1	5	Nil	15/-	—1/8	... ...
do. do. Pref.	1	6	6	18/3	—	6 11 6
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	7½	29/9	+9d.	5 0 10
Henley	1	15	16	3¾	—	4 5 4
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	2¾xd	—7/6	6 7 3
Met.-Vickers Ord.	1	8	8	1 5/16	+9d.	6 14 9
do. Pref.	2	8	9	2⅜	—	6 14 9
Siemens Ord.	1	—	7½	1 5/16	+9d.	4 16 0
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

27,568. "Electrical installations for railway and like vehicles." J. Stone and Co., Ltd., and A. E. Kennard. November 18th, 1924. (250,627.)

28,532. "Couplings for electrical wires." G. S. G. Morgan. August 4th, 1925. (250,628.)

28,883. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). December 2nd, 1924. (250,629.)

1925.

227. "Amplifying systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). January 3rd, 1925. (250,641.)

533. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (G. Deakin). January 7th, 1925. (250,642.)

534. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd. (G. Deakin). January 7th, 1925. (250,643.)

542. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (G. Deakin). January 8th, 1925. (250,644.)

828. "Selecting switches for use in telephone systems." Siemens and Halske Akt.-Ges. and F. Doring. January 10th, 1925. (250,647.)

1,136. "Control mechanism of electric switchgear." A. Reyrolle & Co., Ltd., W. Anderson, and H. W. Clothier. January 14th, 1925. (250,656.)

1,186. "Illuminating appliances." W. A. Dorey. January 14th, 1925. (250,660.)

1,270. "Brush-tensioning spring for dynamo-electric machinery." British Thomson-Houston Co., Ltd., and A. A. Pollock. January 15th, 1925. (250,665.)

1,271. "Oil-immersed electric switchgear installations." British Thomson-Houston Co., Ltd., H. C. Heath, E. D. Regis, and H. G. Ruddick. January 15th, 1925. (250,666.)

1,272. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. January 15th, 1925. (250,667.)

1,273. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. January 15th, 1925. (250,668.)

1,301. "Radio direction finders." F. Woods. January 15th, 1925. (250,670.)

1,371. "Construction of plug and socket connections for electrical purposes." G. O. F. Lane. January 16th, 1925. (250,673.)

1,473. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 17th, 1925. (250,680.)

1,474. "Battery-charging arrangements." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 17th, 1925. (250,681.)

1,709. "Electric switchgear." A. Reyrolle & Co., Ltd., H. W. Clothier, and A. Allan. January 20th, 1925. (250,686.)

1,713. "Electric switches particularly applicable for vehicle warning devices." F. T. Bersey. January 20th, 1925. (250,687.)

1,751. "Dry batteries or batteries with a solidified electrolyte." Soc. Anon. "Le Carbone." February 7th, 1924. (228,872.)

1,803. "Diaphragms for loud-speakers, telephones, gramophones, phonographs, or any sound-reproducing machine." A. M. Foweraker. January 21st, 1925. (250,692.)

2,127. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., J. E. Ostline, and T. M. Edmunds. January 23rd, 1925. (250,694.)

2,165. "Electric switches." F. B. Cox. January 24th, 1925. (250,696.)

2,971. "Carrier current systems." F. W. Le Tall (Westinghouse Electric and Manufacturing Co.). February 2nd, 1925. (250,703.)

4,493. "Electric signalling systems employing carrier waves." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). February 18th, 1925. (250,713.)

4,726. "Wireless aerials." W. E. Durrant and K. I. Rayment. February 20th, 1925. (250,714.)

5,061. "Diaphragms for sound-reproducing instruments." India-Rubber, Gutta Percha and Telegraph Works Co., Ltd., and W. G. Spinks. February 24th, 1925. (250,719.)

6,496. "Anti-dazzle device for the headlights of motor vehicles." C. W. Nesbitt and B. C. Aldous. March 10th, 1925. (250,728.)

7,265. "Electrical condensers." Dubilier Condenser Co., Ltd. (in voluntary liquidation) (W. Dubilier). March 18th, 1925. (250,735.)

8,353. "Plug and socket connectors and adaptors used in or with electrical circuits and apparatus." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. March 28th, 1925. (Cognate application 11,144/25.) (250,741.)

8,465. "Induction electric motors." D. B. Hoseason and Metropolitan-Vickers Electrical Co., Ltd. March 30th, 1925. (250,743.)

8,579. "High-frequency electric signalling." E. W. Brandle and Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1925. (250,747.)

8,580. "Receivers for high-frequency electric signals." W. J. Brown, C. R. Burch, and Metropolitan-Vickers Electrical Co., Ltd. March 31st, 1925. (Cognate application 14,147/25.) (250,748.)

8,618. "Ignition systems and switches therefor." W. Hemingway, Junr. April 28th, 1924. (232,939.)

9,418. "Joint working of combustion flames and electric arcs." G. T. Southgate. May 7th, 1924. (233,674.)

11,170. "Insulated weak-current flexible conductors." S. G. S. Dicker (Kabelfabrik Akt.-Ges.). April 29th, 1925. (250,765.)

11,280. "Rheostats." Sterling Telephone & Electric Co., Ltd., and P. A. Tiller. April 30th, 1925. (250,766.)

14,133. "Illumination of road signs." S. Cooke and Automobile Association, Ltd. May 29th, 1925. (250,783.)

14,161. "Electric motor controllers." G. Ellison and J. Anderson. May 29th, 1925. (250,784.)

15,013. "Separators for secondary batteries." Hart Accumulator Co., Ltd., and F. J. Holmes. June 9th, 1925. (250,789.)

19,222. "Electrical means for synchronising motors." Ateliers J. Carpentier. August 12th, 1924. (238,534.)

20,062. "Means for exciting alternating-current generators." J. W. Kirkland (Allgemeine Elektricitats Ges.). August 10th, 1925. (250,807.)

20,318. "Secondary batteries." J. V. Sherrin. August 13th, 1925. (250,809.)

20,387. "Frequency transformers for short waves." Telefunken Ges. für Drahtlose Telegraphie. August 16th, 1924. (238,559.)

20,467. "Alternating-current electric generators." F. Newton. August 14th, 1925. (250,810.)

20,645. "Wired radio on power lines." Wired Radio, Inc. March 12th, 1925. (249,068.)

21,749. "Envelopes for mercury-vapour rectifiers or similar apparatus." International General Electric Co., Inc. August 30th, 1924. (239,237.)

21,851. "Sound-reproducing devices." British Thomson-Houston Co., Ltd. October 21st, 1924. (241,869.)

22,042. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. September 3rd, 1924. (239,525.)

22,922. "Surgical dilators." E. C. R. Marks (Electro-Thermal Co.). September 14th, 1925. (250,820.)

1926.

293. "Electric cables." Johnson & Phillips, Ltd., and C. Stewart. January 5th, 1926. (250,873.)

1,085. "Shade holder for electric incandescent lamps." A. W. Ryland. January 14th, 1926. (250,876.)

1,793. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). January 14th, 1925. (Divided application on 250,342.) (250,879.)

Contractors' Column.

(These particulars of new building schemes are published for the use of contractors and others in search of possible electrical business. Every care is taken by our correspondents to ensure accuracy; if alleged errors are reported to the Editors they will be fully investigated.)

BIRKENHEAD.—Girls' secondary schools, Park Road South; J. A. Milestone and Son, builders, Wallasey.

BLAYDON.—Hospital (£48,000); Blaydon, Ryton and Whickham Hospital Committee.

BOLTON.—36 houses, Lower Edge Lane, &c.; E. Howarth.

BOSTON.—Housing scheme (44), Tattershall Road site, for the T.C.; borough surveyor.

BRIGHOUSE.—40 houses, Smith House estate; E. C. Brook, architect.

BROMLEY (KENT).—84 houses, for the R.D.C.; L. O. Wall, clerk.

CAMBRIDGE.—Extensions, Fulbourne Asylum (£10,000), for the Committee of Visitors; Mr. Francis, clerk. Extensions to Art and Craft Schools (£10,000), for Cambs. E.C.; the clerk.

CHESTERFIELD.—Housing scheme (51), Old Racecourse, for T.C.; H. Clayton, architect, 12, Corporation Street.

CRAYFORD (KENT).—Housing scheme (42), for the U.D.C.; L. B. Burslem, clerk.

CUDWORTH (YORKS.).—Housing scheme (300), Darfield Road site, for the U.D.C.; surveyor.

DUDLEY.—40 houses; borough engineer.

DURHAM.—Ladies' college and 22 houses, for the Council of Durham Colleges; W. T. Jones, architect.

EAST & WEST ARDSLEY (YORKS.).—58 houses, for U.D.C.

EASTBOURNE.—100 houses, Crumbles and Hampton Park estates; Messrs. Underdown, Ltd.

EDINBURGH.—Church and hall for Morningside Congregational Church (£15,000); the Minister.

ELLERTON (RETFORD).—Schools (£20,863), for Notts. E.C.; Richmond and Sons, builders, Retford.

FIFESHIRE.—Miners' Welfare Institute at Cowdenbeath (£15,000); T. Scobie, architect, Dunfermline.

GATESHEAD.—Elementary school, Carr Hill; Education Committee.

HALIFAX.—Housing schemes (80), Booth Town and Nursery Lane; borough engineer.

HASTINGS.—Concert hall, Pier; Hastings Pier Co., Ltd.

HAYWARDS HEATH (SUSSEX).—Housing scheme (126), off New England Road, for the U.D.C.; surveyor.

HERNE BAY.—Additional 50 houses, for the U.D.C.; surveyor.

HOLSWORTHY.—Re-erection of Whitstone Head Mansion, electrically equipped, for Dr. Robert Wharry (£20,000).

HONLEY.—Secondary school; Education Architect, County Hall, Wakefield.

HULL.—69 houses, Rensbury Street; Messrs. Backwell & Foster. 200 houses, East Hull site; city architect. Secondary school, West Hull; Education Committee.

INVERNESS.—Housing scheme (50), for the T.C.; burgh surveyor.

KESWICK.—Secondary school extensions (£10,500), for Cumberland E.C.; Director of Education, Carlisle.

LEEDS.—34 houses, Easterby Grove, Harehills; C. H. & F. Lax. Dance hall, offices and showrooms, Sheepscar Street; Messrs. Gash and Co. Extension, Wyther Hospital; city architect.

LIVERPOOL.—Houses (500), for the T.C.; Walter E. Hughes, builder, Birkenhead.

LONDON (BRIXTON).—Central School, Loughborough Park; L.C.C. architect.

(ILFORD).—Houses (46), Ley Street, for J. W. Lohden. Houses (48), for P. E. Brand. Vicarage, for St. Andrew's parish; A. P. Griggs, architect. High school for girls (£52,925), for Essex E.C.; W. S. Sharpin, builder, Bow.

(MERTON, S.W.).—Secondary school, Raynes Park; Surrey Education Committee.

(NORWOOD, S.E.).—Central school, Carmac Road; L.C.C. architect.

(POPLAR, E.).—Central school, Janet Street; L.C.C. architect.

(STREATHAM, S.W.).—193 houses, Vale Estate; Watts, Ltd.

(TOOTING, S.W.).—Central school, William Road; L.C.C. architect.

(WALTHAMSTOW, E.).—Housing scheme (148), Higham Hill, for the U.D.C.; surveyor.

(WANDSWORTH, S.W.).—160 tenements, East Hill; Messrs. F. E. Billings & Co., Ltd.

(WOOLWICH, S.E.).—Secondary school, Red Lion Lane; Patman and Fotheringham, Ltd.

MANCHESTER.—Technical school, Newton Heath; city architect. Further housing scheme (3,000 houses), Withington; H. Price, city architect, Town Hall.

MERTHYR TYDFIL.—Housing scheme (256), for the T.C.; housing architect, Town Hall.

NEWPORT (MON.).—Technical institute (£25,000); Director of Education, Monmouthshire Education Committee.

OLLERTON.—Schools (£20,863), for Notts E.C.; Richmond & Sons, builders, Retford.

ORPINGTON (KENT).—Housing scheme (39), for Bromley R.D.C.; surveyor. Offices and mortuary (£13,400), for the R.D.C.; J. W. Ellingham, Ltd., builders, Dartford.

OXFORD.—Extensions, Balliol College; University authorities.

OXTED.—Secondary school (£33,500); Surrey Education Committee.

RAWMARSH (YORKS.).—Additional 41 houses, for the U.D.C.; surveyor.

ROTHERHAM.—Additional housing schemes (236), for the T.C.; housing architect.

SALFORD.—Two public libraries; borough engineer.

ST. HELENS.—Housing scheme (80), Broad Oak Road, Allanson Street and Gower Street; A. W. Bradley, borough and water engineer, Town Hall.

SELBY.—Hospital; S. Brabbs, secretary, James Street.

SHEFFIELD.—140 houses, reconstruction schemes; city architect. 122 houses, Manor estate; Messrs. J. W. S. Randall, Ltd. 30 houses, Huntley Road; Mr. J. Ramsden.

SKEGNESS.—Convalescent home (£60,000), for the Derbyshire Miners' Association; the secretary.

SMETHWICK (BIRMINGHAM).—Housing scheme (206), Slatchhouse estate, for the T.C.; borough surveyor.

STOKE.—60 houses, Fletcher site; city engineer.

SUTTON.—Secondary school (£46,500); Surrey Education Committee.

TAMWORTH.—Housing scheme (40), Wigginton Road site; borough surveyor.

WARMINSTER.—Housing scheme (46), for the U.D.C.; W. W. Snailum, architect, Trowbridge.

WELWYN GARDEN CITY (HERTS.).—Houses (78), for the Welwyn Public Utility Society. Houses (72), for the Moat Wood Housing Co. Houses (40), for the County Homes Co.

WENTNOR.—School, for Salop E.C.; education architect, 1, College Hill, Shrewsbury.

WHITEHAVEN.—Houses (54), for the R.D.C.; Border Engineering Co., builders.

WHITWOOD (YORKS.).—Additional 40 houses, Three Lane Ends, for the U.D.C.; R. A. Easdale & Son, architects.

WROTHAM (KENT).—Housing scheme (30), for the U.D.C.; F. T. Moss, surveyor, Borough Green.

The

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Electricity Supply During the Crisis.

LOOKING back on the events in the electrical world during the recent period of industrial turmoil, an account of which we publish elsewhere in this issue, one cannot but be astonished at the remarkable ease, considering the chaos outside, with which the supply of electricity was maintained. Very few shut-downs were experienced, and those that did occur were in no way due to incapacity on the part of the loyal men to deal with the operation of the plant under emergency conditions. Again, the number of important stations in all parts of the country which, apart from reduced loads, were not in any way affected is almost incredible. Although the success achieved in keeping the machines running was due in great measure to the efficiency of the elaborate emergency schemes, both national and local, which had been prepared months ahead, in the main it was due to the British character of the men who carried on, in many cases under extreme difficulties and hardships. In almost all cases where trouble arose the supply was maintained by the technical staff, which, in practically all instances, consisted of members of the Electrical Power Engineers' Association. We heartily congratulate the E.P.E.A. on the attitude it adopted when the storm clouds appeared, on its passing the "carry on" resolutions, and also on having in its ranks the men who bore the brunt of the situation, involving, in many cases, manual labour.

In the numerous undertakings which were unaffected by the strike there were many men, members of the Electrical Trades Union and similar organisations, who, contrary to instructions from their unions, remained loyal to their undertakings. Great credit is due to these men; it required some courage on the part of the members to defy the unconstitutional instructions of their executives.

The thanks of the industry and of the community are also due to those outside the industry, including many of the fair sex, who came forward with a helping hand.

Many of these volunteers worked hard for long hours under great difficulties, and on unaccustomed duties.

While the successful running of the industry was due mainly to the determination of the participants abovementioned to maintain the supply at all costs, their efforts were the more fruitful as the result of the elaborate plans of the Electricity Commissioners. It is an open secret that these gentlemen had prepared months ahead for such an emergency, and it is whispered that the large number of volunteers who were enrolled were not nearly exhausted. Nor must we overlook the part the Admiralty played in the struggle by co-operating with the Commissioners.

Probably the attitude of certain municipalities with Labour majorities in the control of their undertakings during the crisis has done a good deal to support the suggestion that the general strike was not purely an industrial affair. Certain of these councils appeared to be dissatisfied with the lack of control which the T.U.C. had over their own undertakings, and enlarged on the measures laid down by that body. Many industrial concerns were unable to obtain electricity supplies as the result of the action of some of these authorities. This raises the question of the legality of withholding the supplies, and we understand that the advisability of taking legal proceedings is being considered by some of the firms affected. The action of the St. Helens Council in introducing additional charge engineers into its works will, we believe, require a good deal of explanation.

While it is the desire of all well-meaning men to see as many as possible of the strikers reinstated in their old jobs, it is to be hoped that all employers will support the Prime Minister in his pledge to stand by those who were loyal to the country during the time of trouble. An unsatisfactory situation appears to have arisen in one case, where the chairman of a committee has been compelled to resign as the result of his having neglected the volunteers who were employed during the strike.

One unhappy result of the conflict is the strained feeling which has already been evidenced in the working of certain of the District Joint Councils. The electricity supply industry has during the past six years been able to congratulate itself on the amicable settlement of its disputes through the medium of these bodies; we sincerely hope that both sides will do their utmost to redress any damage to the good feeling within these valuable councils which has been brought about by the breaking of agreements. With regard to the District Joint Boards (employers and technical staffs) the good feeling has been strengthened by the part played by the E.P.E.A., and any doubts which may have existed, as the outcome of the differences of a few years back regarding the relationship between the E.P.E.A. and the E.T.U., have been removed.

The Electric Propulsion of Ships.

It was only to be expected that the discussion which followed Mr. Eskil Berg's paper on "The Electric Propulsion of Ships" (an abstract of which appeared in our issue of February 26th, page 352), should have revealed a disposition to question whether the superiority which the author claimed for the electric drive over the drive through mechanical speed-reduction gearing was justified by actual results. In this country, despite the fact that we were the pioneers in the use of electrical machinery for the propulsion of ships, and also despite the fact that we have built and equipped some of the largest merchant ships which have been fitted with this form of machinery, our shipbuilders and marine engineers have not yet become convinced that for many purposes electric propulsion is superior to all other forms, and they naturally hesitate to accept the claims put forward by our American cousins, who have proved by actual experience with a number of ships of all sizes ranging from the biggest battleship down to small harbour tugs, that the electric drive is better than the system of propulsion which they themselves adopt. There has recently been published in the *Transactions* of the North-East Coast Institution a verbatim report of the discussion which followed the reading of Mr. Berg's paper, as well as a number of items contributed by members who were unable to be present when the paper was read. Much of this discussion—an abstract of which appears on page 811 of this issue—was of a distinctly helpful nature, and together with Mr. Berg's replies to the questions raised, it constitutes a further store of information on this important subject. But where the discussion took the form of questioning the accuracy of the facts given in the paper, or doubting whether the author was not inclined to view his subject in rather too optimistic a light, Mr. Berg was able to show that all that he claimed for the electric drive had already been justified by results actually obtained.

This problem has an interest for the power-station engineer on land as well as for the marine engineer, and the former will read with interest Mr. Berg's remarks on the advantages of the large single-casing turbine as compared with that in which the expansion of the steam occurs in two or more casings. He will note with interest as indicating the trend of power-station practice in the United States, that in that country there are about fifty turbo-generators of 50,000 h.p. running at a speed of 1,800 r.p.m., each built in one casing and all giving high economy. This certainly substantiates the claim that where large powers are required for the propulsion of the fastest and biggest ships, the use of the electric drive enables the number of turbine casings to be greatly reduced, and no doubt this is one reason why the electric drive finds such favour in the United States Navy for the propulsion of battleships and battle-cruisers of the super-Dreadnought type. But the limitations imposed by the Washington Treaty greatly restrict the number and size of battleships which can be built by the naval powers of the world, and electrical engineers will look hopefully towards the adoption of the electric drive for large passenger liners and cargo ships. Mr. Berg appears to be in no doubtful frame of mind as to whether the decision to employ the electric drive for the passenger ship of 17,000 horse-power, the machinery of which was described in his paper, was an eminently wise one. We look forward to obtaining further particulars of the propelling machinery of this vessel, and in due time to have results of the actual trials of her machinery at sea. The latter, it is to be hoped, will prove to be just as satisfactory as have those of the battleships in the United States Navy and thus prove that electricity can be successfully employed not only for the propulsion of vessels of war, but also for large passenger liners. In this way the scope for the electric drive will be considerably widened.

False Economy.

Most of the publicity literature issued by British manufacturers and others in search of foreign trade is of a high-class character. It is recognised by most people that failure to make a good first impression is almost sure to be fatal. The appearance and general "get-up" of a trade list or catalogue go far to make that good impression. The quality of the descriptive matter, illustrations, and other contents must, of course, be such as to maintain the interest, stimulate further inquiry and produce the actual order or contract, but "literature" which, while it contains useful information, is so badly produced that it is ignored or is consigned to the W.P.B. with contempt is not only valueless but worse. All of this may seem so obvious to readers that they may wonder why in these days of publicity activity and propaganda specialisation we occupy our space with such remarks. Our justification lies partly in our own observation of the poor "stuff" that some traders circulate, but especially at this moment in a communication that has just reached us from a very large and important electrical purchaser abroad. Our correspondent, who is constantly in the market for products ranging from the smallest electrical detail to the largest steam and electrical equipment, has sent us some deplorably-produced trade circulars and letters received from a British firm. They are single sheets of the manifold typewritten

class, which are so badly printed that in places they are altogether unreadable; a lot of matter is jumbled together in such a form that it is really painful even to try to read it. Cheap paper, back-slum style of letter heading or none at all, are other characteristics of these cheap specimens of business-killing literature. Far be it from us to magnify the importance of this particular case; we know well enough it is not representative of British manufacturers' methods, and sometimes we have regarded such circulars as the product of cheap and questionable importing houses of the here-to-day and perhaps gone to-morrow class. Our correspondent asks us to warn British manufacturers of the futility of sending such literature abroad, and he adds that in all the matter that reaches him from the United States—and it is very considerable—he has seen nothing like the papers upon which we comment. To this we may add that not only does the circulator of discreditable literature lose through skin-flint economy, but British trading prestige may suffer also.

Italian Engineering.

In its issue for March, 1926, our Italian contemporary *L'Energia Elettrica* makes a bitter attack upon our special correspondent in Italy, in respect of the introductory portion of his article on "The Italian Electrical Industry," which was published in our issue of January 1st, 1926, and upon ourselves, declaring that the critical comments of our correspondent were not only without a basis of fact, but were offensive to the whole body of Italian engineers. The demand is made that our correspondent's name shall be revealed, and that his assertions shall be either substantiated or withdrawn—failing which, we are told, we shall incur the contempt of all decent people ("disprezzo degli uomini onesti").

The impatience of criticism displayed by our Italian friends, as we shall continue to regard them, seems somewhat exaggerated to those who dwell in a country where the freedom of the Press is regarded as a fundamental factor in the liberty of the nation. However, in the interests of international harmony and goodwill we shall not pursue that line of thought, but will content ourselves with the assurance that the comments of our correspondent were made in good faith and with the best intentions; and, if the form they took was not the most acceptable to Italian readers, he shares with us regret that they should have wounded the susceptibilities of those engaged in the construction of Italian hydro-electric installations.

In publishing the letter of Ing. Giacinto Motta, president of the National Association of Electrical Industries, in our issue of February 5th, we appended the explanation of our correspondent, and added an expression of our satisfaction on learning from Sig. Sartori that out of 95 large dams built in Italy, only one (the Gleno dam) had failed. That is a record of which Italian engineers may well be proud, and we freely admit that it goes far to counteract the forebodings of our correspondent.

For the rest, we suggest that our contemporary has taken too serious a view of the matter, putting upon it the worst construction possible, and ignoring the friendly and commendatory remarks contained in the body of the article complained of, which, after all, was an account of the progress of the Italian electrical industry and not a technical treatise on water power. With the request to divulge the name of our correspondent we shall certainly not comply; to do so would be contrary to the traditional practice of the English Press, and a breach of confidence which would indeed bring us into contempt. Our reputation for justice and integrity, fortunately, does not rest in the hands of our Italian contemporary.

Fuel Economy.

THE recent formation of an Institution of Fuel Economy Engineers (announced in our issues of January 1st and February 26th) is a step in the right direction, although the multiplication of associations tends to become somewhat bewildering. The objects of the new Institution are to promote fuel economy and to enable engineers to exchange experience regarding fuel and combustion. The membership is limited to engineers and others who are technicians in fuel consumption. The question of fuel economy is a vital one for electricity supply undertakings, and anything that impresses its importance on the actual executive officers of an undertaking is of immediate value to the financial side of the concern. Especially is this of importance in the smaller undertakings, where it is no one's special job to maintain scrupulous economy in the stoking and general combustion arrangements. It might pay such undertakings to give special encouragement to their engineers to become members or associate members of the new Institution. A glance at the fuel consumption returns of the Electricity Commissioners will indicate that there is ample margin for economy; there are over 200 stations with an average of more than 4 lb. of coal per kWh, a good number being over 7 lb. If we take fuel costs, we find a considerable number ranging upwards from 1d. per kWh sold.

As we have shown on previous occasions, the cost of generation is a minor factor in the total cost of supply, except to long-hour consumers; but it must not be inferred that we would underrate the importance of economy in this, or any other, department of the electricity supply industry, and in most cases it is in the boiler house that the largest saving in working costs can be effected.

As the Institution of Fuel Economy Engineers is collaborating in the movement to form an Institution of Fuel Technology, reported in our issues of March 12th and April 9th, we take it that there is no rivalry between the two bodies, which will eventually form one association.

High-pressure A.C. Rectification.

IN view of the high pressures now employed for long-distance transmission, and the necessity of employing the mains to the best advantage, it is important to keep in mind the possibilities of rectified alternating currents in this connection, and the progress that is being made in the development of the thermionic valve type of apparatus. Rectifying valves, it is true, can at present deal with only very small currents; on the other hand, they can cope with very high pressures indeed, and a small current at a high pressure means considerable power. Valves are made capable of withstanding a maximum inverse voltage (instantaneous value) of 100,000 V, and carrying a current of 0.25 A, which corresponds with a power of 25 kW. Such valves can be put in series for higher voltage, or in parallel for higher amperage, and their efficiency is extremely high. As we pointed out in our issue of December 19th, 1924, the fluctuations usually appearing in the rectified current can be removed by suitable design of the a.c. generator, on the lines explained by Mr. F. W. Maxstadt, giving practically constant current.

Since, for the same stress on the insulation, a line carries twice the power with direct current that it can carry with alternating current, at the same efficiency, it is obvious that the use of direct current implies economy in first cost; it has other advantages, such as the absence of dielectric hysteresis, and the only bar to its employment is the present want of an equally simple means of reconverting it to alternating current of any desired frequency. But this function can also be fulfilled by thermionic or electronic valves, on a small scale, and it is only a matter of time for the method to be developed until it is capable of handling large powers. This subject was dealt with in the papers by the late M. Maurice Leblanc, of which we published translations in our issues of September 8th and 15th, 1922.

That there is a real demand for a system such as this was shown by the exhibit of the Highfield-Calverley "Transverter" at the British Empire Exhibition. One of its great merits is the ability to couple together two undertakings which operate at different frequencies.

The I.E.C. Meeting in America.—III.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

The most important point dealt with by the Committee on Rating was the question of permissible temperature rise for electrical machinery. At the Hague meeting, held in April, 1925, a complete list of permissible temperature rises had been tentatively agreed, and in the meantime considered by the National Committees. It is very satisfactory to find that after this detailed consideration all delegates were able to report that all the National Committees were in agreement with the Hague proposals.

As this is the first occasion on which Germany has been officially represented since the war, this meeting is of special importance and interest. During the past thirteen years German practice has diverged somewhat from that advocated by the I.E.C., so that it was a satisfaction to everyone to find that, after a very full discussion, the German representatives were able to agree to all the proposals in spite of the fact that in certain (but unimportant) points the temperature rise alternatives accepted were different from those at present given in the V.D.E. rules.

Agreement was also reached on the question of dielectric tests for electrical machinery, and an important discussion took place on the subject of embedded temperature detectors. Several questions, such as tolerance on test results, method of stating efficiency, spark-gap dimensions, &c., were discussed in detail, and it was decided to submit these items to the various National Committees.

The work of the Rating Committee was very materially expedited through the assistance given by Prof. Feldmann, of Delft University, who prepared the report for the plenary meeting.

The official British delegate on the Committee on Traction Motors was Mr. Peck, and several long meetings were held at which controversial points were subjected to a very searching examination. Much discussion took place on the classification of rating, temperature rise, ambient temperature, conditions of test, and voltage during test, but it appeared that most of the difficulties were language difficulties, and that on all basic principles there was substantial agreement. Subject, in certain cases, to the agreement of the French National Committee, it was decided to retain three classes of rating for traction motors: (*a*) Continuous; (*b*) one hour; (*c*) excess current; to measure temperature by resistance; and to adopt 25 deg. C. as a standard ambient temperature. The rating of field-control motors should specify the excitation corresponding to the rating, and the rating test should be made at that excitation. For all tests, except the continuous-load test on totally-enclosed motors, the rated voltage should be adopted, but for the exception a reduced voltage will be specified.

Certain questions on temperatures in totally-enclosed motors, and commutation temperatures for class A and B insulation, were also referred to National Committees.

The work of the Committee on Insulating Oils, presided over by Mr. Fulweiler of the A.S.T.M., resolved itself largely into a question of deciding on methods of studying the properties of an oil in order to determine its suitability for electrical purposes. It was felt that a definite distinction should be made between what may be called research tests and other tests employed for acceptance purposes. Different nationalities have at the present time different standard methods of testing for acceptance purposes, particularly for studying the properties, and the time is not ripe for replacing these by one international test. Useful work was, however, found to be possible in standardisation of the research test, and the wide field was narrowed down to four tests, eliminating a distinction which has existed between countries since the question of insulating oils was first studied by the I.E.C. at the Hague meeting a year ago.

There have been three separate groups of organisers in operation in these different countries, tiding over the period prior to complete unanimity, but it has now been agreed to combine the activities of these three groups under one central office which will make for more uniform action.

In addition to the main point, sludge tests, it has been agreed that viscosity shall be expressed in kinematic viscosity units, centipoises, and for the cold test it was agreed to adopt the United States " pour " test. Both the viscosity and the cold tests must, however, be referred to the National Committees. The British delegate on this committee was Mr. A. R. Everest.

The Committee on Prime Movers, which dealt with hydraulic and steam turbines, held a number of meetings, under the very able presidency of Doctor Durand (U.S.A.). The great need of international standardisation of definitions, general conditions covering tests, and methods of making tests, was realised by all the delegates, and as a very evident desire was manifest on the part of all nationalities to adjust any points of difference for the common good of the Commission, great progress was made.

As regards Hydraulic Turbines the British National Committee, through the delegates, Mr. C. P. Sparks and Mr. F. Wallis, put forward proposals, as requested at the Hague meeting last year, and they were taken as the basis of discussion. The proposals were under two heads, Section 1 covering General Hydraulics, and Section 2 Hydraulic Turbines, and finally a report was adopted covering both these items. This report dealt with the subject in a clearly defined manner that should render it of great practical value to purchasers and manufacturers alike.

The Steam Turbine section of the Committee submitted a somewhat similar report, and added the recommendation that the Committee should develop (*a*) a commercial code on the lines of the British proposals to include matters not strictly technical, and (*b*) a strictly technical code, on the lines of the Test Codes of the American Society of Mechanical Engineers, but amplified to include methods and instruments in use in various countries.

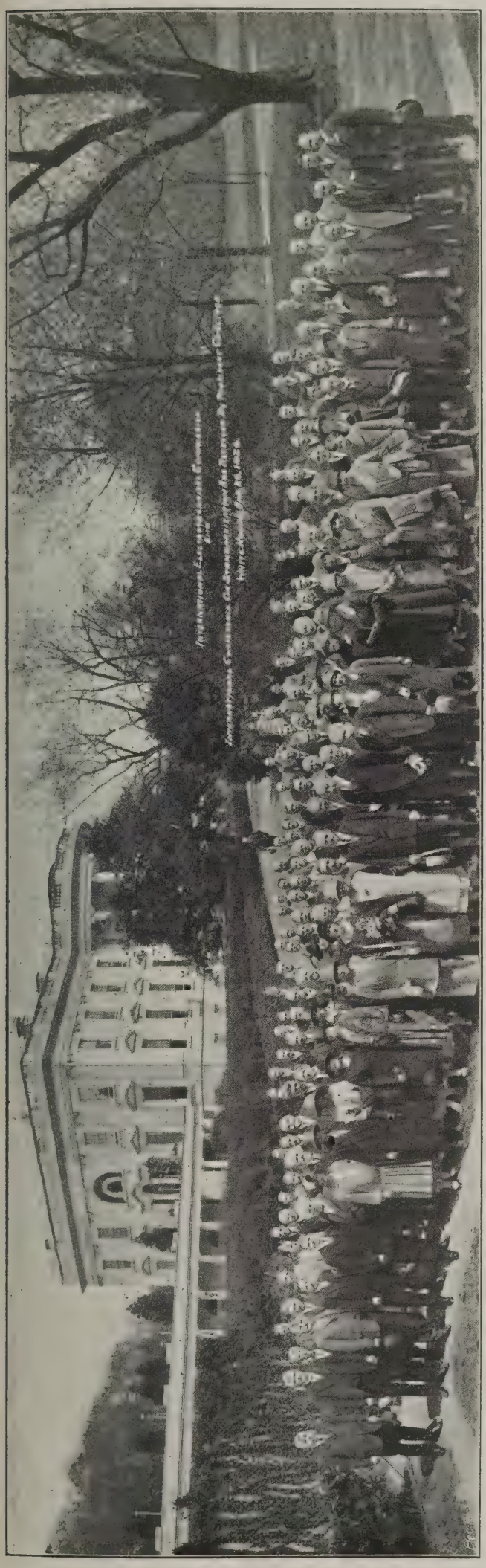
The question of standardising lamp caps and sockets originated at the Geneva Conference, and the matter was referred to a Special Committee at the Hague meeting held in 1925. Whilst progress had been made, however, there still existed a considerable difference of opinion between certain of the various National Committees.

So far as the Edison screw type is concerned, the question was then referred to the Lamp Manufacturers' Committee, which meets under the chairmanship of Dr. Holst, with the request that that Committee should endeavour to compromise the members' views and report to the New York meeting.

Dr. Holst's Committee has given the matter much consideration, and whilst at the moment a unanimous report is not forthcoming, it is anticipated that a satisfactory conclusion of the discussions will be arrived at in the course of the next few months.

With regard to the question of the Bayonet type, it was reported at the Hague meeting that the principal difference of opinion existed between the British and French Committees, which were requested to endeavour to come to some agreement.

In the interim between the Hague and New York meetings, the two Committees have considered the question, and as the result of a meeting which was held in Paris in November last, agreement was reached. This



has been reported to the full Advisory Committee meeting held in New York, which has adopted the conclusions arrived at by the British and French Committees. At the New York meetings the British delegate was Mr. E. G. Batt.

The result achieved means that international agreement has been reached with regard to dimensions of bayonet-type lamp caps and lampholders, giving complete interchangeability of various manufacturers' products.

The Committee on Standard Pressures held three meetings under the chairmanship of Professor Lombardi, the British delegate being Mr. C. P. Sparks. The question of standardising pressures at consumers' terminals, already examined previously to some extent at Geneva and The Hague meetings, was carried a step further, and the ultimate recommendation was to adopt two alternative series of voltages as follows:—

D.C.	A.C. Single-phase.	3-phase (between phase and neutral).
110 ...	110 ...	110
220 ...	220 ...	127
440 ...	— ...	220
115 ...	115 ...	115
230 ...	230 ...	133
460 ...	—	230

The following voltages were standardised for transmission purposes:—1,000, 3,000, 6,000, 10,000, 15,000, 20,000, 30,000, 45,000, 60,000, 80,000, 100,000, 150,000, 200,000, and 300,000 volts (mean value at consumers' terminals).

These values are to be known as nominal I.E.C. pressures of the network, and the maximum pressure at the generator or secondary terminals of transformers is to be considered to be about 10 per cent. higher to compensate for line drop.

For use in new systems, the preferred mean transmission voltages are recommended as follows:—6,000, 15,000, 30,000, 60,000, 100,000, 200,000 volts, with the same 10 per cent. increase at the transmitting end. The consideration of the permissible variation of voltage was deferred until a later meeting of the Commission.

The Advisory Committee on Symbols under the chairmanship of Lieut.-Colonel K. Edgcumbe, was able to report considerable progress in the agreement on symbols for general graphical use on diagrams and lay-outs, hundreds of symbols, including about eightly more particularly suitable for use in traction lay-outs, being submitted to the plenary meeting for adoption.

The international employment of the same symbols for the various types of machine, circuit breaker, conductor rail, and overhead material—to take a few examples at random—should go a long way in the direction of simplifying the reading of diagrams and drawings without reference to any "key," a consummation devoutly to be wished.

An important discussion took place on the letter symbol for the ohm. The V for volt and A for ampere have long been accepted internationally, but as regards the third member in the electrical trinity no agreement had prior to this conference been possible.

It has now been unanimously decided, however, to adopt Ω as the symbol for ohm, and the megohm will be represented by $M\Omega$. It should, perhaps, be pointed out that this decision does not affect the use of R as the symbol for resistance, but only covers the *unit* of resistance, *i.e.*, the ohm.

There has for some time been a difference of practice in the method of indicating the polarity of a battery, when using alternate long and short strokes, as to which shall be the positive and which the negative pole. After discussion, it has now been decided to recommend to the National Committees that they should make the long thin line the positive pole, which practice appears to have ample historical precedent.

The delegates of the International Electro-technical Commission were received individually by President Coolidge at the White House, Washington, on April 24th. We reproduce herewith a photograph of the group taken in the grounds after the reception.

How the Supply of Electricity was Maintained during the Strike.

Some Interesting and Amusing Incidents.

We refer in our leading columns in this issue to the comparative ease with which the supply of electricity was maintained during the recent general strike. This and the normality, apart from reduced loads, with which very many undertakings, including large and important ones, in all parts of the country were able to carry on were the outstanding features of the situation. The Yorkshire Electric Power Co. reports no notable events during the strike; every man in the employment of the company remained at work, and the supply was given normally as required. The Birmingham Electricity Supply Department, where the men refused to act unconstitutionally in spite of definite instructions by the local trade-union branches to cease work on May 11th, was similarly fortunate, and the Sheffield undertaking was not affected in any way; Salford also carried on as usual with the full staff. Among the other undertakings which were able to operate normally, as far as the employés were concerned, were Nottingham, Carlisle (although here the men were notified three times by the unions that they were to be called out, the order being cancelled each time, due, it is believed, to reluctance on the part of the men to come out), Swansea, Manchester, Altrincham, Blackpool, Coventry, Wolverhampton, Stafford, Hereford, Birkenhead, Bury, Wigan, Dundee, Perth, Plymouth, Southampton, Barrow, Belfast, Tynemouth, Glasgow, Crewe, Liverpool, Woolwich, Bedford and Manchester. The following supply companies were also unaffected:— The Shropshire, Worcestershire & Staffordshire Electric Power Co., the Halesowen Lighting & Traction Co., Ltd., the Tewkesbury Electric Light Co., Ltd., the Kidderminster & District Electric Lighting & Traction Co., Ltd., the Ludlow Electric Light Co., Ltd., the North Wales Power Co., Ltd., and the Mersey Power Co., Ltd. The position in the Newcastle Electric Supply Co.'s undertakings was that in some of the stations the men ceased work, while in other cases they remained on duty; it is reported that the men generally were reluctant to cease work.

In many instances the whole of the manual workers left their posts at the commencement of the strike, and the supply was maintained by the technical staff with the aid of volunteers. This was the case at Poplar, St. Marylebone, Bristol, Aberdeen, and other undertakings. In some places, including Fulham, Hammersmith, Hackney, and Islington, naval ratings were introduced to replace the strikers.

In the North Metropolitan Electric Power Supply Co. the men ceased work at different times in the Brimsdown, Willesden and Hertford power stations. The St. Albans power house was not running at the time as the company was receiving the supply for this area from Luton. The Hertford station was shut down, and the supply throughout the area was maintained from the other stations by volunteers and naval men. A Diesel set was run at St. Albans in order to conserve the coal supply. During the first few days of the strike the tramways were shut down, and this relieved the system of 5,000 to 6,000 kW.

There appears to be a misunderstanding in some quarters regarding the supply at Willesden, where a bulk supply is received by the Willesden Council from the North Metropolitan Co. The Council men at Willesden left work on May 7th, and for the following three days the supply in this district was not available to consumers during the day-time. This was not due to the Willesden power station, which was originally the Council's property, shutting down; the bulk supply to Willesden was available during the whole of the strike.

At Wimbledon 133 men left work on the first day of the strike, three returning before the strike was declared off. Five naval ratings and two paid men were introduced into the station to help the loyal men, and the full supply was maintained without trouble of any kind. The Electricity Committee has agreed to pay bonuses to the total value of £368 to the men who remained loyal.

At the commencement of the strike all the men came out at Hackney; volunteers and naval ratings were drafted into the station, and the supply was maintained without trouble of any kind. In accordance with the Council's arrangements the works now constitutes an "open shop," and is to a very large extent restaffed with new men.

A few men at the Leeds undertaking ceased work on May 4th, but most of these returned the next day. On May 12th the majority of the men came out, but all the men were back at work by the 14th. The technical staff carried on without any outside help.

Thirty-three men of the Maidstone undertaking ceased work on the first day of the stoppage. On May 12th a deputation of the men told the chief engineer that they were tired of the strike and would like to return to work. A refusal of the Fulham Council to agree to the cutting-off of the electricity supply to some 54 consumers led to the cessation of work by the men, and the shutting down of the station. Three men who took part in stopping the plant have since been arrested and charged under the emergency regulations. At Stoke Newington the majority of the men came out at the beginning of the strike but the sub-station attendants returned to work on May 8th.

At several of the undertakings in the No. 5 (West Midlands) District the men ceased work, but the supplies were maintained with the help of volunteers.

West Ham reports that some of the men were out, the supply being maintained by the remainder without any outside assistance.

The men at the Valley Road Works, Bradford, ceased work as the result of the running of tramcars, but those employed at the Bolton Road works refused to follow suit, and passed the following resolution:— "That the employés at the Bolton Road electricity works disassociate themselves from the Trades Union Council in their action in calling a strike."

In two instances Government intervention resulted in the undertakings being taken out of the hands of the respective authorities. At Gravesend the entire personnel of the station left their posts, and the undertaking was taken over by the naval authorities. As the result of what appeared to be intimidation towards the staff at St. Helens by the local authority, the undertaking was placed under the control of the District Joint Board, No. 3, North-Western Area, under the instructions of the Civil Commissioner, N.W. Division. It is believed that it was the intention of the authority of the undertaking to replace the staff engineers by selected members of one of the electrical manual workers' unions. The men at Portsmouth, Great Yarmouth, and Lowestoft were out for a few days, returning before the strike was called off. At Stepney it was decided, apparently by the Authority, in spite of instructions to the contrary from the T.U.C., that the supply should be maintained only from dusk till dawn. It is reported that certain consumers whose electricity supply was cut off are considering the advisability of taking legal action against the Council. There was a shut-down at St.

Pancras on the second day of the strike. Some of the workers at this undertaking ceased work, but sufficient remained loyal to the undertaking to get going again quickly and maintain supplies for the rest of the period. The men at Rotherham remained at work as the result of an arrangement with the E.P.E.A. members not to supply the tramways. The members of the Enginemen and Firemen's Union were called out at Wallasey, but the supply was maintained with the help of voluntary labour. At Gloucester some of the men came out at first, but returned soon as the result of an agreement being reached on "essential supplies." It is interesting to note that all the men of the West Gloucestershire Power Co., Ltd., which had no hitch of any description, are members of the Electricity Supply Workers' National Association. All the industrial load at Erith was cut off on May 4th. At Weymouth threats to withdraw the men were rescinded after arrangements regarding electricity supplies to the docks had been arrived at. The Battersea station was run in accordance with the wishes of the Trade Union Council. The men at the Prescot undertaking ceased work, but the town was supplied by means of the bulk supply from Liverpool. Seven per cent. of the men of the Newcastle & District Electric Lighting Co., Ltd., were out for one day only. Believing that its action in calling out the stokers and enginemen at Ipswich had effectively closed down the power station, the local strike committee sent the following communication to the chief engineer:—"I have been instructed in so far as our members are concerned to offer to supply light and power for such services as houses, streets, shop lighting, social services, power for bakeries, laundries, and domestic purposes."

On the eve of the general strike the Executive of the E.P.E.A. passed the following resolutions:—

(1) That the essential public services in connection with the supply of electrical energy should be maintained.

(2) The Association deprecates the introduction of volunteer workers in the electricity supply industry, but in the present emergency this Executive Committee agrees that to maintain the essential public services it hereby instructs its members to co-operate in the Government scheme for the maintenance of such services.

(3) That to prevent a situation arising which may operate to the detriment of the foregoing resolutions, it is advisable for instructions to be given by His Majesty's Government to all electricity supply undertakers that to maintain the supply of energy for such essential public services, care shall be exercised that a supply of power shall not be given to an industrial works engaged in work of a non-essential character.

(4) That the afore-mentioned resolutions be officially communicated to His Majesty's Government at the earliest opportunity, and that copies of such resolutions be sent to the National Joint Board and all the District Joint Boards.

It was on the basis of the above resolutions that working arrangements were made possible in many undertakings, although, as was to be expected, numerous difficulties arose in defining what were "essential services." In spite of the conflicting instructions which appear to have been issued to the men by the various unions, union formations, local union branches and strike committees, much was done in the way of bringing about working arrangements between the staff and the men by conferences between the parties concerned in the local undertakings. It is interesting to note from the following letter received by the secretary of the E.P.E.A. from the Ministry of Transport, that the efforts of the staff during the time of trouble were much appreciated in official quarters:—

Ministry of Transport,
6, Whitehall Gardens, S.W.1.

May 11th, 1926.

Dear Sir,

I am directed by His Majesty's Government to ask you to inform the members of your Association that their action in remaining at their several posts in generating stations and in maintaining the supply of electricity has been of the greatest possible value in the present national emergency, and the Government trust that the Association will continue their splendid work in the interests of the community.

Yours truly,
(signed) Wilfrid Ashley.

In a report to his committee by the chief engineer at Cardiff, where most of the men were out during the greater part of the strike, he said: "It has to be borne in mind that the technical staff, in bearing as they did the brunt of the work involved, displayed their keen appreciation of their obligations to the community they serve, and what must be the feeling of the Committee, to maintain all supplies under all circumstances.

I cannot speak too highly of their devotion to duty, the cheerfulness and comradeship shown under adverse circumstances and unaccustomed duties, and I am sure their efforts deserve, and will receive, full appreciation of the Committee, Council, and citizens."

Another instance of appreciation by the local authorities of the loyalty of the power-station men was at Plymouth, where, at the conclusion of the strike, the Mayor, accompanied by the chairman of the Electricity Committee, Alderman J. B. Love, and the electrical engineer, Mr. E. G. Okell, visited the power stations at Prince Rock, Newport Street, Stonehouse, and Armada Street, to thank personally the 150 employés who resisted all the efforts made to induce them to cease work. The Mayor expressed the gratitude of the public to the men for standing by so loyally during the strike. The employés received the Mayor with cheers and every demonstration of loyalty to the undertaking and to the country. One of them remarked, "We stayed on not because we thought we were going to get anything out of it, but because it was the right and proper thing to do. We are honest men, and when we make agreements we are not going to be drawn by the nose by any Bolshevist agitators." At a meeting of the men at the Horseferry Road Station of the Westminster Electric Supply Corporation, Lord Wargrave (the chairman), on behalf of the directors and shareholders, expressed his warm thanks and appreciation for the loyalty and devotion to the company which the staff had displayed during the national crisis. He concluded as follows:—

"While expressing our sincere thanks, I wish you to accept, as a mark of our gratitude, a sum of over £2,000 as a gratuity, divided as follows:— Engineers £25 each, foremen £10, men £5, youths £2 10s."

As already indicated, in many places the clerical and administration staffs joined forces with the technical workers and became stokers, trimmers, "greasers," and the like. This was the position at Croydon, where the clerks handled some 50-60 tons of coal per day.

Amidst the hardships and difficulties that were met and overcome by those who "carried on," and in spite of the great seriousness of maintaining the electricity supply throughout the country in such a crisis, much food for subsequent reflection was found in the lighter side, particularly by those who were performing unaccustomed duties and others who were living at their work. The following is a copy of one of the many curious and amusing "station orders" which were posted up in various undertakings during the strike:—

May 11th, 1926.

A cordial invitation is extended to all members of the staff not actively engaged on shift duties to-morrow, Thursday and Friday mornings, 12th, 13th, and 14th inst., to join a party at 8.30 a.m.

The venue will be No. 17 boiler, and it is anticipated that an enjoyable time will be spent in clearing the boiler tubes and superheater tubes, &c., of dust.

Dress optional. Engineer and Manager.

The following is an impression of the 11-days' strike from the point of view of the volunteers on sub-station work:—

The Volunteer and the Sub-Station.

By L. S. R.

This article is written specially for the Electrical Review, because it is a review of an electrical disturbance that took place between May 3rd and May 14th,

1926. It began by the receipt of a memo. headed "National Emergency," which contained a warning to "stand by and await further instructions." The following morning our usually quiet road was thrown into a state of excitement by the roar of a sports model "Bentley" labelled O.H.M.S., which pulled up with a jerk at our domicile and pitched out the latest thing in plus-sevens (plus fours is too modest a description). Hastily thrusting a missive into my startled better-half's hands, plus-seven disappeared with another roar, in a trail of lubricating-oil haze. The missive contained the "further instructions"—report at once to U.R. —— Street sub-station. The writer having already departed for the office, the instructions were 'phoned through. Acting as directed, and knowing something of sub-stations, I dashed off to ——— Street, *via* home, where I shed the spats of respectability for the spots on the oldest togs I could find. At ——— Street all was bustle and animation. Scores of fellows were there, each eager to perform his allotted task, whilst it was yet day. A genial official entered up our names and assured us, contrary to our own beliefs, that there was positively nothing we did not know about sub-stations. Leaving him, we descended into the "sub" itself, which was being used as "H.Q. rapid-training centre." Another official—a real stout fellow this, who had already done 48 hours on duty—explained the general lay-out of the board and plant, leaving auxiliary circuits to be worried out by ourselves at the station to which we found ourselves allotted. A 10-minutes' course on starting up the station, synchronising, paralleling, &c., ensued, and then the command, "Let me see you do it." Lord! it was 17 years since I'd synchronised anything, but with a whirling brain and a trust in that little god whose especial care is toddling children and sub-station engineers, I started up. Snap! and, marvel of marvels, those rotaries dropped into step like lovers going for a country walk. Again the voice of our instructor, "right Mr. So and So—these men to report at once to ——— hurry up—car waiting." A blanket was pushed into our hands, and we were off.

At ——— Street, our home for the next eleven days, the lay-out was similar to the station we had left, so we settled down to find out how the 10,500 volts that came into the station found their way out again. As night drew on we tossed to decide who should take night shift. Two of us had all the luck, so, taking our blankets, we wedged ourselves in between the bedplates of two rotaries for our night's rest—unbroken save for the continual row of compressors, Klaxon alarms and gongs.

In the morning I found myself suffering from an acute attack of lumbago—this diagnosis proved, however, to be incorrect. My comrade and bed-fellow had shoved me hard against the makers' name embossed on the bedplate, and the letters B.T.-H. were clearly defined on that portion of the anatomy where one's back changes its name. This was particularly galling to a M.-V. man, but no doubt some B.T.-H. volunteer in another station was similarly stamped "M.-V."

With the morning came also a nice little sack of rations, labelled "One ration for one day for four men." At this point I want to take off my cloak for the lady to walk on who thought those rations out. Everything the U.R. people could provide to make us happy had been provided. A veritable bran-tub of little necessaries in neat packages. Nothing had been forgotten, even bottled beer, cigarettes, and chocolates were there, and what's more, one of our fellows was a teetotaller and non-smoker, so we other three were in luck. Each day the ration was varied—we never expected new-laid eggs—had we anticipated their inclusion, we should never have emptied out anyhow our first rations on the hard floor.

After a breakfast of bacon—minus eggs—we had a call from the Sanitary Authorities, together with a motor lorry with "England collects the ashes" painted on its sides. Six under-grads dismounted. Might they have the privilege of removing such objectionable matter as was contained in our receptacles for the accommodation of refuse? After assuring ourselves that they would endeavour not to scratch the bins and would restore them to the pavement without the accompaniment of that horrible crash one associates with their professional brethren, the privilege was accorded. Oxford and Cambridge bowed—we bowed. Oxford and Cambridge removed their head-gear—we lifted ours in response, and with a "cheerio, chaps" the combined Universities moved off in search of other dust-bins.

And so day followed day, each with its amusing experience. We "bust" nothing, we fed, we washed up, we cleaned up. From the door we revelled in the wit displayed on the sides of the motor-'buses by our fellow volunteers. Didn't the girls have a good time! At sunrise we entertained less fortunate volunteers and "specials" to early-morning tea (we mention "specials" only, as the regular police don't drink tea). In the evening we slipped out for half-an-hour to a friend's flat and enjoyed the luxury of a real settee, and a whisky and soda such as only a friend pours out. We fixed up a wireless set for news, and if some of us "nodded," the ones who kept awake told them the news afterwards.

The chief thing was that on the top of the underlying seriousness of the whole business everybody laughed. A few people had challenged the many, and the many, not immoderately but quietly, laughed. On the first day of the strike, instead of tears there was seriousness —yes! but also laughter. Nothing can survive laughter, not even a strike committee.

Well, it's all over now. We've chucked up our temporary sub-station duties—handed over again with a cheerio to the fellows who went out and came back. Reported "off" at ——— Street, said good-bye to everyone, and each received a delightful little note from Lord Ashfield, which concludes: "We shall never forget our association with you during a great national emergency, and hope that you may carry with you a pleasant recollection of the time spent with us." Sir, we most certainly shall. And now for a hot bath, clean undies, and a good sleep, for to-morrow we must put some more soot round those lettuces to kill those damned slugs.

Transformer Oil and its Treatment.

The Importance of Precautions against Contamination.

By A. D. JUKES.

Those who are interested in, and have a working knowledge of, insulating oils know that in the last seven or eight years vast strides have been made in this particular industry. This is primarily due to the efforts of the various oil companies which have made a speciality of transformer and switch oils, and to the firm stand taken by the British Engineering Standards Association.

Before the war the best grades of white, non-sludging transformer oil were produced in Germany, from Russian crude, and after a time a fairly large demand was created in this country. When the war broke out,

this source of supply was cut off, and users of insulating oil were forced to make the best of a bad job and take what they could get. This resulted in a great deal of oil of inferior quality being put in circulation. In fairness, however, it must be said that some of this oil stood up very well indeed under actual working conditions. In one case, a certain oil, which to-day would not pass standard requirements, was in continuous use in transformers from 1915 to 1922, approximately seven years, before it began to sludge badly. It may be assumed that some of this oil is still in use, but it now requires filtering about every seven months. This is not a bad record for an oil which to-day would not come up to the British Engineering Standards specification for Class B.

When the war ended, progressive oil firms began to look round for a good white, non-sludging transformer oil, and as no Russian oil was available, another source of supply was sought. In due course certain companies in the United States were prevailed upon to make an oil of this nature. Their enterprise was rewarded. Various firms in this country preached the gospel of non-sludging oil assiduously; before very long this grade of oil was very much in demand, and an increasing market was assured. It may be safely assumed that at least 90 per cent. of the transformers manufactured in this country to-day are put in operation on white, non-sludging transformer oil of American origin.

In the last couple of years other refiners in America have commenced the manufacture of a somewhat similar oil, and this, coupled with the fact that Russian oil is once more available, has brought the price down considerably. At the present time none of this white, non-sludging oil is actually manufactured in this country, but there are rumours that this is a possibility of the not far-distant future.

Under present conditions, transformer oil is supplied by the refiner, and is guaranteed to meet a definite specification, apart from the dielectric strength. It is then taken in hand by the oil merchants, dried, cleaned, and barrelled. This seems a very simple procedure, but a peep behind the scenes will be enlightening.

When a consignment of transformer oil is received in this country, samples are drawn off and submitted to a laboratory test to determine if it conforms to the guaranteed specification. As the cost of each of these tests is in the neighbourhood of three guineas, it will be realised that the expense to a firm which disposes of from six to twelve thousand barrels per annum is no small matter. When these tests are found to be satisfactory, the oil is cleaned and dried, and a dielectric test is taken on each and every barrel. If the test results are approved, the oil is then considered ready for shipment. Some firms—those which specialise in insulating oils—are not content with this alone. They allow the oil to stand in sealed barrels for a period of 48 hours, and if the oil, after that time, has a dielectric strength of less than 40,000 volts, it is returned to stock and re-treated. This is a very sound procedure, and if it were adopted by all transformer oil merchants there would be fewer failures. There are rumours that some firms do not take the trouble to treat oil for moisture, &c. If this is a fact, they are certainly asking for trouble, and should not be surprised when it comes.

There are various methods in use to-day for the cleaning and drying of transformer and switch oil, but undoubtedly the most popular and most satisfactory means is the centrifuge. There are about half-a-dozen firms manufacturing centrifugal machines for the treatment of oil; of these, the De Laval Company are the pioneers. One of the machines in use to-day by various oil companies, manufactured by this firm, has a capacity for treating from six to eight hundred gallons of cold transformer oil per hour. This means that it is possible to dry and clean approximately eight hundred gallons of transformer oil in its natural state per hour, and to give it a dielectric strength after one treatment, of over 50,000 volts—a very satisfactory result indeed.

It is absolutely essential to make a test for moisture on every barrel of transformer oil before it is put in circulation. This is of the utmost importance—notwithstanding the source of supply, the guarantees given, or the faith one may have in the supplier. If a genuine dielectric test with electrodes is not possible, a cracking test or poker test will determine whether the oil is dry. Both these tests are effective and easily carried out. For the cracking test, fill a test tube with oil and hold the base over a flame until a faint vapour arises from the oil; if there is moisture present, a cracking noise will be heard. It is generally found that where there is a very faint cracking, the oil will have a true dielectric strength of approximately 15,000 volts. If a fairly pronounced cracking is heard, the oil will probably have a strength of about 5,000 volts or under. The poker test is carried out by heating an ordinary poker or similar instrument to a red heat, allowing it to cool black, and placing it in a beaker of oil. If the oil is wet, the same cracking noise will be heard. Of course, these tests are not reliable where the oil is dirty, but dry. Obviously, dirty oil should not be put into transformers or switches.

It is an undoubted fact that most oil failures, due to moisture and dirt, are caused by the barrels. Cases have been known where oil has been treated and found to have a dielectric strength of 50,000 volts; yet it has depreciated to approximately 20,000 volts, after standing in the barrel for twenty-four hours. Possibly this can be accounted for by condensation, but in nine cases out of ten it is due to the condition of the barrels. In the past most oil merchants have been in the habit of charging for barrels, and crediting the customer when the barrels are returned in good condition. The barrels have then been swilled out with hot oil, drained, dried, and used again. This practice is certainly a risky one. If, for example, a barrel is emptied on site and left out in the rain, with the bung out, or loosely screwed in, moisture is certain to get in. This sets up rust. When the barrel has been cleaned and refilled, this may not be apparent, but by the time the barrel has been manhandled *en route* and tossed from railway to motor truck, the rust adhering to the inside of the barrel will have been loosened and mixed with the oil. When the oil reaches its destination, and samples are drawn for test, it is dirty and is probably condemned. This means that carriage must be paid back to the works, and a fresh consignment sent out. If there are facilities on site for re-treating the oil, and this is done, it will probably cost the vendor a penny per gallon, which will be deducted from the price. A great deal of money is lost every year by transformer oil dealers on this account.

There is no reason why transformer oil should not be shipped any distance in 18-gauge steel drums, and arrive on site in a satisfactory condition, provided that the oil has a good dielectric strength before shipment, and the barrel is not broken open, or the bung removed or loosened in transit. To achieve this result, however, new barrels must be used for each and every consignment. Transformer oil is delivered, in most cases, by the refiners in new 18-gauge steel barrels, with pressed-out rolling hoops. If the oil is cleaned, dried, and sent out in these barrels *once only*, the wet and dirty oil problem, apart from isolated cases, should be solved. There would be no need for 14-gauge steel and galvanised barrels with outside rolling hoops, and the consequent increase in freight charges. It would save the transformer oil merchants and the large consumers many pounds annually, as a 14-gauge barrel weighs approximately 50 lb. more than an 18-gauge.

In conclusion, the price of white, non-sludging transformer oil has reached a very low figure, and if the price is forced down much lower, it may result in the merchants disclaiming all responsibility for dielectric guarantees, and the cessation of the expensive methods of drying and cleaning now in vogue. If this does happen, the onus of responsibility for wet and dirty oil will rest upon the transformer manufacturer, and it will mean the purchase of expensive plant to do this work.

International Standardisation.

A New Standardising Body to Meet in London.

(From Our Special Correspondent in the United States.)

During the recent conference of the International Electro-technical Commission, held in New York, at which about a hundred delegates attended from a dozen European countries, a conference of chairmen and secretaries of various national standardising bodies was called to discuss the general question of international standardisation.

Several meetings were held under the chairmanship of Mr. C. E. Skinner, the president of the American Engineering Standards Committee; Sir Archibald Denny, the president, and Mr. de Maistre, secretary of the British Engineering Standards Association, supported by Sir Richard Glazebrook, Mr. C. P. Sparks, and Mr. Ll. B. Atkinson, represented the British interests.

About thirty representatives attended the discussions, which were restricted in the first place to the broad lines of considering the organising internationally of the collection and dissemination of information from various countries regarding the standardisation of matters, broadly engineering, not at present dealt with by any existing international organisation.

As is widely appreciated at Home, the British Engineering Standards Association makes no attempt to dictate to industry, but only undertakes standardisation on any particular line when it is clear that all the interested parties are in agreement that the step is desirable. Standardisation in other countries does not appear to proceed in such a satisfactory manner. There is a tendency abroad for the deliberations to proceed along academic lines, and for the manufacturer not to be given a full opportunity for expressing his views before the standards are formulated. Such a condition results in some of the foreign standardising bodies not being anything like so representative of the commercial interests as is the B.E.S.A., with the consequence that the standards do not always become effective.

International engineering standardisation has, of course, been in progress through various channels during the past ten or fifteen years, quite apart from official action of the I.E.C. and the B.E.S.A. There has, for example, been a move towards the standardisation of the shape and pitch of screw threads, and the dimensions of ball bearings, as well as of certain replaceable parts employed in engineering generally.

The war, with its development of mass production, gave a great impetus to standardisation, the importance of which was very fully appreciated first in America, where Mr. Hoover started his campaign of simplified practice, then in England, and later on the Continent. A short time ago a movement was set on foot between certain central European countries to standardise, amongst other things, the width across the flats of bright nuts, and it was at once felt by standardising bodies in other countries that if any decision on a subject of such universal interest could be made truly international a great step would be achieved for the common good. So far as this country is concerned, the B.E.S.A. saw that it could not afford to stand outside such a movement, but that steps would have to be taken towards forming an international body to deal with such matters before the separate national bodies had gone too far. The Americans were pressing for the question to be raised in New York while the opportunity existed of obtaining a free discussion between representatives of various nationalities, and full support was given by the representative British delegates.

It has not, of course, been found possible at these preliminary discussions to lay down any very clearly defined field of action, nor is too sudden a crystallisation of ideas in this direction desirable. Naturally, it will be some time before more than interchange of information is possible along these lines without any attempt to obtain international agreement on actual standards. In fact, the new organisation which has seen its birth in New York, to start with may be in the nature of an international technical association rather than a standardising association.

The important suggestion was made by that clear-sighted man, Doctor John W. Lieb, the vice-president of the new York Edison Co., that whatever was done in the direction of international investigation between countries should be done through one organisation, and that the experience and personnel of the I.E.C. should be made use of to the utmost possible extent. With a view to doing everything possible to further Dr. Lieb's suggestions, several conferences and conversations took place in New York between the various nationalities, and in spite of some little misgiving and only after the gravest consideration it was decided to go forward cautiously on these lines, allowing each country full liberty to discuss what it considered to be the proper method to further the work.

It was interesting to observe during the discussions that the proposals for organising this new international understanding had a strong backing from industry in the United States. This augurs well for the future of the movement, which, of course, cannot go forward without substantial financial support.

Prior to the opening of these New York conversations the British, Belgian and Dutch secretaries had co-operated in producing a draft organisation, and during the talks other countries, notably America, which had convened the conference and drawn up the agenda, contributed definite proposals.

In view of the 20 years' active and useful life of the I.E.C., during which it has been formally recognised by many Governments of the world as an existing means of interchange and promulgation, it was felt that collaboration between the new body and the old would result in a valuable saving of energy and overlapping of effort which, while leaving the I.E.C. entire liberty of action, would result in much all-round economy. It was frequently observed, too, during the discussions that with the B.E.S.A. and the I.E.C. working side by side under one general secretary, Mr. Le Maistre, has on all occasions acted internationally in the affairs of the latter body; the recognition of this fact no doubt had considerable influence with the various foreign delegates in bringing them ultimately to a decision to recommend unanimously to the national standardising bodies that the central office of the new body should be in London, and be run in intimate contact with the central office of the I.E.C.

A constituting committee of seven was appointed to receive the replies of the national standardising bodies, and this Committee will meet in London under the chairmanship of Sir Archibald Denny some time before the autumn, to take matters a step further towards setting up the machinery for actually carrying on the work.

The British delegation was ably led by Sir Archibald Denny, and throughout the discussion Sir Richard Glazebrook, who for forty years has taken such an active part in international movements, did yeoman service. The assistance rendered during difficult passages by Mr. Ll. B. Atkinson was also of the greatest value.

Indeed, the confidence and respect accorded to the British delegation when differences of opinion had to be adjusted, have added considerably to the prestige and reputation which this country enjoys in international technical fields. The British point of view has never been more adequately advanced nor has it been received with such respect, and we shall anticipate with a lively interest the growth of this technical League of Nations.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

Insulation of Electric Cables.—On May 17th Mr. DAY asked the Minister of Labour if his attention had been drawn to the death of Edward Cox, Battersea who came into contact with an uninsulated wire when working on the South London Tube extension at Trinity Road station; and, in view of the danger to workmen engaged on such undertakings, would he cause regulations to be made with a view to all electric cables being insulated.

Col. ASHLEY, who replied, said that his attention had been called to the accident. He was making certain inquiries, and proposed to consider, when these were complete, whether there was any action that he could usefully take.

Leicestershire and Warwickshire Electric Power Bill.—This measure was read a third time in the House of Commons on May 4th and in the House of Lords on May 14th.

Lighting in Lanarkshire.—On May 18th, Sir A. SPROT asked the Minister of Transport what was the present position of matters as regarded the obtaining of wayleave from certain proprietors to permit of the laying of an electric cable, the want of which was holding up the public lighting of the Salsburg district, Lanarkshire.

Col. ASHLEY said that objection had been taken to the Power Co.'s application for the wayleaves referred to, and a further inquiry, for which he hoped to make arrangements at an early date, would be necessary.

The Broadcasting of News.—On May 19th, Mr. DUCKWORTH asked the Postmaster-General whether he would arrange for the British Broadcasting Co. to continue permanently to broadcast part of its special service of news and comment initiated during the recent emergency.

Sir W. MITCHELL-THOMSON said that the arrangements for the distribution of news by means of the British Broadcasting Co.'s stations were governed by an agreement between the company and the Press. This agreement would expire with the termination of the present licence to the company on December 31st next, and the new broadcasting authority which it was proposed to set up would be free to make fresh arrangements.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Strike Profiteering.

During the recent strike, we were carrying out an urgent job in North London, under difficulties, and requiring some additional material, we courteously invited a local electrical contractor of, obviously, some standing, to oblige us with these materials, explaining the difficulty in transporting goods, and offering to pay 10 per cent. over and above the usual trade prices to compensate him for his trouble.

Imagine our surprise, when we were informed that he would only supply us at prices approximately *double* those usually charged.

It would be interesting to learn if any of your readers have experienced similar cases of rank profiteering.

Henfrey Electrical Installations,
HY. FREEDMAN, *Proprietor.*

London, *May 18th*, 1926.

Engineers and Labour Disputes.

Mr. Thomas Carter, in the excellent and inspiring paper which he read before the I.E.E. a few months ago, urged the need for engineers to take a greater part in public life, pointing out that it was the work of engineers in the past which had changed a simple mode of life into an extremely complex one, and therefore it was the duty of engineers to endeavour to devise some means of lubricating the industrial machine which had been built as a result of their inventions and labours

Now, while it is perfectly true that some engineers are, by their nature and training, eminently fitted for dealing with the many complex problems of modern industrial life, it is a fact that no body of men is more ignorant than engineers are regarding the history and principles of industrialism; and it is during crises such as we have just experienced that we realise the extent of the average engineer's ignorance regarding the troubles liable to occur in the industrial machine.

Here is a serious disturbance occurring on an elaborate high-tension system, and we have the unedifying spectacle of a large body of highly trained men excitedly discussing the merits and demerits of the indicating instruments, instead of attempting to acquire some knowledge of the system affected with a view to ascertaining the cause of the trouble; and, because the problem is one outside their accepted province, they fail to appreciate their illogical position.

In other words, the average engineer anathematises the trade unionist without knowing anything of trade unionism, and preaches class distinction without realising the modern tendency towards its elimination.

Presumably we are all agreed that engineering problems can only be solved satisfactorily by men well trained in engineering principles and capable of studying the various phases of those problems. Why, then, can we not be logical enough to study the fundamental principles and growth of industrial problems before accepting solutions propounded by someone possibly even more ignorant on the subject than we ourselves?

Scurrilous abuse of trade unions and employers' federations, as served up by a sensational Press, is not a scientific method of solving the complicated problems presented by the elaborate industrial machinery developed during the past two centuries; and if engineers would study the economic growth of that machinery and learn something of the troubles which have occurred during its history, they would be more capable of finding a sound solution than are those who wildly advocate the smashing of unions and the blatant recognition of the class war, with powerful corporations on one side and a disorganised rabble of free labour on the other—possibly with technical employés in the superior position of complacent neutrals.

T. H. R.

Rugby, *May 15th*, 1926.

[Our correspondent appears to have been upset by some occurrence which has not come to our knowledge. We do not agree with his view that engineers as a body are ignorant of the history and principles of industrialism; nor do we accept his statement that the average engineer is hostile to trade unionism and preaches class distinction. The "scurrilous abuse" that he mentions is surely imaginary.—EDS. ELEC. REV.]

The Resistance and Heating of Lampholders.

As manufacturers of lampholders from 1882 until 1902, when we gave up their manufacture, we were naturally interested in the article on "The Resistance and Heating of Plunger-type Lampholders" which appeared on page 689 of your issue of April 30th.

The last patterns of B.C. lampholders which we made embodied this feature, and we believe that Messrs. Dorman and Smith, of Manchester, were at the same time making another pattern which contained a spring plunger device.

These improvements, introduced some 25 years ago, so far as we were concerned, did not, however, receive sufficient recognition to warrant a continuation of manufacture. Probably the reason for this was because B.C. lampholders were not called upon to carry such heavy currents as they are nowadays, when the tendency is to burden these articles with currents far in excess of those for which they were originally designed.

To meet these heavy loads, improvement in carrying capacity is, to-day, most essential, and, unfortunately, the need has arisen when the articles have become very competitive in price, the result being that slight additions in price are looked at unfavourably.

Our own pattern, a sample of which we send herewith, has spring plungers, constructed in accordance with our Patent No. 367 of 1901.

This construction, you will notice, depends upon a stud extension of the terminal, and on this a hollow four-slotted plunger slides, the inward set given to the four prongs of the plunger providing an efficient sliding contact between the terminal and the plunger, independent of the spiral spring.

In Messrs. Dorman & Smith's pattern, we believe that the plunger was solid, split in two, and sprung outwardly, sliding within a tube in a similar manner to that shown in fig. 1 (*a*) of the article referred to.

A. P. Lundberg & Sons.

London, *May 3rd*, 1926.

Country-House Fires.

In your issue of April 23rd a gentleman, signing himself "Engineer Surveyor," says his attention had been directed to my letter, which statement I take to imply that he was writing in a representative capacity; he takes exception to my statement that "Insurance companies do not *cause* very careful tests to be made." I am willing to substitute for the word *cause* the word *insist*. The report form certainly asks for particulars which are more honoured in the breach than in their fulfilment, for the very reason, perhaps, that "Engineer Surveyor" gives, *i.e.*, the disinclination of some clients to be bothered; still, it is the duty of the trade to educate the general public to the need and prudence of inspection by independent and qualified engineers, as in the case of boilers, because you might as well be blown to atoms as be roasted alive, and the multiplication of the risks is certainly a call to action on the part of those most nearly concerned.

"Engineer Surveyor" says that objection is often taken to the inspector getting access to all points to take out lamps and test each sub-circuit. Is this necessary? If the inspector uses a little diplomacy he will usually get more latitude than is absolutely necessary.

But what I object to in "E.S.'s" letter is its general tone and cheap sneers at companies other than his own ring clique; he seems to think that I made an attack on insurance companies and their surveyors, which I did not, and I am glad that he concedes my main contention, that all installations should be compulsorily examined occasionally.

J. Price.

Manchester, May 5th, 1926.

The Heating of Buried Cables—Report No. 2.

With reference to Mr. Fawssett's letter to your journal, a copy of which has been sent me by the courtesy of the Director of Research, I think Mr. Fawssett's remarks now make the matter perfectly clear.

I would, however, point out with reference to his statement that "None of the values of the thermal resistivity given in the report are affected;" that this must not be taken to mean that my statement is incorrect, *viz.*, that you get a wrong resistivity by taking Equation (25) in the form given in the I.E.E. journal.

I ought, perhaps, in explanation of my attitude, to point out that about a year and a half ago, in trying to check the values for the resistivity given in the tables published in the Institution *Journal*, I found I could in no way reconcile these (for three-core cables) with the formula. I spent the best part of a day over the matter and, owing to pressure of other work, had to give it up, thinking that I must have made some egregious mistake.

Then, perhaps a year ago, the results of an actual test on a three-core cable by a leading firm of cable makers came into my hands and I could again in no wise reconcile the temperature attained by the cable with the value of the resistivity as given in the tables published in the I.E.E. *Journal*. The possibility of Equation (25) being wrong seemed to me at that date too dreadful to contemplate, and again I had to leave the matter, after spending several hours, with the firm conclusion that something was wrong, but I did not know where. I was, in fact, on the point of writing to the cable makers to tell them that I thought there must be some mistake in the tests, but fortunately decided not to do so!

Last, about a month ago I found it necessary to return to the charge, and this time determined to get to the bottom of things, with the result that I found the discrepancy in the equations, as given in the two reports.

It is quite possible that others besides myself have been through this painful experience, and I hope, therefore, that Mr. Fawssett will not consider that I was doing him any injustice in letting the matter be known as early as possible for the benefit of saving others from falling into the same trouble.

As Mr. Melsom was always the one who replied to discussions on this question at the Institution meetings—at any rate, those discussions which I attended—I took it that he was the one who was primarily concerned in the mistake, and that is why I have not troubled Mr. Fawssett in the matter.

I hope he will exonerate me from any desire to overlook his excellent work in this connection.

A. M. Taylor.

Birmingham, *May 19th*, 1926.

Burgh of Hamilton—Electrical Engineer.

Under the above heading an advertisement appeared in the Electrical Review on April 23rd, 1926. In the same issue in the "Personal" column appeared the following: "Mr. W. J. Cooper, acting electrical engineer at Hamilton Electricity Works, has been appointed electrical engineer for the Burgh of Hamilton."

Extract from the Electrical Review, May 14th and 21st, 1926, "Personal" column: "We are informed that the appointment of electrical engineer for the burgh has been made by Hamilton Town Council. By 11 votes to 3 Mr. W. J. Cooper (at present acting engineer at the Hamilton Corporation Electricity Works) has been appointed."

Why did they ask for nine copies of testimonials when one would have been sufficient?

Curious.

May 21st, 1926.

[As stated in our issue of April 30th, p. 706, the announcement in our "Personal Column" on April 23rd was premature.—Eds. Elec. Rev.]

Electricity Meters.

In your leaderette on "Electricity Meters" you give the impression that meters generally tend to go slow rather than fast, but, particularly on the alternating-current meters, there is a possibility that many of them may run fast after a certain period of service owing to the instability of the magnets.

There is no doubt that during the war, and even prior to and since the war, there were many makers of magnetic steel in this town who understood very little about the essential properties of magnets, not only as to how essential it was that the magnets should be stable, but as to how to make them stable. Some of the firms which were supplying magnetic steel had not even got the apparatus for testing it; and some did not magnetise the steel and had a most rudimentary idea as to how it should be done. Fortunately there were some makers who employed fully qualified people to advise them, and these remarks only emphasise the absolute necessity of having proper testing equipment and testing service for all consumers' meters.

I am, personally, of the opinion that meters should not be allowed to be out more than from three to five years without a thorough overhauling and testing, yet it is safe to say that over 50 per cent. of the meters in the country are not looked at oftener than once in ten years. In many cases, the practice is to look at a meter only when it has stopped, or when the consumer has left the premises and there is no chance of current being used for some time.

More up-to-date towns have a systematic testing and overhauling of meters whether they want it or not.

Permanence.

Sheffield, *May 21st*, 1926.

Reviews.

Electrical Circuits and Machinery (Vol. III, Experiments). By J. H. Morecroft and F. W. Hehre, Columbia University. Pp. viii + 165; figs. 83. London: Chapman and Hall, Ltd. Price, 10s. net.

The present work completes a series of three books by these well-known American authors, the others having been concerned with the theory of direct and alternating currents respectively. It is intended as a laboratory guide for students who are primarily concerned with a branch of engineering other than electrical and who have but a limited time available for practical electrical work. The authors suggest that the experiments described can be performed by devoting one period per week for one session (which should be allocated to one of the later years of the course taken by the students) to the work, but it seems probable that rather more time would be necessary to obtain the most effective results.

The experiments included in the book are, for the most part, concerned with machines (both direct and alternating current types being considered) and special attention is devoted to the operating characteristics of the appliances under consideration, a method which can be well commended when instructing students of the type mentioned. Of special interest are the descriptions of certain tests in which use is made of a telephone as the indicating instrument in connection with the localisation of earths in armatures and with the determination of the wave form of alternators. A noteworthy omission is the absence of any material relating to temperature rise tests on machines, surely an important matter for the class of engineers for whom the book caters, and an account of a form of Hopkinson test would also be a useful addition.

The chief criticism that we wish to make is in regard to the poor heading of some of the columns in the blank forms for test results. It is important, when recording results, that the name of the quantity and the name of the unit should be expressly indicated in connection with each number booked, but in this work we sometimes find columns headed with the name of the quantity, sometimes with the name of the unit and rarely do we find both pieces of information included.

The authors understand the requirements of students and appreciate the points needing particular stress and this is very clearly shown in the collection of interesting questions, usually qualitative, at the end of each section. It is only possible to obtain the maximum value out of a book dealing with experimental work if the instructor in charge of the class takes pains to amplify the necessarily general information given in the book with detailed help in regard to the particular machines and appliances used in his laboratory, and, if such instruction is efficiently conveyed, we can heartily recommend the volume under notice.

In a list of other works by the same authors we notice that not only are the numbers of pages and figures mentioned but also the dimensions of the pages in *inches*, this seems quite a useful piece of information and might be more generally included. The idea of re-commencing the numbering of the figures in the second part of the book (dealing with alternating current work) cannot be commended and seems likely to lead to confusion.

A Treatise on Electricity. By F. B. Pidduck. Second Edition. Pp. xiv + 664; figs. 385. London: Cambridge University Press. Price, 21s. net.

This is a text book for honours students of physics and the whole of the very wide field now included in the science of electricity is very adequately covered. The book opens with a brief mathematical introduction dealing with vectors and leading up to Stokes's Theorem and Laplace's Operator. A note on Bessell's Functions is also included in this section.

Permanent magnetism, electrostatics and electric currents are dealt with in successive chapters, and then follow chapters on magnetic effects of currents, thermo-electricity, induced magnetism and induction of currents. All these are sound solid stuff upon which the student may confidently build up his knowledge of either the pure or applied branches of electricity. In view of the essentially mathematical and theoretical nature of the general treatment of the whole subject there is little or no justification for the inclusion of a chapter on applied electricity, and, indeed, it is difficult to find in what respect this chapter is more "applied" than any of the others, for surely a triode valve is no less an application of electricity than is a dynamo or an arc-lamp.

The chapter designated applied electricity really deals with electromagnetic machines, and this is followed by a section on electrolysis. In these chapters the author ably elaborates the outcome both in theory and practice of Faraday's two mighty discoveries: the electromagnetic effect and the laws of

electrolysis. In fact, we may look upon the first ten chapters of the book as covering the ground mapped out by Faraday; the second half of the volume deals with the new territory which has been opened up to us during the last fifty years.

This new territory is explored very thoroughly in five excellent chapters on electric oscillations, electricity in gases, Röntgen rays, radioactivity, and the electrical theory of matter. The first of these, commencing with the theory of condenser discharge and the production of electrical oscillations, proceeds to the experiments of Hertz and then treats of the thermionic valve and the subsequent development of modern wireless communication.

The section on electricity in gases is a concise and authoritative account of this subject from the early experiments of Crookes to the modern work of Aston and Rutherford, and the only fault the reviewer would find is in the somewhat scanty treatment of Sir J. J. Thomson's early classical work on the nature and properties of the electron. Radioactivity and the theory of the nuclear electronic atom are dealt with in the last chapters, and the latter subject has been brought up to date so as to include the most recent developments of the Bohr-Rutherford theory.

The book is well produced and has an exceedingly complete index. Its broad and thorough treatment of the established facts and the new theories of electrical science will assure for it a place among the standard works on the subject.

P.H.S.K.

National Economics for Britain's Day of Need: The Solution of the Unemployment Problem. By Edward Batten, M.I.Mech.E. Pp. xi + 217. London: Sir Isaac Pitman & Sons, Ltd. Price, 5s. net.

The book has been written out of the conviction that although war and destruction compel poverty and want, it is only the feeble and the foolish who can accept and believe the proposition that our idleness is as compulsory as our destitution. The author works along the lines that the problem to be solved is one of liabilities and assets with regard to the rationing of the people, and compares the rival systems of production, competitive or individual, and non-competitive or socialist. Much food for thought in connection with our modern national problems is contained in the chapters criticising and comparing the different political aspects of them, and in this direction the chapter on "Foreign Trade Regulation by a Socialist State" is particularly interesting. The author visualises the trade relationship between Socialist Britain and a protected country. Chapters on the influence of tariffs, preferential trading and selective tariffs, dwell much on modern politics, while "Money and the Gold Standard" and "Inflation and Deflation," are chapters which will be read with much interest by speculative and business men. The appropriate remedy for the injurious effects on British trade of the monetary policies of foreign countries, says the author, is to be found in our own wise monetary regulation. "The solution of the problem is the adjustment of the internal purchasing power of domestic money to constant parity with the external selling price in gold of the exported products of national industry."

Radio and High-Frequency Currents. By E. T. Larner. Second Edition, enlarged. Pp. vii + 61; figs. 25. London: Crosby, Lockwood & Son. Price, 2s. 6d. net.

This little manual gives a concise outline of the general principles of radio-telegraphy, and this edition includes also a chaper on radio-telephone transmitters.

It is especially suitable for students and amateur radio experimenters who have an elementary knowledge of mathematics and the principles of electricity, and who are desirous of obtaining a clear grasp of the general methods by which radio messages are sent and received.

It would be a mistake in a book of this size to attempt anything outside the barest fundamental principles, and Mr. Larner does not commit this error.

Short wave working is not touched on at all, but on page 2 the sentence "For short ranges short waves are used, whereas long waves are required for transmission over long distances," should have been omitted in this revision.

The information given is clear, concise and well arranged, and the book should fulfil well the purpose for which it was written.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Sic Transit.—We know not whether to congratulate our esteemed contemporary, the *Electrician*, upon its determination to "miss publication entirely" during the recent emergency, or whether our congratulations should be offered to the electrical industry. The Editor makes no apology—far from it! He appears to be proud of the fact that at last, for the first time in his journal's long history—which, of course, means since it was born in 1878—two weeks passed without the proprietors being able to issue "some sort of a sheet." As for ourselves we supposed that the national policy was to carry on and to keep smiling—to shut down entirely were easy for any of us—so we struggled during a fortnight with all sorts of difficulties and did our best to keep the electrical profession and industry informed through the medium of a weekly Electrical Bulletin which meant hard work and considerable expense. We *did* try, but now, alas, must we feel that we have done the thing that we ought not to have done. Truly there is no health in us! Anyhow, we have the satisfaction of knowing first that our efforts were appreciated, and secondly, that our records were kept up to date by the presentation of the Special Supplement with our last issue.

E.D.A. Activities.—We have received from the British Electrical Development Association a selection of publications—old and new—touching upon many phases of the use of electricity. The principal of these is a brochure describing, with illustrations, the Electric House at Olympia, with its contrasts of Mid-Victorian and neo-Georgian methods. Another useful pamphlet contains an article on salesmanship by Mr. V. W. Dale. In addition to these there are illustrated leaflets dealing with the ease of electric washing and cooking, and the comfort and cleanliness of electric lighting and heating.

Unemployment.—One serious effect of the coal mining dispute and the general strike has been a considerable increase in the number of persons registered at the Employment Exchanges. At May 10th the total was 1,576,000, as compared with 1,105,000 on May 3rd—an increase of 470,000.

Australian Tariff Amendments.—The new Commonwealth Customs Tariff, which has been passed by the House of Representatives, but not yet ratified by the Senate, provides, *inter alia*, that coal-cutting machines shall be admitted free of duty under the British preferential tariff; the duty under the intermediate tariff is 5 per cent., and under the general tariff 10 per cent. The rates for X-ray transformer apparatus, other than that designed exclusively for deep therapy, are, respectively, free, 10 per cent., and 20 per cent., but on and after July 1st, 1926, the rates are to be increased to 27½ per cent., 35 per cent., and 40 per cent.

The British Industries Fair, 1927.—Activities in connection with next year's British Industries Fair have commenced somewhat earlier than usual and we have already received the preliminary prospectus of the Birmingham section. This states that the Birmingham Fair will be held at Castle Bromwich Aerodrome from February 21st to March 4th, and the buildings are being considerably enlarged, giving a total floor area of nearly 200,000 sq. ft. The reduced price for space which was instituted this year is to be maintained and for an overall charge of £10 a "counter display" can be arranged and maintained by the Fair authorities for any exhibitor who has only samples to show and does not wish to employ attendants, although, of course, representatives can be placed in charge if desired. Arrangements are being made to keep visitors to previous Fairs fully acquainted with what is going on. As in previous years the exhibits are classified in eleven groups and although electricity is not one of them, we anticipate another good electrical display. Mr. T. R. Martin (J. H. Tucker & Co.) has been appointed chairman of the Fair Management Committee.

Swedish Electrical Exports.—The official foreign trade returns show that during 1925 Sweden exported electrical generators to the value of 21,000,000 kr. (£1,155,730), as compared with 17,492,000 kr. (£962,680) in 1924. The exports of telephone and telegraph apparatus were valued at 7,006,000 kr. (£385,580). as against 7,519,000 kr. (£413,810) in 1924.

Belgian Company's Developments.—At the annual meeting of the Société des Ateliers de Constructions Electriques de Charleroi, recently, the chairman stated that arrangements had been completed for the production of a new series of up-to-date electrical machines, and that in the company's cable factory, plant had been installed for the manufacture of long-distance telephone cables.

The F.B.I. and the French Debt.—In a letter to the Chancellor of the Exchequer, the Federation of British Industries states that French industry is enjoying very substantial advantages in competition with British Industry by reason of the heavy subsidy in relief of French taxation which is involved by the payment of interest on the French debt by British taxpayers. In addition, the sale of competitive French products is aided by the depreciation of the French currency and the high import tariffs which have been instituted. In these circumstances the Federation says that no settlement with France will be regarded as satisfactory which does not take these factors into account, and it is hoped that any settlement will provide for substantial annual payments in respect of the debt, for the stabilisation of the finance and currency of France, and for some relaxation of the French tariff policy.

Power Companies and the Sale of Appliances.—In its May issue *The Electragist*, the official organ of the American contractors and contractor-dealers (" Electragists ") criticised the American supply companies' sales policy on several counts. In the first place the wisdom of selling appliances by instalment payments spread over as long as two years is questioned. This practice is also condemned as being inimical to the interests of electrical dealers; it is said that only department stores, which will not " service " appliances, can compete on these terms. The companies' contention that they must sell appliances to absorb their power is considered ridiculous, as it is alleged that their activities result mainly in the sale of washing machines, vacuum cleaners and other appliances which consume practically no energy. Figures prepared by a typical company are reproduced showing that the appliances of this nature represented 48 per cent. of the sales; 32 per cent. was accounted for by the sale of installations, while only 20 per cent. was due to the sale of cookers, refrigerators, signs, and other devices which consumed a larger amount of energy. *The Electragist* says: " A utility is first and foremost a manufacturer and distributor of electric energy. It is entitled to build its load and develop its service. . . . The public is entitled to the widest use of energy at the minimum rate. If a utility makes it difficult for other retailers to compete except with inferior articles, the public is not being served in the manner to which it is entitled. If this aggressive policy results in a mechandising loss, such loss is capitalised and the public penalised. And if the loss so incurred is not absorbed by the profit on the energy revenue from the sale, then the public is victimised."

New Municipal Showrooms and Offices.—The Ilkley Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £5,500 for the erection of offices and showrooms for the Electricity Department.

" Ediswan " News Bulletins.—During the General Strike when news was hard to obtain, the Edison Swan Electric Co., Ltd., rendered a real public service by reproducing the bulletins which were broadcast by the B.B.C. and distributing copies grati over a wide area of London. The company had the special permission of the authorities to perform this service, and it was actively assisted in the distribution of the bulletins by the managements of theatres, kinemas, hotels, clubs and business houses. The accompanying picture shows the commencement of the distribution of the final issue of the " Ediswan News Bulletin." The company also made special arrangements for the distribution of its radio products during the emergency, special supply bases having been arranged in advance at Birmingham, Liverpool and Newcastle.



The " Ediswan News Bulletin" being distributed.

South African Customs Duties.—The *Board of Trade Journal* publishes a list of proposed amendments to the Customs Tariff of the Union of South Africa. The list includes " machinery for the conversion and transformation of electric power " upon which it is proposed to raise the maximum duty to 5 per cent. *ad valorem*. Batteries (primary and secondary) are to be subject to higher rates, including 12 per cent. upon batteries for radio purposes, 15 per cent. for automobile batteries, and 10 per cent. for other types, plus a suspended duty of 15 per cent. *ad valorem*. It is proposed to admit welding electrodes free of duty; at present they are only admitted free upon certain conditions.

Hungarian Tariff Reduction.—With the object of encouraging the development of the motor industry in the country, the Hungarian Government has temporarily reduced the import duty on electrical ignition, starting, and lighting equipment, without storage batteries and lamps, to one-tenth of the scheduled tariff.

Catalogues Wanted.—Mr. J. D. Bryan, electrical contractor, who has removed to 513, St. Vincent Street, Glasgow, C.3, wishes to receive catalogues and lists.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during March last were valued at £38,065, as compared with £26,997 in March, 1925. The imports for the first quarter of the current year are officially returned at £129,187, as against £73,404 in the corresponding period of 1925.

Contractors Visit Lamp Works.—Over 70 members of the Electrical Contractors' Association from Nottingham, Leicester and Birmingham were the guests of the General Electric Co., Ltd., in London on April 29th. They were conveyed in parties on arrival to the Osram-G.E.C. lamp works, where many interesting processes were inspected in lamp and valve manufacture. After luncheon the visitors were taken to the Wembley glass works, where they saw glass tubing being made for the Osram Lamp Works, and bulb blowing by automatic machinery. A tour was then made of the research laboratories of the company, where guides explained the nature of the work being carried out.

Swedish Turbines for Japan.—*Swedish Export* says that the Kristinehamm Works of the Karlstad Engineering Co. has recently received an order for three high-pressure water turbines to be installed in Japan. The aggregate capacity of the turbines is 60,000 h.p. This contract has been received after severe competition with the most prominent turbine builders abroad. The firm has already installed turbines at many of the Japanese hydro-electric works.

Trade Announcements.—The annual staff outing of the London Electric Wire Co. & Smiths, Ltd., has been arranged for June 5th, and the head office at Golden Lane, E.C.1, will be closed on that day. A small staff will, however, be in attendance during the morning to deal with urgent matters.

The Suffolk Iron Foundry (1920), Ltd., has appointed the British Oxygen Co. sole selling agents for its " Ferro-Silicon," " Super-Silicon," and " Sifbronze " welding rods. The agency will include Great Britain, Northern Ireland, Irish Free State, India, Australia, and New Zealand.

The Automatic Telephone Manufacturing Co., Ltd., states that its Liverpool registered telegraphic address is now " Strowger, Liverpool "; and telegrams to its London office, Norfolk Street, Strand, W.C.2, should be addressed: " Strowger Estrand London."

The radio apparatus manufactured by Messrs. C. A. Vandervell is stocked at Shaftesbury Avenue, W.1, Newcastle-on-Tyne, Birmingham and Glasgow by Messrs. Joseph Lucas, Ltd., and at Leeds and Bristol by Rotax (Motor Accessories), Ltd.

Messrs. Alex. Brown & Co. have removed to 113, West Regent Street, Glasgow.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Leaflet 36E, containing details and prices of power bells and accessories, and Leaflet 57C, dealing with electric-motor sirens.

Autoveyors, Ltd., 84, Victoria Street, S.W.1.—A priced and illustrated leaflet describing the company's " thermionic relay."

Messrs. L. McMichael, Ltd., Wexham Road, Slough.—Two illustrated and priced pamphlets dealing, respectively, with the company's 7-valve supersonic receiver and a vernier condenser dial.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The " Osram Bulletin " for May, containing descriptive articles and notes relating principally to " Osram " lamps and valves. Also a priced and illustrated catalogue and a folder advertising " Freezor " fans.

Messrs. L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A folder advertising the " Universal " electric curling iron.

Delco-Remy & Hyatt, Ltd., 111, Grosvenor Road, S.W.1.—A brochure containing a simple detailed description of the " Delco-Remy " coil ignition system. Illustrated.

The Hart Accumulator Co., Ltd., Stratford, E.15.—A coloured showcard advertising " Hart " batteries for radio, automobiles, lighting, &c.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—A card advertising the company's time switches, with a topical allusion.

British Insulated Cables, Ltd., Prescot, Lancs.—A general descriptive catalogue containing particulars of cables, joint boxes, tramway material, welders, etc.; a catalogue of " Prescot " house fuse boxes; and leaflets dealing with the company's insulating varnishes and fault-localising apparatus.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester.—Descriptive Section No. 27, containing illustrated particulars of single-phase and polyphase induction regulators for hand, motor-operated, or automatic voltage control. The principles, design and construction are very fully set out.

Messrs. Marelli & Co., Ltd., 19 and 20, Garlick Hill, E.C.4.—Pamphlet L/711, illustrating and describing the company's oscillators and revolving ceiling fans.

Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.—Twenty-four-page pamphlet entitled " All Over the World," " The Drum of Empire "—a Callender drum, of course. It contains some notes on the building up and development of the company's business, accompanied by a series of pictures of many places in different parts of the world where their cables are in service.

Messrs. E. Brook, Ltd., Empress Works, Huddersfield.—A folder advertising " Brook " induction motors.

Messrs. McCormick & Butler, 121, Victoria Street, S.W.1.—Two folders advertising the firm's " Indurite " moulding powder and moulded products.

Messrs. James McMillan & Co., Clun House, Surrey Street, Strand, W.C.2.—A card bearing particulars of cables and wires of Swedish manufacture.

Bankruptcy Proceedings.—B. G. THOMPKINS, Stanley, Durham, radio engineer.—The receiving order in this matter was made on debtor's own petition. The statement of affairs showed liabilities of £255 against assets of £110. The first meeting of the creditors was held recently at the Official Receiver's office, Newcastle-on-Tyne, when the case being a summary one was left with the Official Receiver as trustee of the estate. The following are creditors :—

	£		£
Cooke & Whitfield Wireless, Ltd.	38	Newcastle General Supply Co., Ltd.	28
Hicks & Schofield	32		
Modern Radio, Ltd.	42		

G. R. SPARROW, 11, Cloudesdale Road, Balham, late of Brixton, electrical engineer. The following are creditors :—

	£		£
Electrical Accessories	66	Native Lamp Co.	23
Chapman, Mrs.	52	Russell & Amholtz	20
Toomer, T.	25	Holness, J. C.	105

F. F. GREGORY, 2a, Westbourne Road, Luton, Beds., electrical engineer.—The receiving order in this matter was made on April 24th on debtor's own petition. The first meeting of the creditors was held on May 11th at the Official Receiver's office, Northampton. Public examination June 17th, at the Court House, Luton. The following are creditors :—

	£		£
Berry's Electric, Ltd.	35	Pope's Electric Lamp Co., Ltd.	34
Bankers	163	Sun Electrical Co., Ltd.	52
Gregory, H.	96		

CARR & CHILDE, wireless accessories agents, 38, Park Row, Leeds.—A receiving order was made against this firm in February, 1925, upon the petition of Ashley Wireless Telephone Co., Ltd., creditors for £567, and last week the debtor G. S. Childe applied to Mr. Registrar Warnington at the London Bankruptcy Court for an order of discharge. Mr. Walter Boyle, Senior Official Receiver, reported that the liabilities amounted to £619, and the assets, valued at £51, had realised only 19s. 1d. In 1922 Carr commenced business in Leeds, and in the following year the applicant paid him a premium of £500, and £250 as business capital for a half share in the concern, in which Carr then invested £250 as capital. In November, 1923, requiring more capital, they transferred the business to Carr & Childe, Ltd., for £500 in shares, and £400 in cash, which was paid to the creditors of the firm. The debtors attributed their insolvency to (1) failure to meet overhead expenses; (2) failure by the petitioning creditors to deliver goods in agreed time; and (3) lack of capital. His Honour granted a discharge subject to judgment for £30, to be satisfied by an immediate cash payment.

C. HUBBARD, 13, Magdalen Street, Norwich, electrician and wireless dealer.—The public examination of this debtor was held recently. The statement of affairs showed gross liabilities of £514, of which £206 was expected to rank. Debtor attributed his failure to insufficient capital and delay in the payment of money due to him. His book debts totalled about £300. The examination was closed.

D. E. DAVIES, wireless engineer, Poulton Street, Kirkham.—This debtor, who had a deficiency of £163, appeared at Preston Bankruptcy Court on May 14th, for his public examination. He stated that he commenced in business two years ago with £5, and £45 borrowed from relatives. He had not made any profit from the concern. He attributed his failure to bad trade and illness. The examination was adjourned.

J. A. TREND, electrician, 31, Chapel Street, Luton.—First meeting held May 12th, at the Official Receiver's office, The Parade, Northampton. Trustee, Mr. T. Keens, 11, George Street West, Luton, appointed May 18th. Public examination June 17th, at the Court House, Luton.

A. NORTH & F. NORTH (A. & F. North), wireless and electrical engineers, 38, Bradford Road, and Market Place, Dewsbury. Trustee, Mr. F. Gomersall, 16, Bond Street, Dewsbury, appointed April 22nd.

J. V. WALLIS, wireless goods dealer, 46, King Street, Cambridge, late of 28, Regent Street, Cambridge. Trustee, Mr. J. L. Poland, Official Receiver, 5, Petty Cury, Cambridge, released April 28th.

E. O. HENSTOCK, electrical engineer, 21, Old Road, Brampton, Chesterfield.—First and final dividend of 1s. 10½d. in the £, payable at the Official Receiver's offices, 4, Castle Place, Nottingham.

C. H. PATRICK, electrical contractor, 132, Much Park Street, Coventry.—Receiving order made May 14th, on debtor's own petition. First meeting, May 31st, at the Official Receiver's office, 9-11, High Street, Coventry. Public examination, June 7th, at the County Hall, Coventry.

A. M. WILLMORE, electrical and radio engineer, 45, King Street, Brighton.—First meeting held May 27th, at the Official Receiver's offices, 12a, Marlborough Place, Brighton. Public examination, June 23rd, at the Court House, Brighton.

G. TURNER (Radio Supply Co.), electrician and wireless dealer, 34, Mesnes Street, Wigan.—First meeting, May 28th, at the Official Receiver's offices, 11, Dale Street, Liverpool. Public examination, June 24th, at the Court House, Wigan.

S. PURCELL, electrical contractor, The Arcade, Goole, Yorks.—First and final dividend of 1s. 10½d. in the £, payable at the Official Receiver's office, 21, King Street, Wakefield.

W. H. GREENALL (Hampton Electric Co.), electrician, Newerne Street, Lydney.—First meeting held May 26th, at 34, Market Place, Cardiff. Public examination, June 22nd, at the Town Hall, Newport, Mon.

J. H. PAINTER (Venables & Co.), electrician, 99, The Broadway, Cricklewood, N.W.—Last day for proofs for dividend May 28th. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

J. N. DAVENPORT (separate estate), (lately carrying on business in co-partnership with L. A. Hackett, as Davenport, Hackett & Co.), electrical engineer and contractor, 36, Spring Gardens, Manchester, late of Albert Mills, Albert Street, Manchester.—Last day for proofs for dividend, May 18th. Trustee, Mr. A. Grierson, 21, Spring Gardens, Manchester.

L. A. HACKETT (separate estate).—Last day for proofs for dividend, May 18th. Trustee, Mr. A. Grierson, 21, Spring Gardens, Manchester. First and final dividend of 20s. in the £, payable June 4th at the Trustee's offices.

J. A. BOSHER, electrical engineer and contractor, 33, High Street, Aberdare.—Last day for proofs for dividend, June 1st. Trustee, Mr. S. E. Clutterbuck, 31, Queen Street, Cardiff.

T. ROBERTS and J. TAYLOR (Roberts & Co.), electrical engineers, late of 61, Old Town Street, Plymouth, and at Fore Street, East Looe.—Last day for proofs for dividend, June 2nd. Trustee, Mr. F. West, 2, Courtenay Street, Plymouth.

M. D. ROSENBLOOM (D. Rose & Co.), electrical engineer, 25, Osborn Street, E.1.—Bankrupt's discharge suspended for three years, until April 30th, 1929.

W. C. RHODES (L. J. Palmer & Co.), electrical engineer and contractor, 141, Newspaper House, Corporation Street, Birmingham.—Discharge granted subject to bankrupt's consenting to judgment being entered against him for £50 (£50 paid in lieu of entering up judgment). Supplemental dividend of 4¼d. in the £ payable at the Official Receiver's office, 191, Corporation Street, Birmingham.

T. BARTON, electrical engineer, Electric Works, Ainsworth Street, Blackburn.—Immediate discharge granted.

C. J. NICHOLS (C. J. Nichols & Co.), electrical engineer, 7, Park Street, Bridgend.—Trustee, Mr. C. T. Appleby, 26, Corporation Street, Birmingham, appointed May 14th.

F. V. LAMBERT (Lambert & Curley), electrical contractor, 27, Parrock Street, Gravesend.—Trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., appointed May 17th.

F. H. ARMITAGE, electrical engineer, 9, Occupation Lane, Pudsey.—Last day for proofs for dividend, June 8th. Trustee, Mr. J. O. Morris, Official Receiver, 12, Duke Street, Bradford.

R. HAWORTH, electrical engineer, 154, Duckworth Street, Darwen, Lancs.—First and final dividend of 8¾d. in the £, payable at the Official Receiver's offices, 11, Winckley Square, Preston.

J. HUMPHREYS, plumber and electrical engineer, the Yard, behind the Plough Inn, Oldham, and 22, Buxton Crescent, Rochdale.—First and final dividend of 4½d. in the £, payable at the Official Receiver's office, Byrom Street, Manchester.

Company Liquidations.—SCAMMELL & ABBOTT, LTD., Birmingham, electrical and accessories dealers.—A meeting of creditors was held recently, when a statement of affairs was submitted which disclosed liabilities of £1,572, all due to unsecured creditors. The net assets amounted to £276, leaving a deficiency of £1,296. It was reported that Messrs. Scammell and Roberts commenced business in February, 1919, with £200 capital. They were successful at the outset, and in 1922 borrowed £300 for the purpose of extending their business. In April, 1923, the company was formed, and later larger premises were taken. In June, 1925, in consequence of the slump, reduced turnover, &c., the manufacturing side of the business was closed. The wireless trade proved less profitable, and matters went from bad to worse. In March last, Mr. Scammell advanced a sum of £200 to pay the bank, and he was given a debenture for that amount. The liquidator stated that after consulting some of the principal creditors he had disposed of the business, other than the book-debts, for £400. The meeting was adjourned.

GOODCHILD & PARTNERS, LTD., dealers in wireless components, &c., 56-58, Eagle Street, Southampton Row, W.C.—The statutory first meetings of the creditors and shareholders of this company (in compulsory liquidation) were held last week at Carey Street. The winding-up order was made on March 30th upon the petition of a creditor. The Official Receiver reported that the company was incorporated in April, 1919, for the purpose of acquiring a business of engineers' factor which had been conducted by G. W. P. Goodchild, under the style of Geo. W. Goodchild & Partners. In 1920 a subsidiary company was formed for the purpose of selling certain lamps, and in 1924 the activities of this company were directed to the sale of radio valves and components. In February, 1925, the business was transferred to the company, which Goodchild anticipated would transact a large volume of business, but this failed to materialise. In February last a receiver was appointed on behalf of the debenture holder, and the former had since realised nearly all the assets, but he did not expect them to produce enough to cover the amount due Goodchild had attributed the company's failure to its being induced by a "boom" to extend its activities in the provinces, to the flooding of the market with surplus Government stores, to the slump in wireless goods which had set in, and to other causes. The accounts showed total liabilities of £7,159 (unsecured £5,429), and assets valued at £1,729; the latter would be absorbed by the preferential and debenture holders' claims, whilst the account with the contributories disclosed a deficiency estimated at £23,030. In the absence of any resolution the Official Receiver remained in charge of the liquidation.

Kenmac Radio, Ltd., Dalling Road, Hammersmith, radio manufacturers. A meeting of creditors was held on May 20th, at the offices of Messrs. S. E. Denning, 20, Bedford Row, W.C.1, when a statement of affairs was presented which showed total liabilities of £4,348 and total assets of £927, leaving a deficiency of £3,421. The liquidator reported that the company was formed in October, 1924, with a nominal capital of £100, of which only £3 was issued and paid up. The company was formed for the purpose of exploiting a small crystal set in the form of a book. The inventor was Capt. Mackie, and he was a director of the company. In April, 1925, a small factory was taken at Hammersmith. The company had incurred a gross loss of £1,000 and a net loss of £2,200.

Mr. Baker (Wholesale Traders' Association) said that the company was formed with £3 capital, and he considered that instead of Mr. Petrie advancing money from time to time (totalling £3,480) to carry on the business, he should have put up the money in shares. It was decided that Mr. Petrie should offer the creditors 10s. in the £. It was eventually resolved that subject to Mr. Petrie's postponing his claim until the creditors had received 10s. in the £, the voluntary liquidation should be continued, it being agreed that any funds available after Mr. Petrie had also received 10s. in the £ should be distributed *pro rata* amongst the creditors. A committee of inspection was appointed, consisting of Mr. Head, representing the Marconiphone Co.; Mr. E. H. Hawkins, representing creditors; and Mr. Salaman, of the Carrington Manufacturing Co. The following are creditors :—

	£		£
Marconiphone Co., Ltd. ...	... 100	Denning, S. E., & Co. ...	... 21
Howard Wall & Co. ...	... 367	Chamberlain, E. W. ...	... 24

British Wireless Supply Co. (1924), Ltd.—Meetings of creditors and contributories, June 7th, at the Official Receiver's office, 24, Lower Bond Street, Leeds.

Radio Equipment Co., Ltd.—Liquidator (with a Committee of Inspection), Mr. R. J. Tayler, Coventry House, South Place, Moorgate, E.C., appointed May 1st.

Nelson Electrical Co., Ltd.—A petition for the winding up of this company has been presented to the High Court by E. Durand, trading as C. Melin & Co. and E. Durand & Co., of 7, India Street, Crutched Friars, E.C., and will be heard in London on June 1st.

Burwood (Concessionaires), Ltd.—Particulars of claims to the Liquidator, Mr. G. E. McCanlis, 9-15, Oxford Street, W.1, by June 30th.

Radio Phonopore & Electricals, Ltd.—A petition for the winding up of this company has been to the High Court by Mr. C. W. Slingo, engineer, of 39, Loveday Road, West Ealing, creditor, and will be heard in London on June 1st.

C.A.C. (Radio), Ltd.—A meeting of creditors was called for May 21st at Winchester House, Old Broad Street, E.C. Particulars of claims to the liquidator, Mr. E. W. Sudlow, 358, Cranbrook Road, Ilford, by June 25th.

H. E. Davis, Ltd.—Winding up order made by the High Court on May 11th.

Reflex Radio Co., Ltd.—Winding up order made by the High Court on May 11th.

British Wireless Supply Co., Ltd.—Winding up order made by the County Court of Yorkshire held at Leeds on May 4th.

Dissolutions of Partnership.—Electrical Services, electrical engineers, Sudbury, Suffolk.—Mr. P. J. Gates and Mr. S. Downs have dissolved partnership.

Electrical Installation Co., electrical engineers, 25, St. Mary's Row, Moseley, Birmingham.—Mr. E. Cooper and Mr. T. Yarnit have dissolved partnership.

Private Arrangements.—J. L. Smith and H. G. Smith, trading as J. L. Smith & Co., electrical and radio engineers and contractors, 45, Queen's Road, Peckham, S.E.15.—A meeting of creditors was held on May 13th, at the offices of Messrs. Harper Stringer & Co., Queen Street, E.C., when a statement of affairs was presented, which disclosed liabilities of £431, and a surplus of £30. Mr. Stringer reported that Mr. J. L. Smith had been in business for a number of years and he was joined by Mr. H. G. Smith, who was no relation, in 1924, and he introduced about £300 capital. The present position was attributed to declining business. No offer was made, and the creditors decided that the debtors should execute a deed of assignment in favour of Mr. Stringer as trustee, with a view to the sale of the business as a going concern. It was the trustee's opinion that the creditors would receive 20s. in the £. The following are creditors :—

	£		£
Kye, Ltd.	... 33	Hammond & Smaldon ...	... 23
White, B. E.	... 46	Robinson, A. S., & Co. ...	... 21

C.A.C. Radio, Ltd., 10, Rangoon Street, Crutched Friars, E.C.3, and at Bournemouth and Leeds.—At a recent meeting of creditors Mr. E. W. Ludlow read a scheme prepared by the committee of inspection. Mr. H. Burford Judge intimated that it was not acceptable to the cash creditors unless the bank was accorded a certain amount of preference. The creditors present unanimously refused to accept the scheme with this reservation. Mr. G. Powell Stevens (British Industrial Exhibitions, Ltd.) proposed, and Mr. Roberts (Messrs. Thomas March, Ltd.), seconded, a proposal that in the event of the company's passing into voluntary liquidation the trade creditors should recommend that their nominee, Mr. E. W. Ludlow, be appointed liquidator.

D. H. Robertson, trading as Electrical Agencies, 1, Chapel Hill, Clevedon, electrical contractor.—A meeting of creditors was held recently, at the offices of Messrs. E. T. Collins and Son, Bristol, when a statement of affairs was presented which showed liabilities of £274. The net assets were estimated at £126, leaving a deficiency of £148. The debtor commenced trading, without capital, in January, 1923. He was later joined by a partner, who brought in £50, but the partnership was dissolved in three months, the debtor repaying the £50. The present position was attributed to lack of capital and loss on trading. There was no offer of a composition, and it was decided to confirm the deed of assignment which had already been executed to Mr. Arthur Collins to protect the estate. A committee was also nominated, consisting of the representatives of the Sloan Electrical Co., Ltd., the General Electric Co., Ltd., and J. H. Lewarn & Son.

The principal creditors are :—

	£		£
Baxter, T.	... 30	Sloan Electrical Co., Ltd.	... 50

Illumination Design Course for Contractors and Wholesalers.—Another of the excellent illumination design courses arranged by the E.L.M.A. Lighting Service Bureau is to be held at the Bureau in Savoy Street, W.C.2. This time it is for electrical contractors and wholesalers, who will assemble on Monday, May 31st, for a four-days' course, comprising morning and afternoon sittings from day to day until Thursday afternoon, June 3rd. The subjects of the lectures and demonstrations will be :—The Magnitude of the Lighting Business; Lighting Fundamentals and Principles of Distribution; a Practical Lighting Demonstration; Economics of Light Production; Simplified Methods of Designing Illumination Schemes; Light and Industry; Planning a Factory Lighting Scheme; Electric Lamp Manufacture; Contracts and Sales Rules for E.L.M.A. Lamps; the Possibilities of Colour Lighting; Solving Special Lighting Problems; Standardisation of Lamps and Lighting Equipment; the Lighting of Offices; Floodlighting and its Possibilities; Analysing the Lighting Market; the Lighting of the Home; Display Window Lighting; Efficient Lighting for Shops and Stores; Advertising Lamps and Light; Electrical Advertising; and Selling Better Lighting. The proceedings will close with an informal dinner at Carr's Restaurant, Strand, at 6.30 p.m., on Thursday, June 3rd. There will be accommodation for 80 visitors at the Bureau, and we are confident, taking into account the justifiable popularity of these courses, and the excellence of the arrangements made by the E.L.M.A. staff for the convenience and accommodation of those attending them, that this number will be reached. It is therefore important that applications should be lodged at once.

Safety Lamps in Mines.—The Secretary for Mines has made an Order, under Section 33 of the Coal Mines Act, 1911, approving for use in all mines to which the Act applies, subject to the conditions specified in the schedule to the order, the following types of electric safety lamps :—

Pearson "Ni + Fe" (square).
Pearson "Ni + Fe" (5-volt).
Edison Cap.
Patterson Cap Type J1 and K1.
Wolf Cap.
Worsnop's "Maxilux."
Pearson "Ni + Fe" Officials' Pocket.

For Sale.—Messrs. Veryard & Yates will sell by auction at an early date, at the Y.M.C.A. Huts, Waterloo Road, S.E., large quantities of wireless, electrical and general stores, &c. Mr. E. Fryett will sell by auction on June 3rd, at the London Trade Sale Rooms, 78 and 81, Fetter Lane, a quantity of telephone wire and cable. The Manchester Electricity Committee has for disposal 36 field rheostats, 220 and 520 V. (See our advertisement pages to-day.)

German Enterprise in Turkey.—According to a German correspondent at Constantinople, the establishment of small central stations in Turkey is making progress as a result of the activity of the German firms of Siemens, the A.E.G., and Bergmann. Quite recently the Turkish Electrical and Radio Co. has been formed with the participation of the firm of Siemens, and a prominent share in it has been taken by the Isch Bankassi (Bank of Commerce), which is directly supported by the Government. The foundation stone of the new works to be erected by the company was recently laid at Eski-Shekhir, which is an important railway base, where the central repair shops are situated. In the first place, the new works is intended to produce electrical apparatus and accessories so as to be able to emancipate the country from dependence upon others for these requirements.

Electricity and Gas at Leeds.—The Corporation Electricity Committee proposes to erect an all-electric bungalow, for demonstration purposes, on a vacant site at the junction of Calverley Street and Portland Crescent; and the Gas Department is to erect on the same site an all-gas bungalow, also for public demonstration purposes.

Standard Accumulator Components.—In connection with its provisional standards for battery crates, moulded accumulator containers, terminal posts and cable connectors, the Standards Department of the Society of Motor Manufacturers and Traders has issued a list of nineteen firms which are manufacturing and supplying battery components in accordance with the standards.

Lead.—Reporting on May 22nd, Messrs. James Forster and Co. stated that the position had undergone little change since their last report, the interference with consumption in this country by the strike being offset by a better demand from the Continent. "Supplies are as plentiful as ever and now that consumption is being held up by a threatened shortage of fuel, the position is not likely to get any better, but rather the reverse. The market, on the other hand, contrary to general expectation, has quite a firm undertone which can only be ascribed to sentimental reasons as a result of the settlement of the general strike. With a return to normal conditions the position of lead would seem to be quite sound and there would be no reason to anticipate prices going much lower."

Our Foreign Trade.—The following were the values of imports and exports of electrical goods and machinery during April, 1926:—

	April, 1926.	Inc. or dec.	4 months, 1926.
	£	£	£
Imports—			
Electrical goods and apparatus	289,606	−66,251	−283,575
Machinery	1,250,729	+227,451	+479,134
(Electrical machinery) ...	111,404	+13,306	+2,922
Exports—		...	
Electrical goods and apparatus	786,252	−315,568	−477,098
Machinery	3,594,732	−241,542	−331,042
(Electrical machinery) ...	412,862	−90,799	−82,477
Re-exports—			
Electrical goods and apparatus	17,144	−5,646	−21,781
Machinery	121,389	+1,076	+1,825
(Electrical machinery) ...	7,960	+2,541	+9,571

Russian Electrical Progress.—A report presented to the Presidium of the Supreme Economic Council says that none of the existing regional electric power stations worked by steam is large enough to meet the demands for power, although the capacity of the stations for the general supply of power is twice as large as in 1917. Out of seven power stations built according to the programme of the State Commission for the electrification of Russia, five stations with a power at the beginning of the year 1925-26 of 90,000 kW, have been extended during this year to produce nearly three times as much (266,000 kW) and further extensions are already planned. The Shterovski station will begin to work in the autumn, and its capacity is to be more than doubled during the next few years. As soon as the Volkhov station is finished in the autumn the question will arise of installing another hydro-electric station for the Leningrad district. This shows that in the great industrial centres the growth of the demand for electrical power considerably exceeds the pace of electrical construction. Altogether in 1925-26 nine stations will begin production with a capacity of 183,500 kW, and eleven stations are to be equipped to produce 271,000 kW, out of which four, with a capacity of 90,000 kW, are new stations. The Supreme Economic Council has requested the Glavelektro to prepare a report on the plans for the development during the next five years of the electrification of the country.—*Reuter's Trade Service* (Moscow).

Rewards for Strike Service.—The Westminster Electric Supply Corporation, Ltd., has given gratuities to members of its power station staff who remained at duty during the strike.

The Wireless Retailers' Association.—The annual general meeting of the Wireless Retailers' Association of Great Britain, at which the president, Sir Charles Bright, was present, was held on April 28th. The chairman of the Executive Council, Mr. F. S. Horsey, in the course of an address, said that progress had continued, and the position of the Association had been improved and strengthened in every way. The trade discounts allowed by manufacturers generally had greatly improved during the last two years, and they were now substantially adequate in most cases. The efforts of the Association had contributed materially to that result. In an endeavour to raise the status of dealers, it was decided some eighteen months ago to issue a certificate to members. One of the objects was that it should be a guarantee to the public of reliability and efficiency. The conditions enforced were solely in the interests of members themselves, and were based on those existing in the best organisations. A handbook had been issued containing particulars of the aims, objects and activities of the Association, to retailers generally. Mr. Horsey referred to the formation of the Society of Radio Manufacturers, which had realised the need for dealing adequately with retailers in the matter of discounts, and considered that each section of the industry must have its own representative association. In conclusion, Mr. Horsey said that there were strong indications that under the new order of things which was developing, manufacturers and retailers as independent bodies would co-operate for the common good. By that means the trade might be made an honoured and a lucrative one.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report May 25th:—Copper (electrolytic) bars, £64 15s., 5s. decrease; do. do. sheets, no change; do. do. wire rods, £74 15s., 5s. decrease; do., do. h.c. wire, 9¾d., ¼d. decrease.

Messrs. James & Shakespeare report May 25th:—Copper bars (best selected), sheet and rod, no change; English pig lead, £30, 5s. decrease.

Messrs. Edward Till & Co. report May 25th:—India-rubber, Para, fine, 1s. 8¾d., 1¼d. decrease.

Book Notice.—"The Annual Report and Accounts of the Electrical Trades Benevolent Institution for 1925." London: The Offices of the Institution, 98, Grosvenor Road, S.W.1.

Lighting and Power Notes.

Argentina.—ELECTRICAL DEVELOPMENT.—In its report for 1925, the Cia. Italo-Argentina de Electricidad states that during the current year two 25,000/30,000-kVA turbo-generators are to be installed and put into commission, increasing the capacity of its Pedro Mendoza power station to 100,000 kVA. Additional converting plant is to be installed at various sub-stations, which will raise the total capacity of these stations to 38,300 kW.

The report of the Compania Hispano Americana de Electricidad (Chade) shows that during the past twelve months the number of consumers advanced by 21,692 to a total of 206,320, representing a load of 574,449 kW. The output of the various power stations of the company totalled 496,698,392 kWh in 1925, an increase of 10.77 per cent. as compared with 1924. Work is well in hand on the extensions at the principal power station, where the fourth and fifth 25,000-kW steam turbo-generators are in course of erection. The sixth and seventh sets of similar capacity are about to be shipped from Europe and are expected to be ready for operation by the next Argentine winter. Twelve new boilers have lately been put in service and twelve more have been ordered. The company has commenced the construction of a new power station, the ultimate capacity of which will be 600,000 kW. Two 52,500-kW turbo-alternators have been ordered for this station as well as eight boilers to be adapted for pulverised fuel firing. The total length of the company's distributing mains now amounts to 4,354 miles.

Ashford (Kent).—ELECTRICITY AGREEMENT.—The Urban District Council has adopted an agreement for a supply of electricity to the premises of the Southern Railway Co.

Beckenham.—MAINS EXTENSIONS.—The Electricity Committee is to extend its mains to housing estates at a cost of £3,500.

LOAN SANCTIONED.—The Urban District Council has received sanction to the borrowing of £26,000 for h.p. feeder mains.

Birkenhead.—ELECTRICITY SUPPLY TO WIRRAL.—The Finance Committee of the Corporation has under consideration a recommendation of the Electricity Committee to give a supply of electricity to the Wirral Rural District Council on terms similar to those made in the out-townships of the Corporation's present area of supply. A special meeting of the Town Council may be called to consider the matter.

LOANS.—The Electricity Committee is applying for sanction to loans of £30,500 for mains and £10,500 for h.p. feeders. Sanction has been received to a loan of £5,500 for transformers and switchgear.

Budleigh Salterton.—STREET LIGHTING.—The Urban District Council has decided to invite tenders for lighting the town from the local gas and electricity companies.

Calne.—INAUGURATION OF SUPPLY.—An electricity supply for the town was formally inaugurated on April 23rd. Electricity is obtained at 220 V d.c. from Messrs. C. & T. Harris (Calne), Ltd., and supplied to consumers at 10d. per kWh for lighting and 6d. per kWh for power.

Clayton.—INQUIRY POSTPONED.—The Electricity Commissioners recently informed the parties concerned that the inquiry fixed for May 19th in Bradford to hear applications from Clayton, Bradford, and the Electrical Distribution of Yorkshire, Ltd., for an Order to distribute electricity in Clayton was postponed. This has been necessitated by the dislocation of the Commissioners' arrangements consequent on the general strike.

Continental.—ITALY.—Work is shortly to be commenced by the Società Edison, of Milan, on the establishment of a steam-operated power station at the port of Genoa. The plant will have a capacity of 100,000 kW and will be provided with boilers adapted to use pulverised coal as fuel.

LUXEMBURG.—The A.E.G., of Berlin, in conjunction with the Rhenish-Westphalian Electricity Supply Co., has drawn up a scheme to provide the Grand Duchy of Luxemburg with a greatly increased electricity supply by utilising, by means of two dams, the water power of the River Our, which forms the frontier between the Grand Duchy and Germany. It is proposed to form two large lakes, one of which would have a capacity of 176,076 million gallons, and the other a capacity of approximately 1,100 million gallons. It is estimated that the scheme would cost about five millions sterling.

SWITZERLAND.—According to a report lately issued by the Swiss Water Economy Department, the total available water power of the country is equal to 4 million h.p. for an average of 15 hours per day. Of this only one million h.p. is so far being utilised. At the beginning of the present year work was in hand on the establishment of several new hydro-electric stations, among them being the Ober-Ems, with a capacity of 11,000 h.p., the Vernayaz (108,000 h.p.), the Handeck—the first of three on the Upper Hasli—(100,000 h.p.), and the third extension of the station on the Lungern Lake which will increase its capacity from 20,000 to 22,000 h.p.

Croydon.—LOAN.—The Electricity Committee has recommended that sanction be obtained to the borrowing of £60,000 for mains extensions.

DOMESTIC APPARATUS.—The Committee is voting £5,000 for the purchase of domestic apparatus to be let out on hire. The total expenditure for this purpose amounts to £15,312.

Eastry.—ELECTRICITY SUPPLY.—Messrs. Pearson & Dorman Long, Ltd., have informed the Rural District Council that they are arranging for the laying of an underground cable along the

Nonington Woollage Roads, and the cable will be sufficient to allow for public lighting in addition to supplying electricity for houses.

Epsom.—New Plant.—The Urban District Council has received formal consent to the installation of two Diesel engines, together with the necessary auxiliary plant. The electrical engineer has submitted a revised estimate for the erection of the new plant in an extension of the existing engine room at an estimated cost of £14,500.

Hazel Grove and Bramhall.—Loans.—The Urban District Council has applied for sanction to loans of £2,200 for mains and services for Woodford, and for £1,500 for the general purposes of the undertaking.

India.—Madras Hydro-Electric Project.—The Governor of Madras recently laid the foundation of the important Pykara-Moyar hydro-electric project which is to utilise a fall of 3,088 ft. where the River Pykara descends from the Nilgiri plateau into the plain near the Mysore border, 14 miles from Ootacamund. The proposed dam, 164 ft. high, will impound 3,826 million cubic feet, with a water-spread of 2½ square miles. Owing to the absence of a suitable saddle for the discharge of surplus water, the dam will be of the pierced type, discharging surplus as well as the normal discharge for the development of power through sluices in the body of the dam. The supply required for the generation of power will be picked up from the river by a low masonry weir, three miles below the dam, and conveyed through a head sluice and a flume channel 5,220 ft. long to the forebay, which will be formed by closing the ends of a natural depression by two earthen bunds. The surplus flood discharge of the river will pass over the falls as at present. The main transmission line will be carried up the hill and *via* Ootacamund, Wellington, and the valley down which the road and railway to Mettupalayam pass, to Mettupalayam, whence one main transmission line will proceed to Madras and another to Dindigul. The scheme will supply power in bulk to the Municipalities of Ootacamund and Coonoor, the Wellington Cantonment, the Cordite Factory at Aruvankadu, Coimbatore, Madras, Trichinopoly, Dindigul and Madura, and to the South Indian Railway for electrification between Madras and Villupuram and between Trichinopoly and Madras. This route is flat and easy throughout, and the distance from the power station to Madras is 296 miles.

Moyar Scheme.—The subsidiary scheme, known as the Moyar project, which will feed additional power into the Pykara mains, is designed to utilise a second time the water which passes through the turbines at the Pykara power house. This water will be conveyed by a channel 6,800 ft. long to the Avaraihalla river, picked up again nearly five miles lower down and passed through a small forebay and valve tower down a second pressure pipe 2,000 ft. long to a power house on the banks of the Moyar River, with a fall of 1,050 ft. The turbines at this station will develop an additional 18,000 b.h.p. and the generators will deliver an additional 34.6 million kilowatt-hours. Thus the whole scheme will provide 66,480 e.h.p. at full load and about 150 million kWh per annum. The power from the Moyar station will be transmitted 8½ miles to the Pykara power station, where it will be fed direct into the Pykara main transmission line at 132,000 volts. This supplementary scheme will utilise the same storage works and transmission line as the Pykara power station. The Moyar scheme alone is estimated to cost only Rs.16,45,000, but the total cost of the combined Pykara-Moyar schemes, including indirect charges, is estimated at Rs.2,73,60,000. The complete scheme has not yet been formally sanctioned by the Government or the Secretary of State for India, but it is hoped that sanction will not be long delayed.

Irish Free State.—Blackrock (Dublin).—At a recent meeting of the Urban District Council the report of the Electric Light Committee was adopted, granting a lease of 42 years to the Kingstown Urban District Council for the supply of electricity for lighting, provided that at least 50 per cent. of the labour required for the maintenance of the supply be drawn from Blackrock.

Maidenhead.—Objection to Scheme.—The Rural District Council has decided to raise an objection to the application of the Cookham and District Electricity Corporation to erect overhead lines in the Cookham Dean district.

Northern Ireland.—Lurgan.—The Ministry of Finance of Northern Ireland has sanctioned a loan of £11,305 applied for by the Urban District Council for the purpose of carrying out an electricity scheme for the town. It is reported that the scheme will be in operation by next October.

Lisburn (Co. Antrim).—The Urban District Council has decided to ask a Special Committee to report on a proposal to purchase electricity in bulk from the Belfast Corporation and distribute it by overhead and underground cables.

Poulton-le-Fylde.—Electricity Supply.—The Urban District Council has consented to an application by Blackpool Corporation for authority to supply electricity in its area.

Price Reductions. — Reductions in the charges for electricity have been made or recommended in the following districts:—

Barnsley.—Residential two-rate tariff "unit" charge from 1d. to ¾d.; weekly charge in the Council houses from 1s. per week to 9d. per week, and electricity consumed from 1d. to ¾d. per kWh.

Slaithwaite.—Lighting, flat rate: From 7d. to 6d. per kWh. Domestic rate for private houses, 15s. per room per annum, plus 1d. per kWh instead of 2d.

Doncaster.—General lighting, from 5½d. to 4½d. per kWh during the summer quarters, but to remain at 5½d. in the winter quarters, with a rebate of 1d. per kWh for the equivalent number of kWh used during the two summer quarters. Signs and shop-window displays: From 2¾d. to 2d. per kWh. Prepayment meters: From 6½d. to 5½d. per kWh. Domestic supplies: The fixed charge of 15 per cent. on the net rateable value of the premises, plus ¾d. per kWh in the summer quarters, and 1d. per kWh in the winter quarters, reduced to 12½ per cent. on the net rateable value, with a minimum annual payment of £1 15s., plus the existing charges for electricity used.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation the following Special Orders made by them:—The Urban District Council of Llantarnam for the supply of electricity in the district; the Derbyshire and Nottinghamshire Electric Power Co., for the supply of electricity in part of the rural district of Shardlow; the Bingley Urban District Council to supply in part of the township of East and West Morton.

The Scarborough Corporation has applied for a Special Order authorising it to supply electricity in the borough and rural district of Scarborough and in the urban districts of Scalby and Filey.

Sunderland.—Electricity Supply.—The Sunderland Corporation has agreed to supply electricity through pre-payment meters in certain instances to houses of three to six rooms, at a charge of 6d. per kWh, being 3½d. per kWh for electricity and 2½d. per kWh for the hire and maintenance of the installation. A 325-kVA static transformer with switchgear is to be installed at the Whickham Street sub-station, at an estimated cost of £753.

Swansea.—Electricity in Bulk.—The Electricity Committee has decided to provide a bulk supply of electricity to the Cwyllynfell and New Brock collieries, Amman Valley, at a cost of £16,000.

Mains Extensions.—The Committee is to carry out mains extensions at a cost of £2,000.

Syria.—Electrical Development.—A message from Beyrouth states that in accordance with a decree of the Governor of Great Lebanon, the Société des Forces de la Khadiehach has begun the construction of a hydro-electric power station which will have an initial capacity of 1,500 h.p., and which can be brought up to 3,000 h.p. by using another waterfall. The new station is to supply electricity to Tripoli, Charre, Masroum and Edho. The company intends shortly to erect a similar station for the town of Zahle.—*Reuter's Trade Service* (Paris).

Torquay.—Electricity in Bulk.—The electrical engineer has furnished a special report to the Town Council with regard to the proposal to provide a bulk supply of electricity to the Brixham Gas & Electricity Co., including the charges at which the supply could be given for distribution in Brixham and Churston Ferrers. The report has been submitted to the company for consideration.

United States.—St. Lawrence Development.—The New York correspondent of *The Times* reports that the New York State Power Commission is expected shortly to grant licences for a huge project for the development of the water power of the St. Lawrence to the Frontier Corporation, owned by the America Aluminium Company, Dupont De Nemours and Co., and the General Electric Company. The Frontier Corporation has proposed that the development should be undertaken by the United States alone or jointly with the Ontario Government. The Commission is understood to be in favour of the former plan which comprises two schemes, the first at Cat Island, where Lake Ontario enters the St. Lawrence, and the second at the foot of the big Saulte Rapids.

Weymouth.—New Plant.—The Electricity Committee has received consent to the extension of the generating station by the installation of one 1,500-kW, 3-phase, 50-cycle turbo-alternator, two 20,000-lb. boilers and auxiliary plant.

Loan.—The Committee has recommended that application be made for sanction to a loan of £3,000 for the purchase of electric cookers.

Workington.—Extension of Supply.—The Town Council has offered a supply of electricity to the Seaton district at 7d. per kWh for private lighting, 3d. per kWh for power, and for public lighting at £4 per lamp per annum. As an alternative the Council offers a bulk supply at the borough boundary at a charge of 2d. per kWh with a minimum of 20,000 kWh per annum.

Tramway and Railway Notes.

Japan.—Electric Railways.—An electric railway company is in course of formation with a capital of 5,000,000 yen. The company will be named the Fuji-sanroku Denki Tetsudo K.K., its object being to construct an electric railway to a national park to be laid out at the foot of Mount Fuji. The company will be granted 7 per cent. subsidiary interest by the Government under the Local Railway Subsidy Law.

The directors of the Tobu Railway Co. have recently decided to increase the capital of the company from 24,500,000 yen to 50,000,000 yen, in order to finance the extension and electrification of its lines.

(*Continued on page 799*)

Hydroelectric Power on the Lower Isère.

The First Transmission in France at 120,000 Volts.

By T. RICH.

In the South-East of France near the headwaters of the Loire lies the industrial district of St. Etienne; although comparatively close to the Rhone Valley it is separated therefrom by a rugged ridge of hills. This district is not well known to English people as, in a way, it lies off the beaten track; but, owing to a large extent to the existence of collieries, it has been for a number of years an important centre of industry, especially for the manufacture of arms, cycles, tools, and special kinds of steel. The war, with the temporary destruction of the northern industrial area and the danger to Paris industries through bombing, led to a great development of manufacture in the south, and this has created a demand for power from various quarters, especially in this district.

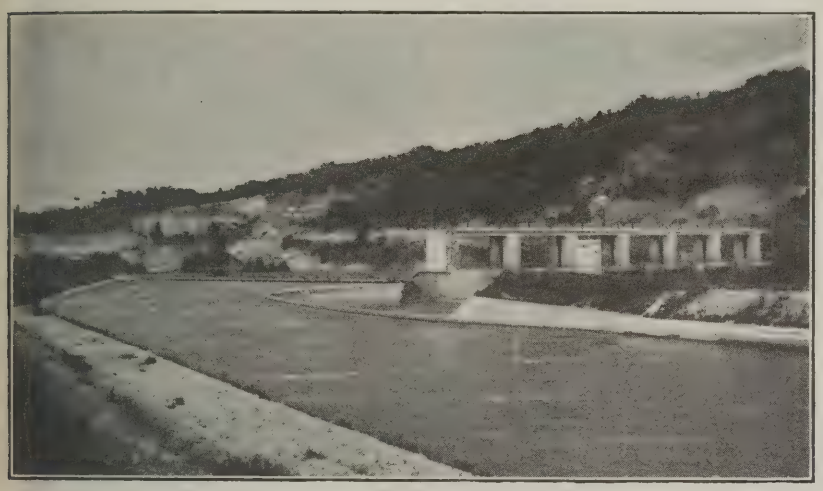
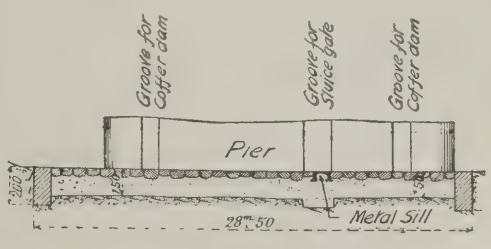


Fig. 1.—The Barrage on the Lower Isere.



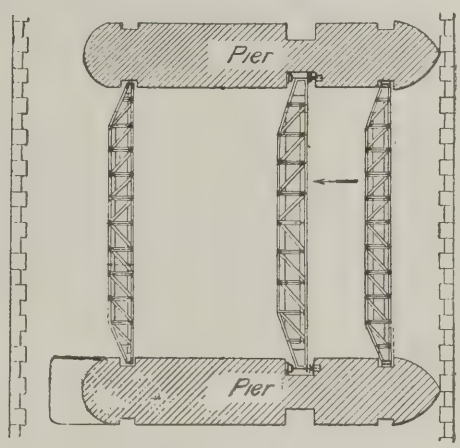


Fig. 2.—One Pass of Dam, showing Gate and Coffer-dams

The watershed of the Isère has been for the last forty years perhaps the most important centre of French water-power development; until recently practically all the power has been developed in the district, which stretches from the Alpine region, bordering on the Italian Frontier, to the watersheds of the tributaries the Drac and the Romanche, whose waters flow into the Isère near Grenoble, which town lies at an altitude of 700 ft.

The development of the water power and navigation of the lower section of the Rhone Valley has been studied for some time; of the former, the power station at Beaumont-Monteux, on the Lower Isère, 4½ miles from its junction with the Rhone, near Valence, is a good beginning; and of the latter the canal tunnel into Marseilles Harbour, which is over 70 ft. wide, to take 1,400-ton barges into a lagoon connected by canal with the Rhone, is an important step, besides being a very fine bit of engineering work.

The problem of the utilisation of a rapidly-running river, liable to very heavy floods after the melting of the upland snow and to a comparatively small flow of water at some seasons of the year, is not so easy as it looks. The site of the Lower Isère power station was chosen where good deep-river banks were available, so that the backing up of the water to the extent of 4.6 miles, due to the erection of a barrage across the main stream, would not give rise to the flooding of valuable lands. In view of the extraordinary floods to which this snow-fed river is subjected, instead of placing the power house on the barrage itself, as is often done, it is placed at the end of an artificial cut formed into a by-pass. The main river is closed at times of low water by means of adjustable sluices, which in time of flood can let pass along the main stream all the water not required for the purposes of power generation.

A barrage, fig. 1, 440 ft. long, is placed across the river; it has six openings, each 17.5 metres (57.4 ft.) wide, arranged to hold up 10 metres (33 ft.) of water.

C, cables to and from switch-gear; G, grill; H, by-pass for rubbish caught by grill; I, switch-gear; P, control board; V, sluice gates; R, motor for sluice gates.

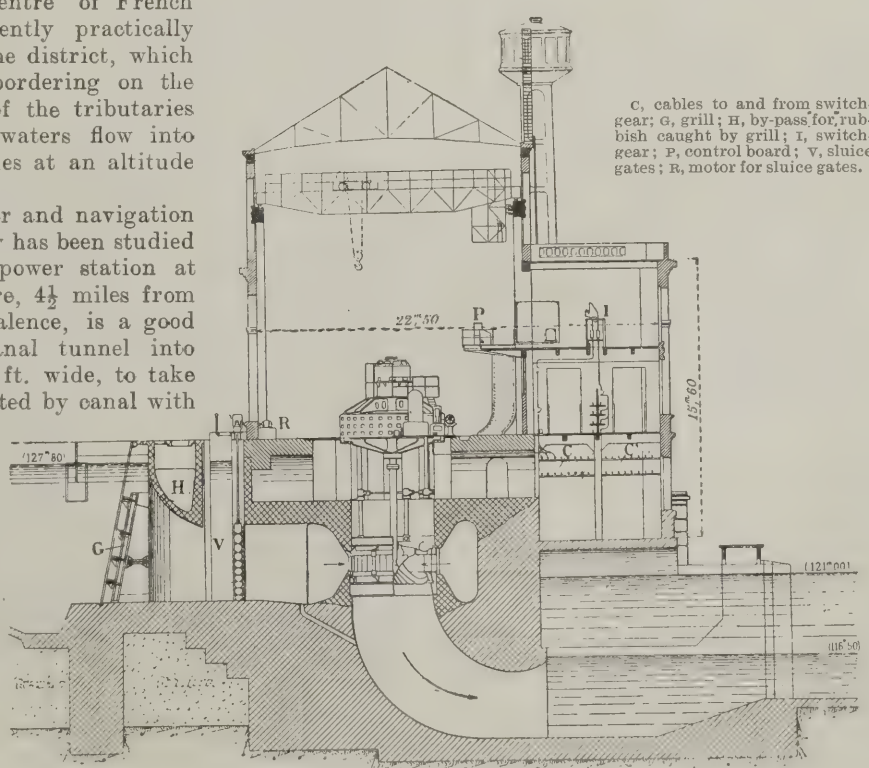


Fig. 3.—Section of Power Station.

The low-water flow is 90 cubic metres (117.7 cu. yd.) per second. At flood time in spring the flow reaches 1,500 cu. metres per sec. By lowering the water level to the extent of one metre a peak load covered by 11,000 kWh can be dealt with.

The foundations of the piers of the barrage are built on a raft made with "ciment fondu" armoured with rails covered with a stone pitching. The piers are 23 metres long and 4.2 m. thick; they are joined by three armoured-concrete ties, which form passage ways. The walls of the piers were built up of pre-cast concrete blocks made with a rich mixture, .50 × .28 × .22 metres, as headers and stretchers, filled in with ordinary concrete, and grouted afterwards under pressure to secure a perfect union: this method of procedure allowed the work to take place with great rapidity during the time when the river conditions were favourable.



Fig. 4.—Downstream Side of Power House.

The sluice gates, fig 2, are of the "Storey" type; their total height is 10 metres and width 18.77 m. overall; at the top of each sluice a section 1 metre deep is arranged on a pivot so that a certain quantity of water can be allowed to flow over the top. The sluice rests on a cast-iron sill embedded in the concrete; the gates are not balanced, and they are lifted by means of chains and winches operated by motor-driven shafts. They are fitted with emergency hand drive. The motor of each sluice is of the 3-phase type, 38 h.p., 570 revs., 220 volts; it is arranged with an automatic brake, and an automatic cut-off which cuts out when the gate reaches the top of the travel; the controller is of the tramway type. The movable flap at the top of each sluice gate is operated by means of wire ropes and drums through a horizontal shaft with reducing gear connected to a 5.5-h.p. motor, 930 revs., 220 V. Each sluice gate weighs about 150 tons; it can be raised at the rate of about 6 in. a minute. Each pier of the barrage is arranged with extra grooves on the upstream and downstream sides; in case of repair being necessary, temporary coffer dams made of steel plate reinforced by lattice work, divided up for convenience into horizontal sections, are placed in these grooves, six on the upstream side and two on the downstream. They are put in place by means of dismountable lifting gear placed on the piers. To resist the extra turning moment which exists when these coffer dams are in use, the piers are reinforced by H iron embedded vertically in the concrete. For the building of the barrage a cableway was used, of 190 metres span, with a 3-ton lift.

The inlet to the head canal is joined to the barrage pier on the right bank of the river; it is protected by a grid 145 metres long (158.5 yd.), which is made of flat bars 60 mm. × 8 mm. (2.3 × .3 in.), inclined at an angle of 1 in 5, and leaving spaces of $2\frac{3}{4}$ in. It is supported by an armoured-concrete bridge. The upper end of the grid is connected to the wall of the inlet canal by means of a lifting grid, which allows rafts to pass along the canal, and eventually barges. In accordance with the concession for the hydraulic development, when a chain of power houses has been placed up the River Isère in accordance with the programme of development, means have to be provided for navigation; space therefore has been left alongside the power house which will allow of the construction of a lock 12 metres wide and 46 metres long.

The inlet canal is 1,600 metres (practically a mile) long; its walls and bottom are of concrete, 30 cm. (11.8 in.) thick where made of cement concrete, and 50 cm. (19.7 in.) where lime concrete is used; expansion joints made with bitumen sheeting are placed every 7 metres. The walls are sloped 1 in 1, the rendering at the normal water line being strengthened by armouring.

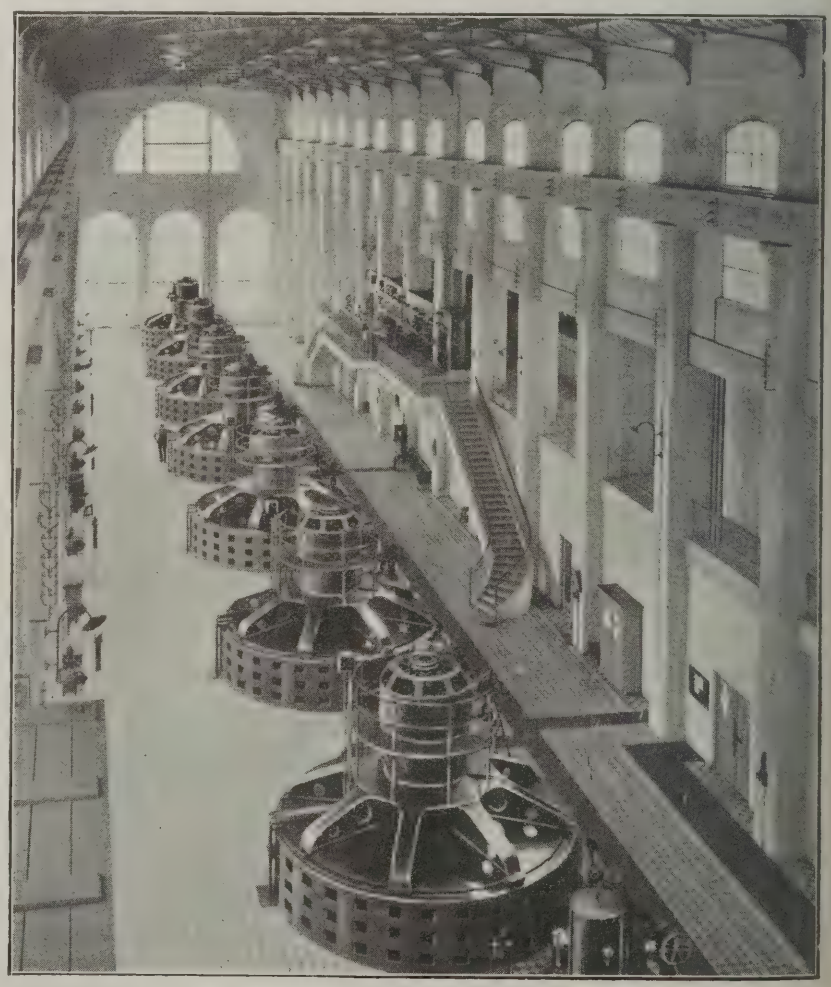


Fig. 5.—Interior of Power House.

The canal is 41.2 metres (135 ft.) wide and 4.6 metres (15 ft.) deep; the cross sectional area is 168.36 sq. metres, and the slope is 1 in 6,400, giving, according to the Bazin formula, a mean speed of 1.95 metres per second.

At the power station a grid is provided 73.5 metres wide, made up of bars 80 mm. × 10 mm. (3.15 × .39 in.) placed 2.75 in. apart; it rests against an armoured concrete trough, into which floating objects can be raked.

The Power Station.

The station is founded on a bed of compact clay, so that, although the foundations were sunk to 8 metres (26.2 ft.) below the mean level of the River Isère, it was not necessary to use compressed air. Fig. 3 shows a section, fig. 4 the downstream side of the building, and fig. 5 the interior of the station.

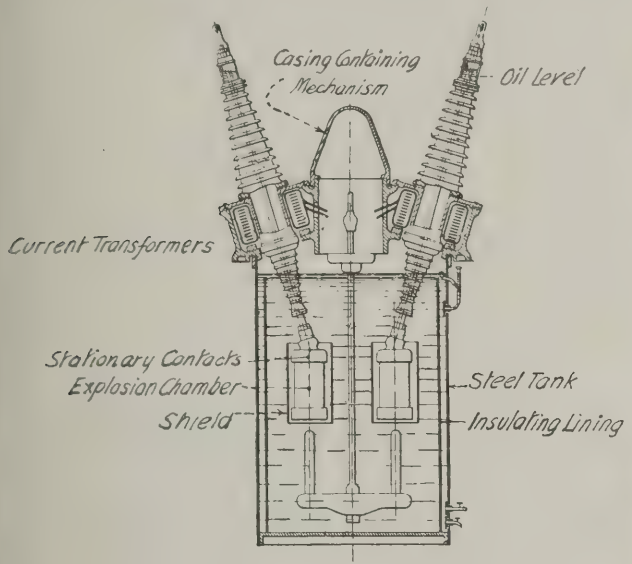


Fig. 6.—Section of 120,000-V Oil Switch.

There are seven turbine sets, of the vertical type, running at 107 revs. per minute, placed 10.5 m. (34.4 ft.) apart. The turbine house is 106 metres long and 15 metres wide; it is spanned by a 45-ton travelling crane. The turbine inlets are made of armoured concrete and they can be closed individually by steel sluices, which can be operated by hand or by electric motor; operation is facilitated by means of a by-pass valve by which the inlet chamber can be filled and equilibrium established. The draught tube is also formed in concrete. The outlet of each turbine is arranged in cells, which can be closed for examination by means of temporary coffer dams.

The turbines are of the Francis type, made by the firm of Neyret-Beylier and Piccard-Pictet, of Grenoble; they have an output capacity of 5,600 h.p. each, under a net head of 10.2 m. (33.45 ft.) and 6,400 h.p. with 11.3 metres (37.05 ft.) net head.

The turbine wheel is 4 metres in diameter, weighing 12 tons; it will pass 50 cubic metres of water a second. The wheel is bolted to a vertical shaft 400 mm. (15.75 in.) in diameter; the turbine shaft is supported by a water-cooled thrust bearing, which has to take the combined weight of the turbine wheel and alternator and the effect of the water flow, a total of 150 tons. Fig. 8 shows a wheel of cast iron made in one piece.

The turbine makers after considerable experiment developed and patented a thrust bearing to suit such conditions. A bell-shaped casting is fixed on the upper end of the shaft, the rubbing surface being a flat disk fastened to the casting by screw bolts. This disk revolves in an oil bath on a series of shoes separated by oil spaces, the shoes in turn being supported on a ring casting with a special seat. The revolving disk, when passing across the gaps between the shoes, draws the oil after it, and forms a film between the surfaces, and therefore without any oil pumping or pressure the bearing is kept cool and lubricated. A coil of copper pipes for circulating water is placed in the oil bath; from the point of view of bearing heating in the ordinary way, the use of this cooling coil has not been found necessary but it has been put in as a safeguard in view of the high temperature which sometimes occurs in the power station itself, due to atmospheric conditions. The turbine guide vanes are actuated by a governor and servo-motor, which can be controlled from the switchboard.

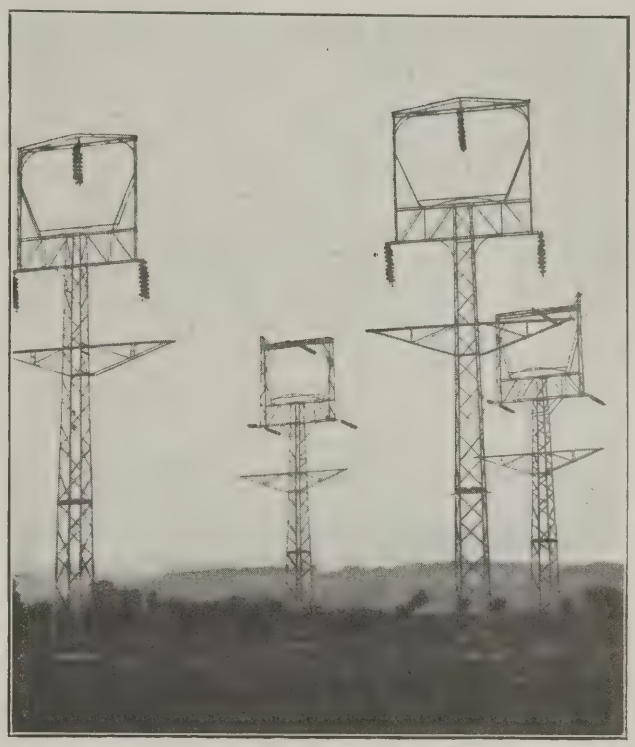


Fig. 7.—Transmission Line at Road Crossing.

The alternators each have an output of 5,720 kVA and are wound for 50 periods, 5,500 to 6,200 volts. They are of a type developed by the General Electric Co. of America; the first two were made in the United States, the others being constructed to the same design by the French Thomson-Houston Co., the contractors for the electrical equipment.

The rotor has a diameter of 4.88 metres (approximately 16 ft.), which at 107 revs. gives a peripheral speed of 90 ft. a second. The rotor wheel is of cast steel, the poles being built up of steel laminations; the rotor is designed to withstand a speed 2.1 times the normal. The windings are of the former type, placed in open slots, and have been tested at 13,000 volts. The neutral points of the star-stator windings are connected direct to earth. An 80-kW exciter, 250 volts, is placed above each alternator; regulation of the alternator is carried out by variation of the exciter voltage. A voltage relay operated from the potential transformer of the alternator, working a contactor, short-circuits part of the rheostat of the exciter fields and reduces the voltage of the alternator to a low value after each opening of the main circuit breaker.

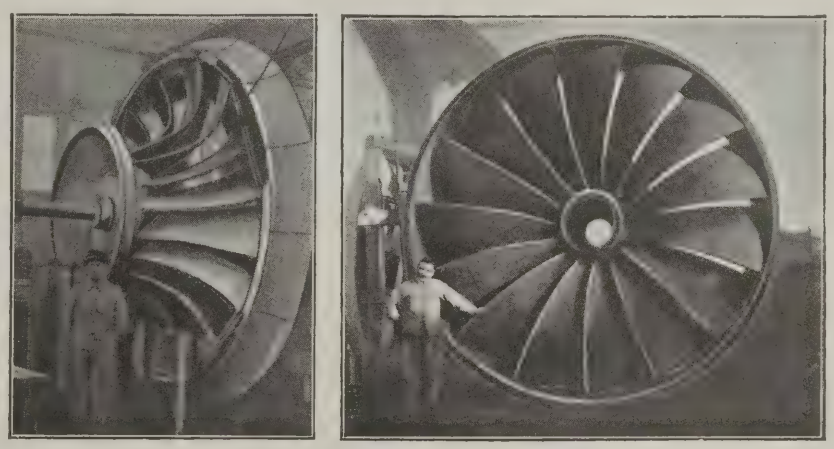


Fig. 8.—Two Views of the Turbine Wheel.

The main switchboard floor has the alternator operating desks for the 6,000-V oil switches. The connections to the alternators are of bar copper supported on insulators. There are two sets of bars; the oil switches can be released by maximum or differential relays. The low-pressure side of the step-up transformers can be connected to either set of bars. There are two 260-kVA, 3-phase transformers, 6,000/220 volts, for the operation of the traveller and other auxiliary motors. The 6,000-volt switches are of the G.E.C. (America) type, designed to break 90,000 kVA per pole. Each phase has two separate cylindrical oil containers placed in a separate cell made of insulating material.

Step-up Transformers.

The main transformers are placed out of doors under a skeleton steel structure, which carries the h.p. insulators (fig. 9). There are two sets of 120,000-V bars, and each of the two lines can be connected to either set by means of section links and a switch connected to each. The outdoor bus-bars are made up of aluminium-steel cable hung on to a double set, each of eight "Hewlett" insulators.

There are four groups of transformers, each made up of three single-phase, 3,333-kVA units. The primary pressure is 5,500 to 6,200 volts, and secondary 55,400 to 69,200 volts; the primaries are connected in delta and the secondaries in star with the neutral direct to earth, each group therefore giving the pressure required for the 120,000-V line. The transformer tanks are cylindrical, 2.15 metres (7 ft. 6 in.) in diameter, 4.70 metres (15.5 ft.) high, and 6.40 metres (about 21 ft.) to the top of the insulators.

The transformer oil is cooled by means of a water coil made of copper pipes. A dial thermometer, connected with the oil in the upper central part of the tank by means of a flexible pipe, is placed on the outer wall of the tank. Each transformer is fitted with a compensator and an air dryer connected with the space above the oil level. A safety device is arranged, consisting of a sloping pipe attached to the cover, which ends in a flexible diaphragm; should any excess pressure be developed inside the tank, the diaphragm bursts and allows the excess oil to escape.

Great care was taken in the installation of the transformers; the windings were dried by means of the circulation of hot air in a special chamber by a motor-driven fan, the air being filtered before entry and heated by a 25-kW heater. The oil itself was dried by a 65-kW, 3-phase resistance heater. Special oil-testing transformers, with disk electrodes and motor-driven portable filter presses, were supplied by the French Thomson-Houston Co. for use with these transformers. The terminals are of the condenser type. The oil switches, fig. 6, are of a type developed by the General Electric Co. of America. Each pole is in a separate tank, each tank having an insulated lining. The switches are designed to break 2,400 amperes at 135,000 volts. The operating and trip gear, which is controlled from the main switchboard, is worked by d.c. at 125 V.

For the protection of the transformers, differential relays are arranged which trip the switches simultaneously on the h.p. and l.p. sides. The transformers are connected to the h.p. bus-bars through the above-mentioned h.p. switches, and the two feeders are connected to the bars by means of oil switches with maximum relays. For the operation of the relays, and in the case of the feeder switches for the supply of current to ammeters as well, series transformer coils are placed round the oil-filled inlet and outlet porcelain insulators of the 120,000-V switches, as can be seen from fig. 6.

For the protection of the line against disturbances, aluminium electrolytic dischargers have been installed of the type developed by the General Electric Co. of America. There are four dischargers on each line, three connected by horns to the line and the fourth connected between the neutral point of the first three dischargers and the earth. Each set consists of two columns of aluminium cones in series in an electrolyte, the whole being contained in an oil-filled tank. The hydroxide film is reformed daily by passing current through carborundum resistances, the operation being made simultaneously for the three phases with the aid of interlinked connectors mounted on insulators.

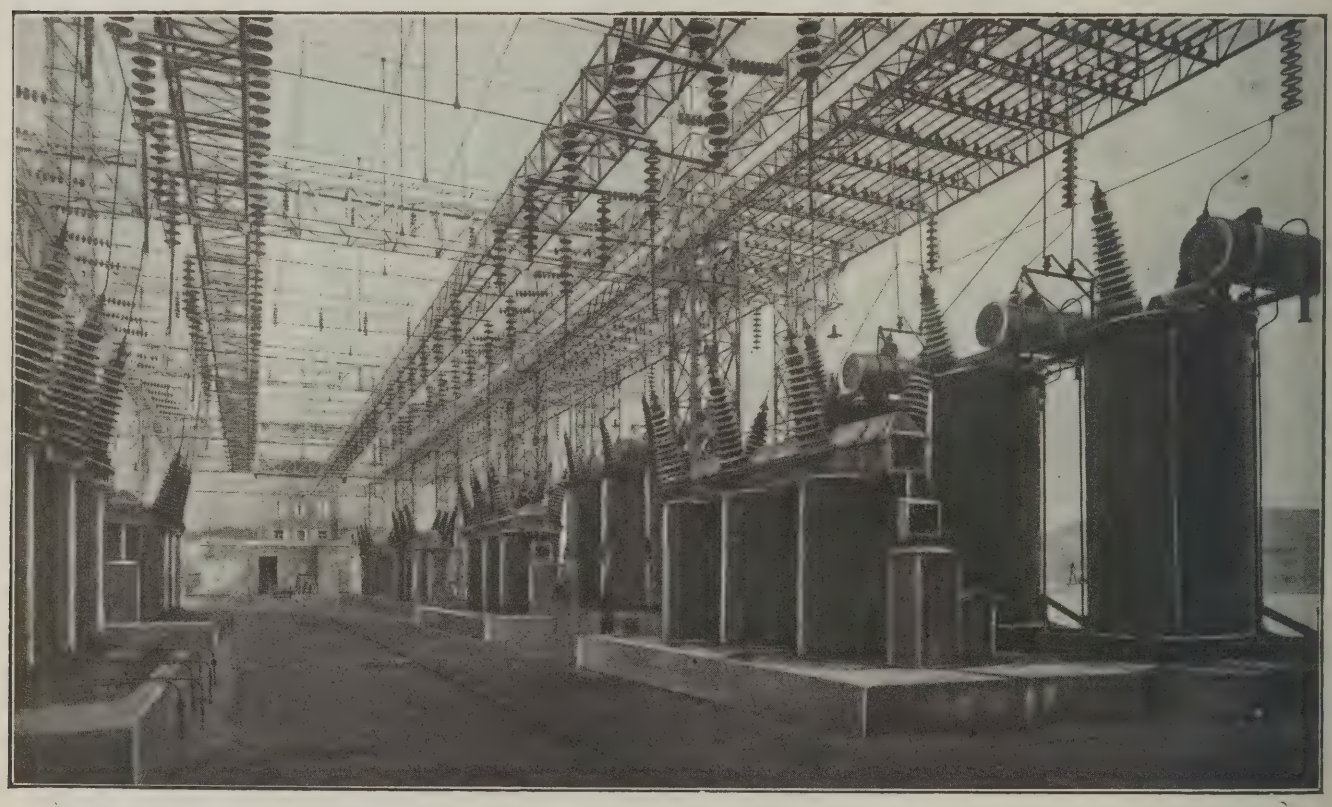


Fig. 9.—Outdoor Transformer and Switching Station.

Although subjected from time to time to heavy surges and discharges due to storms (in two cases breakages of line conductor and earth conductor respectively have been attributed to direct lightning strokes) the electrolytic dischargers have given perfect protection. Monsieur Limousin, the local director of the Basse-Isère Co., in the house journal of the French Thomson-Houston Co., of Paris, in the November-December number, has given interesting details regarding the operation of the transformers, oil switches and electrolytic dischargers adopted for this installation.

(To be concluded.)

Tramway and Railway Notes.

(*Continued from page 794*)

Burnley.—Mr. H. Mozley, Burnley tramway manager, has sent an appreciative letter to all the men who volunteered for service during the general strike. Suitable volunteers desiring to join the regular staff will take precedence of those candidates now on the waiting list when vacancies arise.

Liverpool.—NEW DEPOT.—The foundation stone of the Corporation tramway works, which will cost £385,000, was laid recently. The area of the site is 15½ acres; tramlines on premises will be 3¼ miles; and the constructional steelwork will weigh 3,000 tons. The design of the works was prepared by the tramway general manager, Mr. P. Priestly, who has laid out the whole scheme. The rolling stock of the Corporation consists of nearly 800 vehicles, comprising tramcars, motor 'buses, motor cars, tower wagons, &c. The works, when completed, will be capable of employing at full strength about 1,000 men.

New Zealand.—RAILWAY ELECTRIFICATION.—According to the *Australasian Electrical Times*, proposals for the electrification of the suburban lines running from Wellington, Auckland and Dunedin, are now being examined by the electrical and mechanical engineers of the Railways Department. It is intended for the present to electrify the Lyttelton Tunnel line at Christchurch. Arrangements are being made for the calling of tenders to carry out the work which will be put in hand without delay.

Southern Railway Electrification.—*The Times* reports that the Southern Railway intends to adhere to the programme for the opening of the electrified lines from Charing Cross and London Bridge to Dartford *via* Woolwich, Bexley Heath, and Sidcup, on June 6th, and to proceed with the reconstruction of the lines and platforms at Cannon Street Station, which will be closed, as announced, from June 5th until June 26th. It is more than probable, however, that the services will be restricted, owing to the coal stoppage.

United States.—PITTSBURGH.—According to the *Electric Railway Journal* another step toward providing Pittsburgh with a rapid transit system has been made by a report recently submitted to the City Council by the City Transit Commission. It approves the immediate construction of the first part of the rapid transit system recommended by Mr. D. L. Turner, consulting engineer, and Mr. W. Haydock, chief engineer, of the Department of City Transit. The sections approved are a subway from the vicinity of Federal and Ohio Streets on the north side, *via* Federal Street and Fifth Avenue to Neville Street, in the Shadyside district, to be used by rapid transit trains, and another subway, less than a mile in length, on Grand Street, in the downtown section, to be used temporarily by surface cars. Later, this would form part of a rapid transit line. The City Transit Commission recommends the construction of these lines by the city and their lease to the Pittsburgh Railways under contract. Under this contract the railway would supply the rolling stock, electrical equipment, &c. The city's contribution would be $36,000,000 and the railway's $4,860,000. The Commission recommends a referendum at the next election on the question of authorising the city to float an issue of bonds to the amount of $30,000,000.

Telegraph and Telephone Notes.

Australia.—TELEGRAPH SERVICE.—So soon as the route of the new road from Sydney to Newcastle is decided, the Post Office authorities are to lay a telegraph cable between those two towns, which will provide for at least 100 direct lines between the two cities. That scheme will cost £250,000. Meanwhile valve amplifiers on the line between Sydney and Melbourne are to be used to give some relief on the Sydney-Newcastle lines. By this system one line can be used for ten messages simultaneously.

AUTOMATIC TELEPHONY.—There has been a large increase in the use of the telephone service in New South Wales. The subscribers now number 114,182, as compared with 92,329 two years ago, and the problem so far as Sydney is concerned is the building and equipment of exchanges. Each costs about £200,000, being of the automatic type, and new exchanges in the suburban areas are also automatic.

Egypt.—WIRELESS CONCESSION.—It is understood that General Manifold, acting on behalf of Marconi's Wireless Telegraph Co., Ltd., has secured a 30 years' concession from the Egyptian Government to conduct a radio-telegraph service in Egypt.

Hungary.—TELEPHONE IMPROVEMENTS.—The Hungarian Post Office is to spend a large sum on improvements, including the reorganisation of the Budapest telephone system. It has been decided to introduce an entirely new automatic system. The Budapest system, with three exchanges, is now sufficient for 37,000 subscribers, which figure is to be increased by two stages to 65,000, and the service will be improved by laying subterranean cables. The sums required by the Post Office for the realisation of the plan will be loaned by the State.—*Reuter's Trade Service* (Budapest).

Spain.—TELEPHONE CONSTRUCTION.—The Compañía Telefónica Nacional de España, to which the practical control of the telephone systems of Spain has been granted, has decided to enter upon a wide programme of new construction. In addition to a further line between Barcelona and Madrid, new circuits will be laid to Castellón, Valencia, and Tarragona, and a completely new circuit will be installed between Barcelona, Granollera, and Nataro. When the improvements and extensions are completed, Barcelona will have six new circuits to Madrid, two to Bilbao, three to Zaragoza, and one to San Sebastian.—*Reuter's Trade Service* (Madrid).

The Telegraph Service.—PRESS TELEGRAMS.—Lord Wolmer recently stated in the House of Commons that the revenue from Press telegrams last year was £84,000, and the expenditure amounted to £330,000.

Radio Notes.

Canada.—AMALGAMATION.—All the broadcasting stations in Canada have recently amalgamated under the name of the Canadian Association of Broadcasters. By means of general co-operation and relaying it is hoped to improve the general standard of the programmes.

Germany.—REVISED REGULATIONS.—Recent changes in the radio regulations cancel the requirements that apparatus be tested and marked by the Federal post office, and manufacturers are no longer required to submit a sample of every series of receivers built; listeners are no longer required to be members of an approved radio club. According to *Commerce Reports* a reduction in the amount of manufacturers' licence fees has also been made.

Irish Free State.—IMPORTED APPARATUS TAX.—In Dail Eireann, when the consideration of the Budget resolutions was on, Major Bryan Cooper tried to have the tax on wireless apparatus reduced from 33⅓ to 5 per cent., because the high duty was calculated to check the progress of a new industry. Mr. J. J. Walsh, Minister for Posts and Telegraphs, defended the imposition of the 33⅓ per cent. tax as being one means of bringing crystal sets within the reach of everyone. It was calculated that the revenue from licences would amount to £20,000, and, with the revenue from the tax on imported sets, he believed that he would later on be justified in asking for the necessary funds to equip three extra wireless stations in the Free State with a power equivalent to that of the Dublin station. The proposed new stations would in due time bring everyone in the country within crystal radius.

Japan.—AMALGAMATION.—Now that the novelty of wireless is said to be wearing off, there seems little to broadcast, and, the gramophone being more popular, the Government is reported to be attempting to amalgamate the Tokio, Nagaya, and Osaka stations.

Licences in France.—DELAYED ISSUE.—Mr. Harry Day, M.P., has received from the Foreign Office a reply to a question he raised about delay in granting licences for receiving sets to British subjects resident in France. The British Ambassador at Paris has been informed by the French Government that it is only in very exceptional cases that licences have been refused. Although the French reply does not give any reasons for the delay in the grant of licences, says the *Financial News*, Lord Crewe has since heard that several British subjects, resident at Le Havre, who had hitherto been unable to obtain their licences, have now all received them.

United States.—LABOUR AND WIRELESS.—The weekly bulletin of the International Federation of Trade Unions contains the following:—The Chicago Federation of Labour has obtained permission from the City Council to erect a broadcasting station and aerial at the municipal pier, which was formerly used as a wireless station by the American Navy. The Labour movement will finance and control the station, which is intended to counteract the anti-Labour propaganda of the local newspapers and also to transmit messages to Labour centres in the United States of America and abroad. The local Typographical Union has voted 10,000 dollars for the station, and the Chicago Federation of Labour suggests that local unions raise a levy of two dollars per member; one-half of the sum so collected to be used to purchase and erect the station and the other half to endow its permanent maintenance.

In Holland the Workers' Wireless Association, which hires the national wireless station one evening each week in order to conduct its own propaganda, seized the opportunity last week of broadcasting in English, French, and German reports received from the International Transport Workers, the International Federation of Trade Unions, &c., on the situation in Great Britain.—*Reuter* (The Hague).

DRASTIC INTERFERENCE LAW.—A recent occurrence in Nebraska indicates the drastic extreme to which some city councils are likely to go in attempting to prevent radio interference, when complaint is made by even a few irritated listeners. Just three such persons, alleging that their trouble was due to the Central Power Company's transmission lines, were able to convince the Mayor of Grand Island and the City Council that an ordinance should be passed compelling the Company to remove all of its 33,000-volt lines from the city within 90 days. Because of enlightenment of the City Council by a broadcast listeners' league, the *Electrical World* expects that the ordinance will be repealed.

CONTROL OF RADIO.—The Senate Interstate Commerce Committee has approved the Dill Radio Bill providing for a commission to have control of air communication. The Commission would have supreme power in its field, the Committee having eliminated a provision for appeals to the courts to compel the issuing of broadcasting licences, or prevent the rescinding of them. The Bill's supporters hope to get it passed this session, holding that recent court decisions have made immediate legislation imperative.—*Reuter's Trade Service* (Washington).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares (B.X. 2528).*

June 16th. Victorian Government Railways. One heavy-current motor generator set. (B.X. 2527).*

June 16th. City Council. Turbo-alternator, exciter and condensing plant.*

August 11th. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Canada.—June 2nd. Department of Public Works. One 25-ton electrically-operated portal crane for Esquimalt Dry Dock.*

Belfast. — June 12th. Electricity Committee. D.c. switchgear for sub-stations and transformer kiosks. (See this issue.)

Bristol.—June 14th. Electricity Department. Additions to the premises at Feeder Road generating station. (See this issue.)

Dublin.—June 3rd. Great Northern Railway (Ireland). Six months' supplies of stores, including electrical fittings, lamps, cable, wire, &c. (May 14th and 21st.)

Eccles.—May 31st. Electricity Department. Twelve months' supply of single-phase a.c. house-service integrating watt-hour meters. (May 14th and 21st.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537).*

June 19th. Minister of Education. Dynamo and motors.*

Egyptian State Railways, Telegraphs and Telephones. Underground cables. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1.

Erith.—June 7th. Electricity Department. L.p. cables. (See this issue.)

Epsom.—June 14th. Electricity Department. Removal of boilers and setting them up as fuel tanks, overhead travelling crane, two 300-kW Diesel engine-driven generators and accessories, oil-purifying plant and cooling tower. (See this issue.)

Glasgow.—June 2nd. Corporation. Electric lighting installations at Wellmeadow and Cathcart Road housing schemes. Particulars from Mr. R. B. Mitchell, Corporation electrical engineer.

Harrogate.—May 31st. Electricity Department. Electricity meters (British make) for six months. (May 14th and 21st.)

Hull.—Telephone Committee. Copper jointing sleeves. (May 7th.)

India.—June 15th. India Store Department. 70,000 (approx.) copper bonds for track rails. (May 14th and 21st.)

June 11th. Wireless transmitting sets. Particulars from Department, 11, Belvedere Road, S.E.

Kettering.—June 9th. Electricity Department. Water-softening plant. (May 14th and 21st.)

London.—BETHNAL GREEN.—June 4th. Borough Council. Electric lighting and power installation at Bethnal Green Hospital. (May 14th and 21st.)

June 16th. Metropolitan Asylums Board. Installation of electric cable for arc light treatment apparatus at St. Luke's Hospital, Lowestoft. (See this issue.)

Manchester.—June 1st. Board of Guardians. Two electric hospital bed lifts, Withington Hospital; one ditto, Crumpsall Infirmary; and one electric passenger lift, Union Offices, All Saints. Particulars from Mr. E. Hargreaves, superintendent of works, Union Offices, All Saints, Manchester.

June 4th. Electricity Committee. Two portable air compressors for High Street Depôt. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

June 5th. Renewals and additions in connection with X-ray plant at Booth Hall Infirmary, Charlestown Road, Blackley. Specifications from Mr. F. W. Greenhalgh, clerk to Board of Guardians, Union Offices, All Saints', Manchester.

Middlesbrough.—Electricity Department. Extension of electricity supply distributors, total length approx. 1,000 yd. (April 30th.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

Normanton.—June 1st. Urban District Council. Feeder and distribution cables, feeder pillars, and one 200-kVA transformer. (May 14th and 21st.)

Nottingham.—May 31st. Board of Guardians. One 60-kW d.c. turbo-generator, &c., and alterations to main switchboard, &c. (April 16th.)

Otley (Yorkshire).—June 2nd. Electric lighting at new public slaughterhouses at Station Road. Particulars from Mr. C. J. F. Atkinson, Clerk to the U.D.C.

Rhyl.—June 16th. Electricity Department. 1,000 yd. l.p. armoured cable, 1,915 yd. 11,000-V feeder cable, and switchgear equipment. (See this issue.)

Roumania.—BUCHAREST.—June 8th. Bucharest Tramway Co. 10 000 kg. electrodes, 1,000 kg. electrolytic copper, 3,000 electrolytic copper contact pieces, 1,200 kg. copper plates, 200 kg. brass sheets, 2,500 kg. black insulating varnish.*

South Africa.—June 21st. South African Railways and Harbours. Track bonds for the Cape Town Suburban Railway electrification scheme. (See this issue.)

June 3rd. South African Railways and Harbours. One motor-starting panel.*

June 10th. D.c. electric generating plant (suction gas).*

JOHANNESBURG.—Municipal Council. 8 miles h.p. cable, 41 miles l.p. cable.*

Southern Rhodesia.—June 21st. Department of Posts and Telegraphs. Automatic telegraphs. Automatic telephone exchange for Salisbury. (April 23rd.)

Stoke-on-Trent.—June 9th. Electricity Department. Two 60,000-lb. per hour water-tube boilers. (May 14th and 21st.)

Uruguay. — MONTEVIDEO. — July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523).*

July 9th. 137,500 metres rubber-insulated wires and cables. (B.X. 2548).*

40,000 metres of coloured twin conductor cords. (B.X. 2549).*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—Electricity Supply Committee. Accepted:—

Armour-clad switchgear (£19,985).—A. Reyrolle & Co., Ltd.
Spare turbine parts (£650).—Metropolitan-Vickers Electrical Co., Ltd.

SYDNEY.—Electricity Supply Committee. Recommended:—

Maximum demand indicators (£1,635).—Edison Swan Electric Co., Ltd.
Armour-clad switchgear for sub-station (£104,693), six sets of current transformers (£227), six Fawssett-Parry relays (£192), two 10,000-V feeder panels (£926).—Metropolitan-Vickers Electrical Co., Ltd.
Double-braided weather-proof cables (£4,792).—Enfield Cable Works (Aust.), Ltd. *Tenders.*

Barton-upon-Irwell.—Board of Guardians.—At the meeting of the Guardians last week, protests were made, says the *Daily Dispatch*, against the acceptance of the tender of Bell Bros., of London, at £8,430, for electrical work at the new hospital at Davyhulme. The Ministry of Health had sanctioned the borrowing of £8,430 for the purpose, and it was pointed out by the clerk that the accepted tender was the lowest. Offers from Manchester firms were as high as £10,000. Several members of the Board thought the contract should have been given to a local firm. After considerable discussion, the tender from Messrs. Bell Brothers, recommended by the Ministry, was accepted, with the proviso that local labour should be employed as far as possible.

Belgium. — German, Belgian, Dutch and British (Callender's Cable & Construction Co., Ltd.) firms recently submitted tenders to the Belgian State Railway authorities in Brussels, for the supply of 101 kilometres of insulated cable in two lots of respectively 11 and 90 kilometres. For both lots, the lowest offers were those of Belgian concerns.

Bury St. Edmunds.—Town Council. Accepted:—

Boiler (3,850 sq. ft. heating surface), with superheater.—Babcock and Wilcox, Ltd.

Corsham.—Parish Council. Accepted:—

Installing electric light at the Town Hall.—Edwards & Armstrong.

Croydon.—Electricity Committee. Recommended:—

Switchgear (£507).—Metropolitan-Vickers Electrical Co., Ltd.
Water-softening plant (£1,150).—Becco Engineering and Chemical Co., Ltd.

Edinburgh.—Corporation. Accepted:—

12 months' supply of single-phase meters.—Edison Swan Electric Co., Ltd.

Hazel Grove and Bramhall.—Urban Council. Accepted:

Mains extensions in the Woodford Fringe area (£1,209).—W. T. Glover and Co., Ltd.

Irish Free State.—DUBLIN.—Ministry of Local Government and Public Health (Trade Section).

Contracts for supplies to local authorities for 6 months :—

Vacuum draw wire, M.F. electric lamps, one-watt type, 10 to 100 watts.—Briscoe Importing Co.

Spiral vacuum lamps, half-watt type, 30 to 100 watts, 50 to 260 V.—Sphinx Electric Co.

—*Irish Builder and Engineer.*

CITY COMMISSIONERS. Accepted :—

Switchgear for Pigeon House and Fleet Street stations (£4,705 and £6,369).—Ferguson, Pailin, Ltd.

London.—STEPNEY.—Electricity Supply Committee. Recommended :—

Meters and combined meters and demand indicators for 12 months :—2½ to 25 amp. meters (£7,238).—Reason Mfg. Co., Ltd.

Prepayment meters (£672) and 50 and 100 amp. meters (£229).—Ferranti, Ltd.

Combined meters (£363).—Aron Electricity Meter, Ltd.

Time switches for 12 months (£1,200).—Venner Time Switches, Ltd.

Conduits and troughs and covers for 12 months (£3,111).—Albion Clay Co., Ltd.

Wiring L.C.C. tenements, Willoughby House, Dundee Street, Wapping (£394).—L. G. Tate & Co., Ltd.

7,570 fuse boxes (£1,084).—W. T. Henley's Telegraph Works Co., Ltd.

Rotherham.—Corporation. Accepted:—

Paper-insulated taped and armoured cables.—Edison Swan Electric Co., Ltd.

Shipston-on-Stour.—Board of Guardians. Accepted:—

Installing electric lighting at the casual wards.—Shipston New Electric Lighting Co.

Southend-on-Sea.—Town Council. Accepted:—

1,450 current limiters (£1,160).—Chamberlain & Hookham, Ltd.

Forthcoming Events.

Illuminating Engineering Society.—Tuesday, June 1st. At the Royal Society of Arts, John Street, Adelphi, W.C. At 7 p.m. Discussion on "Research in Illumination," to be opened by Mr. J. W. T. Walsh.

Roentgen Society.—Tuesday, June 1st. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary meeting.

Institution of Electrical Engineers (Wireless Section).—Wednesday, June 2nd. At Savoy Place, Victoria Embankment, W.C. At 6 p.m. Paper on "Low-frequency Intervalve Transformers," by Mr. P. W. Willans.

Notes.

Northern Ireland Power Resources.—The Development Commission appointed by the Government of Northern Ireland to investigate the natural and industrial resources of Ulster has submitted a report to the Government, recommending the increased use of electrical power and the electrification of railways. The Commission's recommendations include the granting of additional powers to the Electricity Commissioners, financial assistance to new schemes, the expansion of the power stations of the Belfast and Londonderry undertakings, and the utilisation of the River Bann and the tides of Strangford Lough. The report will be dealt with more fully in a later issue.

The Yallourn Scheme, Australia.—The report of Mr. Willetts Sawyer, the American expert, upon the Yallourn (Victoria) electricity scheme has been published; according to the *Financial News*, it declares that the scheme is fundamentally sound, but recommends the postponement of the expenditure of half a million sterling authorised by Parliament until modern methods have been investigated. The report also recommends the appointment of Mr. Clements, managing director of the Melbourne Electric Supply Co., as an additional Commissioner, which post the Government has asked Mr. Clements to accept. Mr. Sawyer reports against the extension of the briquetting plant.

Tramways and Light Railways Association.—ANNUAL CONGRESS.—The programme of the annual congress of the Association, to be held at Torquay from June 23rd to 26th, commences with an informal reception by the directors of the Torquay Tramways Company on Wednesday evening, June 23rd. On Thursday the Mayor and members of the Corporation will formally receive the visitors at the Town Hall, and afterwards Mr. L. M. Myers will read a paper on "Competition of Motor Omnibuses with Tramways." The Mayor and Corporation will entertain the members at luncheon, and in the afternoon there will be an excursion to Widdecombe. On Friday the annual meeting of the Association will be held, and a report on "Tramway Rolling Stock" (by a Joint Committee of the two Tramway Associations) will be introduced by Mr. C. J. Spencer, O.B.E., and discussed. In the afternoon there will be an excursion to and on the River Dart, and in the evening the Association will be entertained at dinner by the directors of the Torquay Tramways Co.

Depreciation of Railless Trolley Cars.—The Principal Inspector of Taxes, after a conference with representatives of the Tramway Associations, has made an offer that the annual allowance for depreciation should be 15 per cent. on the written-down value of railless cars, in addition to obsolescence, the arrangement to continue for a period of five years. The Council of the Tramways and Light Railways Association recommended the acceptance of this offer to its members.

A Large Diesel Engine.—What is claimed to be the largest Diesel engine so far constructed, is at present being installed in the Neuhof power station at Hamburg of the Hamburg Electricity Supply Co. The engine, which has been built by the Blohm and Voss Co., of Hamburg, to the designs of the Augsburg-Nuremburg Maschinenfabrik, is of the two-stroke type and comprises nine cylinders with a bore and stroke of 860 by 1,500 mm. The engine, which is expected to develop 15,000 h.p. at 54 r.p.m., is 76 ft. long, 14 ft. wide, and 38 ft. in height.

Fatalities.—While on a bird-nesting expedition, an 11-year old Barnsley boy, Arthur Wilfred Lane, climbed a pole carrying a transmission line from the Yorkshire Electric Power Company's works at Barugh, and came in contact with the line. He received severe burns and died in hospital later. At the inquest recently, John Willison, operation superintendent in the employ of the Power Company, suggested that the boy made contact with the earth wire on which he was standing and the box terminal. This short circuit would cause a huge flame, but no current would pass through the boy's body. The voltage was 11,000.

On May 22nd, an inquest at the St. Pancras Coroner's Court was held on Arthur Henry Jeffreys (52), who died as the result of a fall from a staging in the St. Pancas electricity works. The deceased was employed by International Combustion, Ltd., and was engaged on the erection of a new bunker. A verdict of accidental death was recorded.

Illuminating Engineering in Italy.—Under the auspices of a number of leading Italian electrical engineers, an Italian National Association for the Development of Illumination has recently been organised in Milan. The object of the new body, which it is hoped will receive the financial support of electric lighting undertakings throughout Italy, as well as electrical engineering firms, is to promote the study of improved means of public and private lighting with the purpose of developing the further use of electricity for illuminating purposes. The Hon. Signor Motta has been elected president of the new association, whose offices are temporarily at those of the Edison Co., in Milan, while Signor Carlo Clerici has been appointed director.

Technical Education.—In his presidential address to the Association of Teachers in Technical Institutions at its annual conference, on May 24th, Mr. A. E. Evans, B.Sc., outlined the objects of the Association and defended technical education and training centres. All forms of education, he said, are not separate entities, but merely aspects of one indivisible whole, education. The recent Coal Commission deplored the lack of adequate facilities for research into the methods of winning and utilising coal. Electricity Commissioners might formulate comprehensive schemes for the supply of power; the skilled engineer educated at our technical colleges and schools would interpret these schemes in the light of engineering practice.

Appointments Vacant.—Charge engineer, for the South Lancashire Tramways Co.; junior assistant engineer for the Borough of Newport (Mon.) Electricity Department; general fitter (electrical) (90s.) for the Southwark Hospital, East Dulwich Grove, S.E. Assistant secretary (£551 approx.), for the City of Birmingham Electric Supply Department. (See our advertisement pages to-day.)

Electrical Refrigeration in America. — According to statistics collected by the McGraw-Hill Publishing Co., the number of manufacturers of electrical refrigerators in the United States has increased from five to fifty within a few years and twelve fresh firms have just taken up this branch of production in anticipation of the coming summer demand. The number of electrical refrigerators in use in American homes has increased from 3,000 to over 142,000 within the last six years, and approximately 75,000 were sold during 1925. About 200 homes substituted the electrical appliance for the ice box in 1925, and it is confidently anticipated that the number will reach 500 in 1926. Pointing out that at the present rate of development the next few years will see several million homes solving their refrigeration problems by electricity, Mr. Arthur Williams, of the New York Edison Company, recently said: "Six years ago household refrigerators occupied a position analogous to that occupied by the automobile in the early days of the automotive vehicle industry. It was only in 1923 that electric refrigerators began to be considered a household convenience within the reach of almost any American family and in that year alone more than four times as many homes were equipped with electric refrigerators as during the previous ten years." The great strides taken in the last few years towards transforming the household refrigerator into another electrical appliance for the home, reducing refrigeration costs and increasing its efficiency, are largely due to the efforts of power station companies throughout the country. To-day the smallest of the three leading companies in the electric refrigerator business has a paid-up capital of $5,000,000.

High-Pressure Rectifier Plant.—From an illustrated leaflet issued by Messrs. Brown, Boveri & Co., we obtain the following particulars of a 4,000-V (d.c.) power-rectifier plant which is claimed to be the only equipment of that description in existence designed for such a high d.c. pressure. The normal output is 800 kW with an overload rating of 25 per cent. for 30 min. and 200 per cent. momentarily. It is claimed to have an overall efficiency of 97.5 per cent. The plant is installed in Italy at the Ciriè sub-station of the Turin-Lanzo-Ceres Electric Railway and is used to convert 3-phase energy at 36,000 V to d.c. at 4,000 V.

The International Tramway Congress.—The 20th annual congress of the International Union of Tramways, Local Railways and Public Motor Transport Services is to be held in Barcelona in October next. Among the subjects to be discussed in the electrical section are the standardisation of traction motors, electric transformer stations, mercury rectifiers, and remote control.

Stepney and the Strike.—At a meeting of power users in the borough of Stepney last week, a committee was formed to inquire into the circumstances of the stoppage of the electricity supply from the Council's station during the strike and to report with a view to the institution of legal proceedings against the Council.

A Link with the Atlantic Cable.—Replying to an inquiry in the *Overseas Daily Mail* for news of survivors of the voyage of the s.s. *Great Eastern* when she was engaged in laying the Atlantic Cable, in 1866, Mr. William Cuming, of St. Albans, New Zealand, wrote to the *Daily Mail* of May 19th, stating that he was employed as an extra engineer, attached to the staff of the screw department. "The engineering staff of the ship, both for paddle and screw, were under the supervision of Mr. Beckwith as chief. The scientific staff included Captain James Anderson, Professor Thomson (afterwards Lord Kelvin), Daniel Gooch, Cyrus Field, Glass, and others, afterwards knighted for eminent services. I regret that I at 86 am very nearly the last survivor of an expedition which aroused the deepest interest in the mechanical world."

An American Electrical Leader Dissatisfied.—In an article upon Mr. James E. Davidson, the president of the (American) National Electric Light Association, appearing in *Electrical Merchandising*, it is stated that Mr. Davidson considers that "the electric light and power industry should stop preening itself over its size and think of the absurdly small amount of its sales to the average home. He believes that a capital investment turnover of once in five years, compared with the five turnovers a year of the successful merchant, is a reproach to electrical men. He believes that load factors of 30 and 40 per cent. are something not to be put up with but to be overcome by ingenious selling, just as the telephone and telegraph companies have largely solved their problems with night message offers." It is further stated that "what the household wants is not raw kilowatt-hours, but help in washing, ironing, refrigerating, cooking, heating, cooling, lighting and so on, human service that can only be rendered when appliances are installed." Accordingly, Mr. Davidson calls upon the central station industry to improve its business-getting and appliance-selling organisation.

Electrical Association for Women. — The luncheon arranged in connection with the first annual general meeting of this Association will take place at the Hotel Cecil, London, on Friday, June 4th, at 1 p.m. (not at the Criterion Restaurant as previously arranged). Lieut.-Col. Wilfrid Ashley, M.P., Minister of Transport, and Sir Hugo Hirst, Bart., have again promised to speak on this occasion.

A Strike Sequel.—According to the *Daily Dispatch*, Mr. A. R. Fearnley, general manager of the Sheffield Corporation Tramway Department, has issued writs for alleged libel against representatives of the Sheffield Trades and Labour Council and the printer of a strike bulletin issued by that body. The action arises out of a statement complaining of the way in which it was alleged Mr. Fearnley conducted, during the strike, a ballot of the Sheffield tramwaymen on whether they would return to work. The writs have been issued against Councillor E. G. Rowlinson, A. Barton, H. Gascoigne, and T. Garnett, officials of the Trades and Labour Council, and P. Williams, the printer of the bulletin. A further writ for alleged libel and slander has been issued by Mr. Fearnley against C. J. Mitchell, B.Sc., of Woodhouse, Sheffield.

Institution Notes.

Institution of Electrical Engineers.—Summer Meeting Postponed.—It has been decided, on account of the recent general strike and in view of the situation in the coal-mining industry, to postpone the summer meeting which was to have taken place next month at the North-Eastern Centre until next year. It is hoped that the meeting will be held from June 14th to 17th, 1927.

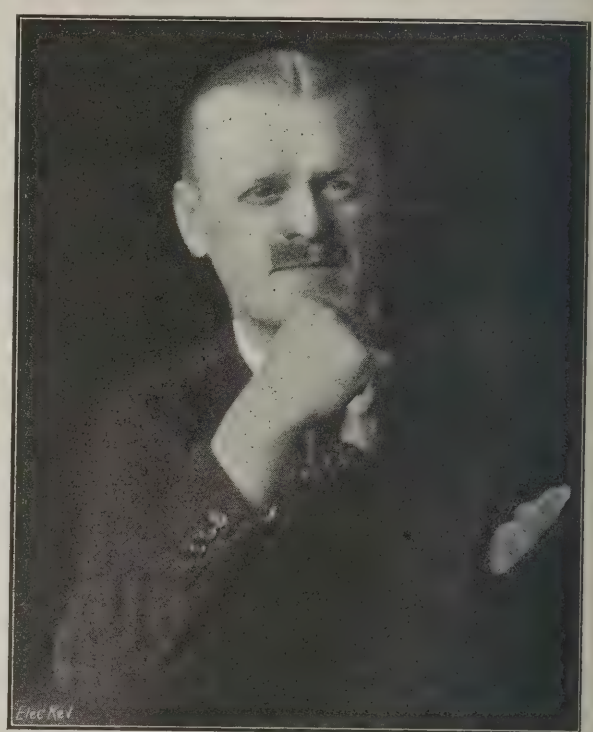
Wireless Section Committee.—The under-mentioned gentlemen have been nominated by the Wireless Section Committee to serve on the Committee from October 1st, 1926:—*Chairman*: Prof. C. L. Fortescue. *Ordinary Members*: Major B. Binyon and Messrs. R. V. Hansford, S. R. Mullard, and G. Shearing. Not later than 14 days after the publication of the Committee's list of nominations, any five members of the Wireless Section may nominate any other duly qualified person to fill any vacancy. The following will continue to serve as members of the Committee: The President, I.E.E.; chairman of the Papers Committee, I.E.E.; a nominee of the Council, I.E.E.; a nominee of the General Purposes Committee, I.E.E.; Mr. P. R. Coursey; Prof. C. L. Fortescue; Capt. N. Lea; Mr. F. C. Phillips; Capt. H. J. Round; Mr. E. H. Shaughnessy; Commander J. A. Slee; and Mr. L. B. Turner, together with one representative each to be nominated by the Admiralty, Air Ministry, General Post Office, and War Office.

Iron and Steel Institute.—The postponed annual meeting of the above Institute is to take place on June 3rd and 4th at the Institution of Civil Engineers, Great George Street, London, S.W.1, when the programme already published will be adhered to as nearly as possible. The annual dinner, which may now necessarily be of an informal character, will take place at the Connaught Rooms, on June 3rd.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. Harry P. Lawson, until lately a director of Messrs. Cole, Marchent & Morley, Ltd., has now accepted the position of sales manager to Messrs. Hick, Hargreaves & Co., Ltd., Soho Iron Works, Bolton. Mr. Lawson's long association with Messrs. Cole, Marchent & Morley, for whom he has acted as outside representative during the last fifteen years, has brought him into touch with municipal, company and indus-



Madame Yevonde] [*London.*

Mr. Harry P. Lawson.

trial engineers throughout the country and we feel sure that his many friends will join with us in wishing him every success in his new position.

Bedford Town Council is increasing the salary of the deputy electrical engineer, Mr. H. B. Jenkins, from £605 per annum to £625, from July 1st next.

In April, Mr. A. Maling, Australian manager of Metropolitan-Vickers Electrical Co., and Mrs. Maling, left Melbourne for Europe.

Obituary.—Mr. H. W. Bowden.—As briefly announced in our last issue, Mr Henry White Bowden passed away on May 9th. Mr. Bowden began his electrical career at Wolverhampton, where he was articled as a pupil with Messrs. Elwell Parker. Two years as electrical engineer with the Eastbourne Electric Light Co. followed and in 1891 he took up the position of assistant manager to the House-to-House Electric Light Co. at Kensington (now the Brompton and Kensington Electricity Supply Co.). He was prominently connected with that company's affairs for very many years, during a period of continuous extension. He became a director of the old Blackheath and Greenwich Electric Light Co. (now the South Metropolitan Electric Light & Power Co., Ltd), in 1898, and supervised the erection of much of the plant of the South Metropolitan Co., of which he was managing director and engineer-in-chief. In 1906 he also joined the board of the Woking Electric Supply Co. Mr. Bowden was one of the pioneers of electricity supply in London and in these days, when so much is being done to bring electrical service within the compass of the general populace, it is interesting to recall that he was very early in the field with free-wiring installation arrangements which gave the consumer up to six points free of charge. Mr. Bowden resigned his position as engineer-in-chief of the South Metropolitan Company in 1919, also his seat on the board, but he continued as consulting engineer to the company. He was a member of the Institution of Civil Engineers and of the Institution of Electrical Engineers.

Mr. F. S. Spiers.—We regret to announce that Mr. Frederick S. Spiers, O.B.E., B.Sc., A.C.G.I., A.M.I.E.E., died suddenly on May 21st, at the early age of 50. Mr. Spiers was a consulting electro-metallurgist in private practice, but was very widely known as one of the founders of the Faraday Society, of which he was secretary and editor up to the time of his death; in those capacities he rendered invaluable service to the electro-chemical industry. He organised the exhibitions of British scientific products which were promoted by the

British Science Guild in 1918 and 1919, and took part in the formation of the Electroplaters' and Depositors' Technical Society last year. The electro-deposition of metals was perhaps his most engrossing study, but he was keenly interested in all branches of physical science, and for many years was a regular contributor to our columns, besides being a personal friend of long standing, whose loss we deplore.

DR. J. T. BOTTOMLEY.—We regret to record that Dr. James Thomson Bottomley, D.Sc., LL.D., F.R.S., F.R.S.E., F.C.S., of Netherhall, Largs, Ayrshire, nephew of the late Lord Kelvin, passed away on May 18th, at 13, University Gardens, Glasgow, in his 82nd year. He was a native of Ireland, and after graduating with distinction in 1866, Mr. Bottomley successively occupied teaching posts at Queen's College, Belfast, King's College, London, and Glasgow University, where from 1869 to 1907 he was lecturer in Natural Philosophy and assistant to Lord Kelvin, with whom he was closely associated for many years. In 1900 he became a partner in the well-known firm of Kelvin, Bottomley & Baird, and on the death of Lord Kelvin in 1907 he became chairman of the company, occupying that position until his death. Mr. Bottomley's bent was towards physical research; he was a member of the Institution of Electrical Engineers and of the Physical Society, and was the author of various works on physics and mathematics. His gentle disposition endeared him to the students of Glasgow University during his long period of service as deputy to Lord Kelvin.

MR. A. J. COLLIER.—The death took place on May 18th, at Horton Chapel, Chartham, near Canterbury, of Mr. Alfred John Collier, of the Eastern Extension Telegraph Co. He was 76 years of age.

Mr. ALLAN DE LUCE, charge electrical engineer at the Colne electricity station, passed away last week at the age of 27 years. He had been in the service of the department 10 years.

MR. F. MACKENZIE.—The funeral took place, on May 20th, at Preston Cemetery, of Mr. Francis Mackenzie, for many years representative of the English Electric Co., Ltd., on the Royal Infirmary Mills and Workshops Committee and for 11 years a Workpeople's member on the board of management. Among the wreaths was one from the employés of the English Electric Co.

Wills.—MR. J. S. AGAR, of Agar, Cross & Co., Ltd., left £152,868.

The late Mr. H. OPPENHEIMER left £12,415.

The late Mr. W. R. COOPER left £15,451 gross and £13,883 net personalty.

The late Mr. THOMAS W. WARD, of Sheffield, left £485,627 gross and £467,853 net personalty.

Mr. G. C. KENT, chairman of Messrs. Taylor, Tunnicliff and Co., Ltd., left £39,443 gross and £32,679 net.

New Companies Registered.

Upfields Wireless, Ltd. (213,849).—Private company. Registered May 19th. Capital, £300 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of wireless apparatus, receiving and transmitting sets, accumulators, component parts and wireless accessories, &c. The permanent directors are:—W. B. Alexander, The Kites Nest, St. Helen's Park Road, Hastings; R. Butler, 26, Baldslow Road, Hastings; B. H. Blackman, 23, St. Helen's Crescent, Hastings. Qualification, 20 shares. Secretary: B. H. Blackman. Solicitor: W. E. F. Cheesman, 23, Havelock Road, Hastings.

Shemelds, Ltd (N.I. 330).—Private company. Registered in Belfast May 7th. Capital, £3,000 in £1 shares. Objects:—To carry on the business of general electrical and telephonic engineers, motor engineers, plumbers, gasfitters, &c. The first directors are:—W. I. Smith, 33, Cherryvalley Gardens, Knock, Belfast, electrician; and J. H. Tyler, 33, Linden Gardens, Belfast, electrician. Registered office: Raleigh House, Queen Street, Belfast.

Northern Electric Supply Co., Ltd. (N.I. 331).—Private company. Registered in Belfast May 10th. Capital, £12,000 in 7,000 ordinary and 5,000 preference shares of £1 each. To produce, store and supply electric energy and power in any part of the United Kingdom, Colonies, Dependencies, &c. The subscribers (each with one share are):—J. H. Graham, 111, Beersbridge Road, Belfast, audit clerk; and H. McCorry, Aughacommon, Lurgan, solicitor's clerk. The first directors are not named. Qualification, 100 shares. Secretary: A. Heggarty. Registered office: 1, Wellington Place, Belfast.

Bergmann Electric Co. (Ireland), Ltd. (7,490).—Private company. Registered in Dublin on May 12th. Capital, £5,000 in £1 shares. Objects:—To carry on the business of electrical engineers and contractors, suppliers of electricity, &c. The directors are:—J. D. Doyle, Mountain Villa, Ballybrack, consulting engineer; H. N. Roberts, 26, Sandford Road, Dublin, consulting engineer; and J. W. Hissink, 63, Seestrasse, Berlin, Germany, engineer. Secretary: J. K. Reilly. Registered office: 4, Saint Andrew Street, Dublin.

Official Returns of Electrical Companies.

London Factors and Agents, Ltd.—A. Leonard, of 82, Victoria Street, S.W.1, was appointed receiver and manager on April 27th, 1926, under powers contained in charge dated February 28th, 1922.

Peter Curtis, Ltd. — S. W. Rowland, of 296-302, High Holborn, W.C.1, C.A., ceased to act as receiver or manager on May 11th, 1926. Satisfaction in full on May 11th, 1926, of debenture dated February 18th, 1925, securing all moneys due or to become due not exceeding £5,000.

Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated May 11th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Paignton Electric Light and Power Co., Ltd. (98,437).—Capital, £40,000 in £1 shares. Return dated April 7th, 1926. All shares taken up. £40,000 paid. Mortgages and charges, nil.

Eddystone Components, Ltd.—Debenture dated April 23rd, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Bird, 191, Preston New Road, Blackburn.

Neutron, Ltd.—Particulars filed of £3,300 debentures (including £1,300 already registered) authorised by resolutions of April 12th and May 4th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,900.

Breeden & Co., Ltd.—Debenture dated April 26th, 1926, to secure £15,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: British Brass Fittings, Ltd., 100, Moorsom Street, Birmingham.

Spensers (London), Ltd.—Particulars filed of £2,000 debentures authorised by resolutions of October 5th, 1925, and February 8th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Perfect Burglar Alarm Co., Ltd. (112,522).—Capital, £4,000 in 1,000 preference and 3,000 ordinary shares of £1 each. Return dated February 9th, 1926. 230 preference and 1,710 ordinary shares taken up. £1,382 10s. paid, being £1 on 1,210 and 15s. on 230. £500 considered as paid on 500 shares. Mortgages and charges, nil.

Sussex Electricity Supply Co., Ltd. (175,686).—Capital, £20,000 in £1 shares. Return dated December 18th, 1925 (filed May 15th 1926). 18,049 shares taken up. £18,049 paid. Mortgages and charges, £10,000.

Townlea Electrical Co., Ltd. (189,297).—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated December 24th, 1925. 500 shares taken up. £500 paid. Mortgages and charges, nil.

Isle of Thanet Electric Supply Co., Ltd. (49,978).—Capital, £360,000 in 150,000 ordinary and 210,000 preference shares of £1 each. Annual return dated December 31st, 1925. All shares taken up. £150,000 paid on 150,000 preference. £210,000 considered as paid on 60,000 preference and 150,000 ordinary. Mortgages and charges, £298,616. Return of allotments, dated May 17th, 1926, shows a further 72,000 preference shares allotted, payable in cash.

City of Buenos Ayres Tramways Co. (1924), Ltd. (82,214).—Capital, £1,240,000 in £5 shares. Return dated March 1st, 1926. All shares taken up. £1,240,000 considered as paid. Mortgages and charges, £172,167.

Finston Manufacturing Co., Ltd.—Particulars filed of £1,500 debentures authorised May 14th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Northampton Electric Light and Power Co., Ltd. (28,640).—Capital, £350,000 in 10 "A" and 349,990 "B" shares of £1 each. Return dated March 4th, 1926. 10 "A," 304,723 "B" ordinary and 45,000 "B" preference shares taken up. £349,733 paid. Mortgages and charges, £200,000. In April, 1926, the capital was increased to £500,000 by the creation of 150,000 new shares of £1 each.

Telegraph Construction and Maintenance Co., Ltd. (1,147C).—Capital, £896,400 in £12 shares. Return dated March 11th, 1926. All shares taken up. £448,200 paid on 37,350. £448,200 considered as paid on 37,350. Mortgages and charges, nil.

Leamington and Warwick Electrical Co., Ltd. (13,780).—Capital, £100,000 in 2,500 preference and 7,500 ordinary shares of £10 each. Return dated February 26th, 1926. 1,100 preference and 6,800 ordinary shares taken up. £79,000 paid. Mortgages and charges, £35,000.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Callender's Cable and Construction Co., Ltd.

The report for the year ended December 31st last shows a balance to the credit of profit and loss of £368,644. After providing for debenture interest, preference dividends, depreciation and income tax, there remains a balance of £233,643, to which is added £462,695 brought forward, making £696,338. A dividend of 2s. per share is to be paid on the ordinary shares, making in the case of the old ordinary shares 3s., or 15 per cent., for the year, and £611,338 is to be carried forward. The company's business continued to expand and excellent results were obtained in its various departments. Keen competition was experienced and the profits on individual transactions were small. The substantial credit balance was due to economies in production, to the use of modern machinery, and to the great extent of the company's operations. The report says that there is every probability that large quantities of underground cable will be required in the near future, not only in Great Britain but also in countries in which a strong position has been secured; arrangements already made will enable the company to participate to the fullest extent in any such new business. The use of e.h.p. mains continues on an increasing scale, and the heavy expenditure incurred in providing plant and appliances for manufacturing these cables has been fully justified. The business in rubber wires and cables, which is a speciality of the Anchor Company, has made excellent progress during the year. Important contracts have been secured from abroad. A large order was placed for the Shanghai Tramways and the installation of the cables was carried out successfully by the company's engineers in spite of the disturbed state of the city. Notwithstanding the serious internal troubles in China, the company's business there still continues. The Okonite-Callender Cable Co., established in the United States, is now in successful operation and has secured many contracts for cables of the same type as those manufactured in England. The directors anticipate continued extension of this business in the United States. The directors of the company are of the opinion that the nominal capital should correspond more closely with the actual capital employed in the business. They therefore propose to increase the ordinary capital to £1,000,000 by the creation of 300,000 new shares. It is intended that 200,000 fully-paid ordinary shares should be distributed as a bonus from the reserves, each existing holder receiving one

new share for each three held. This will absorb the 100,000 shares already authorised but not yet issued and 100,000 of the new shares. There will then remain 200,000 shares to be issued as may be necessary in future. After this capitalisation the balance remaining to the credit of the reserve account will be £70,978. It is proposed to raise this to £400,000 by an allocation from the unappropriated balance at December 31st last, reducing the balance to be carried forward to £282,317. The necessary resolutions for these capital arrangements will be submitted at the annual meeting on June 3rd.

Siemens Bros. and Co., Ltd.

The report for 1925 records further improvement in all departments of the company's business and a substantially larger profit. The value of the unfulfilled orders at the close of the year was also greater. Steady progress was made during the year with the extensions of the Woolwich buildings and plant, and these are being brought into use as completed. The company has not yet reached a settlement with the Inland Revenue authorities in respect of its liability to excess profits duty. The profit for the year was £356,881, an increase of £90,583. After providing for debenture interest, &c., preference and interim ordinary dividends and income tax, there remains £176,112, from which is deducted a final dividend of 5 per cent. on the ordinary shares, making 7½ per cent. for the year (as in 1924), leaving £101,113. To this is added £195,027 brought forward, making £296,140, which it is proposed to carry forward. The report mentions the death of Mr. Francis Hird and the appointment of Dr. H. R. Wright as managing director; it also records the resignation of Mr. G. Chauvin and the appointment of Sir John Mann, K.B.E., to the vacancy on the board. The meeting is to be held on May 31st.

Shanghai Electric Construction Co., Ltd.

The profit for the year ended December 31st last was £72,159. To this is added £26,263 brought forward, less £20,000 transferred to renewals account, making £78,422. A further £20,000 is appropriated for renewals, £703 is transferred to reserve, £1,000 is provided for taxation, and £1,550 is contributed to staff provident fund, leaving £55,169. Interim dividends absorbed £30,000, and it is proposed to pay a final dividend of 4 per cent. (making 10 per cent. for the year), leaving £5,169 to be carried forward. The operating profit fell from £109,119 to £71,893, due to the disturbances in Shanghai, during which it was only possible to maintain a skeleton service. The trouble also delayed the putting into service of the new trolley omnibuses. Thirty-seven of these are now in operation, and the number is being gradually increased. The depreciation of the subsidiary coinage necessitated three fare increases during the year. For the current year the receipts compare very favourably with those for the first part of last year, and profits have been more than maintained. The special allocations for renewals have been necessitated by the heavy expenditure upon the general renewal of the permanent way, which is approaching completion. The newly-formed Singapore Traction Co., Ltd., is progressing with its conversion of the tramways to railless traction, and it is hoped to institute a service next month. The tramway earnings show a satisfactory tendency, but the lighting revenue, as was expected, has diminished. Meeting, June 2nd.

Anglo-Portuguese Telephone Co., Ltd.

The gross profit for the past year was £38,907. After providing for debenture interest, &c., and adding £5,804 brought forward, there remained £27,591. In view of the large sums required for development, the directors recommended that that amount should be carried forward, and they did not propose to pay a dividend.

The annual meeting of the company was held on May 17th. Viscount St. Davids, who presided, stated that although the company was not yet in the position which they hoped to attain, the situation was much better than it was a few years ago. They had earned a profit of £21,700 for the past year, but it was considered advisable to put the whole amount into the company's ordinary business rather than pay a dividend. Their telephone business was improving, and it was necessary to go forward or go under. They had been unable to raise new capital, but they hoped to improve the credit of the company to make that possible at no very distant date. The company's relations with the Portuguese Government remained good. The capital expenditure during the year amounted to £79,300, and they had opened new exchanges in Lisbon and Oporto; much, however, remained to be done, and unless new capital could be raised expenditure would have to be met out of revenue. The prospect for the current year was good, and the profit should, at least, be maintained.

Pernambuco Tramways and Power Co., Ltd.

The annual meeting was held on May 7th. Mr. W. Higgins, O.B.E., who presided, said that the expansion of the company's business continued. That was particularly marked in the tramway section in which traffic had compelled the company to undertake a comprehensive scheme of car building and conversion. The progress of Pernambuco also continued and among the recently-inaugurated improvements was the Boa Vigem line which the company was operating, sharing the profits with the State Government until the latter had recouped the cost incurred by it. It was hoped that the district served by this line would develop to important dimensions in the course of a few years. With regard to the lighting and power business, peak loads had risen to a point which demanded additional plant and the board had accordingly decided to order a new 6,000-kW set and the necessary accessories. The new unit would take the place of one of the old 1,000-kW sets and the plant would then have a capacity of 14,000 kW. The gas department also showed improvement and the business of the Telephone Co. of Pernambuco, Ltd., in which the company was interested held out good prospects. A new 50-year concession had been obtained and it was hoped to have the new automatic system in operation next year.

Swedish Ericsson Co.

The directors of the Allmänna Telefon Aktiebolaget L.M. Ericsson, report that the stock of orders almost doubled last year. At the beginning of 1925 they amounted to 6,550,000 kr. at the telephone factories and 1,040,000 kr. at the cable factory, and at the close of the year they were 14,010,000 kr. and 900,000 kr. respectively. The value of the deliveries from both departments reached 15,720,000 kr., as compared with 13,140,000 kr. in 1924. Out of this total the exports increased from 8,920,000 kr. in 1924 to 9,400,000 kr. last year, but the percentage to the total declined from 83.7 to 76.8 per cent. As the arrival of orders in 1926 has further expanded and represented a stock of 23,968,000 kr. on April 1st, the whole capacity of the works has been brought into use. Moreover, the company's subsidiary companies abroad have specialised in certain manufactures so as to complement the deliveries from Stockholm to foreign customers. The great development of the company and the possibilities of expansion abroad, the directors say, render it necessary to have recourse to the international money market to a greater extent than hitherto for the provision of capital, but a fundamental condition for this is that the balance sheet should be prepared in accordance with the principles practised abroad. In order to achieve this object it is considered that a further consolidation should take place and the directors therefore recommend that out of the profits of 2,042,000 kr., for 1925, the sum of 1,951,000 kr. should be devoted to this purpose and the balance carried forward. The net profits earned in 1924 amounted to 2,037,000 kr. The report further states that the activity of the foreign subsidiary companies proceeded on about the same level as in 1924, the economic results in general having been satisfactory.

Lancashire Electric Light and Power Co., Ltd.

Mr. G. Balfour, M.P. (chairman) presided at the annual meeting on May 14th, and in the course of his speech said that the business of the Lancashire Power Co. could be considered satisfactory. The Radcliffe station had been brought up to date, and the work at the Padiham station had proceeded, and it was hoped to commence supplying from the station in August this year. The cost per kWh delivered to the mains had been reduced from 0.275d. to 0.25d., while the total cost per kWh sold fell from 0.489d. to 0.483d. During the year considerable additions were made to the transmission and distribution systems. Notwithstanding the adverse trade conditions there had been a general expansion in business—except with regard to collieries. Further considerable capital expenditure was in prospect. Referring, in conclusion, to the Electricity (Supply) Bill, Mr. Balfour said that as it stood it was a thoroughly bad measure, and it could only be made to serve the interests of the public by drastic amendment.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

Speaking at the annual meeting, which was held on May 18th, Mr. E. Garcke (chairman) said that distinct progress had been made, resulting in an increase of £38,000 in the profit. A further 15,000-kW set was being installed at the Stourport station, and the Treasury had agreed to provide a further £70,000 on similar terms to the original loan, but with a reduction in interest charges. After a long delay the Stourport station was now in a position to generate energy. The improvement had continued during the first part of the current year, but it had been somewhat retarded by the general strike. In this connection, Mr. Garcke said that not one of the employés had left the company during the emergency. Business was not growing very rapidly in the rural areas, but it was quite satisfactory, and the company had been successful in introducing electricity into many backward districts. Some of those areas were as much as 30 miles from the industrial centre of supply.

Lanarkshire Tramways Co.

The annual meeting was held on April 30th, Mr. A. R. Monks (chairman) presiding. In the course of his speech the chairman said that it was a matter of regret to the board that after presenting for 22 years annual accounts which had disclosed, after making adequate reserves, profits which had enabled the company to pay dividends averaging 6¼ per cent., they now had to submit accounts showing a heavy loss. Motor omnibus competition had shown a continuous increase. They had interviewed the Ministry of Transport and they understood that a Bill would shortly be promoted in Parliament which would enable local authorities to regulate and control motor services; until such steps were taken they proposed to restrict their activities and by exercising all practicable economies they hoped to ameliorate the position. They had recently negotiated a further loan to enable them to carry on until they were in a position to make a capital issue on satisfactory terms.

Calcutta Electric Supply Corporation, Ltd. In presenting the report and accounts (*vide* our last issue, p. 774) at the annual meeting on May 19th, the chairman, Lord Meston, said that the first mortgage debenture loan had been reduced by £430,000 owing to its conversion into ordinary shares. The value of fixed assets had risen by £320,000, due partly to the commencement of the construction of the new power station at the Calcutta Docks. The balance of the necessary funds for that station had been successfully raised by a share issue in the early part of the current year. A part of the proceeds of that issue was to be devoted to the reduction of the outstanding first debentures. The company's output in 1925 had risen by about 15 million kWh in spite of bad trade in Calcutta. The costs had remained practically stationary owing to the lower price of coal. The company's charges for electricity for industrial purposes had been reduced and it was anticipated that the rates for domestic supply would be lowered when the new station was in operation.

French Companies. The report of the *Compagnie des Forges et Ateliers de Constructions Electriques*, Jeumont, for 1925, shows a net profit of 8,834,000 fr., as compared with 5,993,000 fr. in 1924. It is proposed to pay a dividend at the rate 20 fr. per share as against 15 fr.

The *Société Gramme* reports net profits of 590,000 fr. for 1925 as compared with 568,000 fr. in the previous year; the rate of dividend is maintained at 60 fr. per share.

The *Compagnie du Chemin de Fer Metropolitain*, Paris, reports net profits and interest receipts amounting to 15,214,000 fr. for 1925, permitting of the payment of a dividend of 35 fr. gross per ordinary share.

The *Compagnie Electro-Mécanique* reports a net surplus of 1,530,000 fr., of which the sum of 1,210,000 fr. has been written off for depreciation and the balance carried forward.

The *Société des Magnetos R.B.* proposes to pay a dividend at the rate of 26 fr. per share for 1925, as compared with 42.30 fr. in the preceding year, on a larger share capital.

The *Société Parisienne pour l'Industrie des Chemins de Fer et des Tramways Electriques* records an increase in the net profits from 4,803,000 fr. to 5,168,000 fr., the dividend remaining at 16 fr. per share.

The *Compagnie Radio-Maritime* reports net profits of 2,093,000 fr. for 1925. A dividend of 22 fr. per share is again being paid.

The Société des Produits Chimiques et Electro-Métallurgiques Alais, Froges et Camargue (Pechiney), reports net profits of 24,853,000 fr., as against 17,473,000 fr. The dividend is raised from 8 to 10 per cent.

The *Société Indo-Chinoise d'Electricité*, of Paris, is increasing its capital from 11,900,000 fr. to 20 million fr.

German Companies. The *Mix and Genest Telephone and Telegraph Works Company*, Berlin, states that business in automatic telephone stations materially increased in 1925. Besides a number of private installations, exchanges for 17 towns were in hand and two already set in operation. On the other hand the Post Office orders for apparatus declined. The net profit was 605,000 marks, and the dividend is at the rate of 8 per cent.

The *Kortings Electricity Works Company*, Berlin, reports net profits of 187,000 marks in 1925, and proposes to pay a dividend of 8 per cent.

The *Voigt and Haeffner Company*, Frankfort-on-Main, again recommends a dividend at the rate of 8 per cent.

The *Duisburg Cable Works Company* is paying a dividend of 8 per cent. out of net profits of 653,000 marks, as compared with 6 per cent. in 1924.

The *Continental Company for Electrical Undertakings*, Nuremberg, records net profits of 488,000 marks for 1925, permitting of the payment of certain arrears on the preference capital and a dividend of 4 per cent. on the ordinary shares.

The report of the *Hartmann and Braun Company*, Frankfort-on-Main, states that the value of the turnover in 1925 increased, but satisfactory profits were not realised owing to higher production costs. The accounts show a net profit of 122,000 marks and the dividend on the ordinary shares remains at 5 per cent.

Chinese Company.—The *Société des Tramways et Eclairage Electrique de Shanghai* reports a profit of 22,540,151 fr. for the last financial year, as compared with 17,720,235 fr. in 1924. It is proposed to increase the capital of the concern from 30 to 40 million fr.

Marconi's Wireless Telegraph Co., Ltd.—The terms of the agreement with the Postmaster-General for a licence for the conduct of telegraph services between Great Britain and foreign countries provide that the company shall continue under British control, and in order that the articles of association can be altered to meet this requirement extraordinary general meetings are to be held on May 31st. Not more than 25 per cent. of the issued share capital of the company may at any one time be in foreign hands, and under the agreement the words "United Kingdom or India or any British Dominion, Colony or Dependency" cover the Irish Free State. It will be necessary in future for special forms of transfer to be used in order that a proper allocation of shareholdings can be made.

Cuba Submarine Telegraph Co., Ltd.—The report for 1925 records receipts of £63,404 and expenses amounting to £25,970. After providing for taxation and cable repairs there remains £25,350, to which are added £6,196 brought forward and £1,140 difference in exchange, making £32,686. The directors, after charging interim dividends and placing £10,795 to general reserve, recommend final dividends at the rate of 10 per cent. on the preference shares and at the rate of 5 per cent., free of tax, on the ordinary shares, leaving £7,892 to be carried forward. In spite of new competition the traffic derived from the West India and Panama Company's system was well maintained. Meeting: To-day (Friday).

Birmingham District Power and Traction Co., Ltd.—The annual meeting was held on May 19th under the chairmanship of Mr. C. Shirreff Hilton, who said that the accounts showed that the position of the company had again been strengthened. The dividend, the amount carried to reserve, and the balance brought forward had all increased. The difficulties engendered by motor-omnibus competition continued, and their subsidiary companies had had to adopt the policy of abandoning unremunerative tramway lines. The Birmingham and Midland Motor Omnibus Co., Ltd., continued to provide efficient services in an area of 2,000 sq. miles, and the Shropshire, Worcestershire and Staffordshire Electric Power Co. had again increased its ordinary dividend.

Great Northern Telegraph Co., Ltd., of Denmark.—The directors' report for 1925 shows that the net revenue decreased from £367,704 to £253,267. The addition of the balance brought forward makes £566,938 available for distribution. The total distribution for the year is 20 per cent., as compared with 22 per cent. in 1924. The reserve and renewal fund receives £19,444, bringing it up to £3,656,759, and £244,438 is carried forward. The lower revenue is attributed to the general commercial depression in Europe as well as to competition; Government-owned radio stations are particularly mentioned in the latter aspect.

Scottish General Transport Co., Ltd.—The revenue for 1925 was £28,718. From this are deducted administrative expenses, and allocation to renewals, and £11,302 is added from the previous accounts, leaving a disposable balance of £11,345, which the directors recommend should be carried forward. A dividend of 5 per cent. was paid for 1924. The report states that the lower profit is due to the failure of the Greenock and Port Glasgow Tramways Co. to pay a dividend. The capital expenditure during the year was £81,315, largely in connection with the company's omnibus services.

Aron Electricity Meter, Ltd.—The net profit for the year ended March 31st last, after providing for depreciation, taxation, &c., was £11,424 and the balance available, adding the amount brought forward, £14,548. As we have already reported, a dividend of 6 per cent. is to be paid on the ordinary shares. £3,000 is transferred to reserve and £2,942 carried forward. The meeting was to be held yesterday (Thursday).

West Kootenay Power and Light Co.—The profit for the past year amounted to $135,219, and to this is added $11,374 brought forward. $95,854 is transferred to sinking fund, the preferred dividends absorbed $35,000, and $16,609 is carried forward.

Submarine Cables Trust.—The report for the year ended April 15th last records a revenue of £30,264 and a balance (including £11 brought forward) of £28,529. The payment of coupons absorbs £3,258, £25,198 is transferred to the redemption fund, and £84 is carried forward.

Adelaide Electric Supply Co., Ltd.—The directors have authorised the payment of the dividend on the 8 per cent. preferred ordinary shares for the past half-year and an interim dividend of 6 per cent., free of tax, on the ordinary shares.

American Telephone and Telegraph Co.—Last week an issue was made of $154,000,000 of capital stock, bringing the company's capital up to $1,073,000,000, the highest ever reached by an American company.

Dorman, Long & Co., Ltd.—The directors have declared the interim dividend on the 6 per cent. cumulative preference shares, but do not propose to make any interim distribution on the 8 per cent. preferred ordinary or ordinary shares.

Commonwealth Edison Co.—The company reports a gross income for the past year of $16,805,144, and a net income of $10,766,786. Dividends absorb $7,202,942 and a balance of $3,563,844 is carried to surplus account.

Brush Electrical Engineering Co., Ltd.—The directors state that the issue of the report and accounts has been delayed. They recommended the payment of a dividend of 10 per cent. for the past year, as in 1924.

Stock Exchange Notice.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

American Telephone and Telegraph Co.—18,805 shares of $100 each.

British Columbia Electric Railway Co., Ltd.—Dividends of 4⅜ per cent., free of tax, have been declared on both the preferred and deferred ordinary stocks.

Northampton Electric Light and Power Co., Ltd.—The directors state that the issue of 70,000 ordinary "B" shares to existing shareholders at 27s. each has been fully subscribed.

West African Telegraph Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. free of tax, on the ordinary shares.

Dubilier Condenser Co. (1925), Ltd.—The directors recommend a dividend of 5 per cent. on the ordinary shares.

Stocks and Shares.

TUESDAY EVENING.

STOCK EXCHANGE markets recovered easily, in accordance with their reputation for elasticity, from the effects of the general strike. The deadlock in the coal trade exercised but a slight influence over prices except those in the coal, iron and steel group. In the latter, the continuance of the miners' deadlock is held likely to hasten the day when some of the iron and steel concerns will have to take in hand the reorganisation of their finances. Several of the companies are in a sound and a secure position, but others must reconstruct before they can hope to return to financial stability. The coal dispute has no effect upon electricity supply shares, several of whose prices stand higher on the week.

Home Railway stocks are, of course, moving very cautiously. Even in these, however, the tone is fairly firm, all things considered. Undergrounds are better. The lovely weather at Whitsun combined with restricted steam railway services to keep holiday-makers within a narrow radius from their homes, and drove people to 'buses and tubes as a means of escape into the fresh air. Therefore, on returning to business after the holiday, the Stock Exchange sang, with Empire Day fervour, the National Anthem and then proceeded to put up the prices of the various Underground issues.

British Columbia Electric Railway deferred and preferred are several points higher on the increased interim dividends of 4⅜ per cent. declared on both stocks. That the advances of 10s. per cent. had been anticipated, the readers of these notes will need no reminder. British Electric Traction is up 5, on the recent increase of 1 per cent., to 7 per cent., in the dividend. No changes have occurred in the London traction descriptions.

Brazilian Tractions rest within a couple of points of par; the level 100 is likely to be reached before long, if only by reason of the incessant demand for the shares on account of Canadian buyers. Mexican stocks are irregular.

The Shanghai Electric Construction Company has halved its previous dividend of 20 per cent. Profits at £72,100 were down by £32,500 owing to the disturbances, which began a year ago, at Shanghai. Normal traffic conditions were restored at the end of the year. The report states that the traffic returns in the current year are the largest hitherto recorded.

Cable and electrical construction shares are a very lively market. Siemens have been fluctuating sharply. The eagerly-awaited dividend is 5 per cent., making 7½ per cent. for the year, and showing no change. The directors speak well of the progress made in the company's business, with the exception of the foreign branch, which, they say, is not yet satisfactory. Questions relating to E.P.D. are still unsettled with the Inland Revenue; agreement is expected very shortly. The price of the shares touched 32s., to revert to 30s. 6d. upon slight disappointment with the dividend.

Callender's are a good market at 4. The profits shown by the report are £12,000 up at £289,644; the dividend goes on as before at 15 per cent., and £200,000 is to be capitalised from the reserve fund for distribution as a bonus amongst the shareholders. Henley's are 3½, anticipation going for a "banner" report. Most of the other members of this group are better on the week. Rises have taken place in British Aluminium, British Insulated, Edison 5 per cent. debenture, Brush, Electric Constructions, General Electrics, Enfield ordinary, and Johnson & Phillips. A further jump in Babcocks lifted the price 3s. to 52s. Considerable business is being done in this department.

Electricity Supply shares are steady, County ordinary providing the main feature, with a rise to 59s. Charing Cross ordinary gained 1/16 at 45s. 9d. The other fluctuations are smaller. Dealers in this market are large buyers of the best-class debenture stocks. London Power 5 per cent. debenture has strengthened to 97, which is 1 premium above the issue price. A full six months' interest becomes payable in October.

In spite of the ever-growing inquiry for good industrials—capital must seek employment in Stock Exchange securities if trade is too stagnant to absorb it—cable issues are somewhat neglected. Prices in the Eastern quartette remain steady, but are practically unchanged, nor have they moved to any quotable extent during the excitements of this month. The Cuba Submarine Telegraph has declared its regular dividend of 5 per cent. tax free, and the shares are about 6¾ middle. Great Northerns weakened on the reduction of 2 per cent., to 20 per cent., in the dividend, and Indo-Europeans are ex 37s. 6d. dividend, at 45½. An extraordinary meeting of the Marconi's Wireless Telegraph Company will be held next Monday in order to alter the articles of association. Negotiations with the Postmaster-General for a licence for the conduct of telegraph service between Great Britain and foreign countries have been brought to a satisfactory conclusion. Not more than 25 per cent. of the company's capital may be held in foreign hands, and special forms of transfer-deeds will be required to ensure this end. The Egyptian Government has granted the company a thirty-year concession.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924	1925.	Price May 25 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	55/9	—	4 16 0
Brompton Ordinary	1	10	10	31/9	−9d.	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	+1/16	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	45/9	—	6 11 2
do. do. 6% Pref.	1	6	6	22/-	−6d.	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15		59/6	+3/6	5 0 10
do. do. 6 % Pref.	1	6	6	22/6	+6d.	5 6 8
Edmundson's Ordinary	1	7	7	23/-	−6d.	6 1 9
do. 7% Pref.	1		7	22/6	+6d.	6 4 8
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	5	15	15	13⅜	—	5 11 1
Lancs. Light and Power	1	7½	7½	24/6xd	—	6 2 5
London Electric	1	10	10	32/6	+6d.	6 3 1
do. do. 6% Pref.	5	6	6	5⅜	—	5 11 7
Metropolitan	1	11	11	35/9	—	6 2 10
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/-	—	6 0 0
Newcastle-on-Tyne Ordinary	1	7	7	22/-	+9d.	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16½	—	5 8 6
South London	1	15	15	2⅜	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	7	1 1/16	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	43/3	—	6 18 9
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—	7 13 10
Yorkshire Elec.	1	8	8	27/-	+6d.	5 18 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	68	—	5 17
Metropolitan	,,	5	5	65½	+1	7 12
do. District	,,	3⅜	3⅜	53	+1½	6 12
Underground Electric Ordinary	10	Nil	Nil	3⅜	+¼	Nil
do. do. "A"	1/-	Nil	Nil	11/6	+1/6	Nil
do. do. Income	Bonds	6	6	99	—	*6 1

TELEGRAPHS AND TELEPHONES.

		Dividend. 1924	1925.			
Anglo-Am. Tel. Pref.	Stock	6	6	101½	+½	5 18 3
do. Def.	,,	1½	1½	23⅜	—	6 6 4
Automatic Telephone	1	3	6	2½	+1/16	4 0 0
Chili Telephone	5	6	5	6⅝	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6⅜	—	*7 8 2
Eastern Extension	10	10	10	17½	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17¾	—	*5 12 8
do. do. Pref.	10	6	6	10⅜	—	5 11 7
Great Northern Tel.	10	22	20	28	−1	7 2 10
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi	1	10	10	1⅜	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	42/6	+6d.	*5 13 3
United R. Plate Tel.	5	8	8	7 13/16	−1/16	*5 2 7
Western Telegraph	10	10	10	17½	—	*5 15 11

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	+1/16	8 16 0
do. do. 2nd Pref.	5	6	6	2 1/16	—	11 3 4
do. do. 5% Deb.	Stock	5	5	71½xd	—	6 19 10
British Electric Traction Ord.	,,	6	7	132½	+5	5 5 8
do. do. 6% Pref.	,,	6	6	110	+3	5 12 2
Brazil Traction	100	4	5	93	—	5 7 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	+1	5 17 0
do. do. Preferred	,,	96/-	126/9	109½	+4	*5 16 0
do. do. Deferred	,,	129/5	8	132	+6	*6 1 3
do. do. Deb.	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	49	+1	8 3 4
Mexico Trams, 5% Bonds	—	5	5	65½	+2	7 12 6
Mexican Light Common	100	Nil	Nil	32½	+2	Nil
do. Pref.	100	Nil	Nil	73½	−2	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	52/-	+8/-	*5 0 0
British Aluminium Ord.	1	5	10	2⅜	+1/16	5 0 0
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3 3/16	+1/16	4 14 1
Brush Ord.	1	10	10	27/-	+1/9	7 5 6
Callenders	1	15	15	4	+¼	3 15 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	—	4 17 0
do. 5% Deb.	Stock	5	5	83	+½	6 0 6
Electric Construction	1	10	10	33/6	+1/6	6 8 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	+9d.	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	29/9	+9d.	5 0 10
Henley	1	15	16	3¾	+½	4 2 9
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	3	+1/16	5 16 9
Met.-Vickers Ord.	1	8	8	25/-	+2/-	6 8 0
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	30/6	—	4 18 4
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

The Ruths Steam Accumulator.

An Interesting Development with Important Possibilities.

By ALFRED J. T. TAYLOR.

(Abstract of Paper read before the INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.)

AT the Wembley World Power Conference, Dr. Johannes Ruths presented a paper on his steam accumulator, the importance of which was referred to in six other World Power Conference papers by European engineers. The system designed by Dr. Ruths had, up to that time, been the subject of over 200 technical articles in foreign languages, and been applied beneficially in 17 distinct lines of manufacture. The accumulator had been definitely out of the experimental stage for over four years, yet in July, 1924, there was only one Ruths accumulator in the British Empire and only two others in the rest of the English-speaking world. Not a single technical paper in the English language had dealt comprehensively with Dr. Ruths' inventions, which I believe to be the most far-reaching in the field of industrial steam engineering during the past 15 years.

English-speaking engineers, familiar with the limitations of prior developments of steam storage, have felt until recently that the work being done in Scandinavia and on the Continent along these lines was but a variant of work previously done here, and, therefore, suffered from similar limitations. It is partly as a result of this attitude that the entire English-speaking world has been about three years late in grasping the significance of the Ruths system, which has already been applied in more than 200 industrial plants.

The effect that variations in the consumption of steam, or power, exercise on the working methods and overall efficiency of our industrial plants, often much greater than is generally known, has been accepted as unavoidable; and attempts have been made to counteract their effects by providing greater flexibility in the firing apparatus.

All firing equipment has a certain time lag in responding to changes in load conditions, and during this period the operating efficiency falls off. There is one definite point in the output of steam for each boiler when the overall efficiency of the unit is at the maximum.

The Ruths accumulator is based on the principle of storing in a large quantity of water under pressure and at saturation temperature the heat energy of steam, and releasing this energy in the form of steam under decreasing pressure. It will accommodate wide fluctuations in steam demand over periods of hours if necessary, and is, in fact, the flywheel of the boiler plant. For example, if a pressure of 400 lb. in a boiler is lowered to, say, 350 lb., 0.8 lb. of steam will be obtained from each cubic foot of water. The accumulator can be arranged to work at much lower pressures, say, between 60 and 10 lb.; for this pressure range the storage capacity is 4.2 lb. of steam per cubic foot of water. Thus, for the same pressure drop of 50 lb. the storage capacity of the accumulator may be five times larger than in the modern boiler for the same quantity of water. In addition, the boiler in this example has to be built to withstand 400 lb. pressure, but the accumulator only 60 lb. Steam storage capacity in an accumulator can, therefore, be obtained much more cheaply than in a boiler, which should be built only for the purpose of generating steam at a constant rate, and all superfluous water space should be arranged for in a separate receptacle, built for a lower pressure, in which much wider pressure fluctuations may be allowed than in the boiler. It is significant that Dr. Frederick Münzinger in his paper before the World Power Conference on "High-Pressure Boilers" writes:—"One can see, according to our present knowledge, that in many cases the economical use of high-pressure steam in stations with high peaks could probably only be made possible by the installation of such accumulators."

The accumulator is built in the form of a cylindrical steel tank with hemispherical ends. Its volume is so large in comparison with its exterior surface that insulation 3 to 4 inches in thickness is sufficient to reduce the heat loss to a negligible amount. It is usually installed in the open air and consists of two parts: the accumulator proper and the automatic valves which control the co-operation of the boilers and the accumulator, and also govern the steam distribution throughout the whole works (fig. 1). The tank A is filled about 90 per cent. full of water. Over this is a covering B of non-conducting material, with insulation blocks C covering the riveted seams of the shell, easily removable for the inspection of the seams; this lagging is protected by a light sheet-iron cover D. The non-return valve E admits charging steam to the internal steam-distribution pipe F and the charging nozzles G, which are equipped with circulation pipes H to ensure uniform and noiseless heating of the water. Through a non-return valve I the discharge of steam takes place; a de Laval nozzle K limits (in case of emergency, such as a rupture in the steam piping) the maximum discharge of steam from the accumulator to an amount which will not allow priming. A water column L and feed valves M are provided for reading and adjusting the water level in the accumulator.

Condensation of steam in the accumulator, due to radiation losses, tends to increase the average water level, but the fact that the accumulator is charged with steam of higher pressure and higher heat content and discharges steam at lower pressure, *i.e.*, that it is consequently discharging more steam than it is taking in, counterbalances the condensation so well that a readjustment of the water level is seldom required.

The capacity of an accumulator for a given plant is determined by the magnitude of the fluctuations of the steam consumption only, and not by the capacity of the boiler plant. Suppose the accumulator is connected between two pipe lines carrying pressures of 150 and 50 lb. per square inch respectively; one cubic foot of water can store 4.2 lb. of steam; therefore, if a storage capacity of 25,000 lb. of steam is desired, and 90 per cent. of the accumulator volume is occupied by water, the volume of the accumulator will be $25{,}000/4.2 \times 0.9 = 6{,}613$ cu. ft. Steam accumulators have been built in sizes of from 200 to 13,000 cu. ft. volume, and one mill installation has a total volume of 37,000 cu. ft. with a capacity of 150,000 lb. of steam; it is sub-divided into three separate tanks. The total volume of all Ruths accumulators now in operation, or under erection, is 960,000 cu. ft., with a total capacity of about 3,700,000 lb. of steam and a water weight of about 56 000,000 lb.

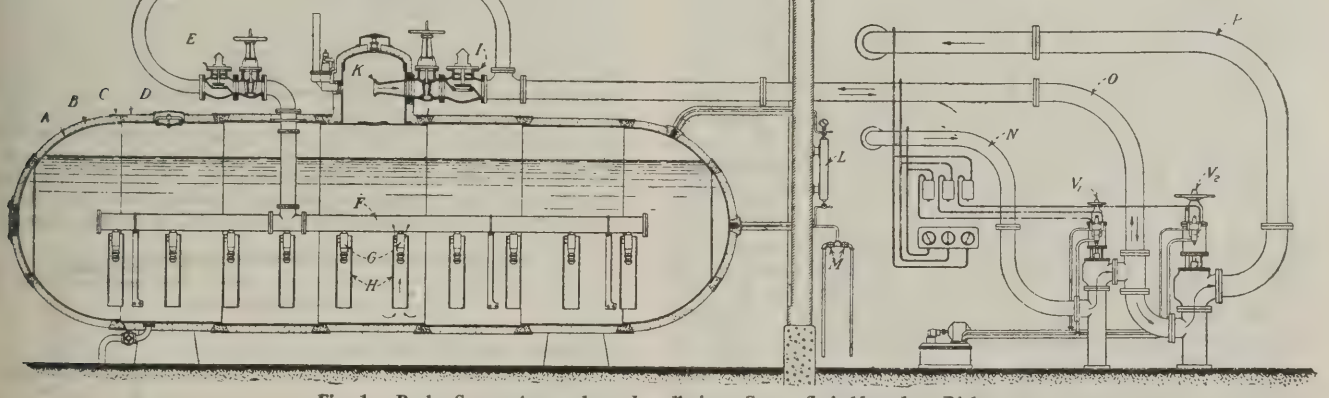


Fig. 1.—Ruths Steam Accumulator Installation; Steam Switchboard on Right.

Of the greatest importance for the proper functioning of the system is the regulating equipment (the steam switchboard). The accumulator must be connected between high- and low-pressure steam lines, and the pressure in the steam header is always kept constant; the accumulator pressure only is allowed to vary. Steam is generated in the boiler house at, for instance, 150 lb. per sq. in. pressure, and reduced by valve RV to 25 lb., fig. 2. Due to a fluctuating steam demand, the boiler pressure cannot be kept constant; Ruths' theory was to insert an overflow valve OV, which only passes enough steam to maintain a constant pressure in the boiler. In most cases, however, the steam supply through OV and the steam demand through RV are not always equal, and there is a difference in time between them; therefore, an accumulator has to be inserted between OV and RV capable of storing enough steam to maintain the balance. If the pressure in the accumulator drops to 25 lb. and there is still demand for

steam in excess of the supply from the boilers, the low pressure will drop below 25 lb. To prevent this, a reducing valve RV is connected in parallel with OV, to by-pass sufficient steam to maintain the low pressure regardless of the condition of OV. Often the accumulator is built for a lower pressure than that of the boiler (for instance, for 125 lb.), in which case a valve MV is required to protect the accumulator from being overcharged, and by using these four valves an absolute balance and constant pressure are maintained, except under extreme conditions beyond the range for which the particular plant has been designed.

In practice the arrangement has been improved by combining in a single valve all the functions of valves OV, RV, and MV. In fig. 1, valve V_1 is connected to the boiler main N, and is controlled by the boiler pressure in such a way as to maintain it constant; that is, the valve acts as an overflow for the boiler, being set for a pressure slightly lower than the safety valves. The popping of the safety valves on the boilers will always be prevented, and when steam is generated in excess of the pressure for which the valve is adjusted it will automatically pass through this valve into the accumulator

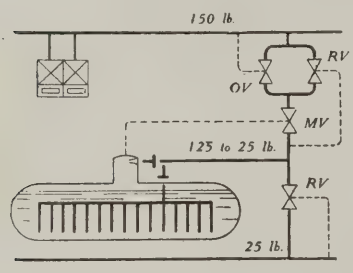


Fig. 2.—System of Automatic Valve Control.

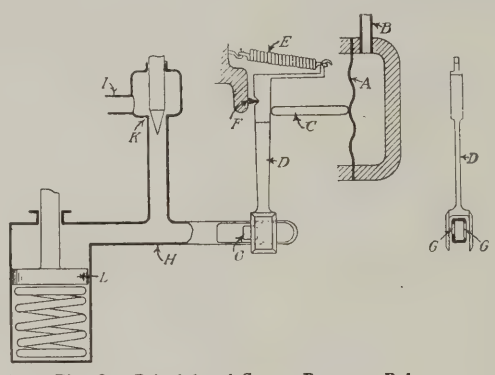


Fig. 3.—Principle of Steam Pressure Relay.

line O. A reducing valve V_2 maintains a constant pressure in line P leading to the steam consumers. According to whether at a given moment more or less steam is passed through valve V_1 than through valve V_2, the accumulator will be charged or discharged. If the accumulator should happen to be charged up to its maximum pressure, V_1 will shut off further steam supply to the accumulator; if the accumulator should happen to be completely discharged, V_1 will secure a sufficient supply of steam to the secondary steam line P, despite the fact that the accumulator is discharged.

Correct co-operation of the different functions of these control valves depends on extremely sensitive pressure regulation, and the principle of the relay developed is shown in fig. 3. The motion of the steel diaphragm A, which is exposed to the steam pressure admitted through pipe B, is transmitted by rod C to the lever D, which is held by spring E against edge F. The lower fork-shaped end of lever D covers, more or less, two opposite orifices G in the oil pipe H. Oil is supplied by a small motor-driven pump under constant pressure through pipe I, and is throttled at K. A small movement of A is magnified about 50 times by D; this changes the size of the two orifices G, and hence the pressure in H, resulting in a certain movement of the spring-loaded piston L which is used to control, by means of a pilot valve, the supply of pressure oil to a servo-motor actuating the regulating valve, which is equipped also with the return motion required for stability of regulation. These valves can be adjusted to regulate any steam pressure, and to keep it constant within a range of less than one pound. The time required for opening and closing may be regulated between one-fifth of a second and 60 seconds. Further, these valves may be closed instantaneously by relieving the oil pressure and then operating the hand wheel on the top of the valve. All moving parts work in a closed oil system, so that wear and need for attendance are practically negligible.

The most important advantage, and the one most difficult to appraise, is the beneficial effect of the system upon the quantity and quality of production. Just as constant voltage is an indispensable requirement in an electrical system, so constant steam-pressure and temperature are indispensable for uninterrupted production and uniform quality in the goods produced. The fact that boiler efficiency during actual operation never equals test results has been confirmed by an increased efficiency in plant equipped with accumulators; the boilers may operate continuously under the most favourable test conditions, and savings in fuel of from 10 to 30 per cent. have been made. Forcing the boilers will be avoided, brickwork and boiler will be kept at an even temperature and relieved of the constant expansion and contraction which acompany a fluctuating load, which will reduce the upkeep cost.

Since the operation of the accumulator installation is entirely automatic, and the operation of the boiler house and power plant is greatly simplified, a saving in labour operation costs will result. Both the capital and operating costs of a new steam-power plant will be considerably reduced, and if an accumulator is installed in an existing plant other savings will pay for the installation in a short time.

Typical installations may be mentioned to indicate some of the advantages of installing a steam accumulator: In the case of a textile mill, the shortening of the time necessary to heat the dyeing kettles resulted in an increased output of not less than 10 per cent.; also the quality of the product was improved, and it was possible to increase the output of the steam engines from 650 to 800 kW, which meant a reduction in purchased power of 150 kW.

The influence of an accumulator on the size and capacity of the boiler plant and on the generation of power from process steam is shown in the case of a cane-sugar refinery: The provision of a 700-h.p. boiler to cope with the peak loads was obviated, and the cost thus saved will pay for the entire accumulator system; the insufficiency of process steam at times and an excess at other times are obviated, thus giving the turbines a constant supply. The saving, as compared with hydro-electric power previously used, amounts to £16,000 per year, and the cost of generating power by process steam amounts to only 6 per cent. of the total fuel cost, plus depreciation and upkeep of the necessary equipment.

In the case of industries which chiefly consume steam, using little or none for process work, such as iron and steel works, the accumulator has to store steam and deliver it to the turbines at peak times, but it is dry saturated steam, whereas it is desirable that it should be superheated. Therefore, another accumulator is added for storing superheat, working on the same principle as the well-known Siemens regenerative heater.

The following example shows how an accumulator system can be designed to suit the most diverse requirements:—The municipal electric power plant at Malmö, Sweden, purchases hydro-electric power which is delivered over a long transmission line. Due to frequent disturbances, a stand-by was required capable of carrying at least the electric load for lighting and street railways. For this purpose a large lead storage battery was installed originally, and some of the boilers in the steam plant were always kept under pressure. So as to save the cost of keeping the boilers under pressure, a Ruths steam accumulator was installed, as shown diagrammatically in fig. 4.

Two accumulators of 8,000 cubic feet volume each, with a capacity (together) of 80,000 lb. of steam, on a pressure drop of from 114 to 28 lb. per sq. in., are kept under pressure, the cooling losses being taken care of by a small electric boiler. Further, a specially designed condensing steam turbo-generator of 3,750 kW has been installed. The generator end of this set normally runs as a synchronous condenser, but as soon as a break occurs in the supply of hydro-electric power, the speed governor on the turbine opens valve V_2, admitting steam from the accumulator to the turbine. The load will thus be instantly carried by the turbine, and no disturbances will be felt in the supply of electrical energy for lighting and street cars. In order to maintain the highest efficiency on the turbine, the steam from the accumulator is passed through the first stage until the pressure drops to 67 lb. per sq. in., at which pressure

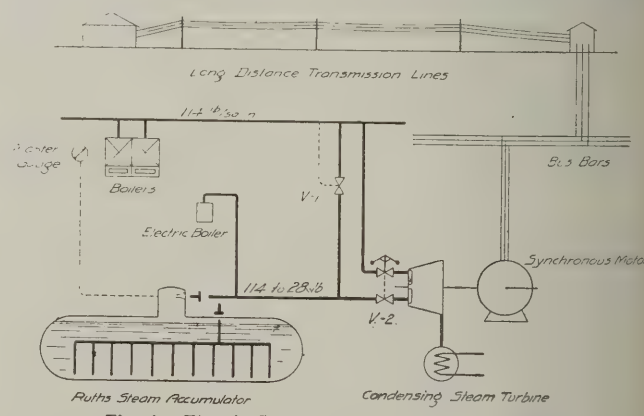


Fig. 4.—Electric Stand-by Plant at Malmö, Sweden.

the steam is by-passed the first stage, and enters the second stage direct until the pressure drops to 42 lb., when it enters the low-pressure stage direct. The accumulator installation is big enough to furnish steam to the turbine for one hour, developing about 3,000 kW, which is sufficient time for the boilers to be started; as soon as the pressure has been raised, the boilers will supply the turbine until the hydro-electric supply is restored, when the boilers recharge the accumulator through valve V_1 and are then shut down again. The installation has been so successful that another municipal power station in Sweden has built a plant of the same type, and other authorities contemplate similar stand-by arrangements.

We know how to produce cheap steam; coal is being burned in powdered form with a monthly efficiency of 92 per cent. The next step will be the carbonisation of coal before it is burned, but it is not sufficient merely to produce cheap steam, for it is in economy in the use of steam after it is produced that the greatest savings in industry will be effected. This is the largest field for the accumulator, and its development is intimately bound up with the study of exhaust steam engineering.

The paper concludes with a bibliography of the subject and a detailed list of the 217 accumulator installations that have been ordered since 1916. The largest has a steam capacity of 100,600 lb. and the smallest 77 lb., most of which are, or will be, used in Europe. There are four installations in Canada, three in Scotland, and one each in Newfoundland, the U.S.A., and Brazil. Practically all industries are using accumulators, in addition to such establishments as a hospital, a university, printing offices, &c., and the ten installations ordered for use in electric power stations will have a total steam capacity of 628,500 lb.

Empire Wireless Communication.

An Outline of the Progress Achieved Since the War.

By W. H. ECCLES, D.Sc., F.R.S., M.R.I., M.I.E.E.

(*Abstract of discourse before the* ROYAL INSTITUTION OF GREAT BRITAIN.)

THE British Empire is a medley of fragments spread as if by blind chance over the habitable portions of the globe. For so dispersed a family the problem of telegraphic communication is important and difficult. Quite early in the development of wireless telegraphy the principal nations began to regulate its employment. Indeed, control was compelled, in the armed camp that Europe then was, by the consideration that, when war came, wireless would be useful to fleets and armies and dangerous in the hands of spies. In peace time even some degree of control was called for to reduce interference, especially between powerful long-range stations. Each such station ought, in fact, to transmit on a different wavelength from other stations; and once a wavelength is assigned to a particular long-range station, it should not be given to any other. In other words, the grant of a wavelength to a powerful station is equivalent to giving a right-of-way to that station. For all these reasons the Imperial Conference of 1911 declared that wireless communication within the Empire should always be regulated with especial care, and that, in the main, the necessary stations should be State-owned and State-operated.

In contrast with our inaction, the United States pressed on with the construction of several large Government stations, and France and Germany made great progress with their respective Colonial plans.

Germany had made great strides with her Colonial communications between 1912 and 1914. She had established thoroughly modern stations in Togoland, in German East Africa, in German South-West Africa, and in the Pacific. The three African stations could intercommunicate with one another, and, to a limited extent, with the great station at Nauen, near Berlin; the Pacific station was at Yap in the Caroline Islands. It was a noteworthy coincidence that all these stations were completed just before the war began. I remember hearing the early trial signals from Yap while I was sailing across the Pacific in July, 1914, and it may be of interest to recall the fate of the station, which I remember because I was called from Sydney to Melbourne by the Australian Government to help in an advisory way with an interesting application of wireless. At that time the German fleet was cruising to the north of Australia and was in nightly touch with Yap. As soon as this was observed each of the small shore stations along the Australian coast was instructed to listen for the signals of the German fleet, to record the strength with which the signals were received, and to report daily to Melbourne. From the reports, by a process resembling triangulation, an estimate was made in Melbourne of the changes of position of the German fleet. Meanwhile an Australian naval force left Sydney with the object of destroying the wireless station at Yap, which was duly accomplished, and for days afterwards the German fleet, unaware of the disaster, continued to call the dead station, in vain. The continued calls, by helping us to keep track of the fleet, eased the anxiety of those who knew that the New Zealand expedition was then well on its way to capture Samoa.

The war closed without any progress in Imperial wireless; the Governments of the British Empire, at the close of the war, possessed only one large station among them—that at Windhuk in German South-West Africa—captured by the forces of the Union of South Africa under General Smuts. Thus at the end of 1918 the Empire was far behind most other great Powers as regards Government-owned stations, and, by the way, equally far behind as regards powerful commercial stations.

Within a year of the conclusion of the war, Lord Milner appointed a Committee, under the chairmanship of Sir Henry Norman, to investigate afresh the problem of establishing a comprehensive wireless network. The Committee's report was, clearly, somewhat ahead of its time, but not, I think, too far ahead, for only five years later the Post Office station at Rugby* has been built with thermionic valves yielding double the output recommended by the Committee. The Rugby station, besides, has shown what the Norman Committee's stations could have done. The station is full of novel features, and includes apparatus for transatlantic telephony.

* See ELEC. REV., April 23rd, 1926.

The ultimate aim of this experiment is to connect any telephone subscriber in this country to any subscriber in the United States and Canada. By aid of the telephone circuits already constructed between England and the Continent it may be found possible later to connect anyone in Western Europe to anyone in North America through Rugby. The Rugby station when in full swing will probably be able to transmit simultaneously three long-distance telegrams and a telephone message.

When one realises that this multiple service station has cost only about half what the single service station near Bordeaux (France) cost in 1919, one appreciates the great strides that wireless design has made during the past few years. Rugby, in fact, has cost about £400,000, much less than even the new stations at St. Assise, near Paris, and on Long Island, near New York. Further, as the Leafield station began to earn within a year of its opening more than covered its working expenses, so we may reasonably look forward to the Rugby station soon becoming a profit-earning concern.

The telegraphic traffic to and from the centre of the Empire will be greater than that to and from any of the Dominions, for the spokes all meet at the hub of the wheel. Therefore Britain must make much greater provision than even the largest Dominion, perhaps tenfold. The English "beam" stations for communicating with four Dominions will cost altogether about half as much as Rugby. For this expenditure good communication is guaranteed for a daily average of 18 hours with Canada, 7 hours with Australia, 11 hours with South Africa, and 12 hours with India. We only know enough so say that both systems will be useful, and that each can do something the other cannot.

Before the end of this year the long-range wireless transmitting equipment of the Empire will include—

(1) The multiple station at Rugby, comprising:—
  (*a*) Long-wave plant of world-wide range.
  (*b*) Long-wave plant of medium range.
  (*c*) Short-wave plant of world-wide range.
  (*d*) An experimental telephony plant of range 4,000 miles.
(2) Medium-power stations for long and short waves at Leafield (Oxfordshire) and at Abu Zabal (Egypt).
(3) Four "beam" circuits for communication between England and the four largest Dominions.

Thus the Empire will shortly possess the most up-to-date wireless equipment in the world, and preparations ought to be made to utilise fully the new facilities. For instance, twice a day Rugby transmits a summary of news prepared by the Foreign Office, and conceivably other news services may be arranged. If I were a settler in Uganda, or the owner of a remote sheep station in Australia, I should install a simple receiving set and so keep in touch with the world, but this implies learning the Morse code, and therefore in small communities where there is a local news sheet it would be more practical to organise a receiving service by paying an operator to listen regularly and decode the messages for the printer. In the Empire there are innumerable remote settlements to which the cabled news messages leak very slowly, and there are many which depend entirely for their news on the occasional visit of a ship. All such outposts can now, by aid of a simple receiving set, be made to feel that they are within five minutes of Fleet Street. Moreover, if these stations were registered messages could be specially addressed to them from England just as telegrams are going from Rugby to-day to ships on distant oceans.

Another method of distributing the Morse messages from home when received, say, in New Zealand, is to announce them, after decoding, through the local broadcasting stations. I refrain from prophecy, and am now speaking of what can certainly be accomplished to-day by mere organisation of existing facilities.

A Hydro-Electric Governor.—Some particulars are given in the *Imperial Industrial Review* of the Cox-Walker hydro-electric governor produced by Messrs. Cox-Walker & Partners. The operating element of this apparatus consists of a special balanced beam (used with the Taylor Scotson pressure regulator) maintained in a horizontal position by means of pilot solenoids, adjusted to the desired voltage. The slightest movement of the beam due to voltage variation closes special non-sparking contacts (provided on each side of the solenoids), which also close in turn one of two relays and the circuit of a small motor. The motor starts up in a direction depending on which relay is operated, and brings into action a series of contacts which cut in or out a number of resistance units, thus adding or deducting artificial load as the actual load varies. The beam is claimed to be sufficiently sensitive to maintain a pressure accuracy of 1 per cent., although in order to limit the number of contacts required, 2½ per cent. is the figure usually adopted. The artificial load may, of course, be put to some useful purpose. A suggestion is that the load be used for central heating, a suitable heater being designed with a number of elements which may be cut in or out. The system also includes a device which, in the event of a sudden drop of load, for instance, a break in a loaded transmission line, trips the breakers and short-circuits the generators' fields. An equipment of this description controls the hydro-electric supply of the Coniston Electric Light Co., Lake District, no mechanical governor being provided on the 40-h.p. Pelton-wheel turbine.

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 760.)

On May 18th Standing Committee C of the House of Commons resumed consideration of the Electricity (Supply) Bill. Sir Robert Sanders presided.

Discussion was continued on Clause 1, which proposes the constitution of a Central Electricity Board, consisting of a chairman and seven other members appointed by the Minister of Transport.

Mr. G. Balfour (Hampstead, U.) moved an amendment to provide for the appointment of the Board by "the Lord Chancellor, after consultation with the Association of British Chambers of Commerce, the Association of Municipal Corporations, the Incorporated Association of Electric Power Companies, and the Provincial Electric Supply Committee," instead of by the Minister of Transport. Mr. Balfour said that this form of words would ensure the appointment of an absolutely impartial body, free from any taint of being influenced by the companies, corporations, or any particular manufacturing or trade interest.

Sir D. Hogg, the Attorney-General, in resisting the amendment, said that the Government could not agree to the appointment of the Board by the Lord Chancellor instead of the Minister of Transport. Under the 1919 Act electricity was specifically assigned to the Minister of Transport as his particular subject. The appointment of such a Board had nothing whatever to do with the Lord Chancellor. The list of bodies mentioned with regard to consultation was not the most exhaustive that might be chosen. He imagined that Labour would want to be consulted in the matter. There was an amendment, standing in the name of Sir Philip Dawson and Mr. Hannon, to provide that the Board should be appointed by the Minister of Transport after consultation with representatives of local government, electricity, commerce, industry, transport and labour. When that amendment was reached he proposed to ask the Committee to accept it. The Government agreed that it would be helpful that there should be some sort of consultation before the appointment of the Board.

Mr. Hardie (Glasgow, Springburn, Lab.), in opposing the amendment, alleged that its proposals showed that Mr. Balfour and his friends were not caring so much for the national interests as that certain private interests should be represented on the Board. He feared that the technical side of the Board would be subordinated to the commercial side.

Sir Philip Dawson (Lewisham, W., U.) said that under the amendment, somebody who knew nothing at all about electricity would be the person to appoint the members of this most important Board. If this Board were purely a judicial body, if it were a court of arbitration which he understood the Attorney-General had said would be appointed with regard to appeals, then he could understand the suggestion that the Lord Chancellor should make these appointments. But the Bill was intended to improve the very bad conditions of electricity supply in this country, and if those conditions were to be improved then those who knew most about the supply of electricity and who had devoted a great deal of time and trouble to it, that was to say, the Minister of Transport should have the appointment of the gentlemen who would form the administrative body. For that reason, he thought the suggestion that the Lord Chancellor should appoint the Board was not satisfactory. It was quite untrue to say that the Electricity Commissioners had been the creatures of the Minister of Transport.

Major Glyn (Abingdon, U.), who also opposed the amendment, caused much laughter by declaring that Mr. Balfour did not appear to trouble whether the Archbishop of Canterbury or the Chief Rabbi appointed the Board, so long as the Minister of Transport did not make the appointment.

Eventually Mr. Balfour's amendment was withdrawn.

Sir Philip Dawson's amendment, providing that the Minister of Transport should appoint the Board "after consultation with such representatives or bodies representative of the following interests as the Minister thinks fit, that is to say, local government, electricity, commerce, industry, transport and labour," was then considered.

Mr. A. Hopkinson (Mossley, Ind.) appealed to the Committee to do away with "eye-wash about Labour," who were the least capable of running such a Board, and who knew nothing about the matter. This view, however, was not shared by the other members of the Committee.

Sir D. Newton (Cambridge, U.) was anxious as to whether the adoption of the amendment would ensure adequate representation for the municipal corporations. He pointed out that the evidence given before the Weir Committee showed that 248 generating stations were owned by local authorities, as were 278 authorised undertakings to supply power. Local authorities had no less capital than £103,000,000 invested in the electricity business.

Mr. Looker (Essex, S.E., U.) asked whether the Minister of Transport would consult representatives of the gas companies in the appointment of members of the Board? Representations had been made to him from gas interests in his constituency. There could be no doubt that the gas companies had rendered inestimable services to the community in the past, and they were apprehensive that those services might be affected by the provisions of the Bill. The gas interests were capable of giving extremely valuable co-operation and assistance; they were not opposed to the Bill, but were only too anxious to co-operate and assist.

Col. Ashley, the Minister of Transport, said that he had already on several occasions had interviews with and communications from the representatives of the gas industry, and he had found them very reasonable and not disinclined to help. In the amendment the words "commerce and industry" were included, and that would enable him to consult with the representatives of the gas industry. He certainly would consult with those representatives.

Mr. Lamb (Stone, U.) hoped that the interests of agriculture would not be neglected. Agriculture was vitally interested in the Bill. Agriculturists would become large consumers of electricity, and the main transmission lines would have to be laid largely over agricultural property.

Col. Ashley said that he could consult with anybody; the amendment did not exclude that; it simply said that he should consult with certain interests.

Mr. Clayton (Widnes, U.) feared that the amendment would lead to the appointment of delegates from the various interests consulted. It would be much better to leave the Minister free to consult whom he liked.

Mr. E. Harmsworth (Thanet, U.) also feared that the Board might become a debating society, incapable of executive action.

The amendment was, however, carried.

Mr. A. Alexander (Sheffield, Hillsborough, Lab.) moved:—"A person shall be disqualified from being appointed or being chairman or a member of the Board, if he has, directly or indirectly, any share or interest in any undertaking for the supply of electricity, or any undertaking for the manufacture or sale of machinery, or plant, or materials for the generation or transmission of electricity, other than as a ratepayer in the case of an undertaking of a local authority." He explained that his object was to obtain absolutely impartial treatment by the Board.

Col. Ashley said that the Government could not accept the amendment, which would introduce a very new and very undesirable feature in our public life. If one could not trust gentlemen of distinction, members of the Board, to carry on the commercial activities of that Board without partiality simply because they might have a few hundred pounds invested in some electricity undertaking, then one had better put up the shutters on the old country.

In the discussion which followed, Sir G. Hume (Greenwich, U.) said that the men to be appointed on the Board would be those who were in close contact, either commercial or industrial, with electricity. If the amendment were drawn on the lines that, a member having been appointed, should dissociate himself from anything that would affect his judgment in the work he had to carry out, then that would be another matter, and might well be supported. But to expect an individual to dissociate himself from every one of his activities in life before he was appointed to the Board was quite unreasonable.

Some other Unionist members took this view, and Mr. R. Hudson (Whitehaven, U.) suggested that the amendment might be withdrawn, and a new clause, embodying the principle of the amendment, might be moved on the report stage of the Bill.

Mr. R. G. Ellis (Wakefield, U.) while not opposed to the principle of the amendment, pointed out that it would make a very drastic cut of all those interested technically in electricity, and its passage would make it exceedingly difficult to appoint a Board. He thought that, if the amendment were withdrawn, it would be possible to devise some form of words to prevent any suspicion of corruption.

Sir D. Hogg, however, said that he could not give any undertaking in the matter on behalf of the Government.

The amendment was rejected by 33 votes to 14, and the Committee adjourned.

On the proceedings being continued on May 20th, Mr. Attlee (Limehouse, Lab.) moved that "a person shall be disqualified from being appointed chairman or a member of the Board so long as he is a member of either House of Parliament." He maintained that this disqualification was necessary in order that members should be absolutely independent. Otherwise, there might be a return to the evil days of the 18th century in which the Government could command an obedient body of henchmen in Parliament.

Sir D. Hogg said he could not possibly accept the amendment. He could conceive no valid reason why, because a man happened to be a Peer and therefore, whether he liked it or not, a member of the House of Lords, he should be disqualified from taking any part in the management of the Board. With regard to members of the House of Commons, a different question was involved. He had himself put down for consideration later a proposal to add words which would allow members of the Board to be members of the House of Commons. He had done so advisedly, because he felt that, although the question of profit under the Crown was not an easy one to decide on, it was probable that the existing qualifications would be wide enough to prevent a member of the House of Commons who held an office of profit under the Crown from accepting office on the Board unless words were inserted permitting him to do so. The important question of principle

whether members of the House of Commons should be eligible could properly be decided by the Committee without any pressure from the Government.

Mr. ATTLEE thereupon amended his amendment so as to disqualify only members of the House of Commons.

Sir D. HOGG then urged that it was undesirable to fetter the choice of the Ministry of Transport in setting up the Board by excluding members of the House of Commons. It was a mistake to think that when the scheme was started, the Board was going to have such a tremendous amount of work put upon it as some members of the Committee seemed to think. Once the Board began to function, the work of its members—the chairman might be in a different position—would not be very arduous. It would be work of supervision, analogous to that of a board of directors. He did not think anyone could hold that there was any substantial danger of members of Parliament being seduced from their independence by appointment to the Board.

Mr. HANNON (Moseley, U.) agreed that it would be a great mistake to impose a condition that might exclude from the Board men of high business ability and experience.

Sir F. HALL (Dulwich, U.), however, supported the amendment, pointing out that members of the Board could be drawn from the whole financial, commercial, and industrial world.

Mr. G. BALFOUR (Hampstead, U.) also thought it undesirable that M.P.'s should be members of the Board.

Lord ELVEDEN (Southend-on-Sea, U.), on the other hand, thought that, in the interests of fair play and good management, some members of the Board should be members of the House of Commons.

After further debate, the amendment to exclude M.P.'s from membership of the Board was carried by forty votes to eight.

Mr. A. ALEXANDER (Sheffield, Hillsborough, Lab.) moved the following amendment, which was accepted by the Attorney-General, and agreed to:—"The chairman of the Board and any member of the Board who is, by the terms of his appointment, required to devote the whole of his time to the performance of his duties under this Act, shall within three months after his appointment sell any securities which he may hold for his own benefit in any company carrying on the business of supplying electricity or the manufacture or sale of machinery or plant for the generation and transmission of electricity. It shall not be lawful for the chairman or any such member of the Board whilst he holds office to purchase for his own benefit any securities in any such company, and if the chairman or any such member of the Board, under any will or succession, becomes entitled for his own benefit to any securities in any such company, he shall sell them within three months after he has so become entitled thereto. Any member of the Board who, by the terms of his appointment, is not required to devote the whole of his time to the performance of his duties under this Act shall, if he is interested in any company with which the Board has or proposes to make any contract, disclose to the Board the fact and nature of his interest, and shall take no part in the deliberations or decisions of the Board relating to such contract, and such disclosure shall be forthwith recorded in the minutes of the Board."

Mr. BALFOUR withdrew an amendment to delete from the clause the provision that the Board should be a body corporate with power to hold land without licence in mortmain.

Sir D. HOGG explained that the Board could not build transmission lines without this sanction.

Mr. LANSBURY (Bow and Bromley, Lab.) moved an amendment to provide that the chairman of the Board, instead of holding office for not less than five years, should hold office "during his Majesty's pleasure."

Sir D. HOGG, in resisting the amendment, said that it would mean that the chairman and the members would be liable to dismissal without notice in the event of a change of Government.

Mr. LANSBURY said his object was to ensure that if a chairman proved unsuitable he could be replaced without waiting for five years.

Sir D. HOGG replied that in the event of misconduct a chairman would be in much the same position as a managing director.

The amendment was negatived.

On an amendment to make the period of office of a member of the Board not less than seven years instead of not less than five years, Sir D. HOGG said that, in order to remove any fears that might exist as to the possibility that at the end of five years, if there was a general election, they would have to have a new Board, he would introduce into the Bill a provision for a maximum period of office of ten years. The effect of this would be that there eventually would be a graduated period of office and they would thus constantly be having fresh blood on the Board.

Sir D. Hogg's amendment to make the period of office not less than five and not more than ten years was then agreed to.

Mr. GRANT (Derby, S., U.) moved an amendment to ensure that the salaries, &c., of the chairman and members of the Board should be under the control of the Treasury instead of being determined by the Ministry of Transport, but Col. ASHLEY pointed out that the Treasury did not desire control, as that would mean that the Board would be a State service, which they did not want. It was to be an independent Board, carrying on its own affairs, and Government control was provided by the fact that the Ministry of Transport was responsible to and subject to the criticisms of the House of Commons.

The amendment was negatived, and Clause 1, as amended, was added to the Bill.

The Committee then adjourned until Thursday, June 3rd.

(To be continued.)

The Electric Propulsion of Ships.

The Equipment of a 17,000-h.p. Twin-screw Passenger-cargo Liner.

(Abstract of a discussion before the NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.)

THE following is an abstract of the discussion on Mr. Eskil Berg's paper on the above subject, which was abstracted in our issue of February 26th, 1926.

MR. STANLEY S. COOK thought there must be some special reasons to account for the fact that electric propulsion had made more headway in the United States than in this country; no doubt it was due to its adoption by the U.S. Navy, but it certainly did not appear to be entirely on the score of economy, as far better results had been obtained with geared-turbine warships, even in the United States. The author based his case on a statement of disadvantages of the geared turbine installation, which was misleading and incorrect. What was the complication of a few fixed steam pipes when compared with the control system and elaborate switchgear which were necessary in an electrical installation? For the new liner of 17,000 s.h.p. which was being built for the International Mercantile Marine, the steam consumption expected was to be 0.85 lb. of oil per s.h.p., but in some recent Orient liners of about the same power fitted with mechanically-geared turbines better results than this had already been obtained; for example, the *Orama*, which was built two years ago, consumed 0.785 lb. of oil per s.h.p., or nearly 10 per cent. less than the author's figure, and this result had been well maintained in subsequent service. In another of these liners, the oil consumption was 0.82 lb. per s.h.p. without the use of superheat. These installations had three turbines driving each propeller shaft through single-reduction gearing.

MR. E. A. EBORALL said that it was stated that double excitation was applied to the generator at starting, when the propelling motor started up as a pure squirrel-cage induction motor. From this one inferred that the motor had two windings, one squirrel cage for running asynchronously, and the other for excitation. At the moment of starting, the slip of the motor would be 100 per cent., and very heavy wattless rotor currents with reduced starting torque would result. In ordinary practice it was usual in the case of large squirrel-cage motors to start them with reduced terminal voltage obtained from a starting transformer, whereas in the present case, according to Mr. Berg, the stator voltage was increased. At reduced speed would the motors operate synchronously or asynchronously? If the former, then the frequency at which the current was generated must be decreased in the same proportion as the propeller revolutions, *i.e.*, at 13½ knots the turbine speed would be reduced by about 26 per cent., and it was rather surprising that in these circumstances the steam consumption should increase by so small an amount as 0.4 lb. per h.p. hour. Apart from reducing the frequency, speed reduction could be obtained by reducing the terminal voltage and increasing the rotor slip of the motors, keeping the frequency, and hence the turbine speed, constant; however, very heavy rotor currents and bad power factor would result, since the slip at a propeller speed of 90 r.p.m. would be approximately 25 per cent. The conclusion was that the reduction of voltage from 4,000 to 3,000 V to which Mr. Berg referred was merely for reducing the iron losses in the machines, and that it was therefore necessary to decrease the turbine speed for reduced ship speeds, which put electric propulsion on precisely the same basis as the geared-turbine drive in the matter of economy at reduced speeds. In the U.S. battleships the difficulty was got over by arranging the main motors to operate with a 24-pole or 36-pole connection, and speed reduction was obtained without loss of turbine efficiency. Another difficulty was that, when a ship was under helm, the largely-increased load on the inner screw might amount to 50 per cent. at full helm. Presumably, when this condition arose, the motor on the inner shaft pulled out of step and ran asynchronously. The alternator load increased and the turbine governor opened to maintain constant speed. What was there to prevent a severe overload on the alternator? If the machine had to be dimensioned to carry this overload, its weight was increased and efficiency at normal load reduced.

Mr. W. D. Horsley said that care must be taken with the insulation to withstand the atmospheric conditions at sea, by the adoption of a closed ventilating system. A disadvantage of electrical transmission was that a large number of links were introduced between the prime mover and propeller. A simple fault, such as a break in the exciter shunt-field circuit, would shut down the installation. It was not made clear in the paper whether the field rheostat and exciter losses were included in the excitation losses. When operating at the lower speed not only were the iron losses reduced, but also the windage losses; the latter formed a large percentage of the losses. Has the author considered leading the hot air from the generator to the f.d. fan inlet? A certain proportion of the alternator losses would be recovered, but the advantages of the closed-air circuit would be lost. Would one turbo-alternator be of sufficient capacity to start and reverse two motors?

Written Contributions to Discussion.

Mr. P. L. Jones stated that the author's statement that "mechanical gears for large power require a multitude of turbines and pinions" was an exaggeration. In H.M.S. *Hood*, for instance, 150,000 h.p. was arranged on four shafts, there being eight turbine casings altogether, and there were numerous examples of ships developing over 20,000 h.p. on each shaft. The figure given by the author of 300 tons of fuel per day for a 50,000-h.p. installation, including everything on board, might appear very optimistic, but it was possible of attainment in the near future. The author's weights of the main machinery for his 17,000-h.p. turbo-electric scheme were low, but not as low as could be obtained with geared turbines. With single-reduction turbines the weight could easily be brought below 30 lb. per h.p., and with double-reduction considerably lower still. It was difficult to understand how the turbo-electric scheme could be cheaper than geared turbines. The foundations for the turbines and the generator might be less costly than for the geared turbine, but the motors would require a good deal of extra expenditure in structural additions to the after portion of the ship which were not necessary in the geared-turbine scheme. The steam consumption appeared to be rather high.

Mr. C. S. Darling said it was certainly unsafe to neglect the possibilities of such a scheme as that made available by electrification. "Experiments were carried out at the outbreak of the Great War; in fact, we may claim to have made some of the earliest experiments in this line on this river with the *Tynemouth* in 1914," he wrote, and was surprised that Mr. Berg's company proposed to vary the propeller speed by varying the turbine speed, presumably to use commercial windings; but was that economical? The robustness and mechanical construction of the squirrel-cage induction motor caused designers to favour the a.c. system almost solely on this account. In this connection the following scheme did away with the bogey of the a.c. system, *i.e.*, constant speed, and permitted of a greater speed range than was otherwise possible. Assuming one synchronous generator with 10 poles; output 590 kVA (one-hour rating) at 350 r.p.m., 500 volts, 29.2 cycles per second, the efficiency at unity power factor at cos $\phi = 0.80$ would be output 590 kVA, 94 per cent. = 92.5 per cent.; output 360 kVA, 93 per cent. = 92 per cent. Combined with an asynchronous generator mounted on the same shaft with 6 poles, fed on the primary side by the above synchronous generator, and producing on the secondary side in accordance with the sense of rotation a three-phase current of 46.6 or 11.6 cycles per second:—Speed of rotor = 350 r.p.m.; output at 46.6 cycles = 500 kW (one-hour rate); output at 11.6 cycles = 240 kW (one-hour rate). Efficiency at 590 kVA and power factor = 0.92 = 91 per cent. This could be connected to one or more three-phase squirrel-cage motors absorbing the above power at the one-hour rate at 500 volts and at 29.2 cycles per second developing 150 r.p.m. approximately. Corresponding to this and the periodicities available, six speeds could be obtained with the following efficiencies (motors of two-speed pole change-over type with 12 and 24 poles and a single-stator winding) —

Periodicity.	No. Poles.	r.p.m.	Output Per cent.	Efficiency Per cent.	Power Factor.
11.6	24	58	40	87	0.6
11.6	12	117	40	87	0.68
29.2	24	150	100	90	0.84
46.6	24	233	100	90	0.84
29.2	12	292	100	90	0.90
46.6	12	466	100	90	0.90

These motors would be of the totally-enclosed pipe-ventilated type requiring each a cooling air quantity of about 0.2 metre^3 per minute per horse-power, at a pressure of about 50 mm. water column. For the synchronous generator it was necessary to provide an exciter that could have its terminal pressure adjustable from 120 to 270 volts. The exciter would be separately excited at from 30 to 50 volts. A d.c. generator of 30 to 50 volts and 700 amperes would be fitted for generating, exciting, controlling, and lighting current and for a storage battery used for emergency starting of the main engin ; and for normal starting of the d.c. generator.

The control would be effected as follows:—Speed control of motors and reversing by means of pilot control with blow-out drum electrically connected to main controller with remote control gear and interlocked with reverser. Economical speeds with constant prime-mover speed would be not less than six. For every change from a lower to a higher speed, the three-phase voltage would be first reduced by means of a small shunt controller which would directly govern the excitation of the synchronous generator. The master controller would then, by pilot control, be put on next speed notch and voltage again normalised. By this means it was possible to reduce the current rush to a minimum not exceeding normal working current and also to get gradual acceleration, which could be increased by not lowering the voltage of the synchronous generator too far, or by rapidly raising the voltage again.

Author's Reply to Discussion.

The only battleship in the United States Navy with geared turbines was the small *North Dakota*, which was equipped with Parsons turbines and gears made from designs furnished by Parsons in England. While this ship was of only 20,000 tons displacement, as compared with 32,000 tons of the *New Mexico*, it consumed more fuel at all speeds, from the lowest to the highest. This fact might have had something to do with the U.S. Navy's adoption of electric drive for this type of ship. He took exception to Mr. Cook's statement that turbine development showed that the best results were obtained by putting two or more turbines in series. Very large turbines of 50,000 kW and over must be split, but what kind of economy would be obtained from a 5,000-h.p., 1,800-r.p.m. machine built in two or more casings? With regard to the International Mercantile Marine liner, 0.85 lb. of oil included a load of over 1,000 kW on the d.c. generating sets. This ship had a very large refrigerating plant—over 500 h.p. Without refrigeration and the elaborate ventilating system required for the passengers in tropical climates, there would be no difficulty in obtaining as low as 0.788 lb. of oil per shaft-horse-power. On account of the weight, he did not as yet advocate electric drive for destroyers or light cruisers, but if higher frequency than was now used on generators were adopted, the weight might come within reach. The United States Navy was most anxious for electric drive, even for the light cruisers; the great economy at cruising speed was what the Navy desired. The new International Mercantile Marine liner had synchronous motor drive. All manœuvring would be done with the motor acting as a squirrel-cage induction motor, but, as soon as the motor reached synchronous speed, it became a pure synchronous motor. The success of this type of motor was so great, and it had so many advantages, that the General Electric Co. proposed only this type, except where economical cruising speeds were required, as on battleships, where induction motors might work better, although with slightly poorer efficiency. Speed variation by varying the turbine speed was by far the simplest and most efficient method known. There had never been the slightest damage to any of the *New Mexico's* electrical machinery; in fact, all ships built by the General Electric Co. for the Navy had so far given 100 per cent. operation. The mishap to the battleship *Tennessee*, the first electric ship built by the Westinghouse Manufacturing Co., was caused by a bolt or piece of steel getting into a motor and wrecking the winding. The accident had absolutely nothing to do with the salt air. Some of the largest power houses in the world, and a great majority of them, were located near salt water, where the ocean water was used for condensing and the air for ventilation. High-voltage machines had been run for years in such places, so no fear need be felt on that account. There was no difficulty in handling 4,000 volts on shipboard, and on ships running now no trouble had been experienced. In excitation losses the field rheostat was included, and in the fuel consumption the efficiency of the exciter was included. One turbo-generator would reverse and operate both motors up to a speed of almost 15 knots. 73.2 per cent. turbine efficiency was low and conservative, but was the guaranteed value. A better result was, of course, expected. Mr. Darling's scheme for obtaining speed variation was not necessary for a passenger ship.

A Spanish National Power Scheme.—The Madrid correspondent of *The Times Trade and Engineering Supplement* states that a recent Government decree created five principal hydraulic basins, corresponding to the great rivers, the first of which—that of the Ebro—is now in course of organisation. All the hydraulic works whether for power, irrigation, or navigation, will be co-ordinated by the Basin Commission. Then will come the linking of one basin system to its neighbours with the object of forming a national unified system. Unification of transmission voltage, standardisation of machinery and facilities for distribution, are some of the advantages hoped for from this system. The distribution lines planned total about 1,400 miles, and their estimated cost is about £4,000,000. Barcelona, where electrification is well advanced, will be the starting point of a line along the foothills of the Pyrenees, *via* Tremp and Jaca to Bilbao, the second great centre of consumption. Thence the line would run to the Duero, where it forms the frontier with Portugal, Alcantara on the Tagus, Rio Tinto, Seville, Granada, Valencia, and back to Barcelona. Branch lines would link this circle with Madrid. On the lines from Granada to Madrid and Madrid to Tortosa, exist fields of poor coal near Almodovar del Campo in the Province of Ciudad Real and near Montalban in the Province of Teruel, where thermal stations would be established. Three-phase transmission at 50 periods and 120,000 V is proposed. It is calculated that Spain has available about two million h.p. of utilisable water power. There is not at present in Spain a market for anything like this amount of power, and unless general electrification of the railways is undertaken, which would require a capital outlay far beyond the present financial capacity of the companies, it is not likely that there can be for many years to come, even with intensive irrigation.

The National Physical Laboratory.

Annual Report for the Year 1925.—*Abstract.*

THE annual report on the work of the National Physical Laboratory for the year 1925 * indicates that development continued in a satisfactory manner. In addition to a good record of research accomplished, the additional provision made for the maintenance of standards of measurements as well as of the quality of performance enabled some arrears to be overtaken; the demands on the Laboratory made by the various Research Boards and Committees of the Department of Scientific and Industrial Research continue to grow, while the volume of tests and investigations carried out for firms and other outside bodies has been well maintained, and the work done for other Government Departments showed a slight increase. The total number of tests carried out was 654,288 (as compared with 683,545 in 1924), the electricity department, including photometry, accounting for 3,674 (against 2,981).

General Research.—The report of the Executive Committee indicates that the investigations in progress in the Physics Department, under this heading, relate mainly to problems of atomic physics and to acoustical measurements. In the Radiology Division work has been continued on the structure of intermetallic compounds, and the properties of single crystals have been studied in collaboration with the Metallurgy and Engineering Departments. The researches on the scattering of gamma rays and on X-ray absorption are also proceeding. Considerable advance has been made with methods of sound measurement: Satisfactory results have been obtained in the measurement of the sound-absorbing and reflecting power of materials; the values obtained for different materials have been shown to be practically independent of the position in the transmitted or reflected beam at which the observations are made. Improved methods of carrying out reverberation tests have been devised, using a loud speaker as the source of sound; telephonic apparatus for measurements of sound intensity have been improved, and microphones based upon electromagnetic, electrodynamic, and electrostatic principles have been tried.

The research programme in the Electricity Divisions has been somewhat restricted owing to the large amount of other work in hand, much of which falls under the heading of "Maintenance of Standards." In the Electrical Standards Division interesting observations have been made in relation to certain properties of dielectrics: when a metal face slides over the surface of an imperfect dielectric, there is a sudden change in the frictional force opposing the motion when a current passes across the faces of contact; the bearing of such phenomena on the power losses and absorption effects in dielectrics has been investigated, and a paper on the subject has been presented to the Physical Society. Investigation has been made into the properties of insulating materials as employed in standard instruments: the fused quartz used in high-class condensers has been found to deteriorate rapidly under certain conditions and a method of treating it has been discovered which enables condensers to be constructed having very small power losses. Experiments will be continued with a method of measuring the amplification ratio, and the relative phase displacement of the output, with respect to the input, of an amplifying system. The construction of the horizontal force magnetometer for use at the Abinger magnetic station of the Royal Observatory will shortly be completed; preliminary trial of the instrument was made at Abinger with very satisfactory results. Progress has been made with the preliminary work on the vertical force magnetometer. In the Electrotechnics Division the research into the methods of earthing electrical circuits has been continued. Research in the Photometry section has related mainly to the use of the photo-electric cell in place of the eye in the comparison of the light intensity of different sources; as a method of colour matching, the cell has been found, under suitable conditions, to give an accuracy ten times as great as the eye, but difficulty has so far been encountered in securing, with the use of the cell, the necessary sensitivity in the comparison of the relative candle-powers of colour-matched lamps.

In the Engineering Department the research on hardness testing has been continued by the use of diamond cones for producing the indentation in the harder materials, with the aid of the machine presented by Messrs. Vickers, Ltd. In the Metallurgy Department a commencement has been made with the study of the magnetic behaviour of iron, nickel, and cobalt from the point of view of the lattice theory; the line of attack adopted is to compare the effects of dimensional changes produced by magnetisation with those caused by elastic deformation and apparatus for producing, and for accurately measuring, the required magnetic field has been designed in collaboration with the Electrical Standards Division. The study of the crystal structure of metals and alloys, in conjunction with the Radiology Division of the Physics Department, has been continued, and apparatus for X-ray analysis, including a Müller X-ray spectrograph by Messrs. Hilger (the gift of Sir Robert Hadfield) has been installed. Experiments on fatigue have been continued and the experimental work done on the behaviour of metals under plastic deformation at varying rates (ranging from slow compression in a testing machine to compression by means of detonating explosives) has been extended to copper and aluminium.

Maintenance of Standards.—The term is necessarily very wide; the additional provision allowed has permitted increased attention to be given to this work during the past year, though, unavoidably, the continuous increase in the demands made on the Laboratory by outside bodies tends to limit the time available for such work. Work on the primary electrical standards has been mainly concerned with the redetermination of the international ohm as defined by the resistance of a column of mercury; the new values of the resistances differed from the previous values by about 1 part in one hundred thousand. Mr. F. E. Smith recently suggested that the time is opportune for the adoption of the absolute electrical units, as defined in terms of the C.G.S. units of mass, length and time, in place of the international units at present employed, and the Executive Committee has appointed a Sub-Committee to give this suggestion careful consideration. The Board of Trade standard one-ohm coil, ampere balance, and voltmeter have been compared with the Laboratory standards and the results indicate that the standards remain in a satisfactory condition.

Much time has been devoted to work on radio-frequency standards and to the use of quartz piezo-electric resonators and oscillators; these possess the particularly valuable properties of simplicity and portability, and at the same time enable selected frequencies to be reproduced with the precision of a primary standard. The Electrotechnics Division has studied methods of measurement and the characteristics of instruments for use in large power installations; new standard alternating-current apparatus has been brought into operation. The general adoption, in lamp specifications, of values of mean spherical candle-power has made it necessary to provide additional sub-standards for such measurements. A comparison of standards has been made with the Bureau of Standards and the Laboratoire Central d'Electricité, Paris, showing good agreement at the temperature of the ordinary carbon lamp; with sources of light of higher efficiency the precision of measurement is reduced, owing to the colour difference between these and the primary vacuum standards, which operate at a much lower temperature.

Government Research.—The Department of Scientific and Industrial Research has taken the valuable step of stabilising some researches by sanctioning expenditure over a term of years. The programme arranged by the Illumination Research Committee relates largely to the illumination of rooms, by daylight or artificial light, and the effect of different kinds of illumination on the accuracy, speed and comfort of working. Tests have been made of the efficiency of certain types of diffusing glass fittings for artificial illumination and an investigation into glare in street lighting has been arranged.

Work for Outside Bodies.—The total volume of work undertaken, on payment, for outside bodies and firms was, approximately, equal to that of the preceding year. Researches in progress include the study of the effect of impurities in copper. An investigation regarding the presence of oxygen in aluminium has led to the conclusion that oxygen is not soluble in aluminium and that oxide is found only on the surface of the metal. The work on buried cables in the Electricity Department has been continued for the British Electrical and Allied Industries Research Association, and other investigations for this Association are in progress.

Other Services Rendered by the Laboratory.—Frequent visits are paid to the Laboratory by the representatives of firms who wish to obtain particulars concerning the methods of test employed by the Laboratory or to gain information which may help them to improve the accuracy of their instruments or the quality of their products. Such intercommunication is not only of value in aiding private firms to bring promptly and effectively into practical use the developments arising from scientific progress, but serves also to keep the staff in close touch with industrial needs. In view of the direct claims on the time of the staff it is difficult to provide adequately for this side of its activities, but the Laboratory strives in this manner, so far as circumstances permit, to place the knowledge it has acquired at the disposal of those to whom it may be of service. Notes on points of interest in relation to the performance of electrical instruments are being collected with a view to publication. Help has recently be given to a firm in the setting up of equipment for carrying out magnetic tests. A large number of visitors is received at the Laboratory from dominion, colonial and foreign institutions, and opportunity is afforded Government technical officers in the Colonies or Dominions to work for a period at the Laboratory in order to acquire familiarity with the methods employed in particular branches of work and with special processes.

New Buildings.—The building for high-voltage work was completed in the course of the year and the necessary equipment and connections for the lighting, heating and power supplies are now being installed. Sir Richard Glazebrook visited the United States to see the high-voltage plant which has been

* H.M. Stationery Office. Price 8s. 6d. net.

erected at the research laboratories of the General Electric Co. and elsewhere, in order to advise the Committee. He was accompanied by Dr. Rayner, head of the Electrotechnics Division of the Laboratory, and by Mr. G. Smith of the Engineering Division of H.M. Office of Works, and also visited subsequently the works of the Compagnie Générale d'Electro-Céramique at Ivry, to inspect the million-volt air transformers which have been installed there for insulation testing. Sir Richard's report recommended the adoption of the air transformer as most suitable for research purposes, and H.M. Office of Works is arranging for the supply of the necessary plant. Plans for the proposed new Physics Building have been prepared and congestion in other buildings of the Laboratory continues to increase. The provision of a new building for photometry, to relieve the present congestion in the Electrotechnics Building, is a very urgent requirement.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Oil Fuse for Rural Use.

One of the hindrances to the development of the rural use of electricity is the difficulty of tapping main transmission lines at small enough cost to render the supply justifiable. Under such conditions an oil fuse produced by MESSRS. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester, should be of considerable utility. The apparatus, shown in fig. 1, with the fuse element withdrawn from, and lying across, the oil tank, is suitable for service on systems up to 11,000 volts between phases for either indoor or outdoor use. The fuses are of the single-pole type, and each is completely self-contained; the main frame casting is fitted with flanges for the fixing bolts and carries the cable-sealing arrangements and the fixed fuse contacts. Its dome shape ensures strength under fusing conditions and allows an air space above the oil level. The fuse plug is inserted through a hole in the top of this casting, and the oil tank is clamped to the main frame by four down rods. The fuse plug is made of impregnated teak with a galvanised metal holder at the upper end and the fuse contacts at the lower; the fusible element, which passes round the base of the plug, is held in tension between two spring contacts which ensure a rapid break in oil. As there is no operating mechanism, the time interval between the occurrence of a fault and the interruption of the circuit is small, the break taking place before the short-circuit current has attained its maximum value, which fact reduces the duty on the fuse. To insert the fuse

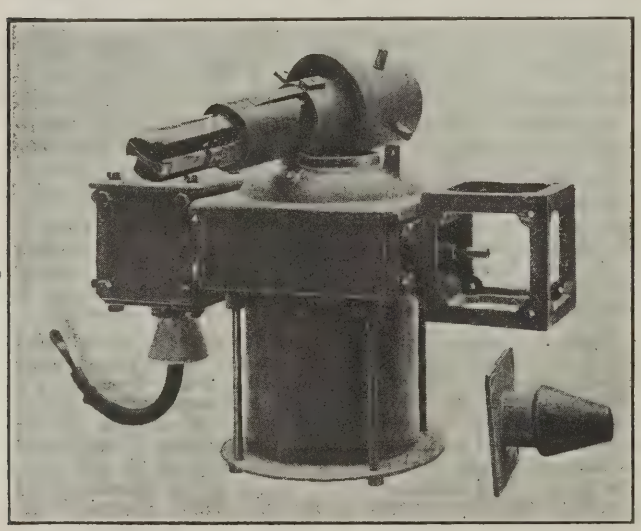


Fig. 1.—An Oil Fuse.

in circuit it is necessary to push the plug fully home, and then turn it, thus locking it in position. Contact is not made until the plug, which is earthed, is turned and locked so that it is impossible for it to be blown out if inserted under fault conditions; v.i.r. cable can be brought right in to the fixed contacts through bell-type porcelain insulators, or cable sealing ends may be fitted.

Another Vacuum Cleaner.

We have received from the BRITISH ELECTRICAL AND MANUFACTURING CO., 7-13, Clavering Place, Newcastle-on-Tyne, some particulars of the "Orion" vacuum cleaner which it has recently put on the market. The machine is equipped with a suitable suction nozzle, 12 in. long, for use under very low furniture. A specially-designed device is embodied for raising or lowering the nozzle to suit the thickness of the carpet which is being cleaned. A continuous-action rotary pedal switch of robust design is fitted. The bag is conveniently emptied, it is claimed, by virtue of a broad rim which can be held between the edges of the soles of the shoes during the emptying operations. The motor is of the universal type for use on a.c. or d.c. circuits.

A Portable Lifting Equipment.

The accompanying illustration, fig. 2, is one of a range of lifting appliances, "Diard Lifters," which is being introduced in this country by MESSRS. TRACTOR TRADERS, LTD., 36-37, Queen Street, London, E.C.4. The apparatus is of a portable nature, and its design and construction suggest its suitability for use in lifting transformers and motors from pits. It consists primarily of a cross beam carrying a travel-

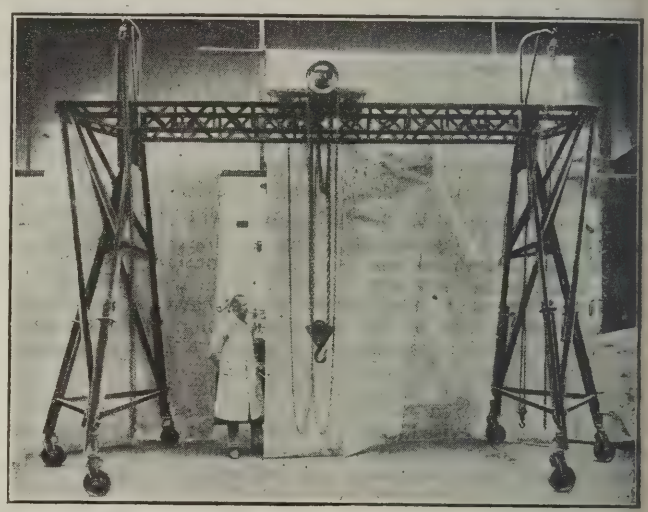


Fig. 2.—Portable Lifting Apparatus.

ling Weston-type block and mounted on suitable tripods. It is made in varying styles of fixed or adjustable height, the latter type being provided with telescopic legs, and with the legs mounted on rollers or not. Plates are supplied for the feet to rest on to prevent sinking on soft ground. It is made in two sizes, with capacities of 1.5 and 3 tons. The travel limits of the whole range varies from 7 ft. 3 in. to 9 ft. 8 in., the minimum and maximum load-hook heights being 6 ft. 5 in. and 11 ft. 4 in. respectively.

An Improved Ultra-Violet Lamp.

The "Percy Hall Clinic," illustrated in fig. 3, is a lamp which has been recently designed for ultra-violet radiation by the COX-CAVENDISH ELECTRICAL CO. (1924), LTD., 105, Great Portland Street, London, W.1. The apparatus is designed for use with one pair of swaged tungsten electrodes, which provide, it is claimed, the richest output of ultra-violet

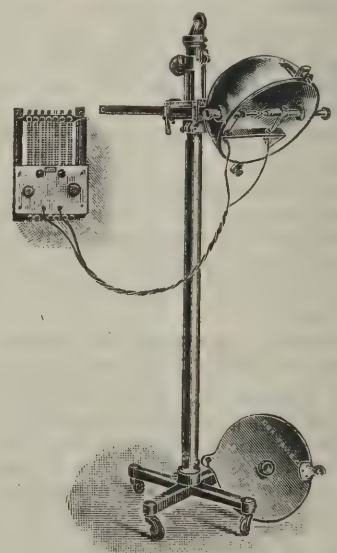


Fig. 3.—Ultra-Violet Lamp.

radiation of any known arc. The desired gap is set in the usual way, but by means of a spring mechanism the arc is struck and set at the required distance. The 14-in. nickel-plated reflector is held in a metal hood, which is

carried on a roller-bearing cross arm. At a distance of 4 ft., it is claimed, the whole body of a normal person may be radiated. The loading of the lamp for the best results is 3½ to 4½ A at 240 V d.c. The adjustable resistance enables the lamp to operate on any pressure from 60 to 250 V.

A Copper Tungsten Electrode.

The GENERAL ELECTRIC Co., of America, has evolved a new welding electrode of copper-tungsten, which is expected to prove of great value in the fabrication of metals, and for which the following claims are made. The alloy has a hardness of 225 (Brinell) as compared with 82 for hard copper and 30 for soft copper, and the compressive strength of the copper tungsten is 208,000 lb. per sq. in., as against 58,000 lb. for hard copper. The tensile strength is 56,350 lb., compared with 30,000 lb. for soft copper and 50,000 to 70,000 lb. for hard drawn copper.

The new material does not anneal at red heat. In view of the higher first cost of copper-tungsten, its chief value is expected to be in special applications. It is particularly adapted for use under severe conditions which copper will not withstand, such as hot-upsetting rivets electrically, and in facings for clamps for rod welding. The durability of the new alloy is shown by a recent test, where the number of welds made with one dressing of a copper die averaged ten, while the first test using copper-tungsten inserts gave more than 1,000 welds with the die still in good condition at the end of the test.

The material, Elkonite, is to be manufactured and sold exclusively by the Elkon Works, Inc., Weehawken, N.J., of P. R. Mallory & Company.

An Electric Singeing Machine.

A machine, the object of which is to burn off the down or short protruding fibres from yarn, is referred to in the *Textile Recorder*. The yarn appears to be passed through a tube, the wall of which is an incandescent electric conductor, the internal heat being just sufficient to perform the object of its design. It is claimed that only a little heat and no injurious gases are generated and that the heat radiated by the tube can be regulated by almost imperceptible degrees to suit any size or count or yarn. The machine is a product of the HUSSA MACHINE WORKS, 50, Church Street, N.Y.

The Economic Situation in Belgium.

Rapid Electrical Progress.

A REPORT bearing the above title has been forwarded to the Department of Overseas Trade by Mr. J. Picton Bagge, Commercial Secretary at the British Embassy, Brussels.*

In his introductory remarks Mr. Bagge says that the year 1925 was on the whole satisfactory, notwithstanding a general tone of pessimism. While imports fell as compared with 1924, exports were higher, in spite of increasing costs of production and dearer money. The work of reconstruction which was commenced seven years ago has now been practically completed. Factories have been re-built and re-equipped; railways, canals, telegraphs and telephones have been repaired: world markets have been regained to a great degree; and finances have been considerably straightened out. The reconstruction has been particularly marked in the great metallurgical industry, in which the capacity of production has been largely increased by the modernisation of plant and by extensions. Economy of production has been attained to a great extent by the utilisation of waste products and by co-operation between several important factories in the matter of electrical energy. The use of electrical power has been a most important feature in industrial development. Power stations have sprung up everywhere and a network of h.p. cables now covers the whole country. The network grows rapidly year by year, and is reaching the most isolated hamlets and farmsteads. One effect of this has been the re-birth of a number of cottage industries.

Electric Light and Power.

As stated above, the development of the use of electricity for light and power purposes is astonishing in its rapidity. In 1924 the extensions undertaken by the various companies called for increases of capital amounting to over 100 million francs, and issues for a similar, if not a slightly larger, amount had to be made during 1925. These capital issues were quite independent of the sums expended by certain provincial and communal authorities. In the province of Antwerp excellent progress has been made in the northern districts with the installation of the system, which, in certain places, has been completed. In the province of Luxemburg a loan has been authorised for the electrification scheme. In the south of the province of Hainault an inter-communal co-operative society has been formed for the establishment of an electrical system. In the province of Namur work on a system is in progress, and the same is the case in the province of Limburg and in the Flanders provinces. The scheme in the cantons of Eupen and Malmédy involves the construction of a barrage in the valley of the Warche. A company with a capital of 40 million francs is carrying out the operations. In addition to the stations of private electrical companies and public authorities, a great deal of energy is produced and sold through distributing companies by the central power stations of important coal mines and industrial concerns. In this connection, the results of the co-operation in the Liége district are of interest. The system of this amalgamation, the Union des Centrales Electriques, now comprises 126 km. of cable, and 24 important sub-stations connect 29 central stations belonging to 22 metallurgical, coal, tramway, and electrical companies. The load-dispatching organisation governs the exchange of energy between the various central stations which have a total power of 125,000 kW. The exchange of energy now annually exceeds 50 million kWh or 27 per cent. of the total consumption of the affiliated works. The substitution of gas from blast furnaces and by-products for fuel which would have been consumed by the independent functioning of the machines, the stoppage or non-installation of which has been rendered possible by this co-operation, represents an annual economy of more than 70,000 tons of coal. Similar co-operation is also to be found in the Borinage, where five collieries have amalgamated for power purposes, and in the Charleroi district, where certain important metallurgical concerns have also done so.

At December 31st, 1924, there were 20 stations with a capacity of over 15,000 kW, the total being 550,000 kW. There were five stations with a capacity of between 10,000 and 15,000 kW, with an aggregate power of 55,450 kW. The total capacity of the stations affiliated to the Union Centrale Electrique de Belgique, which groups the principal distributors, is 690,000 kW. In 1924 these stations furnished 630 million kWh.

Telegraphs and Telephones.

During 1925 a new line, 40 km. in length, was set up between Keppen and Asch, while additional wires totalling 112 km. were placed on 13 existing lines. At October 31st, 1925, the total length of the lines forming the telegraph system was 42,370 km. The contract for the equipment and laying of the La Panne-Ostend-Brussels-Herbesthal international cable was given in December last, and credits for 14 million francs have been assigned for this work in 1926. The total cost is estimated at 70 million francs.

With regard to telephones, three automatic exchanges are now in operation in Brussels and the conversion of two other exchanges is to be undertaken this year, and the remainder will be converted within the next two or three years. In the 1926 budget 124.5 million francs has been set aside for the improvement and extension of the telephone system. During the current year it is proposed to replace many overhead wires by underground cables in several districts. The total length of line at October 31st last, was 870,370 km., as compared with 786,249 km. in 1924. In the international service a number of new lines were put into commission in 1925. The lines under construction are Antwerp-Strasbourg (one line), Brussels-Nancy (two lines), Brussels-Paris (three lines), and Brussels-Rotterdam (one line).

Work on the inter-Continental radio station at Ruysleede has made good progress; the necessary buildings have been completed and are being equipped. Three high-frequency groups and three continuous current groups have been installed, and work on them is almost completed. The station is expected to be opened for service in the autumn of this year.

General.

The Bill introduced by the Government in 1923 with a view to remedying defects in the existing regulations governing concessions for production and distribution of power, and wayleaves over roads and private property, became law in March, 1925. A Royal Decree of April further provided for the formation of a permanent consultative committee composed of between 20 and 30 members appointed for a term of four years. The object of the Committee and of any sub-committees that it may appoint, is to report to the Ministry of Industry and Labour on any question put to them by that department.

While there does not seem to be any general desire to abolish the principle of the 8-hour day, which was instituted by law in 1921, there is an outcry against its rigid application in the present abnormal economic circumstances. It is stated that more flexibility is desired in seasonal industries and in times of urgent orders, and that contracts have been lost owing to the impossibility of giving quick delivery. Several labour conflicts occurred during the past year, the most important being those in the iron, steel and constructional industries. The Charleroi iron and steel works strike had not been settled at the time of the preparation of the report (February).

* Stationery Office, 4s. net.

Legal.

A Long Firm Fraud.

Sentence of three years' penal servitude was passed recently at the Central Criminal Court on Hyam Reuben Spinney, wireless engineer, who was found guilty of conspiracy to defraud and obtaining goods by false pretences. Robert Banks, electrician, was sentenced to 12 months' hard labour for a similar offence, and Robert Spinney, electrician, was bound over in the sum of £5 to come up for judgment if called upon.

Mr. Percival Clarke, for the prosecution, said that the defendants were charged with conspiracy with E. J. Benson, not in custody, and other persons unknown, to defraud such persons who might be induced to part with their goods to the Hotel and Restaurant Staff Supply Co. and the Southwark Electrical and Wireless Supply Co. Banks was charged in connection with four companies—G. A. Kirby & Co., Ltd., F. Garren & Co., the Cry-set Electrical Co., Ltd., and the East End Electrical Engineering Co. Counsel said the defendants falsely represented that they were carrying on a genuine business. The period covered by the charges was from the beginning of October last year to the middle of January of this year, and the amounts involved totalled £172. Reuben Spinney took premises in Blackfriars Road and traded as the Hotel and Restaurant Staff Supply Co. and as the Southwark Electrical and Wireless Supply Co.

G. Cohen & Sons, Ltd., v. London Transit Trading Co., Ltd.

At the Mayor's and City of London Court, on May 14th, before Judge Shewell Cooper, the plaintiffs, of Commercial Road, E., sued the defendants, importers, Long Lane, E.C., for £50 balance due on account of the purchase of a second-hand electric crane. Mr. Fortune, for the plaintiffs, said that representatives of the defendants had inspected the crane in question at a wharf, and were informed that its life as a three-ton crane was ended, but that it was safe to handle loads up to 20 cwt. The defendants agreed to purchase it for £100, but took no further action until proceedings were threatened, when they remitted a cheque for £50. In reply to a further communication, defendants replied that they had had the crane inspected by an expert, who reported that it was unfit for service. Moreover, they claimed that a verbal guarantee had been given that the crane was capable of lifting from 20 to 30 cwt. They claimed damages totalling £165 for putting the crane into condition and preparing foundations. Mr. Foxwell, giving evidence for the plaintiffs, said that the defendants' representatives had been satisfied after examining the crane for half-an-hour. He denied stating that the crane was capable of raising from 20 to 30 cwt.

Mr. Louis Segal, who gave evidence for the defendants, maintained that that guarantee was given and that certain defects were not pointed out to them. He called witnesses to testify to the bad condition of the crane. Mr. Fortune held that it was a case of *caveat emptor*, and the Judge upheld that contention, giving judgment for plaintiffs for £50 and costs and dismissing the counter-claim with costs.

Charge Dismissed.

Before Judge Atherley Jones, K.C., at the Central Criminal Court, on May 17th, Anatole Ivan Zaitzeff, merchant, pleaded not guilty to a charge of conspiring with others to defraud persons who might be induced to part with goods to N. A. Ludwin & Co. and Importex, Ltd., and of obtaining goods by false pretences from Messrs. Hogan and Wardrop, Ernest Flury, the Igranic Electric Co., A. J. Stevens (1914), Ltd., and others.

Mr. Dodson, prosecuting, said that the indictment alleged that prisoner, together with two men, named Ludwin and Smith-Hickie, between July, 1924, and April, 1925, obtained from seven traders radio components valued at between £1,000 and £1,200 by pretending that the goods were to be supplied to firms which were solvent, reputable, and able to pay for what they ordered in the ordinary course of business. Counsel suggested that N. A. Ludwin & Co. and Importex, Ltd., were created merely for the purpose of getting goods from reputable traders, and that there was no intention of paying for them. The goods which had been supplied to the two concerns were never paid for. The men concerned in the case were last September committed for trial on charges of conspiracy to defraud and obtaining wireless goods by false pretences. Ludwin and Smith-Hickie were dealt with but the accused went to Germany, and was extradited. In April, 1923, Ludwin took the first floor of premises at 122, Bunhill Row, in the City, and on the door of those offices the names of a number of concerns were put up, amongst them being The General Distributing and Trading Co., Ltd.; the British Overseas Dental Supplies, Ltd.; N. A. Ludwin & Co.; A. I. Zaitzieff and Co., Ltd.; and Importex, Ltd. There also appeared the name of the Lancashire Trading Co., Ltd., which in the early part of 1924 removed to 25, Budge Row. Counsel said that the accused was really that company, and the part which he played at that address was the giving of references in favour of Importex, Ltd.

The defendant, in the witness box, denied all the charges alleged against him. He stated that he had nothing whatever to do with the negotiations entered into between Ludwin and various wireless traders, beyond giving references which he said he gave in perfectly good faith. His business was a distinct one from the others and it was his misfortune that he was in the dock on the present charges.

He was found not guilty and discharged.

Power Station Employés Charged.

At the South-Western Police Court on May 19th, George Powerswell, a pump attendant, Ernest Calf, a switchboard attendant, and George Sturley, an engine driver, all employés at the Fulham Council electricity undertaking, were charged with committing acts calculated to prevent the proper working of the power station at Townmead Road, Fulham. The prosecution was conducted by the Town Clerk of Fulham, who said that the proceedings were taken under the Emergency Powers Act. During the recent strike the whole of the electricity supply had been stopped, necessitating the closing of all factories in the borough for over an hour.

Mr. W. H. Thompson, instructed by the Electrical Trades' Union, urged that the men lost control of their judgment in the excitement. They did not attempt any damage and in shutting down the machines thought that they were acting in the best manner.

Mr. Ratcliff Cousins, the magistrate, thought that there had been no malicious intention in the men's actions, he therefore bound them over in recognisances of £5 to surrender for judgment if called upon in six months.

Infringement of a Radio Trade Mark.

A motion by Lissen, Ltd., dealers in radio apparatus, for an injunction restraining E. Harper & Sons, trading as the Willesden Wireless Stores, from infringing its trade mark for radio goods, was mentioned to Mr. Justice Romer in the Chancery Division on May 19th.

Mr. Hodges, for the plaintiffs, said that defendants were willing to submit to a perpetual injunction, an inquiry as to damages, and to pay the costs, having agreed to treat the motion as the trial of the action.

Neon Tube Patents Extended.

Mr. Justice Tomlin, in the Chancery Division on May 18th, heard an application on behalf of M. Georges Claude, for an extension of the period of two patents for improvements in vacuum discharge tubes for lighting purposes, and for improvements in neon tubes, owing to loss of benefit caused by the war.

Mr. Trevor Watson said that the phenomenon of the production of light by an electrical discharge was old, but M. Claude was the first man to put it on a commercial footing. Neon light was the best fog-piercer known and was of great importance for shipping and aeronautical purposes.

His Lordship granted a five years' extension in each case.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections may be made against any of the proposed marks within one month from May 5th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Glyptal. No. 468,205. Class 1. Varnishes and lacquers.—British Thomson-Houston Co., Ltd.

Clayton (lettering and design). No. 459,896. Class 7. Electric road traction motors. No. 459,898. Class 22. Electric road wagons, &c.—Clayton and Shuttleworth, Ltd., and Clayton Wagons, Ltd.

Stentor. No. 455,078. Class 8. Thermionic valves.—A. C. Cossor, Ltd.

Sistoflex. No. 462,593. All goods in Class 8.—Spicers, Ltd., 19, New Bridge Street, E.C.4.

Rauland-Lyric (lettering and design). No. 459,462. Class 8. Electric transformers.—All-American Radio Corporation, Chicago, U.S.A. (E. P. Alexander and Co., 306, High Holborn, W.C.1.)

Rectron. No. 467,022. Class 8. Instruments, apparatus and parts thereof for use in radio-telegraphy and telephony.—Radio Corporation of America, New York, U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-90, Chancery Lane, W.C.2.)

Cleartron, No. 468,117, and C. T. Clearton (lettering and design). No. 468,118. Class 8. Philosophical and scientific instruments for useful purposes.—Cleartron Radio, Ltd., 1, Charing Cross, S.W.1.

Edix. No. 468,196. All goods in Class 8.—The Magneto Accumulator and Electro-plating Co., Leafield Road, Dumfries.

M.K. No. 466,422. Class 8. Electric contacts, terminals, fusible cut-outs, and switches (ordinary).—"M.K." Electric, Ltd.

Traun. No. 457,274. Class 40. Hard india-rubber accumulator boxes, insulators, &c.—Heinrich O. Traun, trading as Dr. Heinrich Traun & Sohne vormals Harburger Gummi Kamm Co., Hamburg, Germany. (D. Young and Co., 11-12, Southampton Buildings, W.C.2.)

The

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Supply must be Safeguarded.

THOUGH the more immediately pressing matters with which Parliamentary minds have been occupied prevented the Standing Committee from proceeding as rapidly as might be desired with its consideration of the Electricity Bill, it is perhaps just as well that recent untoward events happened before that measure passed beyond the amendment stage.

It may be that the Acts already contain provisions which adequately cover all recent experiences, and include ample authority for legally proceeding against all who were responsible for interference with the maintenance of electricity supply services. The most remarkable and unexpected action reported in certain areas where councillors, who had been elected as representatives of the public to maintain services, deliberately used their authority to shut them down, must have led to deep thinking on the part of the Electricity Commissioners, the Joint Authorities, the Incorporated Municipal Electrical Association, and others responsible for the future security of electricity supply.

The importance of maintaining continuity of supply has been in the forefront of all questions for many years. Technically and administratively it has been regarded as fundamental—a statutory obligation from which there was no escape, a duty devolving upon the engineer technically and a responsibility resting upon the authority under which he served, to maintain the continuous flow of a vital service for which the State had granted a monopoly. In times past there were prosecutions of undertakings which from various causes were temporarily unable to give service or which failed to maintain the supply at suitable pressure. Where authorities have been able to prove that they have done their best to cope with an exceptional situation, the law has not been exacting. But what shall be said of those who, though as municipal representatives they have shouldered responsibility for looking after the public interests, deliberately cut off all service whatsoever—sinking even to that lowest of all levels which allowed them to deprive hospitals of supply essential to the efficient conduct of operations for the relief of suffering humanity? And where, we may ask, can one find any authority under the Electricity Supply Acts for any discrimination between essential and non-essential supplies? Withholding the supply to any class of consumer for strike reasons can have no legal justification.

Recent experiences seem to us to raise vital issues, and we hope that all that is involved will be fully appreciated by those whose duty it is to introduce any new legislation that may be required to strengthen the weak places against all future attacks on public safety and security. They should consider that all the efforts to secure continuity both by having sufficient plant capacity installed or interconnected and by striving after efficiency of technical equipment, as well as all the advantages of bringing undertakings under Joint Authorities, can be rendered useless if the personnel fail to operate or the local governing authority chooses autocratically to misuse its power and cut off supply to any class whatsoever of ratepaying consumers—part-owners of the undertaking.

It cannot be too plainly stated that councillors are elected by the ratepayers to look after their interests as a whole, and if they deliberately fail in any part of that duty they are traitors, and should be treated as such. Surely the maintenance of a borough's industries, giving employment to people resident in the area and earning profit in the borough, paying rates for the up-keep of the borough services, is a matter of first concern! Councillors and committee-men are servants of the electors, and so are the electrical staff and employés. Those who traitorously impose or authorise the cutting-off of power which is essential to public and private convenience or to any industry—whether there is a national or a local or an industrial dispute in progress does not affect the matter if we have regard to their *raison d'être* as councillors—are guilty of robbing workers of wages, businesses of trade and profit, the State of taxes, and the community of a public service *which is actually its own property*. Men who will do so for no other reason than that the colour of their political or social views places them in sympathy with some self-appointed dictatorial council, are totally unfit to occupy any position of public trust and confidence, and should be subject to suitable treatment under the law of the land, or from Central Government, rather than be permitted to continue in authority until the ratepayers dismiss them at a Borough Council election. They should be rendered ineligible to continue to hold either employment under, or seats on, a Council, for they are a danger to the community.

Powers granted to give supply of electricity involve responsibilities. These must not be lightly regarded, but must be quite beyond all danger of interference due to changes in political thought. There must be heavy penalties, and they must be personal penalties, imposed upon men who, in spite of the fact that their local prestige as councillors or their bread and butter as employés is derived from an undertaking, attempt to shut down their own and others' employment by betraying a trust which has been reposed in them by the community as a whole and by the individual consumers, who naturally suppose that they can rely upon the Council as a contracting party to an arrangement to provide one of the vital services for the maintenance of the working life and safety of the people.

Councils elect committees and appoint officials to control and *run* their undertakings—they do not, indeed *cannot*, give them authority to *shut down*. They have no such power without appealing to higher authorities—neither engineer nor Council, neither committee nor employé—because electricity supply is a service given under monopolistic powers granted by the State. Happily the remarkable incidents which have called forth these comments were exceptional; were it otherwise one would feel that if a policy of municipalisation allowed the continuity of supply to be jeopardised by anti-national parties at whim or in a fit of mental aberration, then it might, even at this date, be necessary to ask seriously whether municipalisation was the right thing after all.

One other thought in closing—areas which acquire for themselves the reputation for being erratic in their regard for vital services will be stamped as undesirable by those who desire to start up new industries, and owners of existing works will be ready to leave at the first convenient opportunity.

Registration of Engineers.

TIRED, apparently, of waiting for the big Institutions to deal with the question, the Society of Technical Engineers has prepared a scheme for the registration of engineers, in the form of a Parliamentary Bill, which has been introduced into the House of Commons by the chairman of the Society's Executive Council, Mr. Herbert Williams, M.P.; but it is not intended to proceed with the Bill before the fullest consultation has taken place with all the interests concerned. To this end, copies of the Bill have been forwarded to the leading engineering bodies for consideration with a view to securing general agreement, and the Society suggests that the matter should be referred to the Engineering Joint Council.

In an introductory memorandum it is pointed out that a somewhat similar measure was passed into law in Italy in 1923, and that in the State of New York an Act of the State Legislature provides for the registration of engineers; moreover, the Royal Society of British Architects is preparing a Bill for the registration of architects. The present Bill contains provisions enlarging the powers and functions of the principal engineering Institutions, which would be brought into the closest relationship with the operation of the scheme if it became law.

With the objects of the proposal we are entirely in sympathy, though many points will call for the closest scrutiny, and in view of the deliberation with which such matters are handled in this country, it is questionable whether it will become an Act within the life of the present Parliament. That the term "engineer" is continually misapplied in the lay Press and in popular usage, is only too well known to those who are entitled to use it, and the ready adoption of the epithet "chartered" by members of the Institutions which are incorporated by Royal Charter is evidence of their desire to obtain a distinctive appellation; but the trouble resides in the fact that the language itself is made and moulded by popular usage, and if the public continues to regard a mechanic or a fitter or an engine-driver as an "engineer," all the Acts in the Statute-book will be unable to turn it from its purpose.

The community has no conception of the part that is played by the engineer (in the correct sense) in its daily life; water, electricity, gas, and transport are only a few of the services for which he is responsible—but he is a "dumb dog," and neither tries nor cares to secure his rightful position in the public eye. Whether the enterprising action of the Council of the S.T.E. will be rewarded with eventual success we cannot tell; it has our sympathy, and we hope that at least it will receive full consideration by all concerned.

The I.E.E., the I.M.E.A., and the Bill.

THE annual report of the Council of the Institution of Electrical Engineers, whilst containing no sensational items, records a very satisfactory year's work. The membership at March 31st was well over 12,000, showing a steady net increase of about 400 a year, and the activities of the main body and its numerous branches and committees were more than maintained, 374 meetings having been held during the year. From the summary which appears on p. 857, it will be observed that there are now nine "Technical Committees," which will endeavour to improve the supply of suitable papers; that the Committee on Electricity in Agriculture is doing good work; that the Council has submitted recommendations to the Electricity Commissioners for the amendment of their regulations for electricity supply; and that attention is being given to the question of status of engineer officers in the Royal Navy. Unfortunately, owing to lack of interest in the establishment of a national proving house, the proposal, so dear to the late Mr. Wordingham, has been dropped.

Conspicuously wanting is any reference to the most important question now before the electrical industry—the Electricity (Supply) Bill. On March 29th the Council of the Institution submitted to the Government

a grave warning to the effect that the provisions of the Bill were based upon a misapprehension of the facts; in the opinion of the Council they might prove detrimental to the progress of the industry, and it was considered of the greatest importance that an inquiry should be held before the Bill became law; but it was elicited from the President at the annual meeting that no further steps were contemplated by the Council, the various sections of the Institution being left to speak for themselves. But the Council cannot have it both ways: either, for the reason stated, no action should have been taken at all; or, having decided to enter a vigorous protest against the Bill, the Council should have been prepared to follow it up with energetic measures to press the protest home. Half-measures "cut no ice." At least we should have thought that a meeting could have been called, informal or otherwise, to enable the members to discuss the Government's proposals and to record their views thereon. Unless that is done, the Council's protest will fall on deaf ears.

The Council of the Incorporated Municipal Electrical Association, not for the first time, has grasped the nettle more courageously, and last week convened a special general meeting of its members, who admittedly have a common and immediate interest in the subject. The meeting passed a resolution, of which the terms are given on p. 840, expressing the belief that in its present form the Bill will fail to attain its object—the cheapening of electricity supply—and proposing that the industry should be consulted before any legislation is enacted. That view, it will be remembered, has been repeatedly put forward by Mr. R. A. Chattock, President I.E.E. The resolution also throws doubt upon the figures and conclusions of the Weir report, and deprecates the suppression of the Merz report. As our readers are aware, we are entirely in accord with the purport of this resolution, as well as with the protest of the I.E.E., both statements having been anticipated in our columns by many weeks. But why has action been deferred until the Bill is actually in Committee? Certainly neither the I.E.E. nor the I.M.E.A. can be accused of "undue haste."

The Radio Exhibition.

IN our "Business Notes" this week we give some particulars of the National Radio Exhibition, which is to be held at Olympia in September. It will be seen from the note that although the show is being organised in the name of "N.A.R.M.A.T.," the Society of Radio Manufacturers is taking a hand, and in our opinion this co-operation is all to the good, preventing the inevitable overlapping and jealousy which the holding of two separate exhibitions would engender. The necessity for two exhibitions has been eliminated by the wise decision of the organising associations not to confine the exhibition to their members only. As we said last year, an exhibition of that character cannot fail to be incomplete and unrepresentative.

The early entrants to the Exhibition are to be allotted space by means of ballots, a method of which no one should complain, for any other system generally brings disputes in its train. British goods only are to be displayed; this, too, is satisfactory, for British manufacturers are now able to produce practically everything that is required in the way of radio apparatus, even if their prices are sometimes just a trifle higher than those of imported products. The decision to ban loud-speaker demonstrations may disappoint a few exhibitors, but the majority will realise that a dozen loud speakers at full blast, some of them reproducing different programmes, will not appeal to the ears or pockets of the visiting public, apart from other considerations. Ordinary telephone demonstrations are in a different category, but for some reason these, too, have been banned.

We see no reason why this Exhibition should not be successful and help to restore harmony in an industry which cannot thrive as it should if divided into hostile parties.

A Clearing-House for Information.

THE paper on the above subject, read by Mr. W. J. Pearce at the last meeting of the Circle of Scientific, Technical and Trade Journalists, raised points of great interest, alike to the technical journalist and to men of science. He pointed out that the amount of valuable scientific and technical "fact-information" was rapidly increasing, and that the public appetite for such data had also grown. Yet the bulk of such information remains locked up in special libraries—often unknown to the man most in need of it. On the Continent, comprehensive schemes of indexing all available knowledge have been attempted, but we think most people would agree with Mr. Pearce that they are too complicated for ordinary life. The average man wishes to be able to get information quickly and easily. Reference was made in the discussion to the simplicity of the arrangements at the Patent Office Library, and a letter from Mr. Bradford, the Director of the Science Museum, South Kensington, was read, drawing attention to the great resources of this special library, which ought to be more widely known. Mr. Pearce explained the aims of the Association of Special Libraries and Information Bureaux, and advocated the establishment of a clearing house, where inquirers could be put in touch with the best sources of information. There are in this country many other special libraries besides the two mentioned, and it would certainly be an advantage if some method of linking them together and making their existence and resources more widely known could be evolved.

Meetings in June.

IN recent times June has become one of the busiest months in the electrical year—at least, that is how it appears to the technical Press—and this year it was to have been more crowded with events than ever; however, fate has ordained otherwise, and in a country which practically lives on coal, the lack of that commodity has necessitated drastic changes in many programmes.

The Summer Meeting of the Institution of Electrical Engineers has been postponed till next year; the annual meeting of the Association of Mining Electrical Engineers, which opens to-day, will be confined to the transaction of formal business, the social events and visits being abandoned.

However, it is satisfactory to be able to announce that the annual convention of the Incorporated Municipal Electrical Association at Glasgow, the principal event of its kind, will be held according to plan. It is true that some modifications in the lighter side of the programme may be found necessary, but up to the time of writing we understand that no change is in contemplation. The members, of course, will not expect to find that the arrangements are in every respect as perfect and efficient as the admirable record of the Association in the past would lead them to anticipate if normal conditions prevailed; the circumstances are abnormal, and have hampered the preparations of the secretarial staff, delaying the issue of the programme, but those who propose to take part in the Convention must make allowance for the difficulties which confront its organisers, remembering that a gathering of 600 or 800 people is no light matter to handle at the best of times.

The first annual convention of the Electrical Contractors' Association will be held at Brighton as arranged, and so will that of the Tramways and Light Railways Association at Torquay, in the same week. The conversazione of the I.E.E. will take place whilst both these events are in progress, and once more we have to regret the clashing of programmes of electrical bodies; apparently a sort of clearing house for conventions is needed. Not many have the leisure or perhaps the stamina to enable them to take part in a succession of summer meetings, but some would certainly wish to attend more than one. Possibly next year the difficulty will be met by the holding of one big electrical convention on the lines which we have already indicated.

Transatlantic Photo-Telegraphy.

The Transmission and Reception of Photo-Radiograms.

RECENT announcements and pronouncements would seem to indicate that the art of picture transmission has suddenly been born; whereas its inception dates from almost the same time as the invention of straight telegraphy, for in 1842 Alexander Bain, an English physicist, first proposed a device for sending pictures from one place to another electrically along wire circuits.

His idea is so basically correct, coupled with simplicity, that all later investigators have, generally, followed his method. A system devised for use on the long-distance Bell telephone network in the U.S.A., which includes very good-quality circuits, has been outlined,* and the feature at present under consideration is the utilisation of a radio-telegraphic circuit for the purpose. Apparatus has been installed in London, New York, and San Francisco for the establishment of a regular, reliable service for the transmission and reception of news photographs, facsimile printed and written documents, or tabulated matter, designs, &c., *via* the 220-mile land line from London to the Carnarvon (North Wales) radio-telegraph station of Marconi's Wireless Telegraph Co., Ltd., thence across the Atlantic Ocean to the Riverhead station of the Radio Corporation of America on Long Island, and further on by land lines.

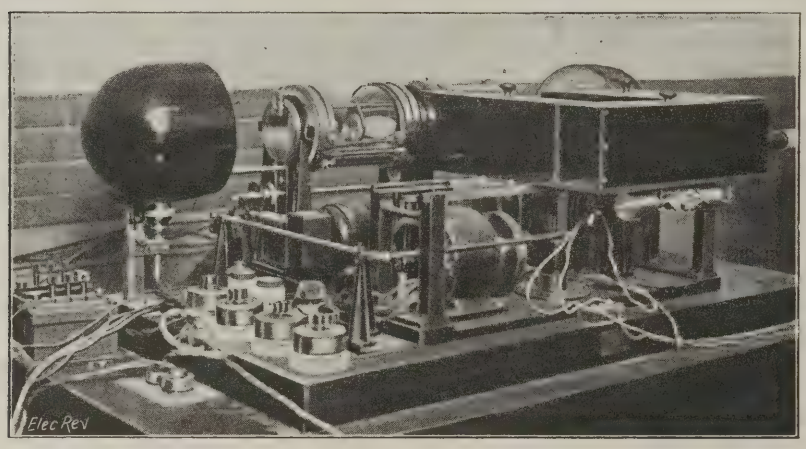


Fig. 1.—Photo-radiogram Transmitter at Radio House, London.

The basic elements of all picture transmission are, first, a synchronous action covering a surface point by point at both transmitter and receiver, and, secondly, the electrical identification of the point value to correspond between transmitter and receiver; and when Capt. R. H. Ranger, and the Radio Corporation of America, undertook the development of his system he soon realised that the solution of his main problem was an economic one rather than that of producing a machine that would work.

Practically every system is based on the division of the picture into small unit areas and the transmission of their values one after another, but when it is realised that the usual newspaper half-tone (and none too good a one at that) has, at least, 65 dots in a row per inch, or more than 4,000 of them to a square inch, the size of the job becomes apparent. Analysed in this way, the usual method of picture transmission found its serious drawbacks in the number of pulses that have to be transmitted and the precision and the time needed to do so. Search for a "shorthand" method of accomplishing the same results was then started. The first effort in this direction consisted of variable dot-spacing, making each dot of generally the same size, so that by their grouping they constituted the shades of the picture. The dots were so chosen that, in size, they would occupy a space of approximately one-fourth of the 64th of an inch (the usual newspaper standard), one such dot per 64th of an inch giving an impression of gray colour; if spaced further apart, gray would give way to white; if spaced closed together, gray would become darker, and for almost black the spacing would be approximately two dots to each 64th of an inch. An advance was accordingly made from the necessary five values of the older systems to two for each 64th of an inch; this dot concentration was carried a step further by starting with separately grouped dots in the white end of the scale and increasing to the densely concentrated dots as before, but the receiver drum is given twice the speed of the movement, so that the spacing which formerly produced black now gives a middle gray. Then, to accomplish the further deepening to the black, each of the dots grouped closely together are lengthened so that they become heavier and heavier, and finally for solid black the transmitter is held constantly. The apparatus is a balanced arrangement, such as the familiar "push-pull" type of amplifier; one side of the outfit works in progression from white to gray and the other side in the light progression from gray to black, with a slight overlap at the centre.

The reduction that is thus accomplished over the previous method is 2 to 1, so that a 5 to 1 overall improvement has been made, which means that with a fixed available speed for the transmission of individual units, the process enables five times the area to be covered in the same length of time. Furthermore, a wide range of tones is secured without abrupt changes from one tone to the next, and the individuality of the alignment of the sharp edge can be made very precise providing the synchronising of the motors is sufficiently accurate.



Fig. 2.—Capt. R. H. Ranger and his Receiver.

The photograph or document to be transmitted is copied photographically, either as a negative or positive, on to a transparent celluloid film that is mounted on a horizontal glass cylinder (to be seen in fig. 1) at one end of which a tungsten-arc lamp (15,000 c.p. per

* See ELEC. REV., July 24th, 1925; pp. 139-41.

sq. in. of surface) is housed in a dome reflector, the beam of light being directed through a system of lenses longitudinally down the cylinder on to a 90-deg. prism which directs the beam radially outwards through the film; the latter being situated at the focus of the lens system, the light passes through small areas of the film progressively, the intensity of the issuing beam depending on the density of the particular portion of the image through which it emerges. Another system of lenses and mirrors directs the light ray on to a light-sensitive cell with varying intensity according as the optical system is moved forward parallel to the film cylinder; the latter is rotated slightly at the end of each stroke so that the light ray traverses the whole picture in a series of parallel horizontal lines. The photo-cell, which interprets light valves into terms of electric current, was developed by the General Electric Co., of America, and the Westinghouse Electric & Manufacturing Co. It is of the glass-bulb thermionic pattern, and somewhat resembles a large radio valve; the basic idea of its operation is the application of a high voltage, almost sufficient to ionize it, photo-electric action being realised when light strikes the photo-cell so that the potassium hydride which lines its inside surface is ionized and electrons pass from the potassium hydride to the cathode in the centre of the cell. Highly attenuated argon gas fills the inside of the cell and increases the ionizing effect materially, so that an appreciable current flows through the cell with the action of the light (to the extent of some two micro-amperes). This current, of course, must be greatly amplified by the use of three-electrode vacuum valves; in a typical circuit, the current is caused to pass through a high resistance, which causes voltage variations to be applied to the grid of the vacuum valve. Such amplification might be carried on in further steps in the usual manner, but for the first dot-concentration plan this was quite sufficient in itself to give effective results. A vacuum valve with its grid thus controlled by the photo-cell has its plate current applied through a condenser charged at intervals, which are determined by the rate at which the condenser discharges; in other words, a sort of low-pressure valve is arranged such that when the condenser discharges to a certain extent, the plate battery is again connected to the condenser to charge it up to the maximum value. This is accomplished by having a large C battery connected to the high side of the condenser and so biased that the plate voltage must fall below a given value before a second three-electrode valve stops drawing plate current through its plate. This second plate current is carried through a relay; while the relay coil is energised the contacts are open, but when the relay falls back against the contacts the charging B battery pulse is sent on to the condenser. Thus the time interval between the successive charges of the condenser is determined by the rate of the plate-current flow in the first vacuum valve, and as this is, in turn, determined by the photo-cell current, a direct interpretation of the light action is obtained in terms of the relay closing which can be used to activate telegraph lines or a radio-telegraph circuit.

An interesting adjunct to the photo-cell is the use of an additional light beyond the normal illumination obtained through the film to be transmitted: it has been termed the C light, and corresponds in its action very much to the C battery used in grid amplification. The use of the C light makes it possible to operate the photo-cell itself more effectively, so that, in conjunction with the amplifiers, it gives a more perfect straight-line characteristic to the reproduction current values.

For synchronizing, a tuning fork gives the appropriate constant rate of rotation to actuate both transmitter and receiver; by the addition of clock check control it has been found possible to obtain uniform speeds at each end, where the clock controls act as a check on the tuning fork. Further, use is also made of dashes at the end of each stroke, which serve to keep the receiving cylinder moving correctly with respect to the transmitting cylinder.

The receiver (fig. 2) may be of various forms; in the present case it is suitable for receiving continuous-wave telegraph signals by the heterodyne-beat method and, following rectification and amplification, the received impulses are made to actuate a siphon recorder mounted on a travelling carriage that is operated by a tuning-fork controlled motor, so that its movement is in synchronism with that of the carriage carrying the optical system of the transmitter. After each stroke of the carriage the paper roll is moved forward slightly more than the width of the lines formed by the pen of the siphon recorder, the horizontal row of ink dots and dashes thus made side by side eventually completing the picture. The amplifier at the receiving end (fig. 3) includes a valve-controlled condenser similar to that at the transmitting end, its function being to overcome the inertia of the siphon recorder and render the latter's action more rapid and certain.

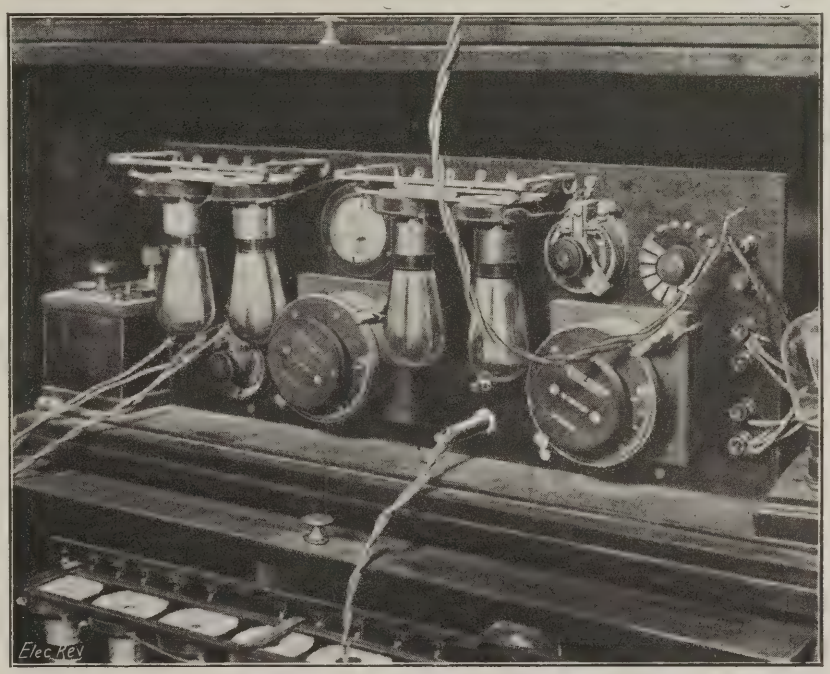


Fig 3.—Receiving Amplifier at Marconi's Main Telegraph Office.

The photogram receiver is capable of making two pictures at the same time, or duplicating one picture, and a film box may be added for obtaining a photographic record at the same time as the visible one is being made. Naturally, when the pictures are reduced in size, their artistic effect is greatly enhanced. Anything up to a photographic half-plate in size can be handled by the plant installed in London, the transmission of a picture of quarter-plate size occupying about 15 minutes.

In such a development it is natural that those who see only the general effects of the work may not appreciate the effort that had to be expended on all the details involved. Actual measurements showed that a film which varies in its ability to transmit light from 25 per cent. at the darkest portions to 80 per cent. at the lightest portions gives the best results. To organise operations on a practical basis a very extensive study of photographic copying had to be made; for example, with a given fixed original, it is possible to get a wide variation in the transparency of the copy by changing either the exposure time in the copying camera, or the development time; also it is possible to get a still wider variation by using different types of films. Such information has been drawn up in the form of a single table, so that the practical operator can obtain from any given

original the copy which will have the exact range desired.

Electrical transmission to a distance always necessitates obtaining sufficient signal strength to over-ride the effects of disturbances. It is in this respect that the telegraph wins, due to the fact that it is in a sense a trigger device, so that it is easier to identify electro-mechanically the times when the current is " on " and when it is " off," than to attempt to analyse variations in current strength. By interpreting picture values in dots and dashes (involving full current of the radio transmitter being " on " even for the shortest dot) full advantage has been taken of this telegraphic supremacy to carry a picture to the greatest distance. Furthermore, it lends itself most readily to relaying operations by means of both wire and radio circuits.

Naturally, refinements remain to be introduced to render the equipment continuously serviceable, so that both transmitter and receiver may operate without interruption between pictures; the equipment now set up is working both eastward across the Atlantic and westward to California and Honolulu, and it is only a question of time when the mechanics of the operations will have been sufficiently mastered by the operators to make photo-radiograms of service to everyone.

On Determining the Value of Earthing Resistances for Alternator Protection.

Typical and Special Arrangements are Indicated.

By B. NUTTALL, A.M.I.E.E.

THE following notes are intended to help those who are sometimes perplexed when having to decide upon a suitable value of alternator earthing resistance, and are based upon the assumption that the neutral point of one generator only is earthed. Two such typical arrangements are shown in figs. 1 and 2. In the case of fig. 1, a simple interlock is desirable, so as to prevent more than one switch being closed at a time. Fig. 2 ensures that it is impossible for the latter condition to exist. Although not indicated in these figures, the machines are connected solidly to the busbars—or else, as indicated in fig. 3, a separate resistance is furnished for each machine, as each alternator constitutes a separate and distinct system.

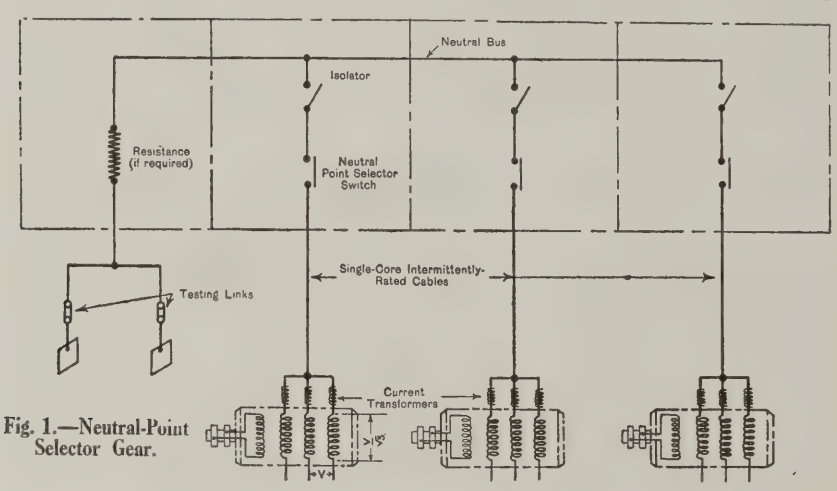


Fig. 1.—Neutral-Point Selector Gear.

For systems as indicated in figs. 1 and 2, it is the usual practice to select the neutral point of one of the largest or strongest machines, so that it may take all the stresses due to earth faults.

The object of earthing one alternator neutral point only at a time with machines coupled solid to the busbars is threefold:—

(1) To keep the resistance between the neutral point of the system and earth constant—that is, the maximum current flowing on a fault to earth—independent of the number of alternators working in parallel, otherwise the leakage current may vary over a wide range. If no resistance is employed, this method limits the value of the earth current to the capacity of one machine.

(2) To avoid interchange of triple-frequency currents between machines. Also in the event of a bad synchronising shot, to prevent a cross-current circulating between machines.

(3) To avoid multiplicity of earthing resistances.

The arrangement, however, suffers from the disadvantage that an earth fault causes a rise in potential on the neutral busbar.

The following examples assume that the machines are protected by the Merz-Price circulating-current system of protection.

Effect of Varying the Value of Resistance.

Assume that for a certain 6,600-volt, 3-phase machine, as shown in fig. 4, the circulating current relays are set to operate with 76 amperes out-of-balance across the winding. With an earth fault on terminal x, the full phase voltage is available to drive 76 amperes through the resistance, which can have a value of $6{,}600/76\sqrt{3} = 50$ ohms. Assume that the fault takes place at y, 60 per cent. along the phase winding; this permits 60 per cent. phase voltage drop across the resistance (neglecting the resistance of the earth return), thus corresponding to $50 \times 0.6 = 30$ ohms. Similarly with a fault at z, 10 per cent. along the phase winding, the limiting resistance would not have to exceed 5 ohms. This clearly shows that the value of the resistance depends upon the degree of protection desired for the generator.

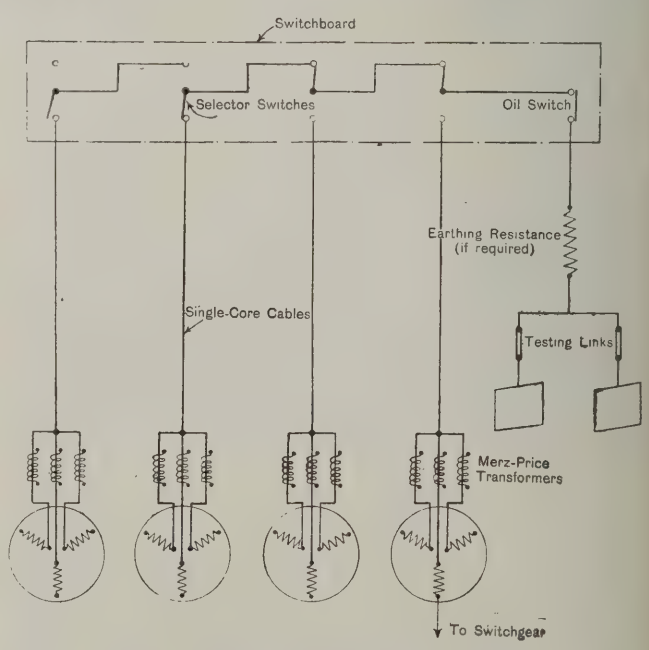


Fig. 2.—Neutral-Point Selector (Throw-over) Gear.

It will be observed that with a fault at y the full phase

voltage (v = 3,800) is impressed across the resistance for a period corresponding to the time required for the automatic field-suppression gear to reduce the field current to zero. This is only a momentary period, and as thermal capacity is not necessary in the resistance,

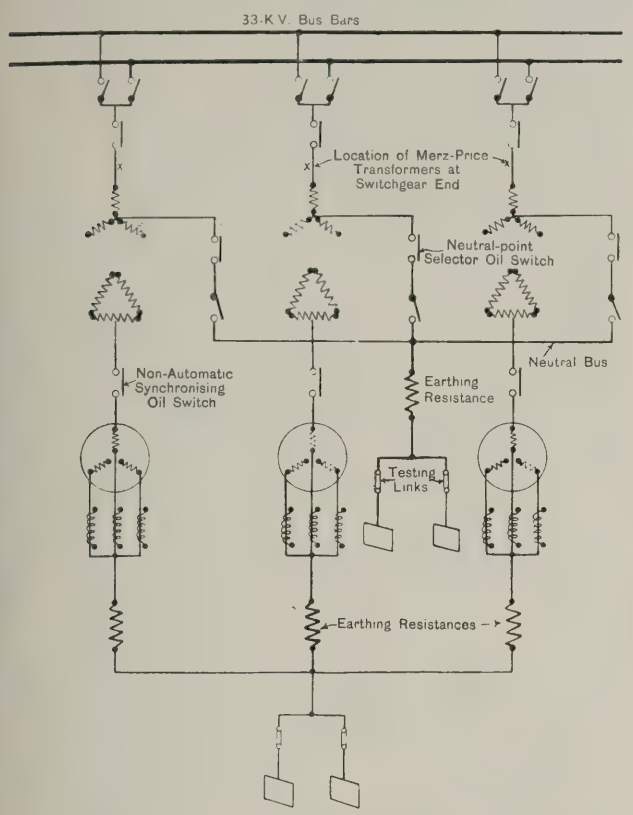


Fig. 3.—Earthing Arrangement with Separate Systems.

it is usual to design the resistance to carry the predetermined earth current for 30 seconds with a temperature rise of, say, 200 deg. C.

Varying Degree of Protection of Alternators with Limiting Resistance of Constant Value.

Not infrequently it occurs that the capacity of a power station is increased to a value several times that of the original scheme, and a review of the protective arrangements is necessary. Fig. 5 indicates such a condition, turbo sets A and B comprising the initial

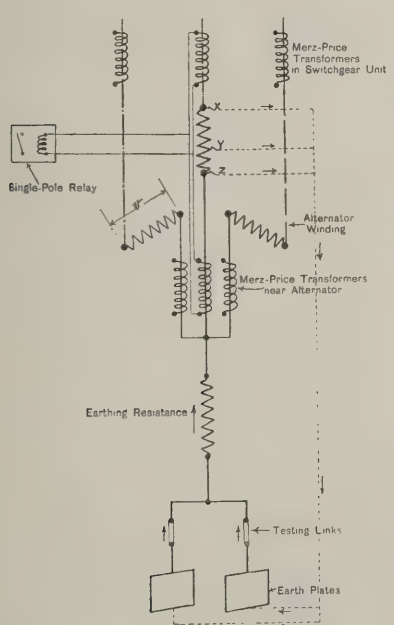


Fig. 4.

installation; set C was subsequently added, but the additional cost involved in modifying the value of the resistance preponderated over the advantage secured by the increased protection to set C. With the installation of sets E and D the resistance was re-modelled and its value adjusted to enable it to pass the normal full-load current of the largest machine, *i.e.*, 1,000 amperes with normal phase voltage impressed across it. In the following examples the original value of the resistance is retained so as to indicate the varying degree of protection afforded to the different sizes of machines.

Assuming that the limiting factor is the degree of stability of the protective transformers obtained, a relay setting of, say, 0.93 A will be taken to ensure that the relay will not operate with a straight-through current equivalent to twenty times normal full load.

The original resistance was designed to pass 300 A for 30 seconds, which corresponds to a resistance of $3,800/300 = 12.66$ ohms.

Machine A.—With 250/5A protective transformers, *i.e.*, 50/1 ratio, the corresponding primary out-of-balance current is $50 \times 0.93 = 47$ amperes.

The unprotected portion of the winding would now be $12.66 \times 47 \times 100/3.800 = 15.7$ per cent., *i.e.*, a protected portion of $(100 - 15.7)$ per cent., or 84.3 per cent.

Machine B.—The transformer ratio is 60/1. The primary out-of-balance current in 55.8 amperes, implying a drop of $55.8 \times 12.66 = 706$ volts across the resistance. Thus the unprotected portion is $706 \times 100/3,800 = 18.6$ per cent., giving a protected portion of 81.4 per cent.

Machine C.—Similarly the unprotected portion is $941 \times 100/3,800 = 25$ per cent., giving a protected portion of 75 per cent.

Machines D and E.—Similarly for each of these machines the unprotected portion is $2,360 \times 100/3,800 = 62$ per cent., giving a protected portion of 38 per cent.

By employing the M.V.E. modified Merz-Price system (S. L. Pearce's patent) and retaining the same value of limiting resistance, more favourable conditions are secured. With this system a much lower relay setting may be employed. Assuming a setting of 0.35 A, the unprotected portion of machines D or E would now be reduced to $886 \times 100/3,800 = 23.3$ per cent., giving a protected portion of 76.7 per cent., as compared with 38 per cent. with standard Merz-Price gear.

The following indicates how the same results may be obtained by employing a formula:—

Let v = Phase voltage.
i = Normal-load current of generator.
i = Primary out-of-balance current.
a = Relay setting = Primary out-of-balance current/normal load current $\times 100 = i/\text{I} \times 100$ per cent.
I_e = Maximum earth current.
R = Ohmic value of resistance.

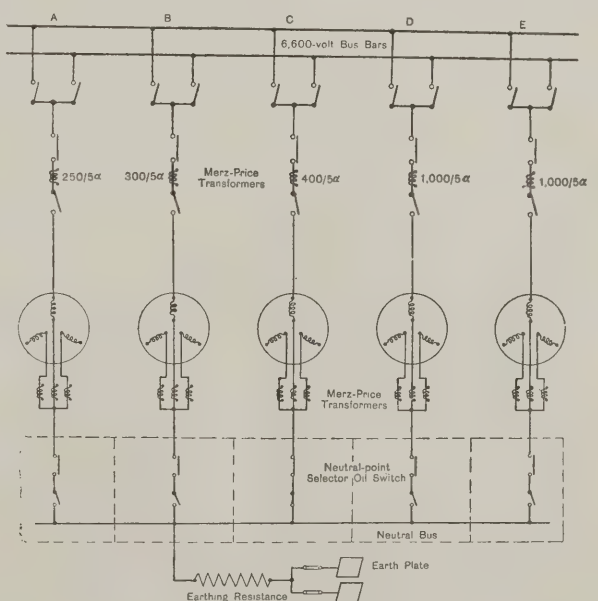


Fig. 5.

Percentage of winding unprotected = $\text{R} \times i \times 100/\text{v}$, but $\text{R} = \text{v}/\text{I}_e$ and $i = a\text{I}$.

∴ Percentage of winding unprotected = $100\ a\text{I}/\text{I}_e$.

∴ Percentage of winding protected = 100 (1 − relay setting × normal load current/maximum earth current) or winding protected = 100 (1 − out-of-balance current/maximum earth current).

Assuming that as an average value $a = 15$ per cent. for

standard M.-P. gear and 7 per cent. for the modified system, the protected portion of the winding can now be readily arrived at for varying values of the resistance so that a suitable value may be selected:—

A Percentage of winding required to be protected.	B % relay setting (*a*).	C Load current/max. earth current = 1/1
85	15	1
70	15	2
45	15	3
92	8	1
84	8	2
76	8	3

The figures in column A are obtained, as shown above, from the formula by mutiplying those in columns B and C and subtracting from 100.

The percentage of generator winding protected may be more readily obtained by plotting the primary out-of-balance (*i*) or leakage current in amperes as the ordinates and the maximum earth current (I) as abscissa, as indicated in fig. 6. Should the out-of-balance and earth-current values exceed those indicated, the curves may still be used by referring to both ordinates and abscissa as a percentage of the normal load current. The resistances of the fault and ground return are neglected.

Whilst determining the most suitable value of resistance when referred to the generator protective gear, it must not be overlooked that occasionally this value may have to be increased to ensure operation of the feeder protective year. If the latter embodies leakage protection, which even with a direct trip set, say, at 25-30 per cent. normal load, the resistance would be quite large enough for this purpose if it permitted 50 per cent. of the load current of the largest feeder to pass. If, however, plain overload protection only is provided and it is desired to protect against earth faults as well as phase faults, the resistance will have to have such a value as to permit the operation of the breaker on the largest feeder when the trip gear is at its maximum setting, unless fused trip coils are employed.

It sometimes may happen with a large-current low-voltage machine that economical considerations may permit only of the employment of direct tripping Merz-Price gear and connecting the neutral point solidly to earth. If a resistance were employed in such a case to pass the full-load current of the machine, the cost would be prohibitive. Such a case is shown in fig. 7, where a 1,000-kW, 3-phase, 350-volt generator composed the initial installation, and on extensions being necessary it was decided to generate and transmit at 6,600 volts, thus necessitating a step-up transformer for the low-voltage machine. With the arrangement indicated, the neutral of the second system (6,600-volt) could be selected from either of the direct-coupled machines or from the secondary side of the generator-transformer circuit. As is customary, the resistance for this system was designed to pass approximately the full-load current of the largest machine with full phase voltage impressed across it—*i.e.*, 150 amps.

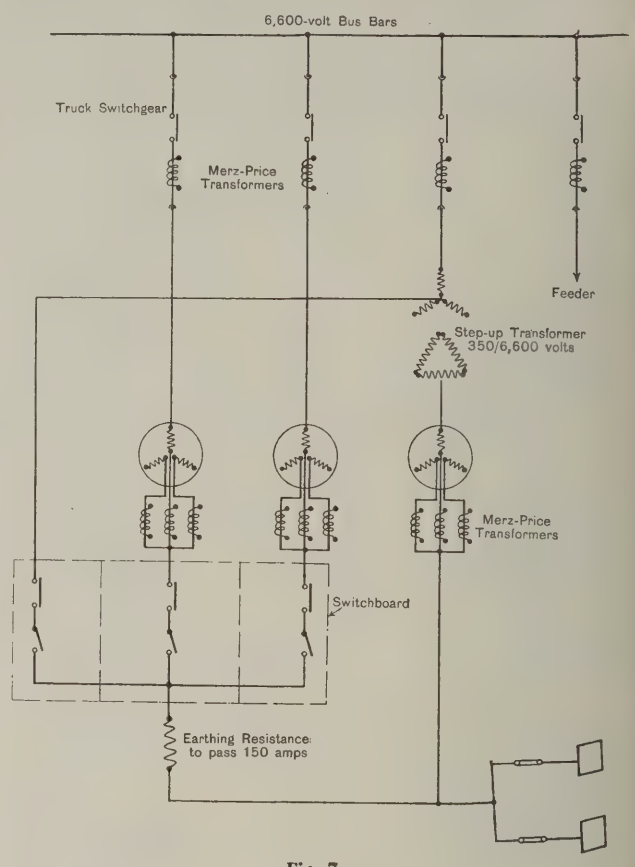


Fig. 7.

It may happen that a section of the system is found wherein no neutral point is available for connection to ground. In such a circumstance, to ensure uniformity of the operating conditions, special provision has to be made, an artificial neutral point being generally provided. Although this requirement may be met by using a transformer adapted for star connection to that side of the system and connected in delta on the secondary side, it is more usual to provide a three-limbed reactor having two coils in each limb, which coils are connected in zig-zag formation, as shown in fig. 8. Full particulars of this "zig-zag" transformer may be obtained on referring to the "J. & P. Transformer Book" by Messrs. Stigant and Lacey.

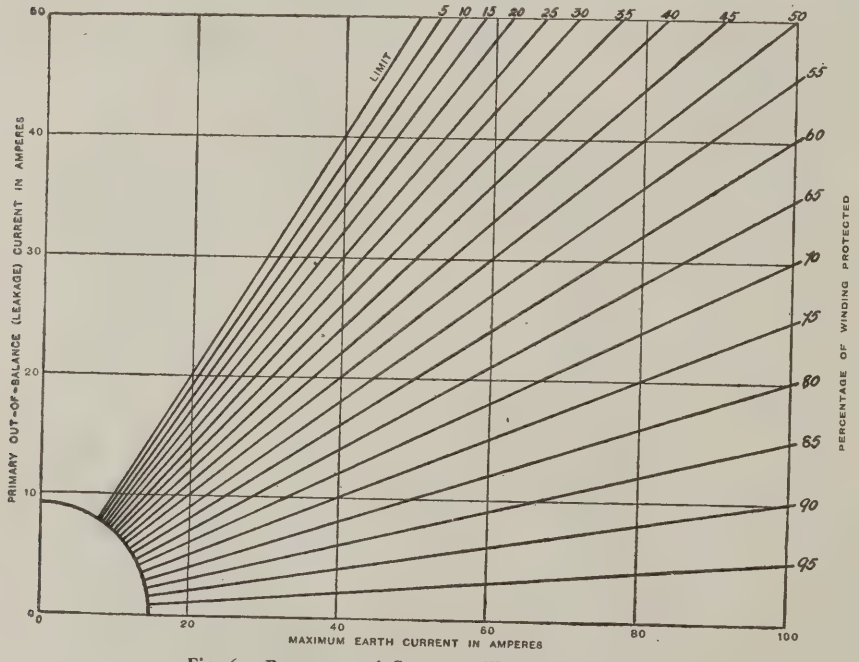


Fig. 6.—Percentage of Generator Winding Protected.

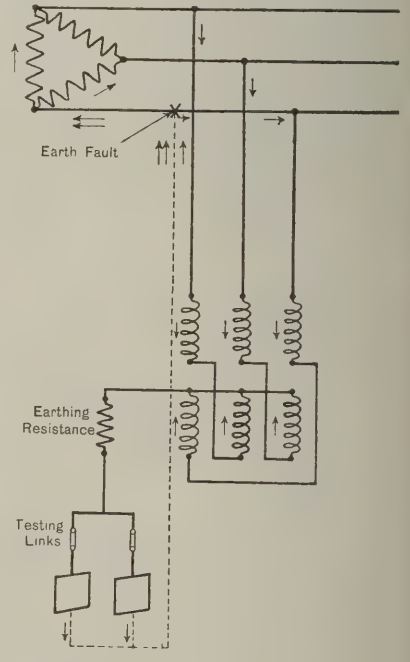


Fig. 8.—Zig-zag Transformer Formation.

The I.E.C. Meeting in America.—IV.

A Cursory Account of the Proceedings.

By PHEIDIPPIDES.

A NUMBER of recommendations are being made to the National Committees in the domain of graphical symbols for telegraph, telephone, and radio diagrams, in connection with which it is hoped that agreement will be reached in favour of definite adoption at the next session of the I.E.C.

The Advisory Committee on Terminal Markings, under the chairmanship of Dr. Strecker (Germany), was only able to review the present practice in various countries in a general way.

The question of obtaining international agreement is an extremely difficult one, since each country has already adopted the scheme which appears most to meet its particular requirements, and to make any change would be an expensive process and one liable to lead to confusion in the interim. However, the importance of international agreement is fully recognised, and it is hoped that by the time of the next meeting of the I.E.C. it may be possible to report a definite step forward in this matter.

The first decision of the Rules and Regulations Committee working under the chairmanship of M. Uytborck (Belgium) was to confine all discussion to overhead lines, underground construction being deferred to a later date. The Belgian Delegation, in accordance with decisions formed at a previous I.E.C. meeting, had prepared a draft set of standard rules. The German delegation circulated schedules showing the various rules and regulations in force in Germany, along with a proposed standard code.

The British delegation put forward proposals which supported generally the Belgian draft, and, in addition, suggested a method by which it would be possible for all countries to base their requirements, as regards the construction of wires and supports, on a simple formula containing a coefficient to meet the climatic conditions in the various countries in place of the various present methods of arriving at the design in different countries.

The British proposals, which were advanced by Mr. Ll. B. Atkinson, were at first subjected to considerable adverse criticism, but the discussion removed misunderstandings, and the merits of the system were recognised to such an extent that agreement was reached on the desirability of preparing standard regulations.

The Belgian Committee was instructed to obtain particulars of the regulations in force in all countries supporting the I.E.C., and on that information to formulate proposals for international agreement.

A council meeting was held at the close of the technical sessions on April 21st to discuss various matters of internal organisation, including the question of the election of the president. It was found necessary to bring the Statutes of the Commission into line with modern requirements, as they had not been modified since laid down in 1906.

Signor Semenza was unanimously re-elected president of the Commission, a decision which will receive world-wide support. Colonel Crompton, who has been the honorary secretary of the Commission for so many years, was promoted to honorary president, and Sir Richard Glazebrook was nominated as honorary secretary, which, in view of his forty years' experience of international work, is a happy augury for the future work of the Commission.

The question of revising the Statutes was referred to the Committee of Action in order that it might prepare definite proposals for the consideration of the various national committees. The Committee of Action will also be called upon to co-operate with the new international organisation on standardisation.

The Council does not, of course, deal with technical matters, so that the decisions of all the technical committees were referred to the final plenary meeting held on April 22nd by the individual chairmen, and in all cases were ratified.

The work of the Committee of Action since its inception at the Paris meeting was also ratified. It will be recalled that the Committee of Action was appointed by the Council to meet and consider important matters during the intervals between the general meetings and to keep the national committees informed.

A meeting of the Committee of Action will be held in Europe during the next few weeks to consider representations formally received from the new International Standardising body for close co-operation. This request was presented to the Committee of Action by Mr. C. E. Skinner, the chairman of the National Conference, Mr. Enstrom (Sweden), and Sir Richard Glazebrook (Great Britain).

Close co-operation between the I.E.C., now in being for more than twenty years and acknowledged by Governments, and the new body will have a far-reaching information and promulgation of international agreements, and the new body will have a far-reaching effect. A criticism has been levelled at the International Conference as being a hole-and-corner affair,* as it is obvious to anyone having experience of such meetings that the freedom of discussion necessary to come to an understanding would have been impossible at a public meeting.

The Conference, which has assumed formal shape in New York, is not the result of a sudden thought, but is the culmination of a series of deliberate steps originating with the national standardising bodies, which in most countries are supported by the industry as a whole.

The wonderful hospitality extended by the American reception committee to the visiting delegates throughout the New York meetings was brought to a fitting climax by a banquet at the Hotel Astor during the second week, when the Mayor of New York welcomed the Commission. Felicitous speeches were made by Signor Semenza (Italy), Monsieur E. Mytborck (Belgium), Professor Feldmann (Holland), M. Domingo Santa Maria (Chile), M. E. Huber-Stockar (Switzerland), Sir Richard Glazebrook (Great Britain), Dr. John W. Lieb (U.S.A.), and Professor Luigi Lombardi (Italy).

Later in the week the delegates tendered a dinner to the United States National Committee, under the presidency of Dr. Guido Semenza. In complimenting the committee on the remarkable kindness and thoughtfulness displayed in every detail of the arrangements for the Conference, Dr. Semenza mentioned specially the names of Dr. Lieb, Mr. Frank W. Smith, and Dr. Clayton Sharp. As a token of the delegates' appreciation of their magnificent reception, the president presented, on their behalf, a delightful souvenir of the visit in the form of a bronze copy of the well-known ancient statue of Victory, in Naples.

On Friday, April 23rd, the serious work of the Conference being completed, the delegates, accompanied by a number of American and Canadian hosts, started off on a 3,000-mile tour of inspection, covering the principal cities in the Eastern States and Canada. A special train of up-to-date sleeping cars had been placed at the disposal of the party, and this remained their headquarters during the twelve days' trip, most of the travelling from point to point being done during the night, leaving the days free for sightseeing.

The first city visited was Philadelphia, with its historic Hall of Independence meaning so much to the

*Because the Press was not allowed to be present at the discussions.

American nation. The party took tea in the Franklin Institute amid many interesting relics of the early days of electrical discovery. The Philadelphia Electric Co., whose chief engineer is Dr. L. Eglin, also president of the Franklin Institute, provided the entertainment for the guests, and this first day of the tour showed that there was to be some competition between the reception committees of the various towns to give the visitors the best possible time.

Washington, with its delightful lay-out and magnificent buildings, was reached at 7 a.m. on Saturday, April 24th, and for the short time available a full and interesting programme had been arranged. After visiting the Capitol and beautiful Library of Congress, the delegates were received by President Coolidge at the White House. The President shook hands with each delegate, and then kindly posed while the amateur photographer in the party "snapped" him.

Luncheon was provided at the Bureau of Standards, under the presidency of Dr. G. K. Burgess, and the afternoon was devoted to an inspection of the extensive laboratories. At the evening function, provided by the Washington Society of Engineers, the principal speaker was Mr. Hoovar, the State Secretary for Commerce.

Sunday, April 25th, was occupied in travelling by daylight through the remarkable Blue Ridge Mountains, along the River Potomac, and through Virginia and Maryland. This part of the country is full of historical associations of the French, Indian, and Civil Wars, and after an interesting journey the party arrived at Pittsburgh, the centre of the steel industry, to be welcomed by the local electrical representatives, under the chairmanship of Mr. T. P. Gaylor, of the Westinghouse Co.

On the Monday morning the party, after proceeding by river steamer to McKeesport, and thus having an excellent opportunity of viewing the vast industrial development of this important centre, lunched at the East Pittsburgh works of the Westinghouse Co., and afterwards inspected the hundred-acre factory. During luncheon the delegates were entertained by the KDKA orchestra, so famous in connection with transatlantic broadcasting.

Later in the day the party visited the Carnegie Institute, that magnificent centre of culture founded by Andrew Carnegie, the steel king, and after a dinner, presided over by Col. Samuel H. Church, rejoined the special train which was to convey them during the night to Chicago.

The competitive element in the entertaining was very clearly marked in the lavish and thoughtful reception accorded the Commission in this metropolis, which is the "beginning of the West." A wonderful programme of visits and entertainment had been arranged by the Commonwealth Edison Co., and when the day of sightseeing and speech-making was brought to a close, a daintily-conceived little surprise was sprung on the party. At the conclusion of an excellent musical comedy in the principal theatre in Chicago, an Indian chief came before the curtain and, in an admirable poem, welcomed the I.E.C. to his country, lauded its peace-making activities, and bade the party God-speed on its journey to other cities. The train left Chicago at 11 p.m. for Detroit.

The Ford works formed, of course, the principal venue in Detroit, and after admiring the working of that remarkable organisation and wondering possibly where such intense industrialism was leading humanity, the party was entertained by the Detroit Edison Co., saw its boulevards and power stations, and then moved across the river to Canada.

Niagara Falls was reached late the same evening, but not too late to prevent many of the delegates walking the few hundred yards to get a first glimpse of the swirling and tumbling waters in the moonlight before retiring. The Hydro-Electric Power Commission of Ontario and the Niagara Falls Power Co. combined to arrange an interesting programme of sightseeing and entertainment under the chairmanship of Mr. George S. Anderson. The various hydro-electric stations of international reputation were inspected, and the full beauty of the falls and gorge exhibited both by daylight and high-power flood lighting.

From Niagara the party moved on to Toronto, and after a short tour of the city it was entertained to dinner at the University, where the *bonne bouche* was a delightfully entertaining and witty speech made by Sir Wm. Muloch, K.C., the chief justice of Ontario. Leaving Toronto at midnight, Ottawa was reached early on Saturday, May 1st. There the Commission was received at the Parliament Buildings by the Speaker of the House of Commons of Canada, the Hon. Rodolphe Lemieux, K.C., LL.D. A pleasing little function followed, at which Dr. Semenza presented, on behalf of the visitors, a copy of the Head of Minerva. This was accepted by Dr. Barnes for the Canadian National Committee of the I.E.C. Several hydraulic plants of considerable interest and importance were inspected.

Sunday, May 2nd, was spent in Canada's commercial metropolis, Montreal—the morning in seeing and appreciating the natural beauties of this delightful city, and the afternoon in inspecting many interesting scientific and historical items in the McGill University. The work of Dr. Barnes, in his study of the ice in the St. Lawrence River, and the magnificent natural-colour photographs exhibited by him, were the cause of considerable comment.

During the night the party travelled to Boston, Mass., where a wonderful day was spent in visiting the Lynn works of the G.E. Co., the Massachusetts Institute of Technology, Harvard University, and the magnificently-equipped industrial Research Laboratory of the Simplex Cable Co. The Boston reception committee had a difficult task before it in entertaining the delegates so late in a tour on which so many wonderful things had been seen; but with its ample resources the difficulties melted. No day of the whole tour was so full of interest and kindly hospitality as the one spent in this city of Oliver Wendell Holmes and so many others whose names mean so much in American science and culture. The day so full of variety, entertainment, and instruction, was brought to a fitting close by an exhibition of a number of films, one showing the delegation arriving at Boston in the morning, and others illustrating the phenomenal rate of power development in the United States.

On Tuesday May 4th, the special train brought the party to its last objective, Schenectady, and the day was spent in a very complete inspection of the works and research laboratory of the General Electric Co. The entertainment was under the direction of Dr. E. W. Rice, and after a full day the delegates welcomed a night in a real bed. On the following morning the party moved off on the last stage of the tour, which consisted very suitably of a steamboat trip down the Hudson to New York. All agreed that this was a fitting finish to thirteen really strenuous days, and by the end of the week America had said good-bye to the European delegation, which was soon speeding eastward once more. Every one of the ninety delegates had the satisfaction of knowing that, as he returned to his own country and separated from this Electrical League of Nations, he had made many real friends, whose native tongue was not his own. The Conference had achieved great things in its official meetings, and by its personal contacts had done good work in cementing the engineers of the world into a common brotherhood.

Electricity in Farming.—According to the *Implement and Machinery Review*, about 90 farms are now using the Chester Corporation electricity supply for lighting, heating, cooking, ironing, vacuum cleaning, corn crushing, root cleaning and cutting, chaff-cutting, water pumping, wood sawing, and other tasks coming within the same category. Electric light in outbuildings has been found to expedite operations. Village craftsmen also make use of the same power, village institutions subscribe to the service, and in one village every house is using electricity. Even village streets and roads are illuminated by it. All this has been achieved without incurring a loss.

Hydroelectric Power on the Lower Isere.

The First Transmission in France at 120,000 Volts.

By T. RICH.

(*Concluded from page* 798.)

Transmission Line.

One of the reasons for the construction of the Basse-Isère station was the desire for an alternative and, so to speak, co-operating supply to the area round St. Etienne and Saint-Chaumond to work in connection with water power developed on the slopes of the central plateau.

A 60,000-V line, 93 miles long, to transmit 15,000 kW, was constructed before the war between the valley of the Romanche, near Grenoble, and St. Chaumond. Owing to the satisfactory results obtained with this line, and the increasing demands for power, it was decided to build the new station on the Isère. Part of the power supplied is used by the Loire et Centre Electrical Company and part by the Steel and Forge Company, of Homécourt, at Saint Chaumond. The supply was commenced in June, 1922.

From the station to Saint Etienne the length of the route is 43½ miles, and from the latter point to Saint Chaumond, a further 7½ miles. As the two companies purchasing power were connected with other water power interests with which it was desired to operate at times in parallel, it was decided to construct two separate transmission lines running parallel at a distance of 46 ft. apart, and arranged so that the two lines could be run separately or in parallel as desired; it was found that there would not be a great advantage from the point of view of first cost in running both lines on the same support, and that if this was done it would be much more difficult to obtain a safe and symmetrical arrangement of conductors. Moreover, the arrangement adopted allowed one line to be shut down when required.

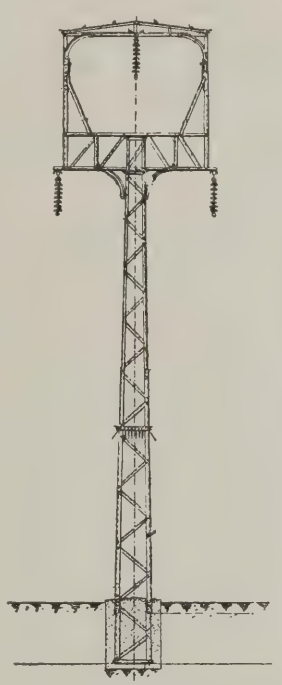


Fig. 10.—Line Support.

On the route to St. Etienne the line rises to 3,836 ft., and on the section on to Saint Chaumond 2,450 ft.; the line is double to the former place, where a 120,000/30,000-volt switching and sub-station exists, and single on to the latter, where the pressure is also reduced to 30,000 volts.

The line passes through several forests; where the line is double a clearance is made 50 yards wide, and with a single line 22 yards.

The supports for this line, which runs cross-country the whole way, are of a new type, fig. 10, patented by the Société Générale d'Entreprises, of Paris; it is designed so that the conductors can be placed in an equilateral triangle, an arrangement which minimises disturbances on neighbouring telephone and telegraph lines and reduces tendencies to surges. The bending moment about the base is reduced, as compared with supports with one conductor on one side and two on the other. The three conductors are suspended in three well-spaced vertical planes (8.3 ft.), which minimises the danger of short circuit when a sudden fall of snow from a conductor gives rise to a whipping motion. At first sight one would think that the enclosure of the top conductor inside a steel frame support would give rise to electromagnetic losses, but tests carried out on the line have shown no trace of the existence of such losses.

On normal line supports the top conductor is suspended at a height of 56.4 ft., the two lower at 42 ft. At the base the four angles of the upright are placed 3 ft. 7 in. apart; the angle steel is $2.75 \times 2.75 \times .275$ inches, with the top half angles $2.36 \times 2.36 \times .23$ inches.

The total height is 51 ft. 11in., of which 6 ft. 6¾ in. is in the ground. The total weight of each support is 1.360 kg., or nearly 27 cwt.

The terminal posts are designed to resist a breakage of the three conductors; they are similar in type to the others, but are stiffened up and weigh 2.185 kg., or 43 cwt. In the district where the line passes over high ground, where great difficulty was foreseen from the formation of ice on the conductors, the supports are still further strengthened; they weigh 3.205 kg., or about 63 cwt.

When crossing railways or telephone lines, angle brackets, fig. 7 (p. 797), are fitted projecting in the direction of the conductors, so that if a conductor broke it would be earthed at once.



Fig. 11.—Installing Suspension Insulators.

For the crossing of the River Rhone with a span of 245 metres (268 yards), the three conductors are arranged in a horizontal line; they are supported at a height of 24 metres above the ground. The supports in this case weigh 8½ tons each. The foundations were protected to resist the action of floods.

Insulators.

The Société Générale d'Entreprises, the contractors responsible for the design and construction of the line, chose insulators of the Hewlett type; they have the high breaking strength of 6 tons, and in case of breakage of an insulator they do not let the conductor down. With single suspension seven insulators are used, double suspension being used for the crossing of railways; for telephones and power lines, seven or eight

insulators are used; and for the Rhone crossing two sets of eight insulators in parallel. Fig. 11 illustrates the fixing of the insulators.

Conductors.

The conductors are of aluminium steel, and each has seven wires, 4.31 mm. diameter (about No. 7 s.w.g.), of total diameter 13 mm. (0.511 inch). The breaking strength is 2.65 English tons; weight 364 kg. per km., or 1,290 lb. per mile. In the upland district, where intense precipitation takes place owing to the peculiar conditions of ice, cold, and fog which exist at times, and where it has been found that ice can form round the cable, making a sleeve nearly 4 inches in diameter, a cable is used of 37 conductors and 15.8 mm. total diameter (.62 inch), with a total weight of 570 kg. per km., or 2,020 lb. per mile, with breaking strain of 4.18 tons. On this section the spans were limited to 80 metres, with a drop of 4.5 metres at 45 deg. C. The conductors are in an equilateral triangle 5.08 metres a side, about 16 ft. 8 in. apart; this allows of ample oscillation for the conductor. The earth wires are of galvanised steel of 50 sq. mm. section; they are attached to one of the top corners of the supports and fixed by means of a clip. The normal spans are 140 metres (153 yards); in special positions spans up to 220 metres have been adopted.

Four section stations are installed along the line so that, by means of links, any section of the line can be cut out for the repair of any damage, and further various combinations of conductors can be used. At each section station the conductors are rotated in position, and to avoid mistakes, the posts of one through line are marked with odd numbers, and the other with even. For the construction of the line, owing to the absence of railway communication on the route followed, extensive use was made of motor lorries for the transport of the necessary materials, the line supports being carried with the aid of two-wheeled trailers.

Experience since 1922 has shown that the precautions taken in the region where ice-cold fogs were prevalent were by no means excessive, and that the adoption of short spans for such sections and conductors of special breaking capacity was justified; in fact, at some particular points a deposit of ice 20 cm. (7.8 in.) thick has been experienced.

The engineers of the power company realise that, owing to the study of conditions ruling in each section of the work, it has been possible to design the line accordingly. At some points, under severe conditions of irregular strain due to ice deposits, the supports have shown signs of bending, but as the elastic limits were not exceeded, they recovered on the removal of the strain. Up to now, apart from wilful damage from gun-shot or the throwing of stones, the insulators have given no trouble, and despite extraordinarily difficult conditions, there has been no interruption in the service. The work at the power station and on the line strikes one as being of a high-class character.

Thanks must be given to the Basse Isère Company, and especially to the resident director, for information and illustrations, and thanks are due to the several contractors mentioned in the text for assistance and for the photographs used in the preparation of these notes.

Municipal or Company Trading.

Its Bearing on the Electricity Scheme.

By F. PEAKE SEXTON, A.R.C.S., A.M.I.E.E., Member Institute of Engineering Inspection.

The question of municipal *versus* private trading is to-day one of the most talked-of problems, and new facts, or even old facts presented in a new way, are likely to be both interesting and instructive. It is for this reason that the writer is presenting some data obtained primarily for a consideration of the new electricity scheme. It is, of course, admitted that even many opponents of municipal or rate-aided trading are prepared to allow that electricity supply forms a very fitting outlet for municipal activities, and the justice of this should be evident from the information here presented. Talking of "Rate-aided trading," the question arises, why not "Trade-aided rates?"—a phrase which the writer has never heard, it being generally left to an assumption that the trading is not successful. It is not fair to bias the mind in one direction before the facts are adjudged, although this is the usual method of dealing with a problem of a political nature, where in general the cry is "party," be it right or be it wrong. Nevertheless, the question is here brought forward in the scientific spirit, where the only party is the community, the right solution being the greatest good to the greatest number.

The word "community" is not to be taken as in any way connected with Communists, a body that has adapted a useful word to a special code of politics. Let the reader carefully consider this policy before reading further, and bear in mind that it is non-party, neither Conservative, Liberal, nor Labour.

The working costs of various supply stations are tabulated in Table I in accordance with the capacity of the plant installed, the municipal- and company-owned stations being separated. The charges for repayment of loans are very severe on municipal undertakings, and although companies do allow for depreciation, it is often inadequate; on the other hand, the municipal repayment is a handicap to municipal cheap production, but at the same time it is commercially a very sound policy.

The figures given are all for public supplies of electricity, and all stations are included for which returns are available.

Table I.

Mean size of plant in kilowatts.	Total cost of generation per unit, in pence. Municipal.	Company.
250	3.31	5.18
750	2.43	3.06
1,500	2.23	2.11
3,000	1.62	1.90
6,000	1.48	1.99
11,500	1.07	2.41
22,500	0.97	0.80*
45,000	0.81	1.27
90,000	0.62	0.98*

*These returns are based on only one station in each case.

Column 1 gives the average capacity of the station; 2, the average cost of municipal production; and column 3 the corresponding figure for company generation.

The cost of generation is affected by local conditions, nature of the plant, and the load factor among other matters, but as these figures are in most cases the mean of many stations, the costs are really comparable.

The results are not what the writer expected, as he anticipated for company stations a lower cost of generation with a higher profit per unit sold. Yet with only two exceptions the costs are higher, and in one of these cases there is only one station in the returns of com-

pany workings from which the average is obtained. In these cases it is only fair to point out that local conditions may have made the costs low, and in some cases the stations are partly buying in bulk and thereby confusing the costs. On the whole, this should lay to rest those tales of municipal waste and extravagance.

Turn now to Table II, where the profit per unit sold is shown both for the municipal and company undertakings cited in Table I.

Table II.

Mean size of plant in kilowatts.	Profit charged per unit. Municipal.	Company.
250	2.12	3.06
750	1.77	3.15
1,500	1.84	2.03
3,000	1.27	2.08
6,000	1.15	1.80
11,500	0.87	2.66
22,500	0.79	0.77*
45,000	0.75	1.40
90,000	0.70	0.58*

*These returns are based on only one station.

Here is shown the much higher profit demanded by the company than the municipal stations, specially in the smaller ones. In fact, in only two instances is the profit less in the case of companies, and here it is only fair to mention that the figures refer to one station in each case, and not an average. In the case of stations of about 750 kilowatts, the excess charged by the company stations is 1.38d. per unit, or nearly 80 per cent.; and, again, in the case of the 45,000-kilowatt stations the results are similar.

The figures given above are in all cases averages, and as the judgment of the results must depend on the number of stations considered, Table III gives the number of stations from which the two previous tables were obtained.

Table III.

Mean size of plant in kilowatts.	Total number of stations. Municipal.	Company.
250	12	47
750	17	26
1,500	32	3
3,000	25	8
6,000	37	4
11,500	29	2
22,500	28	1
45,000	12	5
90,000	5	1

These figures show that for the 250-kW stations there are four company undertakings to every municipal one, whereas in the case of 90,000-kW stations the figures are reversed. Very many of the small stations are subcompanies of some large Corporation, a fact that should tend to economy, but which nevertheless has not brought the cost down.

A careful consideration of these figures must result in an agreement that the municipal stations are able to produce electricity at a lower rate, and are willing to sell it at a lower profit, than the company stations.

In conclusion, it may be pointed out that although the advantages of municipal stations have been shown, this does not give support to the Government electricity scheme, as Table I shows that there is little difference between the "super" and the large stations. In some individual cases, smaller stations are producing at lower rates than the super-stations, so one might suggest the suitable selection of the station rather than size, but it appears that the latter is the main factor in the scheme now before Parliament.

On Applying for a Job.

By "JUDEX."

It has been my lot on many occasions during the last 20 years to sift out applications for advertised engineering posts, to recommend names for a "short leet," and (either alone, or as a member of a selection committee) to interview candidates and make the final choice. None of these things are easy. Some applicants, who would perhaps suit admirably, never get a chance because they do not know how to apply; others, palpably useless when seen, get selected for interview because they have the knack of stating their cases well; between are those who are interviewed, perhaps, for no other reason than a scarcity of candidates, and then turn out to be men of character and ability beyond what their papers would lead one to expect.

It may cost a shilling or two to get an application typed on good paper. Perhaps one ought not to be prejudiced by such a detail, but attention to it shows an orderly mind in the applicant and ensures legibility. For copies of testimonials, either printing or type should be the invariable rule, for no one will willingly wade through hand-written copies. Nevertheless a sample of handwriting should be worked in, preferably in a covering letter to the formal application; since, whether there is anything in graphology or not, most judges of character are in fact influenced by it. A man who cannot keep his lines straight is not likely to be neat in other respects; one who finishes his letter at the side or the top to save a sheet gives a glimpse into his mind. Among a batch of applications are generally some in which the grammar or spelling shows defects of general education which may be fatal for superior posts abroad, especially among natives; for the brown and yellow races are quick to recognise the mechanic who is not a "sahib" but is in a sahib's job. Avoidance of such errors may lead to the "short leet," but a minute's interview will, of course, prove if the candidate will do or not.

If the applicant's nationality is asked it is prejudicial to say "British subject" if in fact the man is also a Maltese or a Eurasian or a Hottentot. To omit to give a father's profession when it is asked for is a tactical error; many a shopkeeper's or drummer's son is a public school man and a first-rate engineer.

In recent years I have noticed that not 1 per cent. of those to whom it applies use the term "chartered (civil or electrical) engineer." Also, those with war service omit to state in what branch of the services they were or in what countries they served. Good war service, other things being more or less equal, is a qualification in itself, at least for the public service.

Young Indians, who go to America and come to England in increasing numbers for training, almost invariably concentrate on a sheaf of personal testimonials to character from their relations and friends who have attained high office; they also frequently apply for an immediate interview, in the hopes of getting a bulge on their competitors. Their experience at 25 is so vast that it is hard to understand why they are not in departmental charge at Schenectady or Trafford Park. One such, having been pitchforked into an assistant's job in a railway workshop, was told (after a week or two) to start up the plant next morning. After an hour's delay his chief had to come and do it; for the young genius *could* not and his subordinates *would* not.

For the men selected for interview I have much sympathy; it is a trying business, especially to a man of 30 or more, to have to answer technical conundrums offhand with three or four grey-beards staring at him.

But here are some questions which chartered electrical engineers have failed over :—

(1) What is the full charging voltage of a secondary cell? (Answers from 1.8 to 2.2 from several.)

(2) What will be the approximate fuel consumption of a 500-kW direct-connected Diesel set and the steam consumption of a similar turbine set, per kWh? (Several had no idea at all and had the sense to say so; others, in the same box, guessed —a foolish thing to do).

(3) What methods can be adopted for preventing the high-tension side of a transformer getting into the low-tension circuits? ("Fuses," said one.)

(4) Mention any methods of rendering an overhead line "dead" if it should break? (This stumped most, including a technical college lecturer.)

(5) How is the pressure drop over a rail joint determined?

(6) Distinguish between a motor-generator, motor-converter and rotary converter.

Not much weight, however, need be given to the ability to reply correctly to a *viva voce* examination. What the examiners are after is to see how the candidate behaves; whether he can look you straight in the face and show character and decision there; whether he can say: "I'm sorry, but I can't answer that offhand"; whether he tries to evade plain non-technical questions that are awkward.

One engineer, now very well known at home, obtained his second job and his real start in life by adding three years to his age, on my very immoral suggestion; I expect he is still saddled with those years, and would be glad to get rid of them. On the other hand, the best of a batch I was once interviewing had taken several years off his age, to get within the advertised limit. After some general conversation, when he was off his guard, I said, "Let's see, you are 29, are you not?" He went scarlet, and without more ado admitted the deception. He got the job and left it for a better within six months.

Perhaps the most extraordinary change in the whole matter is the attitude to degrees and diplomas. When I started life a man with a B.Sc. or the like had to keep quiet about it, for fear of being thought a something else also. Now it is an essential qualification for many posts that the applicant shall either have a degree in engineering or science or that he shall have become an A.M.I.E.E. by examination. The war concession in this matter is a little awkward at times.

The Association of Municipal Electrical Engineers (South Africa).

(From Our Special Correspondent.)

THE seventh Convention of the Association of Municipal Electrical Engineers (S.A.) was held in Johannesburg during the week April 12th to 16th, and was largely attended by members and delegates from various parts of the Union.

The first day was devoted to the business meeting, at which the retiring president, Mr. John Roberts, borough electrical engineer of Durban, presented his retiring address.

Mr. B. Sankey, general manager of the Johannesburg gas and electrical undertaking, was elected president for the ensuing year, while Mr. J. Mordy Lambe, city electrical engineer of East London, was elected vice-president, the members of the Council being elected as follows:—Mr. T. C. Wolley Dod, Pretoria; Mr. G. H. Swingler, Cape Town; Mr. John Roberts, Durban, past president; Mr. L. F. Bickell, Port Elizabeth; Mr. T. Millar, Harrismith; and Mr. E. Poole, Durban, with Mr. R. G. Tresise as honorary secretary and treasurer.

It was resolved that the next Convention be held at East London. During the week many interesting visits to works were made, and papers were read by the following :—

"Presidential Address."—Mr. B. Sankey, Johannesburg.

"Alternating Current Sub-Stations and their Equipment for Urban Areas."—Messrs. A. T. Rodwell and P. Fraser, Johannesburg.



(2nd Row).

? — E. POOLE, Durban (Member of Council). T. C. WOLLEY DOD, Pretoria (Member of Council). J. MORDY LAMBE, East London (Vice-President). B. SANKEY, Johannesburg (President). G. H. SWINGLER, Cape Town (Past President). L. F. BICKELL, Port Elizabeth (Member of Council). R. G. TRESISE, Johannesburg (Hon. Sec. & Treas.)

Members and Delegates of the Association of Municipal Electrical Engineers (South Africa) at the Convention held in Johannesburg.

"The Merits of Suction Gas Engines as Prime Movers in Municipal Power Stations."—Mr. H. M. S. Muller, Beaufort West.

"Discussion on Licensing of Electricians." — Introduced by the President.

A joint meeting of the Association and the South African Institution of Electrical Engineers was also held, at which a paper on "Electric Light and Power Schemes for Moderate-sized Towns in South Africa" was read by Mr. R. F. Botting.

The visits included an inspection of the Johannesburg municipal power station, workshops, and distribution system; the steel works of the Union Corporation of South Africa, Ltd.; the works of the Vereeniging Brick & Tile Co.; the Rand Water Board's pumping station; the Rosherville station of the Victoria Falls and Transvaal Power Co., Ltd.; and the Pretoria power station and Royal Mint.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Conserving Our Coal.—In order to conserve our dwindling stocks of coal, an order was made last week by the Mines Department restricting domestic supplies to 1 cwt. a fortnight obtainable only by the written permission of the local authority or its duly authorised officer. Householders were asked to exercise the utmost economy in the use of electricity and gas. In the case of industries, businesses and establishments, the consumption of coal is to be restricted to one half of the normal, unless a special case can be made out to the satisfaction of the local authority. This applies also to the consumption of gas and electricity. The order banned absolutely all lights used solely for display and advertisement, except where they are necessary for the public safety.

Glasgow Corporation and Tramway Strikers.—At a meeting of the Glasgow Corporation on May 27th, Mr. T. A. Kerr, the leader of the Labour group, moved the suspension of the standing orders to enable him to bring forward a resolution instructing the tramway manager to reinstate all employés who ceased work during the general strike. The suspension was refused by a majority, and the Labour members then prevented further proceedings and the meeting was adjourned for a fortnight.

A Useful Demonstration Device.—The *Electrical World* recently made mention of a demonstration device employed by the Alabama Power Co. in one of its show windows. It consists of a board to which are plugged six devices—a bowl fire, a vacuum cleaner, an iron, a percolator, a churn and a small table stove. An electric fan motor operates a contactor device which puts each appliance into circuit in turn for about six seconds. In the centre of the board is an indicating wattmeter calibrated in cents per hour based on the company's rates for energy, and this shows the actual cost of operating each appliance.

The Australian Duty on Radio Valves.—The *Board of Trade Journal* states that the operation of the Australian import duty on valves for radio-telegraphy and telephony has been deferred until July 1st.

Lead.—Messrs. James Forster & Co., reporting on May 29th, stated:—"Prices during the week have been practically stationary. Consumption has again received a check in this country, consumers being restricted to 50 per cent. of their normal fuel supply. This in turn means a smaller demand for lead. In Germany, on the other hand, consumption is improving and a shortage of lead has developed, with the result that orders are being placed in London for prompt shipment. This had the effect of relieving the pressure of supplies here. . . . The future of the market is obscure, so much depending upon whether the coal dispute is settled quickly or not. A restriction of consumption in this country to 50 per cent. of the normal would be bound to be felt if continued for long, but on the other hand, an early settlement would mean a good demand from home consumers for prompt lead and would probably result in a shortage of ex ship lead and a consequent advance in price. The Board of Trade returns for April are:—Imports 30,652 tons, exports 1,946 tons, leaving for home consumption 28,706 tons."

New Indian Companies.—Among the electricity undertakings recently organised in India are the Narayanganj Electricity Supply Co., formed at Armenitola (106 Kaliprasanna Ghose St.) Dacca, Bengal, with a capital of 500,000 rupees, and the Rangpur Electricity Supply Association, organised at Rangpur (Bengal) with a capital of 100,000 rupees.

Dublin Contractors' Meeting.—The *Irish Electrician* reports that the Dublin branch of the Electrical Contractors' Association held its first annual meeting on May 10th, when the chairman, Mr. A. G. Bruty, gave a *résumé* of the work accomplished during the year, including the formation of a joint committee with wholesalers and factors for the discussion of matters of trade interest. Real progress had been made towards a policy advantageous to all interests. Amongst various matters dealt with, the Dublin Commissioners had been seen concerning the proposed drastic restrictions on the erection of electrical signs, and the city engineer concerning fixing tariffs for electric cookers. Membership had increased considerably. Mr. Bruty was appointed chairman, and Mr. A. J. Orr was elected to the committee.

N.S.W. Preference Proposals.—The Premier of New South Wales (Mr. Lang) recently announced that the State Government had decided that in respect of its orders it would grant a preference of 30 per cent. to locally-manufactured articles over foreign goods, and one of 20 per cent. over British goods. The preferences would be inclusive of Commonwealth tariff duties and preferences already in existence. The preference over British goods would diminish according to the amount of duty already imposed upon them. For instance, where a 10 per cent. preference already existed, the State's preference would be reduced to 10 per cent. The Sydney *Daily Guardian* considers that these preferences mean practically nothing to local industries as the principal items required by the Government are already given more than 20 per cent. preference over British goods by the Commonwealth tariff. This journal quotes electrical fittings (35 per cent.) and electrical machinery (40 per cent.) among other examples.

Wages in the Engineering Industry.—The engineering trade unions intend to proceed with their applications for increased wages by districts, the demand for a national increase having been unsuccessful. A conference is to be held at York on June 11th, when it is expected that those districts which have not yet put forward applications will do so. Although it is understood that there was a majority in favour of a strike in the London area, further action has been deferred.

German Turbines for Russia.—An *Exchange Telegraph* message from Berlin states that despite keen English competition, a Russian order for three turbines valued at £40,000 has been secured by the Allgemeine Elektrizitaets Gesellschaft.

Employment During April.—The May *Ministry of Labour Gazette* says that employment in the engineering industry during April, though still bad on the whole, showed a further improvement. In the electrical section it remained fair, although it showed a slight decline as compared with April, 1925. The general engineering percentage of unemployed was 10.4, while in the electrical section the proportion was 6.6 per cent. as compared with 6.7 per cent. in March and 5.6 per cent. in April last year. In both comparisons unemployment in the electrical wiring and contracting industry showed an increase, being 8.6 per cent. On the other hand, unemployment was lower in the electrical cable, wire and electric lamp manufacturing group, at 6.5 per cent.; this figure compared with 8.5 per cent. in April, 1925.

Carrying on During the Strike.—Electrical manufacturing companies took every measure in their power to continue operations during the general strike. The Automatic Telephone Mfg. Co., Ltd., found itself at the outset with a depleted staff of toolmakers, sheet metal workers, cabinet makers and other "key" men, but by a reorganisation a temporary balance was maintained to keep the various departments working and prevent 94 per cent. of the staff from being thrown out of work. Two of the company's delivery vans were put into service as temporary "'buses" to enable the staff to get to and from their homes.

"Exide" Batteries at the Pole.—Another example of the reliability of "Exide" batteries under strenuous conditions is demonstrated by the fact that the airship *Norge* was equipped with these batteries for radio and other purposes during her eventful trip over the North Pole. The Byrd and Wilkins expeditions also used "Exide" batteries.

Chilean Commercial Secretary's Address.—As from June 5th the address of Mr. W. F. Vaughan Scott, the Commercial Secretary for Chile, will be 66, Calle Teatinos, Santiago.

The National Radio Exhibition.—We have received from the National Association of Radio Manufacturers and Traders full details of the arrangements for the National Radio Exhibition which is to be held in the New Hall, Olympia, from September 4th to 18th next. The Association states that although the space contract will be with itself (as being the only body properly constituted to enter such a contract) the promoters are the Radio Manufacturers of Great Britain—members of the N.A.R.M.A.T. and of the Society of Radio Manufacturers. The allocation of space will be made by ballot in the case of firms whose applications are received by June 14th; thereafter the allotment will be at the discretion of the organisers. The regulations for the Exhibition contain a number of matters of interest. In the first place, there is nothing in them to indicate that the Exhibition is confined to members of the two associations mentioned; it can be assumed, therefore, that any maker or distributor of radio apparatus can enter, subject to the proviso that all exhibits and component parts thereof must be of British manufacture, *i.e.*, made in Great Britain or Northern Ireland. No "listening" or loud speaker demonstrations by exhibitors will be permitted, nor any electric signs or other apparatus capable of causing interference. No exhibitor may give, or assist or support the giving of, any public demonstration within a quarter of a mile of the Exhibition. Publicity matter issued from the stands is to be subject to the Exhibition Committee's approval and must only deal with actual exhibits. Each exhibitor is required to provide a fire extinguisher for his stand. The organisers have made arrangements with the British Broadcasting Co., Ltd., for the reproduction of its programmes, and the Royal Air Force band has been engaged for the run of the Exhibition.

A Handicap to Australian Electrical Development.—Giving evidence recently before the South Australian Royal Commission on Manufactures and Secondary Industries, Sir John Monash, chairman of the Victorian Electricity Commission, said that Victoria was poorly industrialised, in spite of cheap power, on account of the high tariffs on imported articles. He maintained that the heavy duties on electricity consuming devices, such as radiators, fans, stoves, &c., should be removed. In that matter the interests of the community at large were in direct conflict with those of the manufacturers.

Sales Conference.—Representatives of Philips Lamps, Ltd., from all over the country recently came together in conference to discuss the policy for the coming lighting season. On the second and concluding day of the conference a dance was held at the Wellington Hall, St. John's Wood, and the event proved very successful.

New Canadian Works.—New works for the manufacture of secondary batteries for motor car, radio and marine use, have lately been completed in Kingston, Ont., by the Monarch Battery Co., Ltd.

The Timber Market.—Our timber trade correspondent reports that the heavy stocks of building and general utility woods in the country, so noticeable at the end of the first quarter of the year, were supplemented by increased quantities imported in April. The consumption throughout the first four months of the year, however, was good, which kept the stock position at a fair volume. The general stoppage of trade during the early days of May was the means of restricting large supplies going into consumption, but this condition should be levelled off by the expected greater demand in the early future, and particularly when the coal dispute is ended. The hardwood trade on the whole cannot be described as strong. Imports of mahogany have increased, especially of the lower grades, which require much effort to sell from first hands, although good qualities keep firm in value. Sawn hardwoods from the United States, principally oak, arrived more freely last month compared with a year ago; these were not wanted, considering the large stocks already held before their arrival. In hard and fancy woods generally the demand is usually limited, but the call at present is very much restricted. The poor grades, both as regards quality and size, are hard to sell from first hands, but good logs command full figures.

Trade Announcements.—MESSRS. MANDA MOTORS, LTD., of Royal Mint Street, E.C., who commenced manufacturing operations in March last year, are taking additional factory accommodation. They have been placed on the Admiralty list.

The head offices of the SCOTT INSULATED WIRE CO., LTD., have now been removed to their new premises at 44, Queensland Road, Holloway, N.7. Their new telephone number is North 1707 (not 1706, as given in our issue of May 7th).

MESSRS. PRITCHETT & GOLD and E.P.S. CO., LTD., state that they are despatching as quickly as possible all orders which were held up by the strike consequent upon the difficulty experienced in moving goods either from the works at Dagenham Dock or from the Pimlico Road depôt.

MESSRS. MEDWAY'S SAFETY LIFT CO., LTD., have appointed Messrs. Fairclough & Co., Ltd., 11, New Station Street, Leeds (Telephone No. "Leeds 21105"), as their agents for the Leeds district.

The PHŒNIX ELECTRICAL CO., LTD., has removed to 18, Scotland Street, Glasgow. 'Phone No.: "South 2011."

MESSRS. JAMES GORDON & CO., LTD., report a record month in the sale of Cope's feed-water regulators, 50 sets having been ordered during May for super power stations.

Mr. E. A. PINTO has transferred his Margate and Hythe businesses to his head office at 96, High Street, Ramsgate, to which address all communications should be sent.

Catalogues and Lists.—MESSRS. D. H. BONNELLA & SON, LTD., 46 and 48, Osnaburgh Street, N.W.1.—A well-illustrated, priced catalogue of automobile accessories, including lighting fittings, fans, cigar lighters, flower vases, &c.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—A booklet dealing with the design of electric motors, written for users.

MESSRS. FERGUSON, PAILIN, LTD., Higher Openshaw, Manchester.—Catalogue Section No. 30 B1, illustrating and describing oil-immersed circuit breakers for outdoor service at pressures ranging from 11,000 V to 135,000 V and of various rupturing capacities.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 and 39, Upper Thames Street, E.C.4.—A priced and illustrated list (No. 151) of "Siemens" electric fans of various patterns.

MESSRS. NEWTON BROS. (DERBY), LTD., Alfreton Road, Derby.—A catalogue containing illustrations and full particulars of the company's induction motors ranging in capacity from 3 to 240 h.p.

MESSRS. W. WADSWORTH & SONS, LTD., Bolton.—A well-produced brochure, illustrated with half-tone and coloured reproductions, describing the firm's electric lifts in very full detail.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—"The Benjamin Reflector" for May-June, containing illumination data and particulars of "R-L-M" reflectors.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A priced and illustrated sheet advertising the "Supreme" fan and "Universal" toasters, table cookers, &c. Also folders dealing with an electric floor polisher, which can be hired, and the "Universal" electric curling iron.

"Z" ELECTRIC LAMP & SUPPLIES CO., LTD., 73, Newman Street, W.1.—A price list of "Cosmos" electric fans.

THE S.G. BRILL COMPANY, Aldwych House, Aldwych, W.C.2.—A wall-chart bearing illustrations of "Brill" tramcar parts and a pad of order slips.

THE SUN ELECTRICAL CO., LTD., 118 and 120, Charing Cross Road, W.C.2.—A series of illustrated pamphlets dealing with the "Sunshine" vacuum cleaner, lightning arresters for radio sets, electric floor polishers, electric sterilisers, violet-ray apparatus, &c.

STANDARD TELEPHONES & CABLES, LTD., Bush House, Aldwych, W.C.2.—A handsome brochure containing an illustrated description of the installation of the company's "Public Address" system in the new Liverpool Cathedral.

MESSRS. NEGRETTI & ZAMBRA, LTD., 38, Holborn Viaduct, E.C.1.—List No. T6, containing particulars of the company's electrical thermometers and pyrometers.

THE IGRANIC ELECTRIC CO., LTD., 149, Queen Victoria Street, E.C.4.—Publications Nos. 6216 and 6219, dealing, respectively, with a "Universal" coil holder, and a tone control and damping resistance. Illustrated and priced.

MR. J. R. MORRIS, 15-19, Kingsway, W.C.2.—A priced and illustrated pamphlet advertising "Columbia" dry batteries for radio work.

SIEMENS BROS & CO., LTD., Woolwich, S.E.18.—Price Sheet 641, containing full details of the company's dry batteries for all purposes.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—A showcard advertising the company's automobile lamps and Leaflet No. 74, dealing with Philips rectifiers for automobile and radio batteries.

Bankruptcy Proceedings.—STEPHEN PAGE, Carholme Road; FRANK LEECH, Breadgate, both Lincoln; and HENRY HUDSON, Shrewsbury Road, Sneinton, Notts., trading in co-partnership as the East Midland Engineering Co., Lincoln, engineers. The following are creditors herein:—

	£		£
Edison Swan Electric Co., Ltd.	186	Clegg, Stanley	101
Dawson's Electric Co.	91	Crampton & Co., Ltd.	34
Howard, G. A.	45	Tucker, J. H., & Co., Ltd. ...	22
Chloride Electrical Storage Co., Ltd.	52	Lincoln Corporation	22
Shipley & Co., Ltd.	27	Bright, J. & A., J. B. Anderson, Mellers, Basden & Mellers, Darbyshire & Co.	80
Fyfe, Douglas	42		
Croft, Alice	55		

W. H. GREENALL, trading as the Hampton Electric Co., Newerne Street, Lydney, Glos., electrician.—The first meeting of creditors was held on May 26th at Cardiff. The statement of affairs showed liabilities of £472 and assets of £65, leaving a deficiency of £407. Debtor attributed his failure to losses on contracts. The case being a summary one, was left in the hands of the Official Receiver as trustee.

F. J. NORTH, electrical engineer, 13a, Midland Road, Wellingborough.—Trustee, Mr. D. Helliar, The Parade, Nottingham, released May 18th.

S. J. WATSON, lately carrying on business with H. Rothwell and F. C. Jinks as the Vulco Magneto Co., 11, Long Acre, W.C.—Last day for proofs for dividend, June 12th. Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C.

J. WORSLEY, electrician, 10, Green Street, Darwen.—First and final dividend of 5s. 7d. in the £, payable June 11th, at the Official Receiver's offices, 11, Winckley Square, Preston.

Company Liquidations.—C. A. C. RADIO, LTD., 10, Rangoon Street, E.C.3, and at Bournemouth and Leeds.—A meeting of creditors was held on May 21st at Winchester House, E.C., when the chair was occupied by Mr. E. W. Sudlow, C.A., Ilford, Essex, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. No statement of affairs was presented, but it was reported that the liabilities amounted to £14,600, and that there was a deficiency of £6,148. The issued share capital of the company was £19,500, so that the total deficiency was £25,648. The liquidator stated that at two previous meetings of the creditors it was thought that a scheme might be put forward whereby the company would be able to carry on. That scheme, however, did not materialise and eventually resolutions were passed for voluntary liquidation. The liquidator added that since he had been appointed he had found very serious discrepancies between the figures given at the first meeting and those which were now before the creditors and that had full information been given at the time there would have been no possibility of any scheme being formulated. A resolution was passed to the effect that application should be made to the Court for the appointment of Mr. J. W. Galloway to act as joint liquidator with Mr. Sudlow.

SHENTON & CO., LTD., wireless and electrical engineers, 68, Shoe Lane, E.C.—A meeting of creditors was held on May 26th at the offices of Messrs Poppleton, Appleby & Hawkins, Charterhouse Square, E.C., when the chair was taken by Mr. E. H. Hawkins, who had been appointed to act as joint liquidator with Mr. W. B. Pearson, John Street, W.C. The statement of affairs submitted disclosed liabilities of £4,700, and the assets, after allowing £3,600 for debentures, totalled £2,550, leaving a deficiency of £2,150. Mr. Hawkins reported that the company was registered in January, 1922, as a private company with a nominal capital of £4,000, of which 3,000 shares were issued as fully paid to a Col. Handley as purchase price for a business which Col. Handley had bought from the receiver of the company then known as F. J. Shenton & Co., Ltd. Various accounts had been prepared showing a series of net losses. The liquidator said that from time to time the company borrowed money from its bankers on the guarantee of Col. Handley and from the Electrical Trades Supply Co. The company was pressed for repayment of the loans and made strenuous efforts to obtain further capital from another source, and after considerable negotiations a Mr. E. H. Tubbs found £3,500, of which £1,000 was paid to the bank, and £1,500 was utilised to satisfy the claim of the Electrical Trades Supply Co., leaving £1,000, which was used as working capital. To secure the loan the company created debentures up to £4,000 at 7½ per cent. interest, of which £3,500 worth were issued to Mr. Tubbs. Col. Handley then resigned from the board and transferred his shares to Mr. Tubbs and a Mr. W. Nicholson was also appointed a director. At a later date Mr. Tubbs resigned his position as a director and on February 25th last, in order to protect the assets against seizure by the sheriff, he appointed Mr. Pearson as receiver. Mr. Pearson cut down the working expenses of the business to a considerable extent and had paid £1,100 off the debentures. The meeting broke up without any resolution being passed, but an advisory committee was appointed, consisting of Mr. Adams, representing the

Siemens & English Electric Lamp Co., Ltd., Mr. W. A. J. Osborne, representing creditors, and Mr. E. Judd, of Corfield's Traders' Association, representing the "Z" Electric Lamp and Supplies Co. The following are creditors:—

	£
Accumulators (Birmingham), Ltd.	69
British Thomson-Houston Co., Ltd.	121
Byron, C. H., & Co.	38
Bedford Electric & Radio Co., Ltd.	154
Birmingham Mailing Cases, Ltd.	33
Brandes, Ltd.	32
Chasseral (Switzerland)	74
Davies, Kent & Stewart	32
Eifflander, T. (Berlin)	229
Nenn Werke (Nürnberg)	145
Fonteyn, Gilbert & Co., Ltd.	35
Formo Co.	32
Grother & Sohne (Germany)	123
General Electric Co., Ltd.	81
Grau, Hermann (Germany)	32
Hough, J. E., Ltd.	55
Igranic Electric Co., Ltd.	56
Kohler, A., & Co. (Germany)	41
Kromberg & Schubert (Barmen)	83
Hehne, J. G. (Germany)	32
Mullard Radio Valve Co., Ltd.	80
Marconiphone Co., Ltd.	46
Newberger, J. (Germany)	139
Portable Utilities Co.	31
Reeves & Co.	84
S.D.H. Manufacturing Co., Ltd.	89
Siemens & English Electric Lamp Co., Ltd.	333
Trent Electric Wire Works, Ltd.	39
Tubbs, E. H.	400
Tant & Co., Ltd.	32
Wooding & Co.	43
"Z" Electric Lamp & Supplies Co., Ltd.	133

BURWOOD (CONCESSIONAIRES), LTD., wireless and electrical manufacturers, Great Queen Street, W.C.—A meeting of creditors was held on May 26th, at the offices of the Society of Incorporated Accountants and Auditors, E.C., when a statement of affairs was presented, showing liabilities of £1,679, all due to unsecured creditors. There were debentures and interest amounting to £517. The net assets were £213, leaving a deficiency as regarded the creditors of £1,466, and a total deficiency of £2,466. The liquidator reported that the company was registered in July 1925, with a nominal capital of £1,000 in £1 shares, and took over the business originally carried on under the style of the Burwood Electric Supply Co. The total purchase price was £1,308. On January 22nd last a debenture was registered for £500, to Mr. J. H. Wood, for a cash consideration. Branches were opened at Manchester, Dublin and Brighton. None of those branch shops had done an extensive business, and apparently losses were incurred throughout. The present position was attributed mainly to a trade protection agency putting the company on its "black list." In reply to questions, the liquidator said that if there were any books he had not been able to obtain them. He was unable to state who the vendor was or who were the partners of the Burwood Electric Supply Co. Mr. J. H. Wood (the managing director) knew nothing about the business of the company; he supplied the money and left the business entirely to his brother, Mr. L. R. Wood. The liquidator also said that he was appointed as liquidator on April 10th, and on May 10th he was appointed receiver for the debenture holders. He stated that the greater part of the stock was made up of wireless parts. The creditors decided not to confirm the voluntary liquidation. The following are creditors:—

	£
Bergmann Electric Co., Ltd.	623
Brownie Wireless Co., Ltd.	25
Cleartron Radio, Ltd.	60
Ferranti, Ltd.	20
General Electric Co., Ltd.	20
International Wireless Manufacturers	75
Metro-Vick Supplies, Ltd.	40
Maltzhm & Sprager	40
Pratt, F.	40
Raper, C.	28
Rothermel Radio Corporation of Gt. Britain, Ltd.	75
Re-Echo Radio Co., Ltd.	40
Rochester Automobile Co., Ltd.	86

SCAMMELL & ABBOTT, LTD., Birmingham, electricians, and dealers in radio goods.—A further meeting of creditors was held recently. At the previous meeting a statement of affairs was submitted which disclosed liabilities of £1,572, all due to unsecured creditors, while the net assets amounted to £276, leaving a deficiency of £1,296. Messrs. Scammell and Abbott were both present at the adjourned meeting, and stated that according to a balance sheet which was prepared up to the end of May, 1925, the company was then solvent. At that time there were certain moneys due to them in respect of undrawn salaries. The business was disposed of a few weeks previously by the receiver for £400. It appeared that for the past year the trading of the company had resulted in heavy losses. It was decided to confirm the voluntary liquidation of the company, with Mr. W. F. Chaundy, Birmingham, as liquidator. A committee of inspection was also nominated, consisting of Messrs. A. Cripwell, Wood, and F. E. Bendall.

FULLER'S UNITED ELECTRIC WORKS, LTD.—Mr. Justice Romer, in the Companies Winding-up Court, on June 1st, again had before him a petition for the compulsory liquidation of this company. Mr. Hunt, Counsel for the judgment creditor (Mr. R. H. Symonds), said the petition was stood over for a scheme of arrangement, but his client had received no communication from the company since, and so far as he could say, no scheme of arrangement was forthcoming. He, therefore, asked his Lordship to make the usual order for compulsory winding-up. His Lordship made this order.

RADIO PHONOPHORE & ELECTRIC, LTD.—Mr. Justice Romer, in the Winding-up Court on Tuesday, adjourned the petition of Mr. C. W. Slingo, of Ealing, for an order for the compulsory liquidation of this company. Counsel for petitioner said he understood that negotiations were proceeding, which it was hoped would lead to the purchase of the company's business, and to the payment of all the creditors.

ACE BATTERY CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. Sands, Imperial Buildings, Victoria Street, Nottingham.

MAYWOOD ENGINEERING AND ELECTRICAL MANUFACTURING CO., LTD.—Winding up voluntarily. Liquidator, Major L. Russell-Wood, 27, Charles Street, Holland Park, W.11.

DOUGLAS SOUTHERN ELECTRIC TRAMWAYS, LTD.—A meeting of creditors was held on June 3rd, at the offices of the Liquidator, Mr. L. N. Jackson, 71, King Street, Manchester. Particulars of claims to the Liquidator by July 5th.

BRISTOL & SOUTH WALES ELECTRIC WELDING CO., LTD.—Particulars of claims to the Liquidator, Mr. P. Jones, Premier Buildings, 6 and 7, St. John Square, Cardiff, by June 14th.

GENERAL ELECTRIC TRAMWAYS CO., LTD.—Winding up voluntarily. Liquidators, Messrs. T. Gower and H. W. Davis, 88, Kingsway, W.C. A meeting of creditors was held on May 31st. Particulars of claims to the Liquidators by June 30th.

Private Arrangements.—J. V. BRITTAIN, electrical and wireless engineer, 121a, Liverpool Road, Stoke-upon-Trent.—The creditors interested herein were called together recently, when a statement of affairs was submitted which disclosed liabilities of £6,112 and net assets of £2,931, leaving a deficiency of £3,181. It was reported that debtor started business in November, 1923, without capital. Some time ago he opened a cycle factoring business in Liverpool Road and traded as the Stirling Engineering Co. In reply to questions, it was stated that the turnover in 1924 was approximately £12,000 and in 1925 £20,000. Very little gross profit had been made. It was decided to accept a composition of 7s. 6d. in the £ payable as to 3s. 4d. in three months, 3s. 4d. in six months, and the balance in nine months, secured by the execution of a deed of assignment in favour of Mr. G. G. Poppleton, Birmingham, as trustee, with a committee of inspection. The following are the principal creditors:—

	£
Siemens & English Electric Lamp Co., Ltd.	750
Metro-Vick Supplies, Ltd.	200
Marconiphone Co., Ltd.	180
Burndept Wireless, Ltd.	85
Graham, Alfred, & Co.	172
Pope's Electric Lamp Co., Ltd.	313
Edison Swan Electric Co., Ltd.	440
General Electric Co., Ltd.	200
Falk, Stadelmann & Co., Ltd.	270

The Erste Brunner Machinery Works.—A Vienna correspondent of the German *Vossische Zeitung* draws attention in the issue of that journal for May 18th to the position of the Erste Brunner Maschinenfabriks Gesellschaft, which was rightly regarded as one of the greatest industrial undertakings in former Austria-Hungary, and in Czecho-Slovakia after the collapse of the dual monarchy. The company had always paid high dividends and transferred considerable sums to reserve funds. Under the influence of the large banks in Vienna it was able to obtain a big dollar loan in the United States last year, the undertaking tending financially more towards Vienna than to Prague and the interests of the Stock Exchange being greater in Vienna than in Prague, as numerous Austrian shareholders had retained their shareholdings despite the fact that the concern had passed into Czecho-Slovakia. Suddenly a fall in the quotations for the shares of the Brunner undertaking took place and this continued after the markets in other directions had begun to show signs of recovery. The directors announced after a meeting held in February that the dividend for 1925 could be estimated at 25 Czech crowns, with corresponding allocations to the reserve fund, this result comparing with 35 Czech crowns in the previous year. This diminution in the results by no means justified the constant fall in the shares; wild reports got into circulation without, however, the directors finding it necessary to take up a position in regard to them. This incomprehensible situation continued for two months until it was learned that Dr. Franz Pauker, general director of the Brunner Works, had resigned. The directors have now communicated the results of a further meeting, their statements confirming the worst apprehensions. There is no question of any profits for 1925; the secret reserves and probably a large part of the open reserves (56,000,000 Czech crowns) will have to be drawn upon for the extinction of the losses which have been suddenly ascertained. The directors' communication is silent on what has really happened, but the correspondent states that it appears to have been established that false balance sheets have been prepared perhaps for years, in which the stocks, debtors, doubtful claims and even the claims in foreign currency, have been entered at a level far in excess of their real value. The correspondent adds that the losses incurred by the shareholders are immense and that it is incomprehensible how these conditions could have escaped the patronising banks or the investigation which was carried out on behalf of the New York banking firm before the loan of 4,000,000 dollars was granted.

The Pulverised Fuel Plant for Barking.—The contract for the installation of pulverised fuel-firing at the new extension of the County of London Company's power station at Barking will take nearly three years to complete at a cost of more than £750,000. The Lopulco system is to be installed (International Combustion, Ltd.), and we are informed that the contract includes ten B. & W. boilers of 16,500 square feet heating surface, ten Usco air heaters of 18 600 sq. ft. heating surface, ten "Lopulco" furnaces that will absorb 65,000 sq. ft. of Murray fin tubing, ten 15-ton super Raymond pulverising mills, ten exhausters ten cyclones, ten economisers, each with 6,100 sq. ft. heating surface, ten super-heaters, each with a heating surface of 6,500 sq. ft., 20 induced and ten forced draft fans. Each combustion chamber will have a volume of 10,800 cubic feet, based on a combustion of 24,000 B.th.u.'s per cubic foot maximum, and approximately 16,800 B.th.u.'s per cubic foot normal rating. Each combustion chamber will be fitted with 11 burners with Usco suspended arches. In addition, there will be five chimneys complete with two grit catchers, boiler feed pumps, Bailey instruments, boiler house plant buildings, turbine house buildings and switchgear house buildings.

Unemployment.—On May 17th the number of persons registered as unemployed was 1,612,700. This total was 36,801 more than on May 10th and 427,680 more than on the equivalent date of 1925. In addition to the total given above claims for benefit had been lodged by 408,000 persons affected by the coal dispute and the general strike.

Book Notices.—"Touring by Motor Coach" (114 pp. and map). Atherton (Lancs.): The Lancashire United Tramways, Ltd. Price 6d.—This handbook contains full particulars of the company's motor services which cover a very wide area. It is also an illustrated guide book to the places served by the coaches.

The McGraw-Hill Publishing Co., Ltd., 6, Bouverie Street, E.C.4, has issued its May list of books on mechanical engineering and allied subjects. A brief indication of the scope of each work is given.

Handbooks of the U.S.A. Bureau of Standards: No. 6, "Safety Rules for the Installation and Maintenance of Electrical Supply Stations" (10 cents); No. 7, "Safety Rules for the Installation and Maintenance of Electric Utilisation Equipment" (15 cents).

"Southampton Docks." (Pp. xlix + 135, ill.) London: Southern Railway Co.—This profusely-illustrated brochure contains full particulars of the facilities available at the Southampton Docks, with details of handling charges, &c., as well as a great deal of general information of service to shipowners and traders.

"Power-Factor Wastes," by C. R. Underhill. First edition. Pp. xiii + 326; figs. 117. London: McGraw-Hill Publishing Co., Ltd. Price, 17s. 6d.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV. May, 1926. London: E. & F. N. Spon, Ltd. Price, 10s. 6d.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLV. No. 5. May, 1926. New York: The Institute. Price $1.

Dutch Electrical Exports.—The American Vice-Consul at Rotterdam informs *Commerce Reports* that exports of electrical machinery and equipment from the Netherlands during 1925 increased in volume by 208 metric tons, but fell in value by 1,515,000 florins. The total value was 31,135,000 florins and the weight 12,914 metric tons. There was an increase in practically all classes, the only exceptions being lamps, generators, and small motors. The lamp exports accounted for 21,966,000 florins of the total, as compared with 25,076,000 florins in 1924. The exports of radio apparatus (largely to Great Britain) were doubled in value, and there were appreciable increases in shipments of telegraph and telephone apparatus and cables.

Social Events.—On May 19th about 95 of the employés of the Woking Electric Supply Co. travelled by road to Eastbourne for their annual outing. Upon arrival lunch was served at the Gildridge Hotel, and in the course of the proceedings reference was made to the loyalty of the staff during the general strike. The party returned *via* Horsham and on the way organised a tug-of-war competition in which the Wiring Department proved successful.

To celebrate the opening of the Rotherham Corporation's first power station 25 years ago, the staff held a dinner on May 20th. Alderman A. R. Habershon (chairman of the Electricity Committee) presided, and Mr. E. Cross (chief engineer) and Mr. H. N. Rodgers (superintendent) who were with the original undertaking, were present. Proposing the toast of "The Department," Mr. Rodgers said that during the last two or three years the station had produced electricity at the lowest cost in the country. The total plant capacity had risen from 240 kW 25 years ago to 70,000 kW to-day. Mr. E. Cross, in reply, said that when they started the power station in Rotherham there was a staff of eight, and now there were 308. During the current year they had connected 800 consumers; it had taken from 1901 to 1915 to connect an equal number. Referring to the cost of production, Mr. Cross said that last year they were something like 15 per cent. better than the next best. This year they looked like being 20 per cent. better; the figure for 1926, he thought, would be the wonder of the country, it would probably be from .45d. to .38d. per kWh. Mr. Cross criticised the Electricity Bill, and said that in Rotherham they could generate electricity much cheaper, if left alone, than they would be able to do if the proposals of the Government, as they stood at present, were adopted. Alderman Habershon also replied, and said that it was most important for them to see that their consumers got their electricity at the cheapest possible cost instead of aiding the rates. An excellent musical programme was provided.

The Brush Electrical Engineering Co.'s football club wound up a successful season recently with a dinner at the Boot Hotel, Loughborough. The members of the team were congratulated on winning the championship cup and medals and on being the runners-up in the County Medal competition. Mr. W. J. Hume, who presided, was presented with a replica of the cup in appreciation of his services.

The Laundry Exhibition.—The International Laundry and Allied Trades' Exhibition was held at the Agricultural Hall, N., last week. A great deal of laundry machinery was on view and much of it was electrically-driven; it was noticed, however, that the belt drive was favoured rather than the use of direct-coupled motors. Among the firms showing machinery employing the latter mode of driving were Messrs. Thos. Broadbent & Sons, Ltd., who had upon their stand several examples of hydro-extractors with the centrifuge mounted upon the motor shaft—either above or below the motor. The largest machine shown had a 48-in. diameter container. Messrs. Watson, Laidlaw & Co., Ltd., also showed motor-driven extractors incorporating a safety cover which could only be raised when the motor was at rest. Messrs. Thos. Bradford & Co. exhibited a large drying and finishing machine chain driven by a 7.5-h.p. motor, hot air being supplied by a "Thermofan." The control gear was of "Brookhirst" manufacture. The principal exhibit of Messrs. W. H. Allen, Sons & Co., Ltd., was a steam engine coupled to a 100-kW, 220-V, d.c. generator. The company also showed a 15-b.h.p. crude-oil engine; motor-driven centrifugal pumps; a 35-b.h.p. vertical-spindle motor; and a motor-driven turbine borehole pump. The Hurley Machine Co. displayed its washing, wringing and ironing machines. Two of the last were electrically heated—by no means a common practice here. The smaller ironer has a total loading (*i.e.*, motor and heater) of 1,100 W; there are controls at each end—for either hand, and swinging racks for the ironed articles. The length of the roller is 44 in. and it is eminently suitable for domestic use. The larger machine, designed for small laundries, such as those at institutions, has a 50-in. roller and is equipped with the same easy control devices as the smaller ironer. The Singer Sewing Machine Co. showed a number of electrically-driven and illuminated sewing machines. Messrs. Matthews & Yates, Ltd., exhibited a number of "Cyclone" motor-driven fans and an air washer. Boiler furnaces were displayed by the Turbine Furnace Co., Ltd., and Messrs. Crosthwaite (Leeds), while boilers, boiler fronts, and steam engines were shown by Messrs. Davey Paxman & Co., Ltd.

For Sale.—Mr. A. G. Ralston, of Philipstoun, West Lothian, owing to the change-over to the public supply, has for disposal two 32-kW Westinghouse transformers, two 25-kW rotary converters, and several lengths of armoured cable. Grimsby Corporation Electricity Department invites offers for one 210-kW Belliss & Morcom-Westinghouse steam generating set. Aberdeen Corporation Electricity Department invites offers for one 720-kW d.c. generating set, surface condenser, pumps, &c. Aberystwyth Corporation electricity works has for disposal several generating sets, Paxman boiler, two Worthington pumps, heater, water cooler, pipes, &c. Mr. H. J. Shaw will sell by auction on June 9th, at 13, High Holborn, W.C., wireless and electrical goods and material. (See our advertisement pages to-day.)

A Greek Contract.—*The Times* reports that in face of competition from American, German, French, Swedish, and Italian concerns, the new Antwerp Telephone and Electrical Works has secured sole rights for the reorganisation and exploitation of the Greek telephone and wireless services. The contract is worth about two and a half millions sterling.

Lighting and Power Notes.

Argentina.—HYDRO-ELECTRIC DEVELOPMENT.—Work has recently been completed by the Sociedad Empresa de Luz y Fuerza, of Mendoza, on the construction of a hydro-electric station at Cachenta. The new plant will enable the company to dispense with its small steam-operated generating sets which have been very costly to run owing to the high cost of fuel. The company is now supplying electricity to 11,553 consumers, representing a load of 21,418 kW.

Australia.—VICTORIA.—The Electric Supply Co., Ltd., has prepared a scheme in connection with the acquisition of its undertakings in Bendigo and Ballarat by the local authorities. It proposes that the concession shall be extended for a minimum of 30 years. The local authorities would then be paid a percentage of the profits, according to a sliding scale, and a sinking fund would be formed to permit of the authorities taking over the undertakings free of charge at the termination of the concession.

Arrangements are being made by the Victorian Electricity Commission for dealing with the requirements of further energy by the metropolitan and outer metropolitan districts. The output of energy from the Yallourn and Newport "B" generating plants combined has now reached a total of 627,000 kWh daily, and over 15,000,000 kWh was received at the Yarraville terminal station in March. This quantity exceeded that for the corresponding period of 1925 by more than 50 per cent., and it is anticipated that the following year will exceed the current year for the same period by at least 50 per cent. Works are being carried out to accomplish a change by which energy will be transmitted from the Commission's system to the major portion of the area served by the Melbourne Electric Supply Co. Additional electrical circuits are being arranged between the Yarraville terminal station and the South Melbourne sub-station of the Commission, crossing the River Yarra by two steel towers, each 250 ft. high. A number of additional h.p. sub-stations with connecting mains will complete these works.—*Reuter's Trade Service* (Melbourne).

Beckenham.—ELECTRICITY CHARGES.—The Urban District Council has decided to wire the houses on the Shortlands Estate, and electricity is to be supplied at the fixed weekly rate of 1s. 3d. for two-bedroom houses and 1s. 6d. for three-bedroom houses, all electricity consumed being charged at 2d. per kWh, or if a cooker is installed at 1½d. per kWh.

Bridport.—ELECTRICITY SCHEME.—The Town Council has decided to make application for a loan of £25,000 to carry out an electricity scheme for the town. The power station is to be erected at West Allington and the charges are to be 1¼d. per kWh for power and 8d. per kWh for domestic purposes.

Burnley.—MAINS EXTENSIONS.—The Electricity Committee has recommended to the Corporation that mains extensions be proceeded with in the Lowerhouse and Cheapside districts at an estimated cost of £5,000.

Canada. — HYDRO-ELECTRIC DEVELOPMENT. — There is a possible development of 600,000 h.p. on the Gatineau River properties controlled by the International Paper Company, according to Mr. A. H. White, of New York, chief engineer of the company, speaking before the Ottawa branch of the Engineering Institute of Canada. The total cost of the storage dam above Maniwaki, the electrical development, and the paper mill, will be in the neighbourhood of $50,000,000. Mr. White confirmed the purchase of Paugan Falls from the Hull Electric Company, and stated that plans and surveys had been made for its development, but that work had not commenced. The power development at Paugan Falls, Chelsea, and Farmer's Rapids, will deliver 405,000 h.p. Of this amount 220,000 h.p. had been contracted for by the Ontario Hydro-Electric Power Commission and the paper mill would require 36,000 h.p.

Chislehurst.—CHANGE-OVER.—The Urban District Council has given its consent to an application from the Foots Cray Electricity Supply Co., Ltd., to change the pressure of supply in its area from 100 to 200 V.

Continental.—BELGIUM.—The report of the Société Intercommunale Belge d'Electricité shows that the capacity of the plant at its eight power stations increased from 124,250 kW to 150,250 kW. The sales of electricity during 1925 were 36 per cent. in excess of those of the preceding year. In order to provide against any interruption in the supply, the central stations at Sweveghem, Alost, and Malines are being linked together by a 50,000-V transmission line. In order to meet the increasing demand the Société Bruxelloise d'Electricité, of Brussels, is increasing its capital from 15 to 22 million francs with the object of adding a new 30,000-kW turbo-generator at its power station, the output of which last year increased by 30 per cent.

The Société d'Electricité de la Campine, which was formed some time ago, has so far confined its attention to the distribution in a number of communes in the province of Limburg of electric power obtained from collieries in the Limburg and Antwerp provinces. It has now decided to establish its own power station of from 15,000 to 20,000-kW capacity at a convenient point in the new Campine coalfield.

SWEDEN.—Considerable changes have recently been effected at the hydro-electric station at Trollhattan, Sweden, bringing the capacity of the plant up to 120,000 kW. Two of the 10,000-kW sets have been converted from 25 to 50 cycles, while two of the turbines have been provided with double generators, one for either frequency. A 132-kV transmission line has also been established between the Trollhattan plant and the State steam-operated power station at Västeras.

GREECE.—It is reported that a syndicate has been formed in Athens to establish a large hydro-electric station to utilise the power of the Vladova Falls about 75 miles west of Salonica.

ITALY.—The Società Generale Elettrica de l'Adamello is doubling the capacity of its power plant at Adamello, which when completed will be able to supply 300 million kWh per annum.

Ealing.—LOAN SANCTIONED.—The Town Council has received sanction to the borrowing of £52,547 for mains and services, and £67,453 for works on consumers' premises, in connection with the change-over of its system of electricity supply.

Fleetwood.—NEW PLANT.—The Urban District Council is to install a 2,000-kW set, a new boiler and auxiliary plant at its electricity works at a cost of £21,000, and application is being made for sanction to a loan for this purpose.

Glasgow.—PROGRESS DURING APRIL.—During April 110 houses were wired under the Corporation's assisted wiring scheme, bringing the total to date to 2,232. The number of applications for the hire of appliances was 110, bringing the total to date to 10,291.

Guildford.—ELECTRICITY IN BULK.—The Electricity Committee has under consideration the question of providing bulk supplies from the new generating station to neighbouring authorities. The Cranleigh Gas & Electricity Co. is applying for an Electricity Order for the Cranleigh area based upon a bulk supply from the Corporation.

Hornsey.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £26,000 for mains and services

Leeds.—ELECTRICITY IN BULK.—The Electricity Committee has received consent to an extension of the agreement for the supply of electricity in bulk to the Morley Corporation.

London.—ISLINGTON.—The Electricity Committee has decided to install four additional h.p. feeders at an estimated cost of £25,000.

Mansfield.—NEW SUB-STATION.—The Electricity Committee has recommended to the Town Council the erection of a 100-kW sub-station in connection with the supply of electricity to Mansfield Woodhouse, and that application be made for sanction to a loan of £2,500 for that purpose.

Melton Mowbray.—STREET LIGHTING.—The Urban District Council has accepted the tender of the Melton Mowbray Electric Light Co., Ltd., for public lighting for a term of five years at £225 per annum and 4½d. per kWh for electricity consumed, the company to maintain and renew all standards, &c.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

GILLINGHAM.—Heating, cooking and domestic purposes: 1½d. per kWh for the first 100 kWh per quarter and 1d. per kWh beyond.

GUILDFORD.—Lighting: First 500 kWh per quarter from 7½d. to 6¾d. per kWh; all energy in excess of this amount from 4½d. to 3¾d. per kWh. Power and heating: First 500 kWh per quarter, from 2¾d. to 2½d. per kWh; beyond, from 2d. to 1¾d. per kWh. Kinemas and theatres: First 100 kWh per week, from 4½d. to 3¾d. per kWh, above this amount, from 2¼d. to 2d. per kWh. Industrial supplies: Combined rate for lighting and power, from 2d. to 1¾d. per kWh.

Preston.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,000 for the purchase of domestic apparatus to be let out on hire.

Queensbury.—ELECTRICITY SUPPLY.—The Urban District Council has decided to link up with the Yorkshire Electric Power Company, and an electricity supply is promised for next winter.

Shotley Bridge.—ELECTRICITY SUPPLY.—The Cleveland and Durham County Electrical Power Distribution Co. is considering a proposal to provide a supply of electricity to Shotley Bridge and district.

Siam.—BANGKOK.—The Siam Electricity Co., of Bangkok, in order to meet the increasing demand for electricity supply, has recently ordered a new 5,000-kW turbo-generator set. The old boilers are also to be replaced by new ones, a modern switchboard installed, and the distribution system re-arranged to meet present-day requirements.

South Africa.—CAPETOWN.—According to the *South African Engineer*, the electrical engineer (Mr. G. Swingler) estimates that the total sum of £200,000 will be required for extensions and reconstruction of the electrical system during this year.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Colwyn Bay Urban District Council to supply electricity in part of the rural districts of Conway and Glan Conway; the Burton-on-Trent Corporation to supply in the urban district of Swadlincote and parts of the rural districts of Repton, Hartshorne, Seals, and Tutbury; the Electrical Distribution of Yorkshire, Ltd., in the rural district of Wetherby and part of the rural district of Wharfedale; the Orford Electric Light & Power Co., Ltd., in the urban districts of Leiston-cum-Sizewell, and parts of the rural districts of Blything, Plomesgate, and Woodbridge; the Long Eaton Urban District Council in part of the urban district and part of the parish of Toton; Mr. J. A. Purves in the urban district of Bungay; and the Worthing Corporation in parts of the rural district of East Preston, Thakeham, and Steyning West.

Applications for Special Orders have been made by the following authorities:—The Southwold Electricity Supply Co., Ltd., for the supply of electricity in the borough of Southwold and part of the rural district of Blything; the Whitstable Electric Co., Ltd., to extend its area of supply so as to include part of the rural district of Blean; the Leatherhead & District Electricity Co., Ltd., to supply in parts of the rural districts of Epsom, Reigate, and Dorking; and the Torquay Corporation in parts of the rural districts of Newton Abbot and Totnes.

Stoke-on-Trent.—NEW PLANT.—The borough electrical engineer has submitted a report to the Town Council on plant extensions at the electricity works, and the Council has resolved to apply for sanction to install an additional 10,000-kW set and two new boilers, and to a loan of £160,000 to carry out the extensions.

Strathpeffer and Dingwall.—TEMPORARY REDUCTIONS.—The Strathpeffer and Dingwall Electric Co., Ltd., has decided during the duration of the coal dispute to reduce the charge for electricity for heating and cooking to 2d. per kWh. The rate also applies to dwelling houses charged on the valuation system.

United States.—BAY OF FUNDY SCHEME.—Preliminary permits for hydro-electric development on Passamaquoddy Bay, Me., involving the utilisation of the Bay of Fundy tide, have been issued by the Federal Power Commission to Dexter P. Cooper, Inc., New York City. This is the first action taken by the Commission on this proposed development, which is expected by its promoters to yield 500,000 h.p The scheme involves the construction of a number of dams between the islands at the mouth of the bay, so as to make use of the rise and fall of the tide, which amounts to more than 25 ft.—*Reuter's Trade Service* (Washington).

Wirral.—ELECTRICITY SUPPLY.—The Rural District Council has been recommended by the Electricity Committee to accept the offer of the Birkenhead Corporation for an electricity supply. Birkenhead Corporation, it is suggested, should administer the Order granted to the Rural District Council and electricity will be supplied in the Council's area on the same terms as those applying to the out-townships which the Corporation already supplies—*i.e.*, at rates 25 per cent. above those charged in the borough. Birkenhead hopes to be in a position

to supply Moreton with electricity within three months. The completed scheme will cost about £60,000.

The Birkenhead Corporation has received the sanction of the Electricity Commissioners for a " fringe " order to supply electricity to the Plymyard housing estate between Bromborough and Eastham in the Rural Council's area.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—According to the *Industrial Australian and Mining Standard*, the work of preparing the whole of the lines in the Sydney area for electrical operation is rapidly nearing completion (electric trains are already in operation on certain lines), but there still remain to be erected a number of sub-stations and carriage sheds. Sub-stations are being provided at St. Leonards and Gordon, on the North Shore line, and at Lewisham and Homebush, on the main line. The sub-stations at Sydenham, Hurstville, and Sutherland have been completed, and are now in use supplying energy to the trains running on the Illawarra line. On the Bankstown line a sub-station is being erected at Belmore. The large carriage sheds at Punchbowl and Mortdale have been completed, and are now in use.

Blackpool.—NEW CARS.—The Corporation proposes to spend over £15,000 on new tramcars and equipment this year.

Continental.—PORTUGAL.—The work of electrifying the steam railway between Lisbon and Casaes is rapidly approaching completion, and it is expected that the new system will be ready for operation during the coming summer.

SPAIN.—A new electric railway 23 miles in length, known as the Urola, has lately been completed between Zumarraga and Zumaya. The necessary energy is supplied at 30,000 V, three-phase, a.c. from the power station of the Sociedad Hidro-Electrica Iberica, and is converted to 1,500 V d.c. at a transformer station at Azpeitia by means of two sets of transformers and mercury rectifiers. The rolling stock consists of seven motor coaches for passenger coaches and seven motor goods wagons. Each vehicle is provided with four 75-h.p. motors, and although 1,500 V d.c. is used for traction purposes, a converter is installed on each vehicle to enable the controller, the brakes, and the lighting to be operated at 110 V.

Darlington.—RAILLESS CARS.—The Electricity and Transport Committee has appointed a sub-committee to consider and report upon the question of introducing new railless-car services.

Oldham.—TRACK RENEWALS.—The Tramways Committee has under consideration the relaying of the tramway track from Sheepfoot Lane to Royton Town Hall, at an estimated cost of £10,000.

Royton.—TRACK RENEWALS.—According to the *Electric Railway and Tramway Journal*, the Oldham Tramways Committee and representatives of the Urban District Council failed to come to an agreement with regard to the relaying of the tramway track in Oldham Road, Royton, and the running of 'buses in that district. In consequence of the deadlock an appeal has been made to the Ministry of Transport to send an inspector to act as arbitrator. The Oldham Tramways Committee is anxious to relay the length of track from Sheepfoot Lane to Royton Town Hall at a cost of at least £10,000. This increased capital expenditure would, according to the agreement entered into, mean a reduction in the rent that Oldham pays to Royton of £250 per route mile. The Council desires that the present track should be used for a year or two longer.

Sheffield.—TRAMWAY EXTENSION.—It is reported that the City Council has sanctioned the extension of the tramway to the Woodseats terminus at an estimated cost of £50,000.

South Africa.—RAILWAY ELECTRIFICATION.—The electrification of the Cape Town suburban services, just begun, marks the last stage in the 1922 development programme of the South African Railways, involving the construction of 850 miles of new track. This follows upon the electrification of the Natal main line between Glencoe and Maritzburg, which, with a track mileage of 300 miles—as far as from London to Carlisle—is now claimed to be the longest electrified main line in the world.—*Financial Times.*

Southern Railway Electrification.—*The Times* reports that the final stage of the Southern Railway's suburban electrification scheme, the total cost of which is £8,000,000, will be reached on June 6th, when electric services will be opened between Charing Cross, London Bridge, and Dartford. The new electric trains will run by way of Greenwich, Blackheath, and Woolwich, Bexley Heath, and Sidcup. This section represents a mileage of 72 track miles, and the cost of its conversion to electric traction has been about £1,100,000. With its completion, the Southern Railway will have a total electric mileage of 647 track miles, which is the largest suburban electric service in the world.

Staffordshire.—ABANDONMENT OF TRAMWAYS.—The Minister of Transport has made an Order authorising the abandonment of part of the tramway and light railways of the Potteries Electric Traction Co., Ltd., as from September 30th next.

West Ham.—TRACK RENEWALS.—The Borough Council has received from the Ministry of Transport sanction to a loan of £33,855 for the reconstruction of the tramway track in Green Street from Romford Road to Barking Road.

Telegraph and Telephone Notes.

Australia.—BALLAN " BEAM " STATION.—About half-way between Ingliston and Ballan, a few miles south of the Ballarat railway line, are the six steel towers of the Australian " beam " wireless-telegraph transmitting station. The main building at the station itself has been almost completed, and the tests will probably be carried out before August. A very short wave length, probably less than 40 metres, will be used at the Ballan station, the cost of which is likely to be less than one-third of the cost of a long-wave station; six masts, each 250 ft. in height, are required, and it is expected that the power to be used by the transmitters will be about 25 kilowatts. The site at Ballan is about 1,800 ft. above sea level, and is free from " shielding " hills. The masts stand on a plateau slightly elevated above the surrounding country. The station will consist of two separate transmitters, one for communication direct with England and one for working with Canada. Two aerial systems will be needed, each supported by three masts, and the angle of the beam will be about 45 degrees. In the morning the aerial pointing to the north-west will be in use, when the beam path to England will then be for the greater part of its length in darkness; in the evening, however, the beam will be sent in a south-easterly direction, going round the other half of the earth, which will then be in darkness. The Canadian aerial will transmit in a north-easterly direction only. All the electricity for working the transmitters as well as for domestic purposes in the cottages of the station staff will be generated at the station. Each engine and generator is set in a block of concrete which rests on a bed of compressed cork to prevent vibration being communicated to the transmitting apparatus; the concrete blocks on which the transmitters will be built will also be set on beds of cork. Messages will be transmitted from the offices of Amalgamated Wireless (Australasia), Ltd., by whom the station is owned, in Melbourne at a speed of 100 words a minute by means of a telegraph line to Ballan.—*Reuter* (Melbourne).

France.—TELEPHONE SERVICE.—The development of the Government-owned telephone system has improved since the war, but long-distance lines are wholly inadequate, while rural lines are almost unknown. The first of the five long-distance cables planned, the one to Strasbourg, is to be completed shortly. In June, 1923, the French Parliament voted to replace with automatic equipment the manual systems in a number of the larger cities. An appropriation was made for this purpose, but subsequent depreciation of the franc rendered it inadequate, though Nice, with 4,900 lines; Orleans, with 3,200 lines; and Dieppe and Vichy, with 800 lines, each, have been changed over and 5,000 lines at Le Havre have been finished, but not yet placed in operation. Contracts for the installation of automatic systems at Bordeaux and Lyon have been let and the Montpellier exchange of 3,000 lines, is under construction, as are others at Nantes, Reims, Colmar, and Fontainebleau. The Government has appropriated 210,000,000 fr. for an automatic system in Paris. The first contract will be for 40,000 lines, and ultimately there are to be 130,000, says *Commerce Reports*. Eleven new exchange buildings, to supplement the present 14, are now under construction.

JOINT COMMITTEE.—With the object of increasing the value of the telephone service to the public, the French Minister of Posts and Telegraphs in Paris recently appointed the Comitè Pratique d'Amelioration du Service Telephonique, composed of telephone users and officials of the telephone department.

Morocco.—SMALL RADIO STATION.—A small wireless telegraph receiving and transmitting installation has recently been carried out at the offices of the Spanish Consulate in Tangier to afford communication with the wireless service in Africa and with Madrid. The power of the plant is only ¼ kW, but satisfaction is expressed at the fact that it is the first all-Spanish plant to be installed.

New Atlantic Cable.—" PERMALLOY " TYPE.—Unfavourable weather delayed the landing of the English shore-end of the Western Union Telegraph Co.'s new cable from Bay Roberts, Newfoundland, to Sennen Cove, Cornwall, last week. The shore-end is about six miles in length and was landed from the steamer *Clyde Firth* on May 27th. The ocean span will be carried across to Newfoundland by the c.s. *Colonia* in July; returning to England the ship will load the final section of cable, which will be laid from Newfoundland to New York. The new " permalloy "-loaded cable, capable of transmitting 2,500 letters per minute, is the first of its kind to be landed in this country.

The Telephone Service.—DEPOSIT MONEY.—Asked in the House of Commons if he could state the amount of unclaimed deposit money held by the telephone service, Viscount Wolmer, Assistant Postmaster-General, in a written reply, states that figures are not readily available of the amount of deposit money still in the hands of the Post Office owing to inability to trace the addresses of the ex-subscribers to whom it belongs. During last year about £1,640 accumulated in this manner.

DEVELOPMENT.—In March last, just fifty years after the invention of the telephone, the total number of telephones in Great Britain and Northern Ireland was 1,421,150, of which 1,390,153 belonged to the Post Office system, 11,000 to railway and other private installations communicating with the national system, and about 20,000 to the systems maintained by Hull and the Channel Islands.

Radio Notes.

Australia.—NEW HOBART STATION.—Hobart is to have a new broadcasting station capable of transmitting throughout the Commonwealth. The existing station (7 ZL) has been taken over by the Tasmanian Broadcasters Pty., Ltd. (a company registered in Hobart last February), and will be moved to larger quarters ready for operation by July.

Holland.—STATION RE-OPENING.—It is understood that the transmitting station at The Hague is to be brought into operation again this month. At such times as Hilversum is not transmitting, PCGG will broadcast on a wave-length of 1,500 metres, and attempts are to be made to reach the Dutch East Indies on a 130-m. wave.

Japan.—NEW OSAKA STATION.—Work has commenced on a site in Otemae, where the Osaka Radio Broadcasting Bureau is to build its main station. According to *Eastern Engineering*, the site covers 754 tsubo and the term is for 20 years. At an estimated expenditure of y.690,000, the Bureau plans to build a three-storied ferro-concrete structure with three radio rooms, the first intended for foreign music, the second for Japanese music, and the third for lectures, with a battery room on the first floor of the main structure, so as to make broadcasting possible even in case of the failure of the supply of electricity. The height of the antennæ will be 250 ft. It is planned to complete the construction before the end of the year.

Netherlands East Indies.—PRELIMINARY REGULATIONS.—No new permits for radio-telegraph stations will be granted to individuals or private companies in the Netherlands East Indies, while existing or future permits to broadcast by radio-telephony are subject to cancellation, according to a statement published in the *Algemeen Indisch Dagblad*, January 22nd, 1926. There is no provision for any monopoly, either broadcasting or merchandising, but the Government may, obviously, create a monopoly of the former. The stations licensed must be capable of reaching all parts of the archipelago; private broadcasters may not interfere with Government stations, and available Government stations may be used for broadcasting upon terms to be arranged, says *Commerce Reports*.

South Africa.—LICENCES BY MONTHLY INSTALMENTS.—The Durban Town Council has introduced a scheme, on the combined recommendation of the borough electrical engineer and the town treasurer, for the payment of broadcast licence fees in monthly instalments along with the electric light account, at the rate (for the present fee of £2 5s.) of three shillings per month for ten months, the first payment of fifteen shillings being made to the Post Office as under the existing instalment scheme. The next step to be aimed at would appear to be an extension of the system to country listeners not connected to the municipal electricity mains, whose initial outlay for their receiving sets is already so much greater than that of listeners within crystal set range. The zone system of graduated licence fees (already in force in Australia) may be introduced, says the *South African Engineer*, in connection with the enlarged powers conferred on the Post Office authorities under the new regulations.

Sweden.—NEW STATION.—The Swedish Telegraph Board has concluded a contract with Marconi's Wireless Telegraph Co., Ltd., regarding the delivery of transmitting apparatus for Sweden's first big broadcasting station. The equipment, according to the *Financial Times*, will be similar to that at the English station at Daventry.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Asia Minor.—BAGDAD.—June 28th. Direction Générale des Chemins de fer d'Anatolie. One electrically-driven semi-portal crane. (A.X.3191.)*

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 2528).*

June 16th. Victorian Government Railways. One heavy-current motor generator set. (B.X. 2527.)*

June 16th. City Council. Turbo-alternator, exciter and condensing plant.*

August 11th. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast. — June 12th. Electricity Committee. D.c. switchgear for sub-stations and transformer kiosks. (May 28th.)

Belgium. — June 6th. The municipal authorities of Hollogne-aux-Pierres, province of Liége. Supply and laying of armoured cables to connect the various transformer cabins in the town.

Birmingham.—June 11th. Electric Supply Department. Stores, *viz.*: engineers' tools, &c., required during year commencing July 1st, 1926. Particulars from Secretary, Electric Supply Department, Dale End.

June 11th, 1926. Tramways Committee. Stores required during year commencing July 1st, 1926. Particulars from General Manager, Council House, Congreve Street.

June 21st. Board of Guardians. Installation of electric lighting at the various homes on the Monyhull Colony estate, King's Heath. Specifications from Mr. N. W. Greenway, consulting engineer, Lloyd's Bank Chambers, New Street, Birmingham.

Brazil.—PORTO ALEGRO.—July 8th. Municipal Council. Electrical material for street lighting. (B.X. 2571.)*

Bristol.—June 14th. Electricity Department. Additions to the premises at Feeder Road generating station. (May 28th.)

Burnley.—June 26th. Joint Hospital Board. Electric lighting system at the Sanatorium, Marsden Road. (See this issue.)

Dundee.—June 18th. Electricity Department. L.p. cable. (See this issue.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537.)*

June 19th. Minister of Education. Dynamo and motors.*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

—*Reuter's Trade Service* (Cairo).

Erith.—June 7th. Electricity Department. L.p. cables. (May 28th.)

Epsom.—June 14th. Electricity Department. Removal of boilers and setting them up as fuel tanks, overhead travelling crane, two 300-kW Diesel engine-driven generators and accessories, oil-purifying plant and cooling tower. (May 28th.)

India.—June 15th. India Store Department. 70,000 (approx.) copper bonds for track rails. (May 14th and 21st.)

June 11th. Wireless transmitting sets. Particulars from Department, 11, Belvedere Road, S.E.

Kettering.—June 9th. Electricity Department. Water-softening plant. (May 14th and 21st.)

London.—METROPOLITAN ASYLUMS BOARD.—June 16th. Installation of electric cable for arc light treatment apparatus at St. Luke's Hospital, Lowestoft. (May 28th.)

June 16th. Installation of electric lighting at the Hut Building, Pinewood, Wokingham. (See this issue.)

H.M. OFFICE OF WORKS.—June 14th. Incandescent electric lamps. (See this issue.)

Lurgan.—June 21st. Urban District Council. Oil engines and generators, motor-driven pumps, main switchboard, and underground and overhead mains. (See this issue.)

Manchester.—June 8th. Tramways Committee. One 2-ton steam travelling crane. Specification from Mr. H. Mattinson, General Manager and Chief Engineer, 55, Piccadilly.

July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plants and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (See this issue.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

Normanton (Yorkshire).—Installation of electric lighting at Normanton Wesleyan Church. A. Harris, 23a, High Street, Normanton, Yorkshire.

Otley.—Electric lighting installation at public slaughter houses, Station Road. Quantities, &c., from surveyor to U.D.C., Council Offices.

Rhyl.—June 16th. Electricity Department. 1,000 yd. l.p. armoured cable, 1,915 yd. 11,000-V feeder cable, and switchgear equipment. (May 28th.)

Roumania.—BUCHAREST.—June 8th. Bucharest Tramway Co. 10,000 kg. electrodes, 1,000 kg. electrolytic copper, 3,000 electrolytic copper contact pieces, 1,200 kg. copper plates, 200 kg. brass sheets, 2,500 kg. black insulating varnish.*

South Africa.—June 21st. South African Railways and Harbours. Track bonds for the Cape Town Suburban Railway electrification scheme. (May 28th.)

July 8th. Telegraph material, poles, cross arms, &c. (A.X. 3,173.)*

Stoke-on-Trent. — June 9th. Electricity Department. Two 60,000-lb. per hour water-tube boilers. (May 14th and 21st.)

Uruguay. — MONTEVIDEO. — July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Ardsley (East and West).—District Council. Accepted:—
Electrical installation in 40 " D " type and eight scullery houses (£161).—Radio Electric Co.

Australia.—SYDNEY.—With further reference to the note on page 801, ELECTRICAL REVIEW, May 28th, *Tenders* states that a special meeting of the City Council was held recently to receive and consider the report of the committee appointed in connection with the acceptance of tenders for armour-clad switchgear, 33,000-V transformers, and 33,000-V cable. In the case of offers for armour-clad switchgear for 33,000-V step-down sub-stations, it was agreed to cable the general manager, Mr. H. R. Forbes Mackay, asking him to inspect the 33,000-V installation carried out by Messrs. Ferguson, Pailin, Ltd., at the Manchester Corporation power station, and reply as to the suitability of this equipment for Australia. The original motion was for the acceptance of the tender of Metropolitan-Vickers Electrical Co., Ltd. (second lowest) at £106,038. Messrs. Ferguson, Pailin's offer was £99,760. The latest information to hand is that, at a further meeting of the Council, decision was deferred pending the receipt of cabled advice from Mr. Mackay.

For the supply of 33,000-V transformers, the following offers were accepted :—
Section A, three 10,000-kVA, 33,000-5,350-V forced oil cooled (£12,014); section B, ditto, air cooled (£13,840).—Noyes Bros. (Sydney), Ltd.
Section C (£7,420); ditto E (£10,820); ditto F (£7,000); ditto G (£7,000); ditto H (£7,000); section D (£7,000).—Electrical Plant Manufacturers, Ltd.

For 33,000-V cable, tenders were accepted as follows :—
Item 1, 137,000 yd. .25 sq. in. 3-core, paper insulated, lead covered and armoured (£244,347).—Noyes Bros. (Sydney), Ltd.
Item 2, 17,500 yd. 15 sq. in. 3-core p.i. l.c. and double wire armoured (£27,090); item 3, 47,500 yd. ditto, single wire armoured (£59,137).—British Insulated Cables, Ltd.
Item 4, 75,000 yd. each 7/.036, 3-core and 3 pairs 19 s.w.g. telephone wires, paper insulated, lead covered, armoured pilot and telephone cable (£15,094).—Siemens (Aust.) Pty., Ltd.; (£14,475), Johnson and Phillips, Ltd.
Item 5, 47,000 yd. ditto unarmoured (£6,306).—Johnson & Phillips, Ltd.

Electric Lighting Committee. 18 boilers and accessories. Recommended :—

Babcock & Wilcox, Ltd. (Recommended)	**£622,877**
Sterling Boiler Co., Ltd.	£623,730
Vickers Boiler Co., Ltd.	£624,365
Sir W. G. Armstrong, Whitworth & Co., Ltd.	£624,812
International Combustion Co., Ltd.	£633,348
Australian Commonwealth Shipping Board	£1,035,606

Mechanical draught plant (£98,833).—Australian Commonwealth Shipping Board (recommended).

MELBOURNE.—Postmaster-General's Department.
Telephone apparatus.—Siemens Bros. & Co., Ltd. (£1,377); British L. M. Ericsson Mfg. Co., Ltd. (£682).
Equipment in connection with the establishment of a radiophone service between Townsville and Magnetic Island (£548).—Amalgamated Wireless (Aust.), Ltd.
—*Tenders.*

Brighton.—Electricity Committee. Recommended:—
1,500-gallons per hour water-softening equipment (£962).—Kennicott Water Softening Co., Ltd.
Switchboard (£216).—Bruce Peebles & Co., Ltd.
Pipes and castings (£815).—Smith, Patterson & Co., Ltd.

Bridlington.—
Electrical installation at new Spa concert hall (£750).—City Electrical Co.

Chesterfield.—Electricity Committee. Accepted:—
Underground cable (£235).—Standard Telephones & Cables, Ltd.
Overhead line material (£232).—British Insulated Cables, Ltd.

Crieff.—
Electric lighting installation in connection with the new Baptist Church.—Mark Aitken & Sons.

Glasgow.—Watching and Lighting Committee. Accepted :—
Electrical fittings and accessories, &c., for 12 months.—Wm. McGeoch and Co., Ltd.; Simplex Conduits, Ltd.; Thos. Land & Son; Chalmers & Mitchell; Edison Swan Electric Co., Ltd.; Enfield Cable Works, Ltd.; W. Brown & Co. (Engineers), Ltd.; Credenda Conduits Co., Ltd.; Bayliss, March & Newey, Ltd.

Corporation. Recommended :—
Laying the cables in the grounds at Bellefield Sanatorium (£1,593).—Callender's Cable & Construction Co., Ltd.

Government Contracts.—The following Government contracts were placed during April, 1926 :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Electric cable.—W. T. Glover & Co., Ltd.
Electric fires.—Berry's Electric, Ltd.
Aerial insulators.—G. H. Williams & Co.
Motor generators.—Newton Bros. (Derby), Ltd.
Switches.—Whipp & Bourne, Ltd.
Electric tractor.—Electromobile, Ltd.
W/T. transmitters.—Gambrell Bros., Ltd.; H. W. Sullivan, Ltd.; Plessy Co. (1925), Ltd.
Enamelled copper wire.—British Insulated Cables, Ltd.
W/T. boards.—Dorman & Smith, Ltd.; Whipp & Bourne, Ltd.; Veritys, Ltd.
W/T. fittings.—Player & Mitchell.
Lamp ferrules.—Edison Swan Electric Co., Ltd.

WAR OFFICE.
Wireless valves.—British Thomson-Houston Co., Ltd.

AIR MINISTRY.
Electric lighting (Spittlegate).—Malcolm & Allan, Ltd.
W/T. receivers.—H. W. Sullivan, Ltd.
Transmitters and receivers.—Gambrell Bros., Ltd.
Wavemeters.—H. W. Sullivan, Ltd.
Inert batteries.—Edison Swan Electric Co., Ltd.

POST OFFICE.
Manufacture, supply, drawing-in and jointing cable.—Rushden-Finedon Junction : Standard Telephones & Cables, Ltd.
Installing and jointing loading coils and terminating cable.—Ipswich-Marks Tey : Johnson & Phillips, Ltd.
Direction-finding apparatus.—Wick Wireless Station : Marconi's Wireless Telegraph Co., Ltd.
Telephone exchange equipment.—Blackpool, Dundee, Broughty Ferry : General Electric Co., Ltd. Grangewood (East Ham) : British L.M. Ericsson Mfg. Co., Ltd. Malden, Primrose Hill : Automatic Telephone Mfg. Co., Ltd. Kingston, Bournemouth : Standard Telephones and Cables, Ltd.
Private branch exchange equipment.—J. Heywood, Ltd. (Manchester); E. Pollard & Co., Ltd. (E.C.); Shoreditch Borough Council; Edmonton Board of Guardians; Morris Commercial Cars, Ltd. (Smethwick); Transport and General Workers' Union (S.W.); J. Henshelwood and Co., Ltd. (Glasgow); *Bristol Times and Mirror, Ltd.*—Relay Automatic Telephone Co., Ltd.
Telephone repeater station (repeater equipment).—Canterbury : General Electric Co., Ltd. Fenny Stratford, Derby : Standard Telephones and Cables, Ltd.
Telegraph apparatus.—Creed & Co., Ltd.; Standard Telephones & Cables, Ltd.
Telephone apparatus.—British L.M. Ericsson Mfg. Co., Ltd.; International Electric Co., Ltd.; C. Lange; Standard Telephones & Cables, Ltd.; Sterling Telephone & Electric Co., Ltd.; Telephone Mfg. Co., Ltd.
Testing and protective apparatus.—Evershed & Vignoles, Ltd.; Power Equipment Co., Ltd.; Standard Telephones & Cables, Ltd.
Terminal Blocks.—T. De la Rue & Co., Ltd.
Battery boxes.—British L.M. Ericsson Mfg. Co., Ltd.
Cable (various).—Connolly's (Blackley), Ltd.; Enfield Cable Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.
Lamp caps.—W. Johnson.
Wood casing.—Duncan Tucker & Sons, Ltd.
Joint box castings.—Ladywood Ironworks, Ltd.; McDowall, Steven and Co., Ltd.
Loading coils.—Siemens Bros. & Co., Ltd.
Telephone cords.—Peel-Conner Telephone Works; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.; Ward & Goldstone, Ltd.
Ducts.—James Oakes & Co., Ltd.; Standard Brick & Terra Cotta Co., Ltd.
Battery sections.—Accumulators of Woking, Ltd.
Cadmium copper wire.—T. Bolton & Sons, Ltd.; R. Johnson & Nephew, Ltd.
H.d. copper wire.—British Insulated Cables, Ltd.; T. Bolton & Sons, Ltd.; Elliott's Metal Co., Ltd.; Johnson & Nephew, Ltd.; E. & E. Kaye, Ltd.; Nevill, Druce & Co., Ltd.; Pirelli-General Cable Works, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.; Wilkes, Son & Mapplebeck, Ltd.
V.i.r. wire.—Callender's Cable & Construction Co., Ltd.
Switches.—Edison Swan Electric Co., Ltd.

CROWN AGENTS FOR THE COLONIES.
Electrical portal cranes.—Sir W. G. Arrol & Co., Ltd.
2-ton electric portal wharf crane.—Sir W. G. Armstrong, Whitworth and Co., Ltd.
Generating plant.—Ruston & Hornsby, Ltd.; National Gas Engine Co., Ltd.
Electric headlight.—Baldwin Locomotive Works, Ltd.
Insulators.—Taylor, Tunnicliffe & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
X-ray plant.—Watson & Sons (Electro Medical), Ltd.
Telephones.—British L.M. Ericsson Mfg. Co., Ltd.
Telephone switchboards.—Siemens Bros. & Co., Ltd.
Train-lighting testing equipment.—Metropolitan-Vickers Electrical Export Co., Ltd.
Bronze and copper wire.—Elliott's Metal Co., Ltd.; Shropshire Iron Co., Ltd.
Copper wire.—F. Smith & Co.

Halifax.—
Electrical installation at houses in Stamps Lane.—Mr. H. J. Westlake.

Hornsey.—Electricity Committee. Recommended:—
500 fuse boxes (£437).—Motor Gear & Engineering Co.

Irish Free State.—The following contracts were placed by the Controller of Stores (Posts and Telegraphs) from March 23rd-April 22nd :—
Cable and accessories.—W. T. Henley's Telegraph Works Co., Ltd.
Enamelled copper wire.—Hayward Co.
Telephone fuses.—Phœnix Telephone and Electric Works, Ltd.
Telephones.—Siemens Brothers & Co., Ltd.
Telephone accessories.—Standard Telephones and Cables, Ltd.; Sterling Telephone and Electric Co., Ltd.; International Electric Co., Ltd.; Cook Electric Co.; W. J. Kellie. —*Irish Electrician.*

DUBLIN.—Borough Commissioners. Accepted :—
H.p. switchgear, &c., for Fleet Street and Pigeon House generating stations (£11,305).—Ferguson Pailin, Ltd.
—*Irish Builder and Engineer.*

India.—*Reuter* states that a contract for the complete electrical equipment of the new power house at Lucknow (East Indian Railway) has been placed with the General Electric Co. of India, Ltd.

Kidderminster.—General Hospital Management Committee. Accepted :—
Installation of an automatic telephone system throughout the hospital.—Mr. G. L. Harvey.

Lancashire.—South Lancashire Tramways Co. Accepted :—
Twelve 50-h.p. tramcar motors.—General Electric Co., Ltd.

Leeds.—Tramways Committee. Accepted :—
Tramcar tires.—Steel, Peech & Tozer, Ltd.
Electrodes.—Consolidated Pneumatic Tool Co., Ltd.; Allen Liversidge, Ltd.; Alloy Welding Processes, Ltd.
Tie bars.—Hadfields, Ltd.
Thermit joint material and plant.—Thermit, Ltd.
Rails with fish plates (350 tons approx.).—Cargo Fleet Iron Co., Ltd.
Manganese steel rails (£85).—Edgar Allen & Co., Ltd.
200 tramcar meters.—Ferranti, Ltd.
Malleable iron castings.—Leys Malleable Castings Co., Ltd.

Electricity Committee. Accepted :—
Cables.—(£2,948).—Macintosh Cable Co., Ltd., (£1,481) Enfield Cable Works, Ltd., (£2,948) W. T. Henley's Telegraph Works Co., Ltd.

Baths Committee. Accepted :—
Electrification of lifts at Town Hall (£312) and at Municipal Buildings (£578).—Waygood Otis, Ltd.

Leicester.—Electricity Committee. Recommended:—
15,000-kW turbo-alternator (£28,000).—Oerlikon, Ltd.
The most favourable British offer was £43,327.

London.—LONDON COUNTY COUNCIL.—Accepted :—
Electric incandescent lamps for 12 months.—Siemens & English Electric Lamp Co., Ltd.

BATTERSEA.—Electricity Committee. Recommended :—
Alterations and additions to condensing water system at generating station (£27,746).—Foundation Co., Ltd.

Manchester.—Electricity Committee. Accepted:—
Cable.—Pirelli-General Cable Works, Ltd., and Callender's Cable and Construction Co., Ltd.
Switchgear.—Ferguson, Pailin, Ltd.
33,000-V feeder protective gear.—A. Reyrolle & Co., Ltd.
5-ton electric tipping wagon.—Richard Garrett & Sons, Ltd.
10-ton electric tractor and trailer.—General Vehicle Co., Ltd.
Steelwork for boiler at Barton.—John Booth & Sons.

Gas Committee. Accepted :—
Three water-tube boilers.—Sterling Boiler Co., Ltd.
Two 250-kW steam engines.—Brown, Lindley & Co., Ltd.
Two 250-kW open-type dynamos.—Electric Construction Co., Ltd.

Tramways Committee. Accepted :—
Vestibule tramcar bodies.—English Electric Co., Ltd.
Maximum traction trucks.—Brush Electrical Engineering Co., Ltd.
Tramcar motors and controllers.—British Thomson-Houston Co., Ltd.
Fifty 50-h.p. tramcar motors.—General Electric Co., Ltd.

Mansfield.—Town Council. Accepted:—
Electric wiring of the hospital.—G. Hooke & Co.

Rathmines.—Urban District Council. Accepted:—
Meters for 12 months.—Edison Swan Electric Co., Ltd.

Salford.—Electricity Committee. Recommended:—
8,500 yd. l.p. cable (£2,871), 436 yd. l.p. cable (£272); and 2,612 yd. e.h.p. cable (£838).—N.V. Nederlandsche Kabelfabriek, Delft, Holland.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted :—
Cable.—(£826) Bartle & Co., (£4,521) W. T. Henley's Telegraph Works Co., Ltd., (£7,253) Telegraph Mfg. Co., Ltd.
Overhead material, poles, cross-arms, &c.—(£6,793) Hubert Davies and Co., Ltd. (£607) British General Electric Co., Ltd., (£822) Telegraph Mfg. Co., Ltd., (£248) Griffin Engineering Co., Ltd., (£649) Mr. C. E. Scott, (£1,489) A. Vaux, Ltd., (£647) Davis & Soper, Ltd.

Recommended :—
7,500/8,000-kW turbo-alternator (£21,006).—Metropolitan-Vickers Electrical Co., Ltd.

Stirling.—Town Council. Accepted:—
Installing electric light in connection with the Drip Road housing scheme.—Mr. David Henderson.
Electrical work at the Guildhall House.—W. & T. Marshall.

Tynemouth.—Electricity Committee. Accepted:—
Cable (£1,065).—Standard Telephones & Cables, Ltd.

Forthcoming Events.

Royal Institution of Great Britain.—Monday, June 5th. At 21, Albemarle Street, W. At 5 p.m. General meeting.
Friday, June 11th. At 9 p.m. Lecture on "The Spectrum of the Aurora," by Prof. J. C. McLennan, F.R.S.
Institute of Physics.—Monday, June 7th. At the Royal College of Science, South Kensington, S.W. At 5.30 p.m. Lecture on "The Relationship of Physics to Aeronautical Research," by Mr. H. E. Wimperis.
Roentgen Society.—Tuesday, June 8th. At 32, Welbeck Street, W.1. At 8.15 p.m. Annual general meeting and ordinary general meeting.
Radio Society of Great Britain.—Wednesday, June 9th. At the Institution of Electrical Engineers, Savoy Place, W.C. At 6 p.m. Informal meeting.
Salford Technical and Engineering Association.—Saturday, June 12th. Visit to Ferranti, Ltd., Hollinwood.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

ELTRON immersion heaters.
IMPERIAL vacuum cleaners (American).
LATALOID insulation.
ORANGBURG fibre conduit.
RICHMOND vacuum cleaners.
Electric iron stands fitted with springs to absorb shock.

Notes.

How Electricity Supply was Maintained During the Strike.—CORRECTIONS.—In our article on "How Electricity Supply was Maintained During the Strike" the remark that the "Men at Rotherham remained at work as the result of an arrangement with the E.P.E.A. members not to supply the tramways" (page 783, May 28th issue) was somewhat misleading, for we understand that, as the whole of the operating staff there, both technical and manual, were not connected with unions affiliated with the T.U.C., there was no question of them ceasing work.

The statement that in the North Metropolitan Electric Power Supply Company's area the supply was maintained by volunteers and naval men. This was a regrettable error, as our information, since confirmed by Capt. Donaldson, was that all the volunteers employed by the "North Met." offered their services directly to the company, and that the latter did not draw on the Government, either for naval ratings or for volunteers.

National Association of Supervising Electricians.—The meeting arranged for May 4th, to decide the winning papers in connection with the W. E. Highfield Shield Competition, which was postponed owing to the general strike, has now been arranged for Thursday, June 10th, at the Junior Institution of Engineers, London, at 7.15 p.m. The president, Mr. A. M. Sillar, M.Inst.C.E., will be in the chair.

Electrical Engineers in China.—We have received from Mr. C. S. Taylor, hon. secretary and treasurer of the China Centre, Institution of Electrical Engineers, a photograph (reproduced herewith) taken on the occasion of the second annual conference which was held in Shanghai on April 17th last. The programme of the Conference included visits to the Shanghai Electric Construction Co.'s depôt and workshop, to the Tonquin Road super sub-station of the Shanghai Municipal



The China Centre, I.E.E., Conference Dinner.

Electricity Department, to flour and cotton mills, and to the generating station of the Cie. Française de Tramways et d'Eclairage Electriques.

Electricity Supply from Oil Fuel.—The Brompton and Kensington Electricity Supply Co., Ltd., has circulated to its consumers, numbering about 10,000, notice that as the electrical energy supplied by it is generated exclusively by oil fuel, the restriction in consumption required by the Government Order does not apply to its consumers, who are therefore not called upon to practise the economy demanded by the shortage of coal. The company and its consumers are to be congratulated on their independence of coal, an advantage which is shared by the many oil-engine stations which are in operation.

Appointments Vacant.—Mains assistant (£150), for the Cheadle and Gatley U.D.C. electricity department; works superintendent, for the Borough of Newport (Mon.) Electricity Department. Plumber-jointer for the Watford Corporation Electricity Department. (See our advertisement pages to-day.)

Association of Mining Electrical Engineers.—Owing to the disturbed state of the coal trade, it has been decided to cancel the social functions arranged in connection with the annual meeting of the Association at Harrogate. The Council and general meetings will be held there, at 4 p.m. to-day and 10 a.m. to-morrow, for the transaction of formal business only.

Aylesbury Rural Electricity Development.—On Saturday last Mrs. Ll. B. Atkinson, a member of the Council of the Electrical Association for Women, cut the first sod in connection with the Corporation's rural area electricity scheme, in Chequers Park, Aylesbury. The contractors for the scheme (the Craven and District Electrical Construction Co., Ltd.) presented Mrs. Atkinson with a silver spade for the occasion. During the afternoon Mr. Borlase Matthews gave some interesting information with regard to the value of electricity to the farmer, and said that the courageous step which was being taken by the Aylesbury Electricity Committee was one of great significance in the electrical and farming worlds. Mr. Ll. Atkinson thanked the compauy on behalf of his wife, and referred to the excellent work carried out by Mr. W. A. Turnbull, the borough electrical engineer. The Mayor (Alderman C. F. Atkins, J.P.) joined in wishing the enterprise great success, and other speeches were made by Alderman James Robinson, J.P., chairman of the Electricity Committee, and Councillor Viscount Stopford, O.B.E., vice-chairman. At the end of the ceremony, which was held in a most delightful country field, the guests were

entertained to tea in a barn near by. In addition to local people, the party consisted of Mr. W. M. Selvey, consulting engineer, Miss Phyllis Atkinson, Mrs. M. L. Matthews, and Miss Haslett, of the Electrical Association for Women.

Electric Cooking on Board Ship.—The London and North-Eastern Railway Co. informs us that its night mail steamers between Parkeston Quay and Antwerp are now all fitted with electric kitchens.

The I.M.E.A. and the Electricity (Supply) Bill.—At a special general meeting of the Incorporated Municipal Electrical Association which was held at the Institution of Electrical Engineers on May 28th, the following resolution was passed :—

" The I.M.E.A. having considered the proposals of the Electricity (Supply) Bill, 1926, believe that in its present form it will not attain the object for which it is being promoted, *viz.*, cheaper electricity to the consumers, which is a forerunner to its more widespread use. The proposals of the Bill are too cumbersome, as well as costly and unworkable, and the Association considers that before any legislation is proceeded with representatives appointed by the electricity supply industry should be consulted and given an opportunity of submitting proposals as to the most satisfactory manner of effecting any desired improvement.

" The Association further is of the opinion that the figures in, and conclusions of, the ' Weir ' Report are open to serious doubt, and also deprecates the suppression of the ' Merz ' Report and the undue haste with which the Government has pressed the scheme."

Institution Notes.

Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur on September 30th, 1926 :—President : W. H. Eccles, D.Sc., F.R.S. Vice-President : Col. T. F. Purves, O.B.E. Hon. Treasurer : Lieut.-Col. F. A. Cortez Leigh, T.D., R.E. Ordinary Members of Council : A. C. Cramb, A. H. Railing, D.Eng., S. Parker Smith, D.Sc., A. J. Stubbs; Associate Member, F. W. Crawter.

PREMIUM AWARDS.—The Council has awarded the following premiums for papers read or accepted for publication during the 1925-26 session :—The Institution premium to Mr. L. C. Grant; Ayrton premium to Mr. S. Mavor; Fahie premium to Messrs. B. S. Cohen, A. J. Aldridge, and W. West, B.A.; John Hopkinson premium to Mr. S. Ferguson; Kelvin premium to Mr. P. Dunsheath, O.B.E., M.A., B.Sc.; Paris premium to Mr. T. Carter; extra premiums to Prof. S. P. Smith, D.Sc., Messrs. J. L. Thompson, M.Sc., and H. Walmsley, and Dr. A. B. Wood; wireless premiums to Messrs. R. A. Watson-Watt and J. F. Herd, Mr. J. Hollingworth, and Dr. R. L. Smith-Rose, Ph.D., M.Sc., and Mr. R. H. Barfield, M.Sc.

Institution of Mining Engineers.—It is announced that the general meeting of the above Institution, which was provisionally arranged to be held on June 15th and following days at Newcastle-upon-Tyne, has been postponed to later dates, possibly in the early autumn, to be announced later.

Institute of Physics.—The lecture by Mr. H. E. Wimperis on " The Relationship of Physics to Aeronautical Research," which was to have been held on May 11th, will be given on Monday, June 7th, at 5.30 p.m. in the Physics Lecture Theatre, Royal College of Science, South Kensington.

Faraday Society.—The general discussion on " Explosive Reactions in Gaseous Media," postponed from May 13th, will be held on Monday, June 14th.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Mr. R. W. DALTON, H.M. Senior Trade Commissioner in Australia, has arrived in this country for the purpose of an official visit. He will be in attendance at the offices of the Department of Overseas Trade for one month from May 31st, during which period he will be pleased to meet representatives of United Kingdom firms interested in the export of British goods to Australia. Applications for interviews should be made at once to the Comptroller-General at the Department, 35, Old Queen Street, London, S.W.1.

An Australian contemporary states that Mr. G. A. JULIUS has been appointed chairman of the Australian Commonwealth Engineering Standards Association for 1926.

According to the *Industrial Australian and Mining Standard*, Mr. H. S. VOGAN, assistant engineer in chief for existing lines in the N.S.W. Railways Department, has retired from the service and his place has been taken by Mr. W. B. HUDSON, chief assistant engineer, who has been, and will continue to be, responsible for the supervision of the electrification of the suburban lines, and the construction of the new works at Chullora.

Mr. W. J. LIBERTY, public lighting superintendent for the City of London, has resigned his office (under the Corporation Pension Scheme) after forty-seven years' service, having reached the retiring age.

The Stoke Newington B.C. has passed a vote of thanks to Mr. HANN, the borough electrical engineer, for his return to duty during the strike. He was in Switzerland on sick leave and promptly returned and assumed charge of the station.

We understand that Mr. E. F. DARKER, who recently represented the Benjamin Electric, Ltd., in London, is now with the Cape Town Corporation Electricity Department.

According to the *Sydney Daily Telegraph*, the Sydney City Council Electricity Committee has recommended the appointment of Mr. W. RILEY, superintendent of the electricity accounts branch, to the position of sales superintendent, at a salary of £800 per annum.

Mr. H. BURROWS has joined the Mersey Cable Works, Ltd., and all communications should be addressed to him there (Linacre Lane, Bootle).

Mr. FREDERICK C. DAIN has just taken up an appointment under the Blackburn Corporation electricity department as showrooms manager. He was previously on the sales staff of the Manchester Corporation electricity department.

The Halifax Electricity Committee recommends that the salary of the borough electrical engineer be increased to £1,200 per annum from June 1st.

Guildford Town Council has increased the salary of Mr. M. J. DOWNING, mains superintendent foreman, from £247 to £275 per annum.

Mr. JOHN MCLELLAN, A.M.I.E.E., who has been for many years connected with Messrs. Simplex Conduits, Ltd., and for the last few years sales superintendent for the company for the North of England, has severed his connection with the company and commenced a re-selling agency business in Manchester. His address is 78, Park Road, Southport.

According to *The Times*, acting on medical advice, Mr. W. F. SADLER, special director and general manager of Vickers, Ltd., has had to resign those positions.

According to a local newspaper report, the Lighting Committee of the Kingston-on-Thames Town Council reports that on May 6th the engagement of Mr. J. BATCHELOR as chief assistant at the electricity works was terminated forthwith.

Obituary.—MR. CARL HERING.—We regret to learn from the *Electrical World* that Mr. Carl Hering passed away suddenly on May 10th at the age of 66 years. A day or two before he had entered the Hahnemann Hospital, Philadelphia, to rest with heart trouble, and he passed away while picking up a telephone receiver, ten minutes after chatting with his physician. He had had a lengthy and distinguished career in electrical science and engineering. In the electrochemical and electrometallurgical fields especially he achieved international distinction, his discovery of the " pinch " effect being his greatest accomplishment, though by no means his only one. In 1892 he served as technical editor of the *Electrical World*. He originated and for many years conducted the " Digest of Current Electrical Literature " of that periodical. Carl Hering graduated from the University of Pennsylvania in 1880 in mechanical engineering. In 1882, while teaching at the university, he began the study of electrical engineering. In 1883 he published his first technical article, the precursor of a long series of writings, including at least eight books and innumerable papers read before technical societies and contributions to the engineering Press. He acted as a juror for many electrical exhibitions in Europe and at home. He began a course in electrical engineering at Darmstadt, Germany, in 1884. In 1885 he became chief electrical engineer for a German manufacturing company which made and installed motors and dynamos, but he soon returned to his native country, where as early as 1886 he began practice as a consulting electrical engineer in Philadelphia; he therefore lived to complete 40 years in this occupation. Our contemporary says that " Dr. Hering was all his life an enthusiastic searcher for a scientific explanation of apparent exceptions to generally accepted physical laws, and as an outcome of this trait he became a stickler for the correct expression of scientific results in standard units and contributed considerably to the construction and classification of electrical nomenclature." His work in electrochemistry dates back to some tests in 1900 for the reduction of arsenic ore. " Some six years later, while designing and operating electric furnaces, he began a series of experiments which resulted in the announcement of the discovery of a new internal electromagnetic force tending to contract a conductor through which current is flowing even to the extent of rupture when it is a fluid. This discovery was the ' pinch ' effect, already referred to. He later demonstrated the existence of other effects showing that the electromagnetic forces act on the material of the conductor. In 1909 he applied these forces to impart rapid motion to masses of molten material, and on this principle invented an electric furnace which is now in wide commercial use. As early as 1883 he began the computation of conversion factors of electrical and mechanical energy, and he published a comprehensive book on this subject in 1904. A few years later he made a recalculation of all electrochemical equivalents. In 1908 he made an analysis of the interrelations of the various quantities of units entering into the calculation of light phenomena. In the same year he described an experiment purporting to demonstrate a hitherto unrecognised factor in electromagnetic induction to show that Maxwell's well-known law of induction should be modified in order to acquire the status of a universal law." Dr. Hering was one of three men who in 1901 laid the plans for the organisation of the American Electrochemical Society. In 1900 he was elected president of the American Institute of Electrical Engineers and presided at a session held abroad. In 1906 he was president of the American Electrochemical Society. It was our privilege to be in close

conference with Dr. Hering during some of his visits to this country, and we can testify to his charming personality, his geniality and courtesy, as well as to his cordiality and assiduity in correspondence on technical subjects in which he was so absorbingly interested.

MR. G. MOILLIET.—A message has been received by cablegram from Japan stating that Mr. Georges Moilliet, the manager of the Tokio office of Boving & Co., Ltd., succumbed to typhoid on May 17th. The deceased was of French-Swiss origin, and was educated at the "Polytechnicum" at Zurich, but Yorkshire is the home of the Moilliets in this country. Mr. Moilliet became associated with Mr. Boving in 1898. He specialised in water power plants, and during his period of training he was in the employ of Escher Wyss & Co., of Zurich, and A.B. Karlstads Mekaniska Verkstad, Kristinehamn, Sweden. In 1908 he took up the position of residential engineer of Boving & Co. in Japan, and his advice on hydraulic power plants was widely sought.

MR. H. F. ALBRIGHT.—The *Electrical World* records the death, on May 11th, of Mr. Henry F. Albright, vice-president in charge of manufacturing and a director of the Western Electric Co. At the time of his death Mr. Albright was in charge of all the company's manufacturing and plant engineering activities.

MR. R. S. RILEY.—The same journal also reports that Mr. R. Sanford Riley, president of the Riley Stoker Corporation, and a distinguished combustion engineer, died on May 7th. Mr. Riley was born in Hamilton, Ontario, in 1875. His most notable work was the development of the Taylor stoker, and the invention of the stoker bearing his name. He was connected with the Riley Stoker Co., Ltd., in this country.

MR. J. L. JONES.—Messrs. A. Reyrolle & Co., Ltd., state that they regret to report the death of Mr. J. Lyons Jones, who has of recent years been in charge of their department dealing with wall plugs and other stock articles. He had been with the company for 18 years. He had been ailing for some time and had only recently recovered from pneumonia when he contracted a fatal chill in travelling to the coast by boat during the strike.

MR. A. H. FELTON.—A newspaper report states that Mr. Arthur Harold Felton (47), superintendent of the East Usk power station, Newport (Mon.), died while playing lawn tennis at St. Julian's.

Mr. C. H. FRYER.—We regret to learn that Mr. Charles H. Fryer, manager of the Glasgow branch of Messrs. Houghton-Butcher (Great Britain), Ltd., for over 20 years, passed away on May 20th.

Mr. ROBERT TAYLOR.—We have to record the death, which occurred on May 21st, at the age of 71 years, of Mr. Robert Taylor, founder, and director for 25 years, of the Liverpool Electric Cable Co., Ltd.

Wills.—The late Mr. GEORGE BERRY, manager of the British Electric Transformer Co., Ltd., left £10,813 (net personalty £2,635).

The late SIR HENRY MANCE left £22,325 gross, and £22,183 net personalty.

New Companies Registered.

Smith & Sturt, Ltd. (213,999).—Private company. Registered May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, &c. The directors are:—W. A. Smith, 28, Avenue Road, Leamington, Warwickshire; M. A. S. Sturt, D.S.O., 288, Mansell Road, Small Heath, Birmingham; and J. A. Stevens, 2b, Shoot-up-Hill, N.W.2 (director of J. A. Stevens, Ltd.). The first two named are permanent. Registered office: 192, Corporation Street, Birmingham.

Mirrlees Watson Co., Ltd. (14,155).—Private company. Registered in Edinburgh on May 20th. Capital, £100 in £1 shares. Objects: To carry on the business of mechanical, electrical, hydraulic and marine engineers, ship and boat builders, manufacturers of locomotive engines, &c. The directors are:—A. F. Baird, 124, St. Vincent Street, Glasgow, solicitor; C. Day, Highfield, Mile End, Stockport, engineer; H. N. Bickerton, Thorneycroft Hall, Siddington, Cheshire, engineer; C. Ker, Milngavie, Glasgow, C.A.; A. Lamberton, Easterhouse, near Glasgow, engineer; W. S. Herriott, 12, Woodrow Road, Pollokshields, engineer; and W. A. Dexter, 7, Knowe Terrace, Shields Road, Pollokshields, Glasgow, engineer. Solicitors: Boots, Edgar and Rylands. Registered office: 45, Scotland Street, Glasgow.

Battery Supplies, Ltd. (213,940).—Private company. Registered May 26th. Capital, £500 in £1 shares. Objects: To acquire the business of electrical engineers carried on as the "Accumulator Charging Service Co." at Cumberland Works, Forest Road, Kew Gardens. The first directors are:—J. Golding, 65, Mortlake Road, Kew Gardens (managing director); G. J. L. Armitage, 27, Burlington Avenue, Kew Gardens; H. P. Middleton, 62, Defoe Avenue, Kew Gardens (chairman); and D. E. Bowden, 62, Defoe Avenue, Kew Gardens. Qualification, £10. Secretary: G. J. L. Armitage. Solicitors: Wright & Son, 9, Gray's Inn Square, W.C.1. Registered office: Cumberland Works, Forest Road, Kew Gardens, Surrey.

Wholesale Electrical Supplies (Salford), Ltd. (213,855).—Private company. Registered May 19th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical goods and wireless apparatus, glassware, &c. The first directors are:—A. E. Jones (chairman), "Clairmont," Gledhow Lane, Chapel Allerton, Leeds; W. Walker, 7, East Parade, Leeds.

Mersey Cable Works, Ltd. (213,994).—Private company. Registered May 27th. Capital, £40,000 in 10,000 7½ per cent. cumulative preference and 30,000 ordinary shares of £1 each. The preference shares take priority in a winding up for arrears of dividend and return of capital. Each share confers one vote, provided that preference shareholders may vote only when their dividends are six months in arrear or when a resolution affecting their rights is proposed. Objects: To carry on the business of manufacturers of electric wires and cables, electrical, magnetic, galvanic and other apparatus, &c. The subscribers (each signing for one ordinary share) are:—Wilfred Stephen Taylor, 9, Caithness Drive, Wallasey, Cheshire, electrical engineer; and Henry Burrows, 5, Harold Street, Egremont, Cheshire, electrical engineer. The first directors, to number not fewer than two nor more than five, are W. S. Taylor (permanent) and two others to be nominated by the subscribers. Qualification, 1,000 ordinary shares. Remuneration as fixed by the company (subject to any agreement). Solicitor: E. B. Driffield, 20, Castle Street, Liverpool. Registered office: Mersey Cable Works, Linacre Lane, Bootle, near Liverpool.

Official Returns of Electrical Companies.

Middlesbrough Steel Tube and Conduit Co., Ltd.—Issue on April 19th, 1926, of £700 debentures, part of a series already registered.

C. F. Palmer (London), Ltd.—Particulars filed on May 17th of £2,000 debentures, authorised January 20th, 1926, charged on 63a, Effra Road, and the company's other assets (subject to first mortgage for £3,000 on the said property), the whole amount being now issued.

Willet & Robinson, Ltd.—Mortgage dated May 3rd, 1926, to secure £390 charged on 16, Beaconsfield Road, Tovil, Maidstone. Holders: Trustees of the Loyal Providence Lodge of the Independent Order of Oddfellows (Manchester Unity) number 6,265.

Runbaken Magneto Co., Ltd.—J. Collier, King's House, King Street West, Manchester, ceased to act as receiver or manager on May 4th, 1926.

Nelson Electric Co., Ltd.—G. S. Hyams, Salisbury House, London Wall, E.C., ceased to act as receiver on May 12th, 1926. G. H. Robinson, 95a, Chancery Lane, W.C.2, was appointed receiver on May 12th, under powers contained in debenture dated April 20th, 1926.

Burwood (Concessionaires), Ltd.—G. E. McCanlis, of Oxford House, 9-5, Oxford Street, W.1, was appointed receiver and manager on May 11th, 1926, under powers contained in debenture dated January 15th, 1926.

David J. Patton, Ltd.—Particulars filed on May 5th of £1,500 debentures, authorised March 31st, 1926, charged on the company's property, including uncalled capital, the whole amount being now issued.

Ferrow Electrical Co., Ltd.—Satisfaction in full on January 28th, 1926, of debentures dated December 2nd, 1924, securing £1,000. (Notice filed May 19th.)

Cymbal, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated May 4th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

J. Churly Cann, Ltd.—Particulars filed of £800 debentures, authorised May 1st, 1926, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Chambers & Champion, Ltd.—Debenture dated May 14th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. E. Mott, 14, King William Street, E.C.4.

White & Mantle, Ltd. (186,403).—Capital, £1,000 in £1 shares. Return dated December 31st, 1925 (filed March 6th, 1926). 551 shares taken up. £301 paid. £250 considered as paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Siemens Bros. and Co., Ltd.

The annual meeting was held on May 31st, Mr. G. Mure Ritchie presiding. The chairman, in proposing the adoption of the report (*vide* our last issue, p. 804), said that the results could be regarded as satisfactory. They could not have been attained without a sound and progressive policy, adequate capital, good plant, efficient management, and friendly co-operation on the part of employés generally, but those advantages by themselves could not have produced such a balance-sheet. Many other companies in different lines of industry possessed all those advantages in equal degree, but nevertheless showed meagre profits or, indeed, losses. That was because they had lacked the one additional thing needful, which, fortunately, the company had had at reasonable prices—an order book large enough to enable the works to be operated practically at full capacity during the year. In so far as they were a sheltered industry, *i.e.*, contractors to H.M. Government, sharing with other contractors a large amount of work for which they competed keenly, they were at least relieved of competition from foreign countries employing cheaper labour and working longer hours, whose home markets were protected, and whose exports were subsidised both directly and indirectly. That limited protection did not, however, apply to their general Home or export trade. Their relations with their employés continued harmonious and friendly. Except for the strike of wireless operators, when about 25 per cent. of theirs ceased work, they were not affected by labour disputes. The policy of the directors in providing extensions of buildings and plant had been amply justified; indeed, but for the provision made, they would have been in danger of being unable to maintain their manufacturing position. The large volume of orders received in 1924 was well maintained during 1925. In 1925 the Pacific Cable Board resolved to duplicate its cable between Vancouver and Fiji, and the company was successful in securing the order for the section to be laid between Fanning Island and Fiji, a distance of over 2,000 nautical miles. This would be the latest type of high-speed loaded cable, the manufacture of which required special machinery which had been installed in part of the new Woolwich extensions. In 1925 they manufactured the latest balanced and loaded type of submarine telephone cables for communication between the north and south islands of New Zealand, and also for the Japanese Government for laying across the Straits of Tsugaru. Further orders were also received for lead-covered submarine telephone cables, one for extending telephone facilities with Bel-

gium and one for communication with France. The volume of business in underground telephone cables was not quite so large as in 1924, but they had obtained orders which kept the shops fairly well occupied. In the case of power and lighting cables, their full manufacturing facilities were needed to cope with the orders received. Substantial contracts for underground cables for overseas were secured against keen competition. During 1925 there was a steady demand for telephone exchanges, both of the manually-operated and automatic types. Their contracts with H.M. Post Office, now in course of execution, included the public exchanges of Wakefield, Hereford, Colwyn Bay, Llandudno, Brighton and Hove, as well as many other smaller exchanges at Home and abroad. Among overseas contracts might be mentioned automatic exchanges for Pernambuco, Stratford (New Zealand), West Winnipeg and Edmonton (Canada), Newmarket and Albion (Australia), and Kloof (South Africa). The work on the "Western" exchange, in connection with the conversion of the London telephone system, was proceeding satisfactorily, and they expected to commence installation of the automatic exchange before the end of 1926. Their telephone shops during 1925 had been considerably extended in anticipation of the development of the public telephone service at Home, but such development was necessarily dependent on the yearly allocation of Government funds, the expenditure of which, however, in that direction, was truly economic, inasmuch as it was not only revenue-earning, but was also vital to the commercial progress of the country. Their wireless marine apparatus business in 1925 again showed an increased turnover, though expansion was still retarded by the depression in the shipbuilding and shipping industries. Their telegraph section was transferred last year to their associated company, Elliott Brothers (London), Ltd., in order to centralise under one management the business carried on by both companies. Though their overseas business was not yet on a satisfactory scale, they had secured notable increases in some directions, chiefly in South Africa and Australia. Dealing with the future prospects, the chairman said that the value of the unfulfilled orders brought into 1926 was larger than that brought into 1925, but a substantial proportion of the business was of a sporadic character and did not recur every year. Their orders received during 1926 were so far smaller in volume than they were for the equivalent period of last year. He saw no reason, however, to apprehend that the profit for 1926 would be lower than that realised for 1925, provided their manufacturing operations continued without further interruption on the present scale. They would, however, realise that profits depended not only on the favourable conditions he had already indicated, but on continuity of manufacturing operations. When their stokers, transport workers, electricians, and engineers—in all only a small fraction of their employés—suddenly stopped work at the beginning of May the works were brought to a standstill, thousands of employés willing to work became idle, and a very serious loss was inflicted on the company. The existing coal dispute, whilst not so far seriously limiting their activities, would, if it continued, do so. The report was adopted.

British Thomson-Houston Co., Ltd.

The annual meeting was held on May 31st. Mr. H. C. Levis (chairman), who presided, expressed his regret at the death, in January last, of Lord Carmichael, who had been a member of the board since 1917. In moving the adoption of the report (*vide* Elec. Rev., May 14th and 21st, p. 773), Mr. Levis said that during the year under review the general trade conditions of the country had been depressed, and competition had continued to be very keen. The value of the orders received during the year was slightly less than in 1924. On the other hand, the amount invoiced to customers was somewhat greater, but, due to competition, the percentage of profit was lower, and, as a result, the profit for the year had been reduced. The expenditure on buildings and equipment during the year amounted to £289,000. It was the policy of the company to develop its manufacturing facilities as rapidly as business warranted; there were few new commitments made during the year under review, and at present the outstanding amount was quite small. After reviewing the accounts, the chairman called attention to the fact that sundry creditors and retentions amounted to £1,332,333, whereas on the other side of the account sundry debtors amounted to £1,907,384; apparatus, supplies, &c., finished and in process of manufacture, to £1,415,544; and cash at bankers to £342,762, giving quick assets amounting to a total of £3,665,609, so that their financial position was strong. The falling-off in orders for heavy plant for use in this country was very marked during the year, but to some extent that was offset by orders from abroad. It was probable that this falling-off was due to the uncertainty created by the Electricity Bill, as well as by the general trade conditions in the country. That situation had continued up to the present, but as it now seemed to be the policy of the Government to pass the Electricity Bill, the uncertainty should disappear and the flow of orders should be resumed, provided there was an early and definite settlement of the coal dispute, and the general business of the country was not interfered with by further industrial troubles. The Government had not exaggerated the possibilities of growth, and it was to be hoped that the outcome of the proposed legislation would be such that the electrical business could advance unhampered, to meet the demand which existed, and a still further demand which could be created. The immediate effect of the strike upon the operation of the company's works was felt but little, and the percentage of employés who were out at any time was very small. The effect upon the placing of new orders was much more serious, and it was to be feared that the strike and the coal situation would continue to have an adverse effect upon prospective orders. On the other hand, it was probable that matters would ultimately so settle down that they would enjoy a period of industrial peace. It was to be hoped that the revival would not be delayed so long that trade conditions during 1926 would fail to reap any benefits therefrom. The report and accounts were adopted.

Westinghouse Electric and Manufacturing Co.

The report for the year ended March 31st last shows gross earnings of $166,006,800 and a net manufacturing profit of $14,294,862. The gross income was $16,590,225, and the net income available for dividends, &c., $14,122,001. To this was added the surplus brought forward, &c., making $65,404,090. Dividends absorbed $9,474,511 and $51,715,396 was carried forward. The report mentions the operations of the Westinghouse Commercial Investment Co., which was formed to increase the distribution of the company's products by supplementing its system of jobbing agents with its own jobbing houses throughout the United States. The investment company declared a dividend of 6 per cent. for the past year. The Westinghouse Electric International Co., which conducts the company's export business, now has branch offices or distributors in 42 countries and has operating agreements with manufacturing companies in England, Holland, France, Germany and other countries.

Rangoon Electric Tramway and Supply Co., Ltd.

During the past year £117,880 of 4½ per cent. debenture stock was redeemed, leaving £103,778 outstanding; the amount of 5 per cent. debenture stock outstanding at December 31st was £300,000. The gross profit for the year was £169,869, plus £1,250 interest, &c., making £171,119. After providing for debenture interest, &c., including transfers of £20,000 to the reserve for cables and £45,000 to renewals account, there was a net profit of £47,983, to which was added £17,599 brought forward, making £65,582. Preference and interim ordinary dividends absorbed £40,582, and after paying a final dividend of one rupee per ordinary share, free of tax (making one rupee 8 annas for the year), a balance of £20,582 is carried forward. The tramway traffic showed an increase during the year and the electricity supply business also expanded. Considerable extensions were made to the distribution system to meet the growing demand, a 3,000-kW turbo-generator was taken over from the contractors, and two 500-kW rotary converters to take the tramway load were installed.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The report for the past year records a balance of £8,498 at the credit of profit and loss after charging debenture interest, &c., and transferring £900,000 from the general reserve fund. To this is added £656,893, making £665,391. After providing for the interim preference dividend, a balance of £645,391 is to be carried forward. The directors attribute the adverse result to bad trade, heavy production costs, and foreign competition. The company has been unable to obtain business to compensate for the loss of armament orders. Many contracts have shown heavy losses, and it is considered that the greater part of the £900,000 transferred from the reserve will be needed to write these off. The directors have been in consultation with certain of the largest shareholders and the company's bankers, and the present position will be further explained at the annual meeting. The following directors have resigned :—Sir G. H. West, Mr. J. M. Falkner, Sir G. H. Murray, Sir C. L. Otley, and Lord Sydenham.

Aron Electricity Meter, Ltd.

The annual meeting was held on May 27th. Mr. H. Kahn, presiding, said that they had purchased the lease of their old factory building and two adjoining buildings, and the alterations which were being made would equip them with up-to-date factory and office accommodation. The fall in the trading profit was due to the lower profits obtained by the Austrian company, which was caused to a great extent by loss on exchange. Austrian currency was now on a gold basis and the loss should not recur. The outlook for the current year was satisfactory for both the company and the Aron Taximeter Co. Although the Vienna works had had a temporary setback, it was hoped that impending developments would counterbalance that. Altogether the future appeared promising, but the directors intended to pursue their careful policy.

Prospectus.—*Ericsson Telephones, Ltd.*—A prospectus appeared at the beginning of the week inviting subscriptions for an issue at par of 99,980 seven per cent. cumulative preference shares of £1 each in this company, which has heretofore been known as the British L.M. Ericsson Manufacturing Co., Ltd. The issue is being made to provide additional working capital required for handling the largely expanded trade of the company. Record sales figures were experienced for 1924 and 1925, their totals being treble those for 1912, when the last increase in capital was made. Further capital is also necessary to enable the company to commence the manufacture of automatic exchanges and equipment. The ordinary dividend for each of the years 1924 and 1925 was 16 per cent. less income tax. The reserves and undivided profits amount to £227,258, and it is proposed shortly to capitalise part of this sum by applying it in paying up the unissued ordinary shares and issuing the shares so paid up to the existing ordinary shareholders. The list was to close on or before yesterday, June 3rd.

Weston-super-Mare and District Electric Supply Co., Ltd.—The revenue for 1925 was £34,881, and the balance available after deducting expenses, £14,000 for renewals account, &c., and adding £6,356 brought forward, is £18,603. It is proposed to transfer £4,000 to reserve, to pay a dividend of 10 per cent. on the ordinary shares, and to carry forward £6,204.

Electrical Finance and Securities Co., Ltd.—In compliance with the Stock Exchange regulations, this company last week published particulars of its objects, &c. It has an authorised share capital of £100,000 (£76,162 issued) and debenture capital of £20,000 (all issued). The company owns the whole of the capital of the Foots Cray Electricity Supply Co., Ltd., and the Colne Valley Electric Supply Co., Ltd. (which holds a controlling interest in the Northwood Electric Light & Power Co., Ltd.), and the whole of the ordinary shares of the Boston and District Electric Supply Co., Ltd. It has also acquired the share capital of the Lothians Electric Power Co.

Eastern Telegraph Co., Ltd.—The revenue for the year ended December 31st last was £3,473,047, and after deducting expenses there remains a balance of £1,321,125. After providing for taxation, preference stock dividends, debenture interest, &c., and adding £511,317 brought forward, there is an available surplus of £1,555,716, as compared with £1,461,317 for 1924. The directors have placed £500,000 to general reserve and have applied a similar amount from that fund to reduce the expenditure on new cables, renewals, &c. A final dividend of 2½ per cent., free of tax, has been paid (making 10 per cent., tax-free, for the year), and a balance of £555,716 is carried forward. Meeting, June 8th.

Stock Exchange Notices.—The undermentioned securities have been ordered to be officially quoted :—

River Plate Electricity Co.—£35,987 ordinary stock.

Application has been made to the Committee to allow the following to be officially quoted :—

Kaministiquia Power Co.—$1,248,500 seven per cent. cumulative preference stock (in shares of $100) and £200,000 first mortgage 25-year five and a-half per cent. sinking fund debenture stock, series "A."

Marconi's Wireless Telegraph Co., Ltd.—At an extraordinary general meeting on May 31st, an extraordinary resolution for the alteration of the articles of association to provide that the British character of the company should be maintained was carried unanimously. Subject to the confirmation of the resolution as a special resolution at a further extraordinary meeting to be held on June 15th, special forms of transfer, which will be supplied to Stock Exchanges, will be necessary on and after June 16th for the transfer of shares in the company.

Merthyr Electric Traction and Lighting Co., Ltd.—The net revenue for 1925 was £27,337 and the balance on working £4,497, as compared with £11,190 in 1924. To this was added £4,929 brought forward, making £16,119. Debenture interest absorbed £2,178, £2,000 is being put to reserve, and after paying the 5 per cent. preference dividend, a balance of £3,730 is carried forward.

Anchor Cable Co., Ltd.—After the general meeting yesterday, an extraordinary meeting was to be held for the purpose of considering resolutions providing for the capitalisation of £130,000 of the undivided profits and the issue of two fully-paid £10 ordinary shares for each £10 ordinary share at present held. A confirmatory meeting is to be held on June 24th.

Lewes and District Electric Supply Co., Ltd.—The surplus on working for the past year was £9,545, and after charging debenture interest, administrative expenses, &c., there remained £3,550, to which was added £3,444 brought forward, making £6,994. After transferring £1,000 to reserve and paying a dividend of 10 per cent. on the ordinary shares, a balance of £3,667 is carried forward.

Electric Construction Co., Ltd.—The directors recommend a final dividend in respect of the year ended March 31st last at the rate of 9 per cent. on the ordinary shares, making 7½ per cent. for the year, and a bonus of 2½ per cent.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors of the company recommend a final dividend on the ordinary shares of 3s. per share, making 4s. per share for the year, as compared with 4s. for the fifteen months ended March 31st, 1925.

Barcelona Traction, Light and Power Co., Ltd.—A dividend of 1¾ per cent. has been declared upon the 7 per cent. non-cumulative participating preference shares.

Glenfield & Kennedy, Ltd.—A final dividend of 6 per cent. has been declared on the ordinary shares, making 10 per cent. for the year.

Erinoid, Ltd.—An interim dividend of 4 per cent. has been declared.

Stocks and Shares.

MONDAY EVENING.

ALTHOUGH at the time of writing on Monday evening, nothing has been settled definitely in regard to the termination of the miners' lock-out, this is making little difference to the firmness that prevails in most Stock Exchange markets, nor is it having a noticeable effect in any department except those sections which are most intimately connected with the coal industry. It might have been assumed that, having regard to the grave issues involved, electricity supply shares would have declined, but the reverse is the case, and in several shares improvements have taken place during the past few days.

Railway stocks are, of course, inclined to be dull, although, with regard to the electric services, prices are steady, holding their rises of last week. Central London Assented ordinary and Underground Electric Income Bonds are both a point to the good. It is doubtful whether there has ever been, on any previous occasion, an industrial disturbance of magnitude comparable to the present miners' lock-out which has exercised so little influence over Stock Exchange prices. Moreover, business in a good many of the markets, if not exactly brisk, is tolerably well maintained, and it may be said that racing has had more to do with interference of ordinary business this week than the coal crisis.

Rises in electricity supply shares are divided between Bournemouth and Poole, City of London, Metropolitan and Westminsters. Electric Supply Corporations are 1/16 down at 31s. 3d., and North Metropolitan Electric preference eased off to 22s. Midland Counties have recovered to 20s. 6d., the Provincial group as a whole being distinctly firm. Edmundsons regained their previous slight decline.

The market for cable and electrical construction shares is a little quieter after the remarkable strength which it showed last week. All the rises then scored have been retained, and fresh gains of half-a-crown accrued to Henleys and Johnson and Phillips. Henleys have declared a final dividend of 3s. per share, making the dividend 20 per cent., as compared with 16 per cent. in the previous twelve months. As, however, the figures last year covered 15 months, precise comparison with the figures just presented, for twelve months, is liable to be confusing.

Siemens strengthened to 31s. 3d. Callenders hold their rise at £4 per share. The new issue is expected to be made on Thursday in this week. Babcocks keep good at 52s., and General Electrics are 1s. up at 30s. 9d.: the "B" preference at 24s. 6d. have gained a trifle. The buying has slackened to some extent in this section, on the assumption that current prices are fairly well valued, although at the same time it is known that a wide circle of prospective buyers watches closely for any opportunity of picking up stock which looks cheap. Electric Constructions are unchanged at 32s. 6d. upon repetition of the 10 per cent. dividend and bonus, less tax, for the year.

Aron shares are a shade harder at 16s. 3d., as a result of the meeting at which its chairman stated: "I think we may say we are going steadily ahead." It will be well when the company is able to obtain from the Government a satisfactory settlement of the terms upon which the company's income tax ought to be calculated. There is a palpable hardship imposed upon any company that has to keep in hand a considerable sum of money against Government claims which, to the ordinary business man, it would appear obvious should have been settled long ago. The same conditions apply to Siemens, and it seems surprising that the Inland Revenue should be so dilatory over matters of tax collection.

The Eastern Telegraph Company reports an increased profit, the figures for last year being nearly a million and a half. Receipts and expenses both expanded. The allocations are liberal and the company's position is stronger than ever. The dividend is maintained at 10 per cent. free of tax for the year. No change has occurred in the list of Eastern cable stocks. Anglo-American Telegraph preferred strengthened to 102, upon that investment demand which is now so evident in most parts of the House. The American Telephone & Telegraph Company is about to offer next month to its stockholders, new shares at par ($100) in the proportion of one new share for each six shares at present held. The price of the existing stock is 154, so that there is a useful bonus involved in the distribution. This week there have been offered 99,980 7 per cent. cumulative preference shares of £1 each at par in Ericsson Telephones, Ltd.

Brazilian Tractions are at last in three figures again, being quoted at 100. The preferred strengthened to 106. Shawinigan Water has risen 5 points to 188. Montreal Light & Power shares are better at 232½. Anglo-American Tramways Second preference rose to 2¾. Mexican Utilities show a better disposition. In the English group, the excellent British Electric Traction dividend led to a further advance, to 111, in the preference stock: the ordinary holds its last week's gain of 5, at 132½.

Marconis, while nominally unchanged, are a better market at 24s. 6d. The Swedish Telegraph Board has recently concluded a contract with the company in respect of transmission equipment for Sweden's new and extensive broadcasting station. Engineering shares remain firm, although a deplorable report from Armstrong Whitworth was not conducive to cheerfulness in this group. The Armstrong Company transfers £900,000 from general reserve, and even then the profit for last year is but £8,500, compared with £505,000 a year ago, when no assistance was taken from the reserve. The price of the ordinary shares has dropped from 9s. to 6s. 6d. All the preference issues have to go dividendless, as previously announced. Rubber shares lack interest, the price of the raw material being about 1s. 9½d. per lb.

"A New Fuel Industry" is the legend that appears on the prospectus of the Chalk Fuel, Power-Gas and Bye-Products Corporation, Ltd. This concern is the latest of the series in which Sir Charles B. H. Soame and Major Brigden are two of the shining lights on the board. "Fancy burning chalk——!" exclaims one indignant reader: "it were easier to eat coke—to advantage." It is only necessary to add that the prospectus is so bare of the ordinary information which investors should require before parting with their money, that the issue should be left alone by anyone with regard for his capital. The prospectus claims that chalk will burn. So will paper.

Share List of Electrical Companies.

	Nom.	Dividend. 1924	1925.	Price May 31 1926.	Rise or fall.	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	1	14	14	57/-	+1/16	4 16 7
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	47/-	+1/16	6 7 8
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15		59/6	—	5 0 10
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	23/6	+6d.	5 19 2
do. 7% Pref.	1		7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	31/3	—1/16	6 8 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5⅝	—	5 11 7
Metropolitan	1	11	11	37/-	+1/16	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/6	+6d.	5 17 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—£d.	5 9 1
St. James' and Pall Mall	5	17½	17½	16⅛	—	5 8 6
South London	1	15	15	2⅝	—	6 6 4
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	7	1⅛	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44/6	+1/8	6 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—	7 13 10
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
Home Rails.						
Central London Ord. Assented	Stock	4	4	69	+1	5 15 11
Metropolitan	,,	5	5	65½	—	7 12 8
do. District	,,	3½	3½	53	—	6 12 1
Underground Electric Ordinary	10	Nil	Nil	3¾	—	Nil
do. do. "A"	1/-	Nil	Nil	11/6	—	Nil
do. do. Income	Bonds	6	6	100	+1	*6 0 0
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102	+½	5 17 8
do. Def.	,,	1½	1½	23¾	—	6 6 4
Automatic Telephone	1	3	6	2½	—	4 0 0
Chili Telephone	5	6	5	6¾	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾	—	7 8 2
Eastern Extension	10	10	10	17⅝	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—	*5 14 0
Globe Tel. and T. Ord.	10	10	10	17⅞	—	*5 12 8
do. do. Pref.	10	6	6	10⅞	—	5 11 7
Great Northern Tel.	10	22	20	28	—	7 2 10
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi	1	10	10	1⅝	—	8 8 6
Marconi Marine	1	10	7½	18/9	—	8 0 0
Oriental Telephone Ord.	1	12	12	43/9	+1/16	*5 9 7
United R. Plate Tel.	5	8	8	7⅛	—	*5 2 7
Western Telegraph	10	10	10	17½	—	*5 15 11
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅜	—	8 16 0
do. do. 2nd Pref.	5	6	6	2¾	+1/16	10 18 2
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord.	,,	6	7	132½	—	5 5 8
do. do. 6% Pref.	,,	6	6	111	+1	5 8 1
Brazil Traction	100	4	5	100	+2	5 0 0
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	86½	—	5 17 0
do. do. Preferred	,,	96/-	126/9	109½	—	*5 16 0
do. do. Deferred	,,	129/5	8	131	—1	*6 2 2
do. do. Deb.	,,	4¼	4¼	75	—	5 13 4
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	49	—	8 3 4
Mexico Trams, 5% Bonds	—	5	5	65½	—	7 12 6
Mexican Light Common	100	Nil	Nil	32½	—	Nil
do. Pref.	100	Nil	Nil	73½	—	Nil
do. 1st Bonds	—	5	5	71½	+1	6 19 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10
Manufacturing Companies.						
Babcock & Wilcox	1	12	13	52/-	—	*5 0 0
British Aluminium Ord.	1	5	10	2½	—	5 0 0
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3 3/16	—	4 14 1
Brush Ord.	1	10	10	27/-	—	7 5 6
Callenders	1	15	15	4	—	3 15 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	—	4 17 0
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	30/9	+1/-	4 17 9
Henley	1	16	20	4	+⅛	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	22/6	—	*4 8 11
Johnson & Phillips	1	10	17½	3⅛	+⅛	5 15 8
Met.-Vickers Ord.	1	8	8	25/-	—	6 8 0
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	31/3	+9d.	4 16 0
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.	Price June 1st.	Inc. or dec. Since April 27th.
a Acid, Oxalic ... per lb.	5¾d.	...
a Ammoniac, Sal ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ,,	...	...
a Borax ... ,,	£25	...
a Copper Sulphate ... ,,	£25 10s.	...
a Potash, Chlorate ... per lb.	4d. to 4¼d.	...
a ,, Perchlorate ... ,,	5½d.	...
a Shellac ... per cwt.	£15 15s.	...
a Sulphur, Commercial ... ,,	£9 10s.	...
a ,, Roll ... ,,	£9 10s.	...
a Soda, Chlorate ... per lb.	3¼d. to 3½d.	...
a ,, Crystals ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton.	£120 to £125	...
b ,, Wire ... per lb.	1/9 to 2/6*	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		...
Grade I ... per ton net.	£240	£5 dec.
Grade II ... ,, ,,	£168	£3 dec.
Grade III. ... ,, ,,	£92	£1 dec.
c Brass (rolled metal 2" to 12" basis) per lb.	9⅝d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ,,	9¼d.	...
c Copper Tubes (solid drawn) ... ,,	1/0¾	...
c ,, Bars (best selected) ... per ton.	£90	...
c ,, Sheet ... ,,	£90	...
c ,, Rod ... ,,	£90	...
d ,, (Electrolytic) Bars ... ,,	£64 10s.	10/- dec.
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ,,	£74 10s.	10/- dec.
d ,, ,, H.C. Wire per lb.	9⅝d.	¼d. dec.
f Ebonite Rod ... ,,	2/3 to 2/6	...
f ,, Sheet ... ,,	2/3 to 2/6	...
n German Silver Wire ... ,,	2/2	...
h Gutta-percha, fine ... ,,	8/-	...
h India-rubber, Para fine ... ,,	1/8½	1½d. dec.
i Iron Pig (Cleveland No. 3.) ... per ton.	72/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ,,	£30 10s.	5s. inc.
g Mercury ... per bot.	£15 10s.	5s. inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2¾	...
p ,, ,, wire ... ,,	1/3½	¼d. dec.
o Platinum ... per oz.	£23 10s.	...
d Silicium Bronze Wire ... per lb.	11¾d.	¼d. dec.
r Steel, Magnet, in bars ... ,,	7½d.	¼d. dec.
n Tin, Block (English) ... per ton.	£264 5s. to £266 5s.	15/- to 45/- dec.
n ,, Wire, Nos. 1 to 16 ... per lb.	4/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

An International Congress of Producers and Distributors of Electrical Energy.—This congress is to be held in Rome in September next. The principal subjects to be dealt with include pulverised coal as boiler fuel, the gasification of coal and lignite for electricity production, the employment of steam at high pressures and temperatures in central stations, the position of hydro-electric development in different countries, tele-communication between power plants and distribution stations, &c.

The I.M.E.A. Convention.—We understand that, as far as possible, the programme of the Convention outlined in our issue of April 2nd, p. 545, will be carried out without change at Glasgow, though under the circumstances slight departures from it may be unavoidable.

The exhibition of electrical appliances and novelties will be held at the McLellan Galleries, Sauchiehall Street, a space of about 10,000 sq. ft. being available; twenty-four manufacturers will be represented, besides the Electricity Department of the Corporation and the E.L.M.A. Lighting Service Bureau. The British Electrical Development Association and the Electrical Association for Women will also take part in it. The exhibits will cover not only, as usual, cooking, heating and lighting apparatus, but also a much wider range of appliances of interest to engineers, such as heat storage apparatus, industrial heating appliances, thermostats, meters, new wiring methods, &c. The exhibition will be open from 10 a.m. to 9 p.m. every day during the week; on Monday only members of the Convention will be admitted, but on other days certain hours will be allotted to the general public.

Exports and Imports of Electrical Goods and Machinery in April, 1926.

IT is unfortunate at a time when we need every encouragement to make up for the time lost last month, to say nothing of the effects of the coal dispute, the origin of it all, that our statistics of foreign electrical trade during April make such a bad showing, both against the March figures and those of April, 1925. The position cannot be attributed to the incidence of the Easter holidays, for Easter occurred in April last year, and yet our export total is over £400,000 smaller than in April, 1925. It may be that there was a slowing-down in anticipation of the industrial troubles, which were fully realised last month, but whatever the reason the fact remains that our exports declined for the third time this year.

The fall of over £280,000 in the total value of exported electrical goods followed a decline of £99,275 in March, although in the latter case the figure was above that for the equivalent month of last year, whereas April's total shows a serious falling-off from the 1925 total. The decline was spread over practically all classes, the only exceptions being "other motors and generators," switchboards (not telegraph or telephone), and telegraph and telephone instruments and apparatus. The most serious fall occurred in the exports of insulated wires and cables which lost over a third of their March value. This was accompanied by large decreases in the other two cable sections—submarine and non-submarine telegraph and telephone cables. Unenumerated electrical machinery and traction motors were affected heavily, and unenumerated electrical goods and apparatus was another item which "slumped." The other decreases were of comparatively small importance. As a result of the large fall in electrical exports during April, the total for the first four months of the year is about £560,000 behind the figure for the equivalent period of 1925. The May total is, naturally, certain to be smaller, but there still remain seven months in which the exports have time to recuperate. We may observe as an extenuating circumstance that April, 1925, was a very good month indeed, in which exports rose by over a quarter of a million above the comparative totals.

Turning to the import section it will be seen that although there was a net decline of £4,100 as compared with March, the increases and decreases were fairly evenly balanced. The largest alteration was a rise of £18,000 in the imports of unenumerated electrical goods and apparatus, which, by the way, accompanied a large fall in exports of the same class. Insulated wires and cables showed the greatest decrease (about £15,000); none of the other items showed large alterations in value. As compared with the April, 1925, figures there was a large decrease in imports, but this was mainly due to the fall in the value of imported telegraph and telephone instruments and apparatus. On the other hand, the figures for batteries and accumulators and unenumerated electrical machinery were well up as compared with those for April, 1925. Imports for the four months also show a substantial decrease in comparison with the corresponding period of last year.

The comparatively unimportant re-export section also has decreases to record both in comparison with the preceding month and with April last year. As compared with March the decrease was fairly general, there being only two small increases. This section again shows a diminution for the first four months of the year as against January-April, 1925.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.	Electrical imports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.	Electrical re-exports for Apl., 1926.	Inc. or dec. as compared with Mar., 1926.	Inc. or dec. as compared with Apl., 1925.
Electrical goods and apparatus (unenumerated)	£149,458	− £41,697	+ £3,401	£106,877	+ £18,011	+ £5 776	£8,162	− £856	+ £3,077
Insulated wires and cables	183,127	− 109,742	− 8,740	47,534	− 14,987	+ 1,798	1,074	− 900	− 651
Glow lamps	35,857	− 5,178	− 4,896	17,464	− 4,615	− 12,103	532	− 575	+ 1
Arc lamps and parts	730	− 164	− 6,250	742	− 386	− 199	7	− 1,397	− 1,721
Batteries and accumulators	58,224	− 9,373	− 16,989	38.468	+ 1.489	+ 10 086	2,122	− 80	+ 290
Meters and instruments	32,415	− 3,781	− 1,777	19,331	− 4,255	− 4,620	787	− 885	+ 329
Carbons	881	− 390	− 1,526	10,864	+ 1,983	+ 2,243	54	− 134	− 55
Electrical Machinery—									
Electrical machinery (unenumerated)	213,017	− 59,623	− 100,333	111,404	− 5.751	+ 13,306	7 960	− 3,798	+ 2,541
Railway and tramway motors	22,344	− 21,930	− 16,013	—	—	—	—	—	—
Other motors and generators	177,501	+ 10,002	+ 25,547	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	9,491	+ 6,083	+ 2,329	26	+ 22	− 125	—	− 18	− 8
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	65,772	− 21,135	+ 22,038	12.389	+ 2.568	− 2,246	60	+ 38	− 1
Submarine telegraph and telephone cable	12,157	− 37,444	− 278,195	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	238,140	+ 14,219	− 24,963	35,911	+ 1,821	− 66,861	4,346	− 321	− 6,907
Totals	£1,199,114	−£280,153	−£406 367	£401,010	− £4,100	−£52,945	£25,104	−£7,214	−£3,105
	Exports.			Imports.			Re-exports.		
Decreases for four months of 1926	− £559,575			− £280,653			− £12,210		

United States Electrical Exports.—The value of electrical goods exported from the United States during March reached a high level, totalling $8,586,252. Comparing the statistics with those for March, 1925, it is seen that there was a large decrease in the value of exported generators (except small lighting sets) and the exports of mining and industrial locomotives also declined. On the other hand, the exports of railway motors showed a very large increase, as did also transformers, converters and transmission and distribution apparatus. With the exception of the fractional-h.p. types all classes of motors recorded increases, particularly those from 1 to 200 h.p., which were nearly doubled in value. Domestic apparatus exports were larger and radio goods, including batteries, increased by $286,000.

Manufacturing in Belgium.—The report of the Société d'Electricité et de Mécanique (Procédés Thomson-Houston et Carels) states that although the industrial reorganisation of the undertaking was methodically continued in 1925 and the volume of orders received was considerably larger than in the preceding year, the accounts only show profits of 2,804,000 fr., which just cover the financial charges and permit of some necessary provision for depreciation. The company's inability to derive full benefit from the progress made in its various branches is said to be due to a labour dispute which lasted from July 2nd to the beginning of September. The result was that it was impossible to complete and invoice important orders which ought to have been brought into account last year. It is stated that the increase in the orders received was due to the continued development of the export trade.

The Frequency Characteristics of Telephone Systems.

The Apparatus and Methods used for Testing.

By B. S. COHEN, A.M.I.E.E., A. J. ALDRIDGE, A.M.I.E.E., and W. WEST, B.A.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The paper demonstrates the value of the frequency-amplitude characteristics of telephone systems and apparatus in determining the transmission efficiency, including volume and articulation efficiency. The audio-frequency ranges of importance for speech and music are considered and methods are described for the direct and indirect production of constant acoustic output over the audio range, and the calibration of acoustic measuring instruments is dealt with. Next, the production of electrical energy of constant value over the required frequency range is treated of and a special form of oscillator, together with associated apparatus for the direct recording of frequency characteristics, is outlined.

A thermionic oscillator can be arranged to cover all the requirements, and during preliminary work the use of two ultra-audio oscillators heterodyning with one another appeared to be the method which could be usefully applied to the present problem. If an oscillator working at a frequency of, say, 25,000 cycles per sec. is coupled loosely with another which is caused to oscillate at any point between 25,000 and 30,000 cycles, the fundamental of each oscillator will be inaudible, but a "beat" frequency will be introduced varying between 0 and 5,000 cycles. No difficulty is experienced in obtaining the "beat" frequency, but considerable difficulties are encountered in rendering it sinusoidal in shape and constant in value, and it is essential to secure these qualities if the maximum use and convenience are to be obtained from the instrument.

At frequencies of 25,000 cycles a change of frequency of 5,000 cycles can be effected by changing the oscillator capacity by a small amount, which can be covered in a 180 deg. movement of a small air condenser. This means that the whole range of audio frequencies normally required (say 0 to 5,000 cycles) can be obtained by the rotation through 180 deg. of a single dial. The range can, of course, be altered by modifying the ultra-audio oscillators, or the small variable condenser.

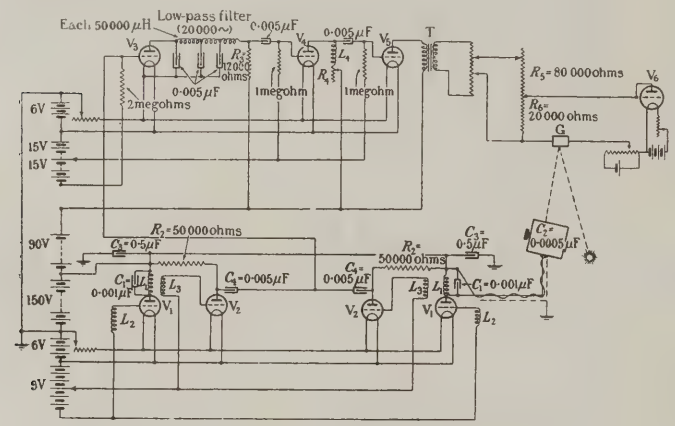


Fig. 1.—Complete Heterodyne Oscillator.

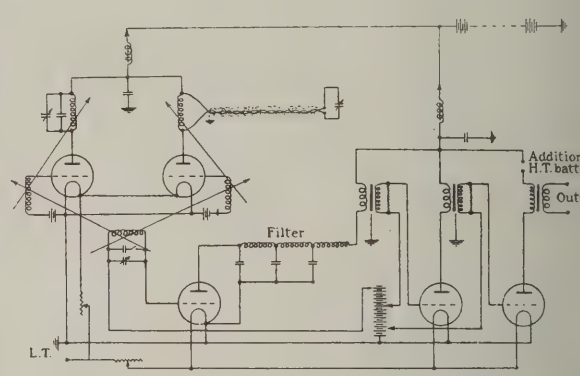


Fig. 2.—Portable Heterodyne Oscillator.

The general method of operation is to cause the oscillator to actuate the apparatus under investigation, the result of this actuation being measured as a galvanometer deflection recorded photographically on paper on a drum which is rotated with the variable air condenser used to obtain the variation in frequency. This method of operation required the use of receivers or transmitters having equal outputs over the range of frequencies under consideration. For example, in examining a transmitter for resonance it would be actuated by a special non-resonant receiver operated from the oscillator, and the a.c. output would be rectified and passed through a d.c. galvanometer, the deflections of which would be recorded, as described above. A receiver would be tested by operating it from the oscillator, and causing it to actuate a non-resonant transmitter. Non-acoustic apparatus, such as transformers, induction coils, &c., are examined by current or voltage measurements.

In designing the apparatus at present in use the following requirements have been covered:—(1) The range of audio frequencies covered by the rotation of the dial of the operating variable condenser through 180 deg. is from 0 to 5,000 cycles. (2) The output at all frequencies within the range is practically sinusoidal. (3) The output voltage is practically constant for all frequencies within the range. (4) The high frequencies of the oscillators are eliminated before reaching the audio-frequency output, in order to prevent interference with current measurements on the galvanometer.

The circuit diagram of the heterodyne oscillator used by the authors is shown in fig. 1, which illustrates also the method employed for taking photographic records. Each high-frequency oscillator circuit comprises a grid coil L_2 of 50,000 μH, coupled to a plate coil L_1 of 20,000 μH, tuned by a fixed condenser C_1 (about 0.001 μF). A variable condenser C_2 with a maximum value of 0.0005 μF is connected in parallel with one of the condensers C_1, to cover a frequency range of about 5,000 cycles. Output coils L_3 of 10,000 μH introduce the high frequencies from each oscillator into the high-frequency amplifying valves V_2, which serve to prevent, as far as possible, interaction between the two oscillators; each oscillator, with its associated high-frequency amplifier, is also enclosed in an iron box. The high frequencies are taken by resistance-capacity coupling and a common input lead to the grid of the detector valve V_3, which operates on the anode rectification principle. In the plate circuit of this valve is a low-pass filter having a cut-off at about 20,000 cycles, serving to reduce to a negligible quantity the high frequencies in the audio-frequency output; moveover, it provides (for the high frequencies) a sufficiently low-impedance path from the plate to the filament to ensure efficient operation of the detector valve. Two stages of resistance-capacity coupling bring the audio-frequencies to the output transformer of the set.

With an ordinary-type output transformer, the output/frequency characteristic was found to be unsatisfactory, the output increasing too slowly as the frequency was raised from zero, and falling off again at the higher frequencies. Output transformers for the heterodyne oscillator are accordingly built on 1-in. square cores of Stalloy stampings, the windings consisting of a number of interleaved wave-wound slab coils. It is, of course, essential that the secondary winding should terminate with a non-reactive load, a generally useful value for which is 800 ohms, through which a current of about 10 mA is obtainable. When more current is required this load may be increased to, say, 100 ohms, and the transformer ratio and resistance of the secondary winding may conveniently be adjusted by joining in parallel certain of the slab coils.

Whilst such a transformer gives a satisfactory output at the low frequencies, there is a tendency for the output to fall off at the higher frequencies. In order, therefore, to flatten out the characteristic, the output at the lower frequencies is cut down to the same value as that obtainable at the high frequencies. To effect this, a 0.2 henry air-cored inductance L_4 was inserted in the anode circuit of the first audio amplifying valve in series with a variable non-inductive resistance R_4, the impedance of this circuit thus having a rising characteristic with frequency.

The method of measurement is illustrated in fig. 1. A rectifying valve V_4 has in circuit a quick-moving reflecting galvanometer G, the spot of light from which falls on photographic paper wound round the drum of the condenser camera C_2 (V_4 is shown as a diode rectifier; as a general rule, however, it is preferred to use a triode with anode rectification.)

For many purposes it is convenient to substitute for the condenser camera a pair of variable condensers in parallel, one of, say, one-half the capacity of the other, and one equipped with a vernier that can be adjusted so that the beat frequency is zero when both condensers are set at zero. One condenser will then give half the available frequency range of the oscillator for a 180 deg. rotation of its dial, whilst the whole frequency range is obtainable from the other condenser; the dials of both condensers may be engraved in frequencies.

The wave-form impurity is almost entirely due to a second harmonic, as was tested by tuning out first the fundamental and then the second harmonic. From a measurement (with the impure wave-form) of the capacity of a condenser, the impurity did not exceed 5 per cent. of the fundamental.

A variable condenser (about 0.001 μF maximum) shunted across the input to the detector valve is a useful addition to the heterodyne oscillator, for as the value of this capacity is increased, so the output from the oscillator is reduced and, at the same time, the wave-form is improved. Hence, when-

ever the maximum output from the oscillator is not required, a suitable adjustment of this capacity is made in order to obtain the best wave-form available. The operation of the condenser in this respect is two-fold, by reducing the magnitudes of the alternating voltages in the audio-frequency amplifier it lessens the percentage of harmonics generated therein, and by providing, in the plate circuits of the high-frequency amplifying valves, an impedance, which is lower for the harmonics than for the fundamental, it tends to purify the wave-form of the high frequencies introduced into the detector valve.

The general method preferred for making frequency characteristic tests with the heterodyne oscillator is to introduce a constant voltage from the oscillator across a non-reactive resistance, which forms a part of the normal input connections to the apparatus under test, and to record the voltage output, with the circuit terminated by an impedance equivalent to that used under working conditions. This method involves the use of a suitable non-reactive attenuator run between the output transformer of the oscillator and the apparatus under test, serving to maintain a non-reactive load on the transformer and also to retain the normal impedance, on the input side of the apparatus under test, uninfluenced by the presence of the transformer.

A smaller and more portable pattern of heterodyne oscillator has also been constructed. The arrangement is somewhat different from that of the large instrument, and the circuit is shown in fig. 2. It will be observed that no high-frequency amplifier stages are used in conjunction with the oscillators.

The concluding part of the paper contains the frequency characteristics of each part of the apparatus used in a telephone connection, and also of audio-frequency amplifiers and loud-speakers. For the purely electrical portions of the circuit, current or voltage characteristics are added, whilst for such apparatus as transmitters and receivers the characteristics are given in terms of acoustic pressures on the diaphragm. The characteristics of some commercial types of granular transmitters are outlined, then under the heading of receivers will be found the characteristics of both the Bell pattern and some typical loud-speakers of the horn and hornless types. Particulars are given of apparatus designed to measure diaphragm motion, some results obtained by an aural balancing method being included.

In the section dealing with lines will be found characteristics of unloaded open wires and cables and loaded cables. An impedance/frequency characteristic is also given and its application to fault location illustrated. Some notes on telephone line repeater characteristics are followed by a section dealing with exchange cord circuits and subscriber's instrument characteristics. Under audio-frequency amplifiers some typical inter-valve transformers of the type used for broadcast reception are characterised, and an extension is given of the theory of this type of transformer covering the effects of resistance and capacity loads.

Finally, it will be obvious that it is impossible to deal adequately in one paper with the frequency characteristics of all apparatus used for the transmission of speech and music, and little attempt has been made to do more than indicate the results obtained with typical apparatus of each of the various classes. The few characteristics given indicate the highly resonant output of commercial telephone receivers and transmitters and the extent to which the volume efficiency must depend upon resonance. The characteristics show that there is considerable room for improvement in the case of receivers and transmitters, and it is claimed that the apparatus described in the paper forms a ready means of enabling the effects of change in construction and design to be conveniently observed, measured, and recorded.

Discussion in London.

During the discussion that followed the reading of an abstract of the paper by Mr. B. S. Cohen, it was pointed out that the paper differed markedly from that which the authors had previously presented. Telephone devices must be operative over a band of frequencies, and accordingly any single-frequency method of testing them was of no use by itself. The paper marked the advance which had been made in five years by the Post Office research staff, who not only knew what was being done, but also carried out original research. The authors made no reference to the "transmission unit."

The great strides made by weak-current engineers was due to the development of the thermionic valve; at the City and Guilds Engineering College attempts had been made to obtain similar results to those claimed by the authors by means of an oscillator very like that shown in fig. 1, but without much success. Whilst the values of various coils, condensers, resistances, and voltages had been carefully indicated in the diagram, the valves used were simply designated v_1, v_2, &c., and the authors had not explained how they had managed to obtain their results, nor how they were able to use a common high-voltage battery. Scientifically accurate pictures needed to be very carefully interpreted acoustically, for the ear very quickly became saturated; for broadcast radio-telephony the full picture was required, for ordinary telephony an outline sufficed, whilst telegraphy conveyed a cubist impression which needed expert interpretation.

The employment of a heterodyne oscillator was a question of the degree of accuracy and constancy permissible, as distortion was introduced by the position of the listener's head. The Western Electric Co., in America, had carried out similar experiments and obtained like results. A gramophone and records, in the construction of which telephone principles had been applied, were exhibited; the machine and records could be calibrated and, therefore, the total output of the machine was known. As a producer of ascertained sound intensity its demonstrator claimed such a machine to be a better proposition than the so-called simple oscillator with its several valves, batteries, &c.

Much research had been carried out, and it was hoped that more of it would be translated into practical results, *i.e.*, better telephone lines and instruments. Many questions were put to the authors, and in reply to some of them Mr. A. J. Aldridge remarked that no real difficulty had been experienced in using the oscillator shown in fig. 1, but the Post Office authorities had no intention of placing an instrument of that kind on the market.

Insulating Compound Tests.

New Belgian Regulations for Cable Box Insulation.

The Comité Electrotechnique Belge has recently issued a new series of conditions for tests of insulating compound intended for the filling of electricity supply cable boxes. A distinction is made between the material, M.O.B., used in boxes located in positions subject to normal temperatures, and M.E.C.B. for use where high temperatures are met with. The temperature at which the material flows must not be lower than 40 deg. C. for M.O.B. and 60 deg. C. for M.E.C.B., when tested by the Kraemer-Sarnow method, which determines the temperature at which 5 grammes of mercury pass through a 5-mm. layer of insulating material contained in a glass test tube of the same diameter.

The apparatus is prepared by cutting a glass tube of a certain length and of a diameter of 5 mm. Inside the tube is placed a glass disk arranged to slide exactly within it, and wetted so that the test piece of material shall not adhere to it. After pouring the compound into the tube, when everything is cold the glass disk is removed, and the 5 grammes of mercury

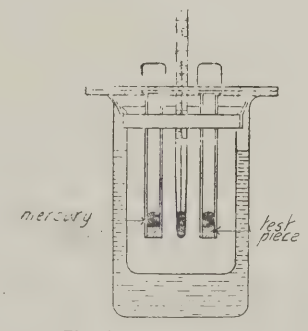


Fig. 1.—Temperature Test.

inserted on the top of the test piece. The tube is then fixed in a test bowl placed in a heated bath, fig. 1. The temperature at which the mercury passes through the insulating material is recorded by the adjacent thermometer.

At 20 deg. C. the insulating material is required to be non-breakable, although capable of being scraped by the finger nail, and when melted at 100 deg. C. it should be perfectly homogeneous and quite free from lumps.

The material must also be capable of adhering to metal, and to ensure that it possesses this property it is tested by flowing it, when melted at 100 deg. C., on to a 0.3-mm. sheet of tin set in a rectangular frame, 130 by 180 mm., made of 3-mm. sheet metal. The layer of compound is levelled off and allowed to cool to 15 deg. C. Then with the material on the upper side, the tin sheet should be capable of being bent in all directions, without the material becoming detached from the tin, although splits or cracks in the surface are permissible.

The minimum dielectric rigidity is laid down to be 25,000 volts effective per mm., the voltage curve to be practically sinusoidal and the frequency 50 periods per sec. The dielectric rigidity test is made by flowing on a flat circular horizontal plate, heated to a temperature of about 100 deg. C., a layer of the melted material at least 250 mm. in diameter and from 1 to 1.5 mm. in thickness. The plate and layer are then put aside until the former is quite cold and the material thoroughly hardened. The testing appliance consists of a lower electrode of at least 250 mm. diameter, and an upper electrode, of the shape shown in fig. 2, weighing 1 kg. and having a surface contact with the material of 25 sq. cm., and an outside diameter of 110 mm. By measuring the thickness of the test disk at a distance of 5 or 6 mm. from the pierced crater, it is possible to deduce, by a simple proportional calculation, the rigidity per mm. in terms of breakdown pressure.

The contraction of the material at temperatures from 150 deg. C. to 15 deg. C. should not, during test, exceed 7.5 per cent. This test requires a graduated metallic recipient in which a sample of the material is first heated to 150 deg. C. and then allowed to cool to 15 deg. C. Oil is then added to the 150 deg. C. level, so that the degree of contraction can readily be determined. There should be no sign of bubbles when the material is kept heated up to 200 deg. C. for five hours. Finally, the tests for acidity and alkalinity provide that the compound when placed in boiling water should impart

neither alkalinity nor acidity to the liquid, nor at temperatures below 150 deg. C. should it have any attacking effect on metal, while when dissolved in sulphide of carbon the material should not leave a residue of more than 2 per cent.

In using insulating material in cable boxes, the Comité points out that the flow of the material should only take place after the boxes have been thoroughly cleaned. When filling the boxes the material should be at about 125 deg. C. in order that it should neither burn the insulators nor solidify before it has penetrated into every part, so that the formation of air

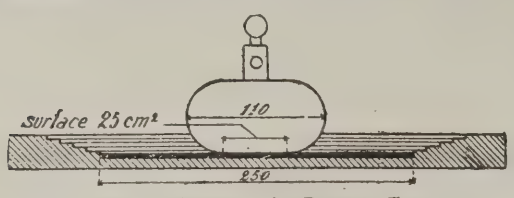


Fig. 2.—Apparatus for Puncture Test.

pockets is prevented. The material should be poured slowly, a little at a time, until the box is filled. Insulating material which has been kept heated a long time is unsuitable for successful use.

Our Mr. Smith.

By a Tenderfoot.

Out of the cold, drizzling rain and the gloom of a small manufacturing town, into the comparative warmth and light of the hotel, comes a tired, travel-stained person carrying a bag. The bag is small, but tightly packed drawings, photos and catalogues, plus a slide rule and a few other essentials, seem to increase in weight during the day and finally turn the scale at about .25 lb. per cubic inch. Probably the weight varies according to some such formula as $W = w + wkt$, where w is the weight at the beginning of the day, k a constant depending on the weather and the state of trade, and t the time in hours which has elapsed since the last meal.

The figure with the bag collects an envelope, and finds inside a copy of a letter sent from his head office to a prospective customer—sorry, client—in a particularly obnoxious town 80 miles away on a branch line. The letter reads :—

"We thank you for your letter of the 2nd inst. Our Mr. Smith is in your district, and we have asked him to call on you at the time you suggest, to discuss our quotation of the 23rd ulto."

At the bottom is a penned note, "10.30 Friday morning. Hope you can manage—we must get in with these people."

Mr. Smith, for the transporter of the bag is none other, murmurs a little prayer, chalks up 6.30 on the call board, and departs to extract food after "service hours" out of an unwilling kitchen staff.

The morning fulfils the promise of the previous night; rain in parts, further outlook unsettled. Mr. Smith, his brain cleared by a little blood-letting—why are hotel bedrooms built so that a shaving mirror can never be suspended in a favourable position?—reflects that he has to be 80 miles away by 10.30, and in the afternoon is due to investigate some trouble on plant installed some miles from a station on another branch line.

The breakfast is not good. Doubtless the cook is a slow starter, and serves up delicious bacon after a few trial runs, but Mr. Smith always seems to be down in time for a trial run.

We will not follow our friend's fortunes through the day. The branch line was typically branch, the prospective client disappointing, the plant trouble something which any ordinary engineer would have cured without worrying the makers. Lunch, taken late, was a respite from rain, but as a meal left much to be desired.

After a long (time, not distance) and foodless journey, our Mr. Smith seeks a haven for the night. Tucked in his little bed, in a room near the lift and overlooking the tram terminus, he reviews the happenings of the day; he has not "got in" with the prospective client; the trouble which he cured was due to unskilled handling of the plant, and he will not receive any plaudits from a delighted works for saving the visit of a proper trouble-man; he has left his slide-rule somewhere around the engine room, and if not broken by now it will certainly be damaged in the post; he must have a hair-cut to-morrow, but doesn't quite see how or when.

A few hours later, at the works, a worried manager is scanning an attenuated list of orders and cursing the sales staff, ignoring the effect of trade depression, competition, seasonal slackness and other factors. At a desk in a neighbouring office an engineer gazes out of the window at a blue sky and wishes he had an outside job, instead of being chained to a desk in an unbeautiful works.

At about the same time our Mr. Smith is sitting at a wayside junction watching the back of his train vanish into the distance and murmuring, perhaps, "Now more than ever seems it meet to die, to cease upon the midnight with no pain." A thin rain is falling and there is no refreshment buffet.

There is a moral for us all in this, somewhere.

The Electrical Imports of Egypt.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1925 is taken from the recently-issued trade statistics. The figures for 1924 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1924. £E	1925. £E	Inc. or dec. £E
Electrical machinery and parts—			
Total	147,000	165,000	+ 18,000
From Great Britain	29,000	31,000	+ 2,000
,, United States	13,000	6,000	− 7,000
,, France	46,000	52,000	+ 6,000
,, Italy	13,000	12,000	− 1,000
,, Switzerland	18,000	10,000	− 8,000
,, Germany	17,000	29,000	+ 12,000
Internal combustion engines, stationary—			
Total	400,000	650,000	+ 250,000
From Great Britain	217,000	371,000	+ 154,000
,, France	4,000	4,000	—
,, Italy	12,000	7,000	− 5,000
,, Switzerland	93,000	135,000	+ 42,000
,, Germany	68,000	123,000	+ 55,000
Electric light bulbs—			
Total	39,000	45,000	+ 6,000
From Great Britain	700	1,600	+ 900
,, Germany	7,000	9,600	+ 2,600
,, France	1,000	2,000	+ 1,000
,, Italy	700	200	− 500
,, Holland	19,000	15,000	− 4,000
,, Czecho-Slovakia ...	100	1,300	+ 1,200
,, Austria	5,000	7,000	+ 2,000
Carbon rods for arc lamps—			
Total	700	500	− 200
Electric cars and wagons—			
Total	4,000	1,000	− 3,000
From United States	4,000	—	− 4,000
Telegraphic and telephonic apparatus and fittings—			
Total	49,000	121,000	+ 72,000
From Great Britain	36,000	92,000	+ 56,000
,, France	3,000	3,600	+ 600
,, Sweden	8,000	22,000	+ 14,000
Meters, electric, gas and water—			
Total	25,000	26,000	+ 1,000
From Great Britain	2,000	3,000	+ 1,000
,, France	16,000	16,000	—
,, Germany	5,000	3,000	− 2,000
Electric and gas pendants—			
Total	49,000	64,000	+ 15,000
From Great Britain	1,000	2,000	+ 1,000
,, France	20,000	28,000	+ 8,000
,, Germany	17,000	15,500	− 1,500
,, Italy	9,000	12,500	+ 3,500
*Electro-medical apparatus** ...	—	9,300	—
Other electrical appliances and batteries—			
Total	50,000	44,000	− 6,000
From Great Britain	14,000	9,000	− 5,000
,, Austria	1,000	600	− 400
,, France	6,000	6,800	+ 800
,, Germany	15,000	14,000	− 1,000
,, Italy	10,000	8,000	− 2,000
,, Switzerland	1,000	700	− 300
,, United States	2,000	3,000	+ 1,000
Electric cables, insulated—			
Total	96,000	40,000	− 56,000
From Great Britain	14,000	1,500	− 12,500
,, Belgium	9,000	5,000	− 4,000
,, France	36,000	8,000	− 28,000
,, Germany	15,000	12,000	− 3,000
,, Italy	14,000	7,000	− 7,000
,, United States	1,000	300	− 700
Electric wire and cable, armoured†—			
Total	—	69,000	—
From United Kingdom ...	—	3,000	—
,, Belgium	—	11,000	—
,, France	—	27,000	—
,, Germany	—	16,000	—
,, Italy	—	11,000	—
Uninsulated electric copper wire—			
Total	23,000	55,000	+ 32,000
From Great Britain	—	16,000	+ 16,000
,, France	14,000	25,000	+ 11,000
,, Germany	6,000	12,000	+ 6,000
,, United States	—	1,000	+ 1,000
Electric light fittings—			
Total	66,000	70,000	+ 4,000
From Great Britain	6,000	4,500	− 1,500
,, Belgium	2,000	2,000	—
,, France	14,000	14,000	—
,, Germany	28,000	34,000	+ 6,000
,, Italy	5,000	5,000	—
,, Switzerland	5,000	4,000	− 1,000
,, United States	2,000	3,000	+ 1,000

£E = £1 0s. 6½d.

* Previously included under "Other electrical appliances."
† Previously included under "Electric cables, insulated."

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

A New Rectifier.

A rectifier has been put on the market by MESSRS. PHILIPS LAMPS, LTD., of 145, Charing Cross Road, London, W.C.2, for charging motor-car batteries of up to 6 V at 6 A, or up to 12 V at 3 A, from alternating-current circuits of various voltages up to 260 V. It consists of a transformer, a rectifying valve, and two current-regulating lamps, mounted on a base 8 × 6 in., in a neat case standing 14 in. high. The apparatus weighs 24¼ lb. It is provided with a plug

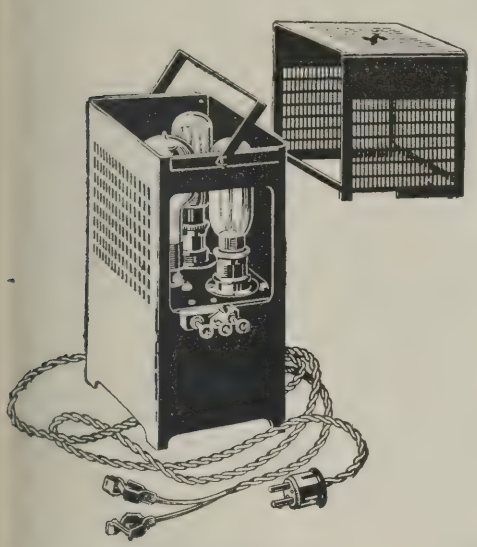


Fig. 1.—The Philips Rectifier.



Fig. 2.—A New h.p. Cable-handling Pole.

for connection to the lighting circuit, and terminals for connection to the battery. When charging at 6 amperes, both waves are utilised, but for 3 amperes it operates as a single-wave rectifier; in the former case it takes about 150 W; in the latter case, at 10-14 V, 125 W, and at 2-8 V, about 90 W. On no-load it takes 20 W. The current remains constant, independently of the number of cells charged, and no ammeter is necessary; the charging terminals can be short-circuited without any ill effects, and the rectifier is silent in operation.

A similar rectifier, using both a.c. waves, is made to charge from 1 to 6 cells at a constant current of 1.3 A, and is very suitable for charging accumulators for radio sets; we have used one for some months for this purpose, and have found it in every way satisfactory. This set is contained in a neat perforated aluminium case.

The rectifiers work on all frequencies from 40 to 100 cycles, and on any voltage specified; the life of the valve and lamp is stated to average 1,000 hours. The appearance of the device is shown in the accompanying illustration (fig. 1).

An Electric Iron with Damping Device.

A new development in electrical apparatus for domestic ironing operations is represented by the introduction of the "Eldec" electric steaming iron, described in *Electrical Merchandising*, by the ELDEC CO., INC., 501, Fifth Avenue, New York, which applies moisture to the material during the ironing operation. The "Eldec," a 6-lb. iron, fig. 3, is fitted with a water reservoir, contained in its insulated handle, with conduit leading to the bottom plate. The water, regulated by a

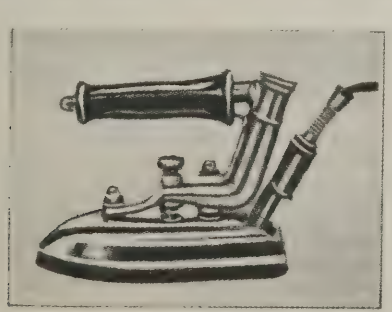


Fig. 3.—A Damping Electric Iron.

small turn-screw valve, passes drop by drop into the heated plate, and issues as steam through a series of tiny holes, forming a mist-like film on the fabric being ironed. The iron is designed for 106/115 V. It is nickel finished.

A New H.P. Cable-Handling Pole.

With the object of indicating the electrical state of the apparatus being dealt with, the Etablissements Merlin and Gerin, of Grenoble, France, have recently introduced an improved form of insulated cable-handling pole for the accompanying sectional drawing of which we are indebted to *L'Electricien*. The device (fig. 2) consists of a narrow tube C of bakelite, which, when protected from wet and damp, has a very high dielectric rigidity. As an additional protection against damp, the lower portion of the pole, from A to B, is filled with a melted insulating compound. The upper end of the pole terminates in a double hook used for the manœuvring of the cables, the hook being secured in position by a concentric device. The novel feature of the pole consists in mounting within it, between the hook and the plug A, a glass bulb which is visible through a slot in the pole. The bulb is filled with low-pressure neon, a gas which has the property of self-illumination when placed in an electrostatic field. The bulb is held in place by a felt packing and upper and lower springs R1 and R2. The two extremities of the bulb are connected through the springs with the double hook and with a metallic ferrule V.

When the hook is in contact with a live cable the electric field causes the neon to show a red light at voltages of 5,000 and over. The luminosity increases with the pressure and for voltages of 20,000 and over the bulb will show a light when brought near to but without touching the cable. It is claimed that by using a suitable length of bakelite tubing the pole can be safely employed for voltages up to 70,000. For the high pressures the neon tube is located at a lower point in the pole and is not connected with the hook.

In addition to manœuvring live cables into position the new pole can be utilised to test whether the two ends of an open sectioniser are of the same potential and phase. By placing the hook on one conductor and bringing the metallic ferrule into contact with the other, the luminosity in the neon bulb will disappear if the two conductors are of the same pressure and phase. The luminosity will, however, continue if only one of the conductors is live or if both are live but are not in phase. In using the pole for this purpose luminosity appears in the bulb at 2,000 V, due to the fact that not only is there an electric field, but a flow of current in the tube. In using the device for the testing of two conductors, the safe pressure limit so far as tests have been made is from 30,000 to 35,000 V.

Low-Speed Worm-Geared Motors.

MESSRS. MARRYAT & PLACE, 28, Hatton Garden, London, E.C.1, have recently added to their range of worm-geared

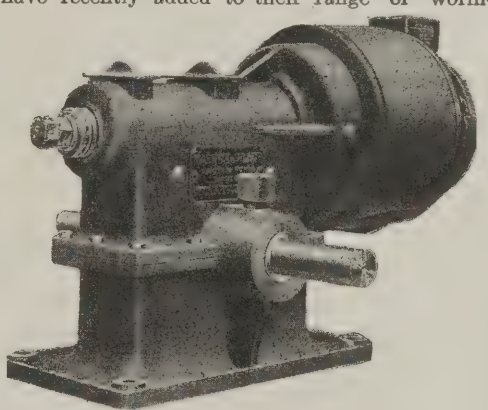


Fig. 4.—A New Fractional-h.p. Worm-geared Motor.

motors, machines covering from ⅛ to ¾ h.p., with shaft speeds of from 20 to 80 r.p.m. Fig 4 shows one of these machines. It is fitted with ball-thrust bearings, gun-metal bushed main bearings, gun-metal worm wheel and a castor-oil bath. The motors are continuously rated.

A Self-contained Outdoor Sub-station.

With a view to reducing the distribution costs in connection with the construction of brick and concrete transformer chambers and sub-stations, the FOSTER ENGINEERING CO., LTD., Morden Works, Wimbledon, London, S.W.19, has produced a self-contained outdoor sub-station, marketed in sizes up to 200-kVA capacity, and constructed for single-, two-, or three-phase, or for "Scott" connected three/two-phase transformation. The device is particularly suitable for use in connection with supplies to rural areas and isolated consumers. The transformer is housed in only one enclosure, thereby reducing heating losses. A specially designed chamber is fixed on top of the transformer containing the h.p. and l.p. control fuses, &c., including a tapping switch (connected to either the h.p. or l.p. side) and a substantially designed voltmeter and ammeter by which the load and pressure can be measured at any time. The standard control equipment also includes a plug connector, an isolating link and a tetrachloride on each phase, and an earthing link, mounted on a h.p. panel. A l.p. panel

is equipped with four fuses per phase, a bus bar for the return leads, and the necessary terminals for the incoming cables. The switch chamber has doors on opposite sides, one giving access to the h.p. panel and the other to the l.p. control gear. The combination of the transformer and switch chambers makes a pillar unit to which is added a cable column leading from the ground to the upper compartment. Fitted at the top of the column is a sealing chamber provided with armour clamps. Sockets are provided to accommodate the plug connectors on the h.p. side, and provision is made for the l.p. cable ends to be brought to the appropriate terminals. The transformer is of the oil-cooled type mounted in a strong steel tank of special construction, provided with rollers, which is fitted with cooling tubes for outputs of over 25 kVA. As it is desirable to keep the exposed fittings down to a minimum, the oil drain cock is arranged underneath the tank, and the oil gauge takes the form of a float with an indicating rod, the latter being inside the switch chamber.

In the case of a breakdown or other emergency it is intended that the whole sub-station be removed and another put in its place, making the operation much less formidable than removing a transformer out of a kiosk or chamber. The overall dimensions for a 3-phase, 100-kVA unit, are 72 in. high, 49 in. long and 32 in. wide.

Electrical Progress at Shanghai.

Annual Report of the Electricity Undertaking.

WE have received from Mr. T. H. U. Aldridge, M.I.E.E., engineer-in-chief and manager of the Shanghai electricity undertaking, a copy of the report of that concern for the year 1925. For the first time since its inception in 1901 the undertaking has suffered a drop in its output, the kWh sold during the year being 294,343,905, as compared with 307,307,401 for the previous year, a reduction of 4.22 per cent. This was due, of course, to the great strike. In spite of the diminished sales, the year's trading yielded a net profit of £212,953, against £219,624. In view of the reductions made in charges for lighting and heating during the year, 15.38 per cent. and 14.28 per cent. respectively, the result is particularly satisfactory. The estimated net profit for the present year, 1926, is £276,967. Of the profits for 1925 £180,000 has been contributed to the general municipal funds.

The plant capacity of the Riverside Power Station, including a 20,000-kW turbine then in the course of erection, was at December 31st last 121,000 kW The maximum peak load on the station during the year was 77,000 kW, and the maximum sustained load for thirty minutes was 76,600 kW, against 66,200 kW for 1924; the maximum load delivered to the feeders was 72,930 kW, an increase of 14.92 per cent. on the 1924 figure, as compared with 0.88 per cent. increase in that year on the 1923 figure. Since the close of the year under review the maximum sustained load has risen to 80,000 kW. The load factor for 1925 was 53.06 per cent.; this factor was calculated on the kWh generated to bring the result into line with the figures for the municipal undertakings in Great Britain. The number of consumers being supplied at the end of the year was 38,932, an increase of 2,413, representing 12,173 kW. The thermal efficiency of the station was increased from 16.2 per cent. to 17.43 per cent. The B.th.u.'s consumed per kWh generated have been reduced from 21,047 to 19,593.

The overall boiler efficiency was 77 per cent., but in the boiler house equipped with the larger boilers and operating under better conditions than the other two houses, the average efficiency was 79 per cent. Two of the larger boilers are being equipped with Howden-Ljungstrom air preheaters, which it is anticipated will increase their efficiency to 85 per cent.

The total length of underground cable in the distribution system at December 31st was 348 miles, of which 120 miles was 22,000-V cable. 4,265 miles of overhead cable was in existence. The total capacity of transformers in sub-stations, including induction regulators, was 266,278 kVA. The total c.p. of public lamps at the end of the year was 476,700, representing an increase of 25,000 c.p. A total of 116,650 h.p. of motors was connected to the mains, an increase of 6,857 h.p., during the year. The heating and cooking load added to the system during the year was 4,282 kW, bringing the total up to 13,450 kW. The rate covering these services was 1.08d. per kWh. The power rates varied from 1.08d. to 1.62d., and the lighting flat rate was 3.96d. per kWh. Special bulk supply rates are in some cases as low as 0.6d. per kWh, which is made up of an annual capital and fixed charge per kW demanded plus a running charge per kWh consumed, the latter being subject to adjustment each half year in accordance with the cost and calorific value of the fuel consumed.

In view of renewed business activity in Shanghai, the first instalment of a 50,000-kW extension is now in hand. This will consist of the 20,000-kW turbo-generator referred to and three boilers, each to evaporate 150,000 lb. of water per hour. A second turbo-generator and a fourth boiler of the same respective sizes are, it is hoped, to be ordered next year. Referring to the two new turbo-generators, Mr. Aldridge says that, as these machines will produce a considerable percentage of the total output, the economies of adopting higher steam pressures and superheat far outweigh any slight inconvenience which might be apparent by having two steam pressures in the same station. It is interesting to note that it is not expected to have to raise new money for the additional plant.

Notes from Canada.

(From Our Special Correspondent.)

FOLLOWING the death of Sir Adam Beck there was not for some time much to record regarding the doings of the Hydro-Electric Power Commission of Ontario. No doubt there would have been somewhat of a lull in any case until the new chairman had had time to take in the situation and get his bearings, but it seems as though the past few months must have been filled with work behind the scenes which has just begun to bear fruit. Owing to the rapid rate of growth of the loads on the Commission's systems, the one urgent need was to find sources of power additional to those at present available. There were several possibilities:—(*a*) Additional diversion of water from the Niagara river; (*b*) Development of power on the Ottawa River; (*c*) Development of power on the St. Lawrence River; and (*d*) The building of one or more large steam generating stations at suitable points.

With regard to (*a*) Canada desires to have a full settlement of the Chicago diversion question before any change is made in the International Boundary Waters Treaty which specifies how much water may be diverted from the Niagara river by Canada and the United States, the figures being 36,000 and 20,000 cubic feet per second respectively. Chicago, in the language of her opponents, is "stealing" something like 10,000 cubic feet per second from the Great Lakes system by taking water from Lake Michigan through the Chicago Drainage Canal and running it into the Mississippi River. The ostensible reason is for sewage purposes, but incidentally a considerable amount of power is generated from this water from which, it is said, the Chicago authorities derive a by no means insignificant profit. Development of power on the Ottawa River (item *b*) seems likely to be undertaken by the Commission in the near future, but it would not be available for use in time to prevent a power shortage. The same objection applies with greater force to item (*c*) on account of the international problems which have to be solved, the magnitude of the undertaking, and the fact that the question of navigation is more or less bound up with that of the generation of power. Item (*d*) seems to have received a good deal of attention, particularly in Toronto, where the simultaneous supply of electrical energy and heat, combined with the possibility of establishing a coking plant which would supply coke for domestic heating and, presumably, oil and gas for power generation, has been under discussion. In the United States the supply of heat (using exhaust steam) as well as electricity is undertaken in a number of instances and seems to be making headway steadily if somewhat slowly.

The Commission is meeting the more immediate needs of the power situation by arranging to purchase power from Quebec Province. The Ontario Government has recently authorised the Commission to make a contract for the supply of from 230,000 to 260,000 h.p. with the Gatineau Power Co. The company will develop the power on the Gatineau River at a point near Ottawa and close to the boundary between Ontario and Quebec. Delivery of 80,000 h.p. is to be made in 1928 and the full amount by 1931. The contract is for 30 years, commencing with 1928, and the price of power at the point of generation will be $15 per h.p.-year. The Commission will build a 230-mile, 230,000-V transmission line to take the power to Toronto, where the total cost of the delivered power will be about $22 per h.p.-year. The capacity of the transmission line will be from 300,000 to 400,000 h.p., so that the needs of Eastern Ontario can be served, as later on power from other sources will be fed into the same transmission line.

Shortly after making an official statement regarding the power contract mentioned above, the Hon. Howard Ferguson, Premier of Ontario, made a most important and gratifying announcement to the effect that the Provincial Governments of Ontario and Quebec will in the very near future appoint a joint engineering board to survey and report on the power possibilities of the Ottawa River, the question of the remission of Quebec's export tax on power (50 cents per h.p.) in the case of the contract to be made between the Gatineau Power Co. and the Hydro-Electric Power Commission of Ontario, and the agreement between the two Provincial Governments to jointly resist any action by the Dominion Government to lease or sell any power sites of which either of the Provincial Governments claims to have the ownership. It is understood that the Provincial Government of Quebec has already agreed that the power to be exported to Ontario shall be free of the tax.

The full accord on all matters relating to power questions as affecting the two provinces which has thus been reached is of great significance as, owing to differences in race and in religious beliefs, the people of Quebec and Ontario have a tendency to look each on their own side of the shield without paying over much attention to the other. Consequently, any drawing together such as is indicated by the decision to create a joint engineering board is hailed as the forerunner of better relations all round.

Referring to the Gatineau River, a recent issue of the *Canadian Engineer* states that "acquisition of the Hull Electric Co. by the International Paper Co. will give the latter company practically full control of the Gatineau River as far north as the great water storage dams which are being built at Maniwaki." The International Paper Co. controls the Gatineau Power Co., which will supply power to Ontario as stated above.

The Institution of Electrical Engineers.

The Council's Annual Report and Accounts for 1925-26.

At the annual general meeting on May 27th the Council's report and accounts for the year April 1st, 1925, to March 31st, 1926, which are summarised below, were presented, indicating a net increase in membership of 399, which raised the total to 12,142; there were 67 deaths, 140 resignations, and 381 lapses of membership during the period under review; there are 11 honorary members. The A.M.I.E.E. examination was held at eight places in this country, and also in Australia, Ceylon, India, New Zealand, South Africa, and the U.S.A.

During the past 12 months 374 meetings were held in London and at the local Centres by the members, the Council, and the various committees. The interest in, and attendance at, the meetings of the local Centres and Sub-Centres have been well maintained, whilst the Wireless Section held eight meetings at which nine papers were read and discussed. In view of the suggested formation of a separate wireless society the Committee of the Section reported to the Council with a view to developing and extending the activities of the Section.

Eleven informal meetings have been held during the session, the average attendance being 65, as against 59 last year. There are at present 3,582 students on the register of the Institution, and meetings, visits to works, and social functions have been carried out at the eight Students' Sections now in existence. The London Students' Section created an interesting precedent last summer by holding a summer meeting in London, and in addition to London students it was attended by some 20 students from the provinces and Scotland.

The Faraday lectures this session were given by Mr. A. P. Trotter, who took for his subject "Illumination and Light," and were delivered at Cardiff, Dublin, Liverpool, and Manchester. The attendances were very satisfactory, and the principal object of the lectures, namely, to direct the attention of the general public to electrical engineering, was achieved to a marked degree by the presence of many hundreds of non-members.

The Council decided this session to publish in the *Journal* periodical reviews of progress in electrical engineering, and for this purpose the subject has been divided into 13 sections, a beginning having been made this year with six sections, and a further selection will appear in 1927. The reviews briefly record recent advances and are intended, not so much for the information of experts in the particular subject under review, as for the information of those members of the Institution who wish to follow the trend of progress in branches of electrical engineering other than their own.

A David Hughes and two Salomons scholarships were awarded by the Council, in addition to a grant of £100 for educational purposes from the War Thanksgiving Education and Research Fund (No. 1).

The annual conversazione was attended by 1,400 members and guests; the annual dinner was particularly well attended, members and guests numbering 575, and 350 members and ladies took part in the summer meeting.

At the third session, in June, 1925, of the Paris International Conference on Large E.H.P. Supply Systems the number of countries represented was 27, Great Britain being represented by seven delegates appointed by the Institution and 21 ordinary members; the number of papers presented was 98. At the New York meeting of the International Electrotechnical Commission, in April, 1926, 16 countries were represented, and there were 24 British delegates, including four appointed by the Council to represent the Institution. The Council, which took an important part in founding the Society of Radiographers in the year 1920 and (under that Society's constitution) had until last year nominated six out of the 18 members of the Society's Council, has withdrawn its nominees and terminated the Institution's connection with the Society because the majority of the Council of the Society of Radiographers resolved upon alterations to the Society's articles, which in the opinion of the Council of the Institution were not in the public interest.

The September, 1921, edition of the Model Conditions "A" (Home—with Erection) has been amended to make it clear that the regulations and by-laws with which the contractor has to conform are those which the local or other authorities are authorised by statute to make; the new edition (revised January, 1926) in all other respects conforms with the old edition. The following sets of conditions were also issued during the session:—B1. Conditions for Export Contracts (delivery f.o.b.); and B2. Conditions for Export Contracts (including complete erection, or supervision of erection).

The former five "Sectional Committees" have been reorganised as nine "Technical Committees," whose functions will be to obtain suitable papers on subjects within their respective fields and to assist the Papers Committee in connection with the reviews of progress referred to above. With the concurrence of the Council of the Institution and of the National Gas Council, a joint committee has been set up "to consider whether in the national interest an inquiry might advantageously be held into the possibility of closer co-operation between gas and electricity undertakings in promoting capital and fuel economy in the supply to the public of energy derived from coal."

During the year 163 books and pamphlets have been presented to the Reference Library, and 80 volumes have been purchased. The total number of readers for the year was 3,537, of whom 114 were non-members, as against 2,419 and 108, respectively, in 1924-25. The Council records the continued circulation of books from the lending library, to which 71 new volumes have been added; during the year, 1,938 books were issued to 857 borrowers, the corresponding numbers for the previous year being 2,184 and 872, respectively.

The number of applicants for posts who were registered by the Electrical Appointments Board on March 31st, 1926, was 87, against a total of 78 last year. The Council earnestly hopes that members in a position to assist will not fail to make use of the register.

The net cost of printing and posting the *Journal* in 1925, after allowing for sales and the revenue received from advertisements, was £4,166, as compared with £3,078 in 1924. This increase was due to the greater size of the volume (1,180 pages, as compared with 1,006 in the previous volume), the larger number of copies printed (12,500, as against 12,000), and an appreciable increase in the number of illustrations. The revenue from sales and advertisements was practically the same in the two years. The physics volume of *Science Abstracts* for 1925 contained 195 pages less than for 1924, and the electrical engineering volume contained 39 pages more than in the previous year; the net cost of the publication to the Institution in 1925 was £281.

The report of the Committee on Electricity in Agriculture has been published, and the Council has instructed the Committee (1) to prepare a special recommendation to the Government in connection with the provision of financial assistance for rural electrification, and (2) to co-operate with agricultural bodies in tests and experimental work. The Council has also addressed a letter to the Electricity Commissioners urging that, in any schemes of railway electrification, regard should be had to the requirements of rural areas.

Regarding the award of national certificates and diplomas in electrical engineering, for the final examinations of 1925 the Joint Standing Committee representing the Board of Education and the Institution examined at various schools and colleges students from 46 approved courses for the award of ordinary certificates in electrical engineering, 17 courses for higher certificates, 3 courses for ordinary diplomas, and 1 course for higher diplomas. The final examinations were held during the summer of 1925, and the number of awards was as follows:—229 ordinary and 79 higher certificates; 8 ordinary and 2 higher diplomas.

The Council has authorised the publication of a revised edition (the second) of the I.E.E. Regulations for the Electrical Equipment of Ships, and as a result of suggestions in connection with the revised edition of the Regulations for the Electrical Equipment of Buildings, the Wiring Rules Committee recommended the Council last summer to publish a small number of amendments which were considered to be of sufficient importance to justify their immediate publication. Further alterations have been, and some still are, under consideration by the Committee and, if not published separately, will be incorporated in the next revision of the Regulations. The Committee is also conferring with the B.E.A.M.A. and the B.E.S.A. in connection with certain of the Regulations.

The Council has approved for submission to the Electricity Commissioners a report from the Electricity (Supply) Regulations Committee containing recommendations on the Electricity Commissioners' Regulations (*a*) for securing the safety of the public, and (*b*) for ensuring a proper and sufficient supply of electrical energy. During the session the Council approved a report of the Proving House Committee, "having in view that there appears to be very little interest in the establishment of a testing authority and proving house," that the proposal be dropped.

In December, 1925, the Council received an invitation to join a delegation which the First Lord of the Admiralty had consented to receive on the status of engineer officers of the Royal Navy, which, it was considered, was detrimentally affected by the new conditions introduced by Fleet Order No. 3,241, of November 21st, 1925. Representatives duly met in conference delegates of the Institutions of Civil and Mechanical Engineers and of Naval Architects, and the deputation was received at the Admiralty on January 14th, 1926. A reply has since been received which is considered by the joint Conference as unsatisfactory, and steps are being taken to carry the matter a stage further.

The Committee of Management of the Benevolent Fund of the Institution reports that on December 31st, 1925, the capital account of the fund stood at £10,004 and the accumulated income at £2,380. The donations and subscriptions to the fund in 1925 amounted to £1,241. In 1925, 78 grants were made to 30 persons, amounting to a total of £1,199.

The Institution's annual accounts show that, after making provision for contingencies, there is a margin to the good on the revenue account for 1925 of £1,196, which has been carried to the credit of the general fund, and compares with £2,925 in 1924. The assets amount to £145,336.

The Annual General Meeting.

The usual small attendance was presided over by Mr. R. A. CHATTOCK, who drew attention to the chief items in the Council's report for the year, intimating at the same time that the summer meeting at Newcastle would be held there next year, it having been cancelled this year on account of the coal miners' strike.

Mr. E. W. Moss seconded the adoption of the report and accounts, and asked about the Registration of Engineers' Bill.

Mr. F. W. PHILLIPS asked about the possibility of arranging for the publications of engineering institutions to be obtainable abroad at reduced rates, and suggested that it would be more in keeping with the dignity of the award if the Faraday medal were made of gold or platinum. He then spoke of grievances which are said to exist on the part of some students who are transferred to the Graduate class, and urged the Council to make the Graduate class more attractive so that it would be regarded as a real step in the upward direction of membership. After commenting on the Council's action in issuing a circular in December in connection with members enrolling as volunteers in case of a national emergency, Mr. Phillips suggested that the time had come to reinstate "enemy" members.

Mr. F. W. PURSE said that although there was a total increase of 399 in the membership last year, it represented principally Students and Graduates, the fact being that in two years there had only been an increase of 17 corporate members; that could not be regarded as satisfactory for the premier engineering institution in this country. The Institution did not seem to be making the progress it should, for no fewer than 228 Students had lapsed last year and 77 had resigned. The average expense per member was about £2 10s., and the subscriptions of the Students did not cover that; the Council should review the position as regarded Students' subscriptions and also the relationship between full and associate membership, his point being that many Associate Members ought to be full Members, but they did not transfer because they got all the privileges for a lower subscription.

Mr. A. H. ALLEN commented on the fact that no reference was made in the report to the protest made by the Institution some time ago in connection with the Electricity Supply Bill, 1926, and expressed the hope that the matter would not be left there.

The PRESIDENT said it was not intended to take further action in connection with the Electricity Supply Bill, it being thought that the various sections of the Institution could better voice their own particular points of view with regard to the Bill; no decision had been come to with regard to the Registration of Engineers' Bill, and any necessary action would be taken when the occasion arose. The Faraday medal, after all, was given as an honour (not for its material value), and the Council felt that it should remain a bronze medal. He did not agree with the comments of Mr. Phillips as to the Graduate class, and he regarded it as a very useful class for those Students who could not, for the time being, take the associate membership examination. As to the strike, the Institution merely sent out the circular at the request of the Government without expressing an opinion, as the Council did not consider it within its province to take part in industrial matters. The fact that there had been only a small number of new corporate members during the past two years was due to the stiffening-up of the requirements for membership, and there need be no fear that the Institution was going back; it was essential to maintain the supply of Students, who, however, had not much money, so that they should "temper the wind to the shorn lamb" by fixing a small subscription for Students. The question of "enemy" members would be dealt with when the articles of association were next revised.

The accounts were adopted after the hon. treasurer had explained that the increase in expenditure of nearly £5,000 was accounted for by certain special items, such as the rewiring of the Institution building, which would not recur as an annual charge.

Electric Incubation.—It is known that eggs hatching under a hen vary in temperature by several degrees at the top and bottom. Although it is not known why this is desirable, experimenters in this country, according to *Science*, have tried to imitate the condition by covering artificially hatched eggs with a thin sheet of rubber to keep the top warmer; they claim a highly increased percentage in their hatch. Mr. Edmund Burke, Chemist at the Agricultural Experiment Station at the University of Montana, has, as the result of recent experiments, concluded that the electric incubator is the most satisfactory substitute for the hen. The temperature can be more readily controlled to simulate the required conditions than with the older types of hot-air incubators. Mr. Burke found in his experiments that the carbon dioxide and moisture given off by the body of the hen during hatching are necessary elements in the chemical changes that render the calcium of the shell available for the bone formation of the embryo chick. Electric incubators were found to be superior in reproducing this condition also. The amount of moisture and carbon dioxide could be more easily controlled than in the hot-air types, and the quantity of each admitted to the eggs approximated more nearly to the amount given off by the hen with a consequent increase in the hatching percentage of viable chicks.

Electroplaters' and Depositors' Technical Society.

Heavy and Rapid Copper Deposition.

A DISCUSSION on this subject was held at the Northampton Polytechnic Institute on April 14th. The opener, Mr. J. S. SUNDERLAND, dealt principally with the deposition of printers' electrotypes, but subsequent speakers, Mr. F. S. SPIERS (since deceased), Mr. A. E. OLLARD, and Mr. D. J. MACNAUGHTON among others, spoke on the process of manufacture of heavy copper cylinders, such as are used by calico printers, copper engraved printing plates, the reproduction of chased or modelled decorative panels, and other processes where deposits of considerable thickness are required.

It is well-known that the rate at which the electrodeposition of copper can be maintained and the quality of the deposit, both as regards mechanical properties and smoothness, are determined by the following factors:—(1) Composition of the solution; (2) its temperature; (3) the rate of agitation of the solution; (4) the presence of so-called "addition agents." As regards (1) all experience shows that a solution consisting of about 14-18 per cent. crystalline copper sulphate and 4-6 per cent. free sulphuric acid is the most satisfactory for most purposes and within that range any composition will yield satisfactory metal if the other factors are suitably adjusted. It appears that a solution approximating to 15 per cent. sulphate and 5 per cent. acid happens to be the optimum composition for maximum current efficiency at the cathode combined with minimum corrosion of the electrodes by chemical action. Too high a concentration of copper in solution tends to yield soft deposits—that is, of large crystalline structure—unless the acidity also be high, and then the solubility of the sulphate is diminished, so that on cooling the solution the salt may crystallise out on the electrodes, rendering them non-conducting.

The advantages of working at high current densities are increase of output, and thus a diminution of capital charges, and a good mechanical quality of deposited metal. For such purposes as printing plates the latter requirement is essential, and it is also necessary that the deposits should be extremely smooth. Both conditions can be satisfied if the solution be adequately agitated, and one speaker advocated the procedure of driving the solution between anode and cathode by means of suitable pumps, as being a far better method than the employment of blowers, agitators, or fans. Of course, in certain uses, such as the manufacture of copper tubes, the cathode itself can be revolved at a high speed on a mandrel, as in the Cowper-Coles process. In either case, there is a beneficial quasi-burnishing effect of the solution on the cathode which tends to harden the deposit, as well as the rapid renewal of electrolyte close to the deposit required when a high current density is employed. The "treeing" which occurs along the edges of a deposit when a high current density is used can be reduced, if not eliminated, by keeping the solution perfectly clear and free of suspended matter. In some processes the solution is being constantly filtered while circulated, and it may sometimes be advantageous to enclose the anodes in bags to prevent the anode-sludge from contaminating the solution.

Changes in the constitution of the solution were referred to in the course of discussion. It was pointed out that current at the cathode converted cupric into cuprous ions, and that but for the free acid present cuprous oxide would be deposited. The presence of cuprous copper might be the cause of a change in the colour of solution from blue to green often observed. From such solutions copper inferior in mechanical qualities would be deposited and one remedy was to oxidise it by means of aeration. This reaction, as well as ordinary chemical corrosion, would usually cause more copper to dissolve than was deposited, an effect accelerated by high current density and rapidity of agitation, so that solutions usually needed periodical readjustment due to enrichment by copper.

Where copper of high tensile strength or hardness was required it was desirable to apply mechanical tests, a procedure not sufficiently practised in this country. The use of Brinell hardness tests, in particular, was recommended. The curious phenomenon was referred to of the influence of the cathode material on the crystalline structure, and hence mechanical properties, of the deposit. Copper deposited on plaster was large-grained and therefore inferior in quality to that deposited on wax, for example; and even the treatment of the surface, such as graphiting and silvering, had an effect on the grain. The reason for this was pointed out many years ago by the late Professor A. K. Huntington, who proved experimentally that the first layers of an electrodeposited metal tended to conform to the crystalline structure of the base metal. It was stated that to obtain copper of the highest ductility and tensile strength it was necessary to have recourse to one or other of the colloidal organic substances added in minute qualities to electrolytic solutions. Experience could indicate to a nicety how much to add from time to time, the quantity depending mainly upon the acidity of the solution and the amount of work it was called upon to perform.

The discussion generally must have been of considerable value to those engaged in the practical art of copper deposition and was a tribute to the utility of the newly-formed Society.

The Electric Drive of Reciprocating Machine Tools.

The Ward-Leonard v. The Single-Motor System.

By L. MILLER, A.M.I.E.E.

(*Abstract of a paper read before the* MANCHESTER ASSOCIATION OF ENGINEERS.)

THE paper discusses investigations carried out by the author, assisted by certain members of the staff of the Metropolitan-Vickers Electrical Co., into the question of developing a satisfactory drive for the table of a planing machine. At the time the investigations were started the most successful drive was the Ward-Leonard. The single-motor drive utilising d.c. from the power mains was a very bad second. Its lack of success appeared to be due to trouble with the control gear, but the application of contactor gear solved the difficulties, with one exception, *viz.*, the prevention of the table of the planing machine coming off the slides in the event of failure of voltage. This difficulty was eventually overcome by utilising a series winding on the motor to provide excitation on the failure of the power. This winding was connected so as to obtain dynamic braking at the instant of reversal, but not in the current-carrying circuit, except when stopping and starting in the reverse direction at the end of the stroke, or on failure of power.

From oscillograph curves taken from planers equipped with the single-motor drive and also the Ward-Leonard drive, it is clear that the acceleration curve for the planer table is such that on short-stroke work the planer table cannot achieve full speed before a reversal takes place. This is true of either the Ward-Leonard drive or the single-motor drive. The actual effect of this on the time occupied in completing two reversals, a cutting stroke at 42.4 ft. per minute and return strokes varying from 51.4 ft. per minute to 150 ft. per minute (or a complete

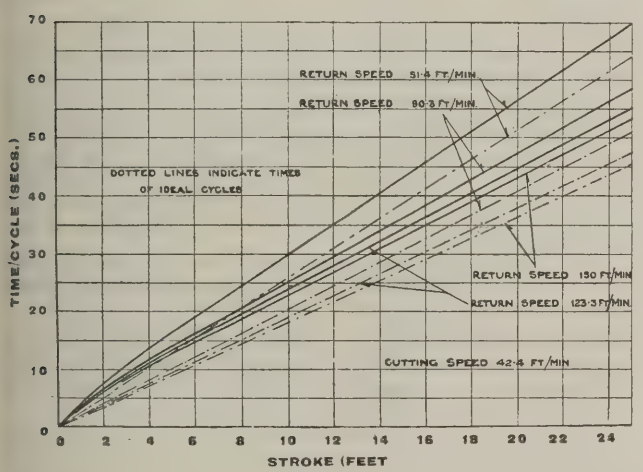


Fig. 1.

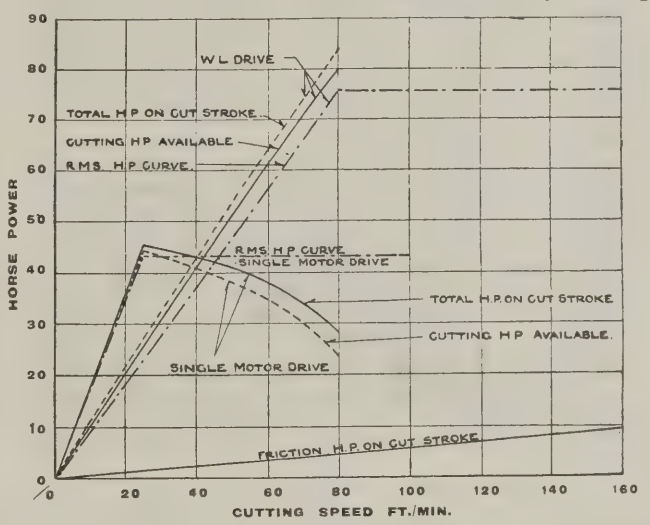


Fig. 2.

cycle) for different lengths of stroke, is shown in fig. 1. The straight lines on the curve indicate the ideal time of one cycle, that is, the time occupied on the assumption that the planer takes no time to reverse, and immediately reaches speed on either stroke. These results were taken for a very heavy planer of an old type, that had been converted to electric drive. These curves make clear the fact that the saving in time between a return speed of, say, 100 ft. per minute and one of 150 ft. per minute amounts to not more than 8 per cent. on the large planer. They also show that the loss of time due to reversing and accelerating is very small indeed, and nothing like as much as would be at first anticipated. At 1/5 of the maximum stroke on the large planer, it amounts to 2.93 per cent. and on the maximum stroke 2.28 per cent., an average of about 2.6 per cent. The power required to return the table at 150 ft. per min. is 50 per cent. greater than that required to return it at 100 ft. per min. An objection to returning the table at a high speed is that it is often very difficult to secure the work to the table in such a way as to ensure that it will not move when accelerating and retarding on the high-speed stroke.

In order to get a high-speed return, say, of 150 to 180 ft. per minute, with a minimum cutting speed of, say, 25 ft. per minute, by shunt field control, it would be necessary to utilise a Ward-Leonard equipment, since the single-motor drive would only give about 100 ft. per minute with a minimum of 25 ft. per minute by shunt field control. The extra cost of the Ward-Leonard equipment, compared with a single-motor equipment, is approximately 70 per cent., and it is very difficult to justify such a capital outlay. This difficulty is further increased when it is realised that, if heavy cuts at low speeds can be taken, the single-motor equipment is capable of removing considerably more metal in a given time than the Ward-Leonard equipment in spite of the high-speed return.

The single-motor drive can only give a maximum difference of speed between the lowest cutting speed and the highest return speed of one to four without dissipating some energy in resistances. This is due to the fact that it is not regarded as commercially feasible to build a motor having a greater speed range than one to four. It is possible, however, to get a wider range by a double-voltage system, or by means of resistances connected in the armature circuit. It is also possible by suitably arranging the resistance to obtain very little speed variation with load, and some very successful drives are operating with this form of control embodied. On the other hand, the Ward-Leonard drive, since it is a self-contained power unit, will give almost any reasonable speed range up to a maximum of one to ten. This speed range is obtained by varying the voltage of the generator up to about half of the maximum speed, and varying the field of the motor driving the planer to obtain the other portion of the speed range.

The Ward-Leonard equipment has its motor running at the top speed for a much higher table speed than the single-motor drive. As a consequence of this the motor of the single-motor drive runs at a much higher speed than that of the Ward-Leonard drive on the cutting stroke for the same cutting speed. Therefore, the single-motor drive has to deal with considerably more stored energy on the cutting stroke than the Ward-Leonard equipment. The effect of this, in reducing the available h.p. for cutting metal, is clearly indicated in fig. 2. This means, of course, that in actual fact it would be possible to push up the speed of the Ward-Leonard motor and to make a reduction in the price by doing so without seriously affecting its cutting characteristic at normal cutting speeds. The exact difference in the cost between the two drives depends upon the design of the Ward-Leonard set.

The h.p.-speed characteristics of the Ward-Leonard and single-motor drive are shown on fig. 2. Characteristic curves have been drawn for the r.m.s. h.p. and for the actual h.p. available for cutting in both cases. The root-mean-square characteristic indicates that constant h.p. is obtained with the Ward-Leonard drive from 80 to 160 feet per minute, and constant torque from 80 feet per minute downwards. The curve showing the power available for cutting also indicates the same characteristics except that, of course, reductions have to be made for the friction load at the high speeds and the stored energy at reversal. The effect of these factors is clearly indicated on the curve. The r.m.s. curve for the single-motor drive indicates constant h.p. from 25 to 100 ft. per minute, and constant torque by control of the voltage by means of resistance in the armature circuit from 25 feet per minute downwards. The power available for cutting is also clearly indicated on this curve, and the effect of the stored energy and friction load is clearly indicated for the various speeds. It will be seen that the effect of the stored energy is nothing like so great in the case of the Ward-Leonard equipment as it is in the case of the single-motor drive. In spite of this, however, it is clear from the curves of the Ward-Leonard equipment that it is not possible to take a bigger cut at 25 feet per minute than it is at 80 feet per minute, whereas with the single-motor drive it is possible to take a cut at 25 feet per minute of practically six times the area at 80 feet per minute. This characteristic conforms more nearly to that required for removing metal than the Ward-Leonard characteristic, and also a great deal more metal is removed at low speeds when heavy cuts can be employed.

The power available at the low speeds, in the case of the single-motor drive, enables it in practically all the cases investigated to remove more metal in a given time than the

Ward-Leonard equipment, in spite of the very considerably higher speed return. It is also seen that the high power, which can be obtained at high speeds with the Ward-Leonard curve, cannot be used because it usually falls outside the limit of cutting speed. The characteristic, with the 1 : 2 speed range on the motor, is very bad in this respect, and fails to give adequate power at the low speeds, and in fact is really not suitable for removing metal. The characteristic with the 1 : 4 speed variation is better, and conforms more nearly with that of the single motor drive. It is apparent, however, that the results obtained with the Ward-Leonard equipment cannot justify any increased cost, except in such cases where it is impossible to remove heavy cuts. In order to get any advantage from the Ward-Leonard drive sufficient to warrant the extra cost, it would be necessary to increase the distance between the two limit curves. This can only be done by decreasing the time per cycle, which is practically impossible.

Notes from South Africa.

(From Our Special Correspondent.)

Durban Bulk Supply.

AN agreement has been prepared between the Electricity Supply Commission of South Africa and the Durban Town Council embodying certain amendments which have now become necessary consequent on the decision of the Commission to purchase two 6,000-kW turbine sets and two 60,000-lb. boiler equipments from the Durban Town Council when the Council's present station shuts down on its taking supply from the Commission. It may be remembered that the original agreement was entered into in March, 1925, and provided for a supply of 9,000 kW and 48,000,000 units per annum, the charges being :—A fixed charge at the rate of £33,500 per annum, or £3 14s. per kW, and a minimum of 48,000,000 units at 0.29d. The amendments to the agreement are that the basis be fixed at 14,000 kW at a standing charge of £5 8s. per kW, and 60,000,000 units at 0.2d. per unit, which will operate from about January, 1929, by which date it is hoped that the Commission's plant will be installed and in working order at the Congella (Durban) power station.

While the existing agreement shows a load factor of 61 per cent., the new proposal will not be so high, being 49 per cent. Though at first sight it may not appear to be so advantageous to the Durban Town Council, the new scale will certainly show a distinct saving when its consumption exceeds the 60,000,000 units, which, judging from the present rate of growth, is likely to be the case well before supply is available, as it is estimated that by July, 1928, the Durban power station will be turning out well over 70,000,000 units, in view of the present demands that its cheap supply of current has brought about for cooking and heating, &c. The Commission station will thus have installed two 6,000-kW and three 12,000-kW sets and eight large boilers fitted with pulverised fuel firing apparatus, and it is anticipated that an early start will now be made with the foundations and buildings. The agreement is for a term of 30 years.

Pietermaritzburg (Natal) Bulk Supply.

An agreement has also been prepared between the Electricity Supply Commission of South Africa and the Pietermaritzburg Town Council in regard to supply of electricity in bulk to that city from the Commission's power station at Colenso. The agreement will date from August 1st, 1927, to July 31st, 1932, and the charges are as follows :—

(1) A fixed charge of £150 per annum, plus £5 per kVA of maximum demand.
(2) A charge of 0.3d. per unit for the first million units.
0.2d. per unit for the next two million units.
0.15d. per unit for all over.

The change-over to the Commission supply will mean drastic alterations in the distribution system, as the supply at present is single phase, 100 cycles, whereas the Commission's supply is three-phase, 50 cycles.

Durban Time Clock.

Durban has for many years made use of its electricity supply for indicating the time by the dimming of the lights at 8 p.m. by the insertion momentarily of extra resistances in the field exciter circuits of the generators at the power station, but it is now proposed to go one better and have the time controlled throughout the whole 24 hours by those who wish to install such clocks, which will be of the synchronised type. The master clock has already arrived, and will shortly be put into operation, so that Durban will be the first town in South Africa to introduce this service, and perhaps it may be ahead of many a Home town in having municipal synchronisation of time.

Trade Mark for C.M.A. Cables.—It is announced that as the result of certain cable manufacturers at home and abroad who are not members of the Cable Makers' Association applying to their own products the term "non-association grade," the trade mark Nonazo has been registered in the name of the C.M.A. This name is to appear on the labels of "Non-Association" class cables made by members of the Association.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Earth Tubes in Radio Sets.

Radio users should be indebted to Mr. Paul D. Tyers for his article in your issue of May 7th. With reference to water-pipe earths, he remarks that "the efficiency depends upon the actual conditions of each specific example"; I think this is even more applicable to driven earth tubes, as those which give poor results are as a rule not properly designed for use in the ground which is usually found near a house, but may be satisfactory in a moist flower bed. For this reason, I prefer an iron tube with a welded spike, which can be driven, if necessary, through a gravel path; by filling the tube with carbon, kept moist in dry weather, I utilise the internal surface of the tube, the carbon surrounding the earth wire. I received the following account of a two years' test from the technical expert of a well-known company: "Your tubular earth was driven through brick rubbish and stones just below the window, where the set is installed, and there is not the slightest difference between this and the water main earth."

If Mr. Tyers will make a test, I am sure the G.E.C., who supply the device, will be very pleased to give every facility.

Killingworth Hedges.

London, *May 25th*, 1926.

The Independent Power Plant.

One of the first steps taken by the Government to deal with the situation created by the General Strike was to restrict the use of electric power. As a direct consequence, many works were compelled to work short time, although they were really in a position to carry on normally. The resulting loss to the firms concerned, and the hardship to their employés, were, unfortunately, unavoidable, and everyone must agree that the Government acted wisely in imposing the restrictions.

The very fact that these restrictions were necessary does, however, make one wonder whether the Government will still proceed confidently with its electricity scheme.

The General Strike has forcibly demonstrated the value of the independent power plant. Manufacturers who generated their own power, and were, consequently, not dependent on the electric power stations, found themselves in a very favourable position, and it is certain that many of those who suffered under the restrictions will profit by the lessons the strike has taught them, and will install their own power plant at the earliest opportunity.

Cheap and plentiful power is one of the country's greatest needs, but it is a great mistake to assume that super power stations are the only means of providing it.

Power can be produced now in private plants quite as cheaply as (and in some cases even cheaper than) the super power stations will be able to distribute it. (It is, of course, the distributed cost that the consumer will pay, which is quite a different thing from the cost of production.)

In common with most other makers of power plant, we can show the manufacturers of this country how to produce electric power and light for use in their own works, at from ½d. to 1d. per unit (everything included), at the same time rendering them quite independent of power station strikes or lockouts.

For **Blackstone & Co., Ltd.**
G. M. BLACKSTONE, *Managing Director.*

Stamford, *May 26th*, 1926.

Country-House Fires.

Having followed the correspondence in connection with the above, I should like an opportunity of replying to "Engineer Surveyor." Speaking generally, I have not found any great difficulty in obtaining tests provided the client is approached in the right manner. What is often refused when insisted on is generally obtained when asked for. I also think "Engineer Surveyor's" remarks *re* the non-tariff companies are in the way of a cheap advertisement. I can assure him that as far as my own company is concerned I have yet to find it accept any risk that I, as its electrical surveyor, turn down. What I consider to be even more important than an occasional test is an inspection during the time that the installation is being put in.

Electrical Surveyor
(NON-TARIFF).

May 31st, 1926.

Electricity Meters.

Both your leaderette and your correspondent emphasise the fact that meters may go either slow or fast owing to the instability of the permanent magnet.

The Bastian Meter Co., Ltd., have for many years been working to produce a meter *without* this so-called permanent magnet, and I am happy to inform you that their efforts have now been crowned with success.

After a great deal of research work a method of overcoming this difficulty was invented and a meter on this invention has been designed, tested, and patented. Work is in progress now to place this meter on the market on a commercial scale.

F. J. Campbell Allen,
Managing Director BASTIAN METER CO., LTD.
London, *May 31st*, 1926.

Legal.

McCarthy v. Leicestershire and Warwickshire Electric Power Co.

AT the Ashby County Court on May 20th, Michael McCarthy, New Swannington, sued the defendant company for damages and an injunction in respect of poles erected by the company on his land at Coalville. Mr. F. W. WALLACE, for the defendants, stated that the land was in no sense building land, and it was not possible that the value of the land had been seriously reduced by the erection of the poles, as was alleged by the plaintiff. Colonel GERMAN, a witness for the defendants, said the land was quite unsuitable for the erection of dwelling houses. It was almost tucked under a railway embankment, where the coal from seven collieries was collected, and shunting went on day and night. After a long hearing Judge T. E. HAYDON said that the railway traffic at the spot made it an impossible site for houses, but he was not satisfied that the land could not be made use of as a site for factories. He estimated the value of the land at 10d. per square yard; and in his view the erection of the poles halved the value of the land. He was therefore in favour of plaintiff for as many fivepences as there were square yards in the plot affected. The exact amount having been ascertained his Honour gave formal judgment for plaintiff for £3 10s. 10d., plus the amount paid into Court, in all £15 18s. 4d. Costs were awarded on Scale B and the injunction was refused.

An Electric Stove Exonerated.

BEFORE Judge Cluer, in the Whitechapel County Court, on May 21st, Esther Libstein, Clapton, E., sued Mr. S. Skropski, Whitechapel Road, E., to recover £7 7s., damage done to a coat through the alleged negligence of the defendant. Mr. White appeared as counsel for the plaintiff and Mr. Walter Stewart, barrister, for the defence.

In opening the case, Mr. WHITE said the suit was a novel and peculiar one. The plaintiff went into the defendant's shop to make a purchase, and at the time there were three other customers there. The shop not being a large one, she went into a corner of it and had not been there long before she noticed a smell of burning and discovered her coat was alight. This had been caused by its coming into contact with an electric stove, and irreparable damage was done. He (Counsel) submitted that it was negligent for a shopkeeper to have an electric stove in his shop, unprotected, and without giving the plaintiff any warning of its presence.

The plaintiff gave evidence in support of Counsel's statements and said she called the attention of the defendant to the ridiculous place in which the stove had been put.

For the defence, DAVID ANDERSON, an employé of an electrical firm, said that this stove or radiator was fitted up behind the counter, but had a flexible lead about two feet long; it was capable of scorching at a distance of six or seven inches.

Judge CLUER said he did not wish to hear any further evidence. Negligence had been alleged but not proved, and this stove was not in the nature of a trap. The stove was in a reasonable position and therefore there was nothing in the nature of a trap, as when it was on a certain amount of light would be given off, which could be seen by anybody using reasonable care. The plaintiff had not proved negligence, and judgment would be given for the defendant, with costs.

Theft of Radio Valves.

AT Old Street Police Court on May 28th, Arthur Ernest Peers, Bethnal Green, was charged with stealing five radio valves, value £2, the property of his employers, the London and North-Eastern Railway, from Bishopsgate goods depôt. He was found guilty and sent to prison for one month.

Stepney Councillor Fined.

The Times reports that on May 27th Daniel Frankel, Mile End Road, E., a member of the Stepney Borough Council, was at the Thames Police Court fined £25 and ordered to pay £5 5s. costs for unlawfully committing an act calculated to injure or to prevent the proper use or working of the shop and bakery of Israel Kossoff, by threatening to cause the electric power to be withdrawn. Evidence was given that during the recent strike the defendant, who was chairman of the Stepney Trades Council, sent a letter to Kossoff, from the "Stepney Council of Action," stating that the Council's attention had been drawn to the trade dispute which had occurred between him and his workmen, suggesting an immediate settlement, and stating that unless the council heard from him it would be compelled to consider the recommendation of a withdrawal of electric light and power as far as his premises were concerned. The defendant said that, as a fact, he was not aware at the time the letter was written that the current had been already cut off. The object of the letter was to prevent trouble arising, in view of the general strike.

False Pretences Charge.

AT Hull, on May 31st, Edward W. Clark was charged with having obtained £1,000 from Mr. W. F. Shuttleworth, a director of the Humber Electrical Engineering Co., by false pretences. It was stated that the accused had obtained nearly £8,000 in connection with patents which he proposed to exploit. The prosecution alleged that forged documents purporting to bear the signature of Sir George Thurston had been produced by the accused. Clark's counsel applied for bail, stating that previous patents of the accused were very valuable, but development had been retarded by the shipping depression. The accusations of forgery were denied. Bail was refused, and a remand to June 10th was ordered.

Reviews.

Industrial Electricity, Part II. By CHESTER L. DAWES, S.B., M.A.I.E.E. Pp. xv + 480; figs. 431. London: The McGraw-Hill Publishing Co., Ltd. Price, 13s. 9d.

The first volume of this work, which is concerned with direct current circuits, has already been noticed in our columns. The present volume, which, like its predecessor, is largely of a descriptive nature, deals at length with the flow of alternating current in circuits and with electro-magnetic appliances for use on alternating current mains. In addition, there are chapters dealing with the transmission and distribution of electrical energy, illumination and photometry (though little matter is given concerning the art of illumination), thermionic valves and their uses, and the interior wiring of buildings. The chapter dealing with the last named subject seems to lie outside the general scheme of the rest of the book and in any event will not be of general utility to readers in this country since it deals with methods and conditions which are usual in America.

The general mode of treatment in the book is one involving only the simplest mathematics, considerable use being made of wave and vector diagrams, though it is rather surprising to find that the chapter on the transformer does not contain a single vector diagram since one would have thought that they could have been used with good effect in explaining the action of this appliance. The chapter on the thermionic valve and its uses may be well commended as giving a very useful account of the present state of this branch of electro-technology.

The book appears to be accurately written and the only error of moment which we have observed is on page 74, where it is stated that the *natural frequency* of the oscillations of current in an oscillatory circuit is given by the expression $f=1/2\pi\sqrt{LC}$. This formula is only true if the resistance of the circuit is zero. When there is an appreciable resistance, though not of sufficiently large an amount to render the circuit non-oscillatory, the frequency of the natural oscillations has a somewhat different value which can be found by a well-known formula.

The work concludes with a large number of examples, including some dealing with purely trigonometrical matters which seem rather out of place. The value of these examples would be increased if answers were given to those involving numerical working.

The book is well supplied with illustrations, including many half-tone blocks, and will perhaps be found most useful by those engineers and students who are studying electrical engineering as a subsidiary subject and do not desire to enter too deeply into details of matters of an electrical engineering nature.

Illuminating Engineering. Prepared by a Staff of Specialists for Students and Engineers. Edited by F. E. CADY, B.S., and H. B. DATES, E.E. Pp. xiii + 486; figs. 162. London: Chapman & Hall, Ltd. Price, 25s. net.

This volume is something of a departure in literature on illumination. It is a textbook based on six years of experience of a course in illuminating engineering. The Editors are respectively Mr. Frances E. Cady, of the National Lamp Works of the General Electric Company, and Professor Henry B. Dates, head of the Electrical Engineering Department at the Case School of Applied Science, where the course was held. The fourteen chapters, based on this series of lectures, are contributed by experts on the various phases of illumination discussed.

This method of treatment presents certain advantages and also some possible drawbacks. Each subject being treated by an expert one may expect accurate and up-to-date information; but careful editing is necessary to avoid gaps or duplication of matter. On the whole the editors seem to have been successful in avoiding the latter difficulties. The earlier chapters are devoted to the physics of light-production and sources of light. It is desirable that students should have a good knowledge of such principles and the treatment is adequate. The nature of spectra, black body radiation, the distinction between incandescence and luminescence are discussed and the distribution of energy in the spectrum with rising temperature is illustrated. It may be noted that the highest luminous effi-

ciency theoretically possible, in the most efficient yellow-green region of the spectrum, is 670 lumens per watt, whilst a body radiating in much the same manner as the sun, but yielding no non-visible energy, would operate at about 250 lumens per watt. For black body radiation 90-95 lumens per watt is the limit—but even this is far greater than the highest efficiencies (10 to 30 lumens per watt) obtainable from commercial illuminants.

A brief account is given of the sun as an illuminant. Gaseous light-sources are then discussed, after which electrical illuminants are treated. This section is well done and incandescent lamps are particularly fully treated. We notice a complete and useful diagram comparing the distribution of energy in the spectra of the chief electric illuminants. Neon lamps are somewhat cursorily dismissed, whereas a considerable amount of attention is devoted to mercury vapour lamps and their operating mechanism. The apparent absence of any account of mercury vapour lamps using quartz tubes seems a rather marked omission. The space devoted to the Nernst lamp (following the treatment of vapour lamps and somewhat out of place), might preferably have been used for a brief account of the quartz tube lamp and the special nature of its radiation.

The treatment of photometry is on sound lines, though the illumination photometers described are either American or German; the Bechstein instruments (described as "Beckstein") are singled out for special reference.

After a chapter by Professor Cobb on Physiological Optics, we come next to the use of polar curves, calculations and various forms of globes, shades and reflectors. There is a table of foot-candle intensities, and it is interesting to observe that data are presented in two parallel columns, one containing "recommended" values, the other showing the range of illuminations applicable in practice. The ingenious "guide to the selection of reflecting equipment," in terms of efficiency, favourable appearance, glare, &c., which is a feature of recent American literature, is also included; 28 different typical units are thus illustrated and appraised. Other tables deal with coefficients of utilisation on familiar lines. The chapter entitled "Light Shade and Colour" makes interesting reading. The hints subsequently given on natural lighting of buildings are sound, though one misses any reference to the "daylight factor," widely used in this country.

The final chapters on applications (domestic and industrial lighting, illuminated signs, street-lighting, &c.), are well handled and contain a good review of these problems in the space available. The book is exceptionally well illustrated, and although it is naturally based on American experience and written primarily for students in the United States, it is well worth study by those in this country concerned with illumination.

Trade-Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from May 12th. In the case of foreign applications, the names and addresses of the British representatives are given in parenthesis :—

Elektrophit. No. 468,005. Class 4. Electrical and galvanic carbons, and graphite, raw or partly prepared, for use in manufactures. No. 468,006. Class 6. Brushes and commutators for dynamos and electro-motors.—The firm of C. Conradty, Nuremburg, Germany. (S. Sokal, 1, Great James Street, Bedford Row, W.C.1.)

Dimic. No. 466,936. All goods in Class 8.—L. McMichael, Ltd.

Ecco. No. 467,463. Class 8. Batteries, cells, accumulators, and Leclanché cells.—Ecco Battery Co., Ltd., 5, Bow Common Lane, E.3.

Millgate (lettering and design). No. 467,840. Class 8. Electric batteries (not for medical purposes), coils, coil holders, thermionic valves and holders, condensers, transformers, and headphones.—The Chorlton Metal Co., 60, Long Millgate, Manchester.

The Electro-Hit. No. 468,398. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Homophon Gesellschaft, Berlin. (J. E. Evans-Jackson & Co., 57-60, Holborn Viaduct, E.C.1.)

Deckorem. No. 468,477. Class 8. Apparatus for use in radio-telephony and telegraphy.—Arthur F. Bulgin, trading as A. F. Bulgin & Co., 9-11, Cursitor Street, W.C.2.

Antix. No. 468,077. Class 11. Lead glass, lead-loaded india-rubber and similar appliances for use as protection against X-rays.—Watson & Sons (Electro-Medical), Ltd., 43, Parker Street, W.C.2.

Perfecta. No. 466,817. Class 13. Steel tubes and steel electric conduits.—Perfecta Seamless Steel Tube and Conduit Co., Ltd., Birmingham.

Cosmos Lamps (lettering and design). No. 468,879. Class 13. Electric lamps.—Metropolitan-Vickers Electrical Co., Ltd.

Sax (lettering and design). No. 468,204. Class 18. Electric bells and alarms (as systems in buildings).—Julius Sax & Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

24,819. "Frequency and voltage regulation of self-excited dynamo-electric machines." British Thomson-Houston Co., Ltd. October 18th, 1923. (223,599.)

24,926. "Lamps for use in producing photographic records of electrical variations." T. W. Case. October 20th, 1924. (251,307.)

30,810. "Copying telegraphy." L. Semat. July 25th, 1924. (237,549.)

30,862. "Liquid rheostats." A. Gray (legal representative of B. Gray, deceased) and R. Curtis. June 16th, 1924. (227,431.)

1925.

1,151. "Rotary distributors for use in telegraph or like systems." Automatic Telephone Manufacturing Co., Ltd., H. H. Harrison, and S. R. Smith. January 14th, 1925. (250,996.)

1,632. "Electric coils." Fuller's United Electric Works, Ltd., and A. P. Welch. January 19th, 1925. (251,000.)

1,755. "Systems and apparatus for electric distant-control or signalling." M. E. A. Baule. January 21st, 1924. (228,166.)

1,883. "Electrodeposition of nickel." E. A. Ollard and Metropolitan-Vickers Electrical Co., Ltd. January 21st, 1925. (251,010.)

1,905. "Manufacture of fixed electric condensers." Paralite Composition Co., Ltd., and W. A. M. Valon. January 21st, 1925. (251,012.)

1,984. "Vacuum electric tube devices." R. W. Lunt. January 22nd, 1925. (251,015.)

1,993. "Electromechanical telephone systems." F. Aldendorff. January 26th, 1924. (228,173.)

2,077. "Electrolysis or splitting-up of air or water." T. D. Kelly. January 23rd, 1925. (251,021.)

2,208. "Variable coupling-devices for alternating-current coils." British Thomson-Houston Co., Ltd., and J. Hutt. January 24th, 1925. (251,025.)

2,625. "Electric switches." British Thomson-Houston Co., Ltd., and P. T. Harris. January 29th, 1925. (251,034.)

3,182. "Thermionic valve circuits for wireless signalling and like purposes." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). February 4th, 1925. (251,041.)

3,519. "Electric generating plants operated by windmill power." L. Constantin and P. Fortier-Beaulieu. February 11th, 1924. (229,290.)

5,053. "Variable electric condensers." C. G. Hofman and L. C. Hofman. February 24th, 1925. (251,049.)

5,083. "Armatures for dynamo-electric machines." W. B. Sayers and P. Baxter. February 24th, 1925. (251,050.)

5,262. "Variable resistances." W. Knorr, W. A. Appleton and J. Joseph. February 25th, 1925. (251,053.)

7,260. "Electric connector or adaptor." General Electric Co., Ltd., and W. Manchester. March 17th, 1925. (251,068.)

7,648. "Electric switches." G. Edmonds, Ltd., and H. Edmonds. March 21st, 1925. (251,071.)

7,758. "Thermionic valves." W. R. Bullimore. March 23rd, 1925. (251,073.)

7,769. "Means for connecting electric conductors." F. V. Collins and L. F. Mayersbach. March 23rd, 1925. (251,074.)

8,172. "Receiving systems for high-frequency electrical oscillations." H. Wade (Carborundum Co.). March 26th, 1925. (251,078.)

8,243. "Electric cables." Siemens Bros. & Co., Ltd., A. E. Foster and H. G. Wood. March 27th, 1925. (251,081.)

8,686. "Electric fuses." Electrical Improvements, Ltd., R. W. Gregory and L. C. Grant. April 1st, 1925. (251,085.)

10,262. "Electric motors." A. H. Midgley. April 20th, 1925. (251,095.)

10,295. "Lead accumulators." Soc. Anon. Le Carbone. June 14th, 1924. (235,530.)

10,302. "Machines for helically winding wire on a travelling mandrel wire." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 29th, 1924. (233,330.)

10,372. "Lead accumulators." Soc. Anon. Le Carbone. December 11th, 1924. (Addition to 235,530.) (244,399.)

11,115. "Electric heaters." G. Wilkinson. October 5th, 1925. (251,099.)

11,390. "Sound-diaphragms and the like." Soc. Française Radio Electrique. May 3rd, 1924. (233,356.)

13,152. "Starting switchgear for electrical coal-cutting machines." W. A. Logan. May 20th, 1925. (251,114.)

13,354. "Loud-speaking telephone." C. A. Vandervell & Co., Ltd., and A. L. Murrell. May 21st, 1925. (251,116.)

14,361. "Sound amplifiers." C. H. Payne. June 2nd, 1925. (251,125.)

15,254. "Electric polyphase current arc lamps." E. Steinberg. June 12th, 1925. (251,129.)

16,012. "Relay mechanism responsive to voltage control." R. Wetzer. June 20th, 1925. (251,137.)

18,715. "Articulated coupling adapted to permit misalignment of two shafts, especially for power transmission in electric railway vehicles." Maschinenfabrik Oerlikon. September 1st, 1924. (235,179.)

19,276. "Electron-discharge devices." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Bell Telephone Laboratories, Inc.). July 29th, 1925. (251,149.)

19,776. "High-voltage cables and methods of maintenance." Standard Underground Cable Co. February 5th, 1925. (247,143.)

19,810. "Loud-speaking devices for wireless receiving apparatus." J. Piquart. August 6th, 1925. (251,151.)

22,108. "Method of and means for use in binding insulated electrical conductors or insulating bare conductors or the like." P. F. Hellermann. February 9th, 1925. (247,147.)

22,760. "Frequency transformers." Telefunken Ges. fur Drahtlose Telegraphie. September 12th, 1924. (Addition to 238,559.) (239,873.)

23,806. "Device for indicating sparking and other disturbances and for automatically cutting-out transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Addition to 198,936.) (Divided application on 7,933/25.) (250,827.)

24,668. "Electric heater element." E. W. Moss (McClary Manufacturing Co.). October 3rd, 1925. (250,833.)

25,074. "Electrical driving arrangements for sewing and other machines." W. Fairweather (Singer Manufacturing Co.). October 8th, 1925. (250,835.)

25,132. "Indicator devices for variable electrical instruments, such as variable condensers, variometers, and tuning units." A. H. Midgley and Auto Sundries, Ltd. October 8th, 1925. (250,836.)

25,460. "Electric flue-gas testing apparatus." G. Sokolow-Winchnevsky. October 12th, 1925. (251,170.)

25,540. "Spacing device for electric accumulators." Soc. de Loye et Touzot. June 15th, 1925. (250,840.)

26,101. "Thermal time-lag relay." Schiele & Bruchsaler-Industriekonzern. October 18th, 1924. (241,587.)

26,354. "Electric welding." British Thomson-Houston Co., Ltd. October 25th, 1924. (241,915.)

27,063. "Electric contact-breaker arms." British Thomson-Houston Co., Ltd. October 30th, 1924. (242,293.)

28,539. "Electric jet-wave commutators and interruptors." J. F. G. P. Hartmann. November 12th, 1925. (251,189.)

28,600. "Dynamo-electric generators." R. Bosch Akt. Ges. February 3rd, 1925. (247,152.)

29,561. "Conductors with artificially increased self-inductance." Dr. U. Meyer. November 22nd, 1924. (243,390.)

29,652. "Spark-gap discharges for use in connection with electric condensers." Dubilier Condenser Co. (1925), Ltd. November 24th, 1924. (243,392.)

29,958. "Current-collecting devices for dynamos." Ruthardt & Co. Ges. November 27th, 1924. (243,753.)

30,368. "Rectifying installations for electric current." Siemens-Schuckertwerke Ges. December 2nd, 1924. (244,092.)

32,434. "Machines for making electric incandescent lamps and similar articles." British Thomson-Houston Co., Ltd. February 21st, 1925. (247,923.)

32,474. "Electrically-driven vacuum cleaners." Soc. de Paris et du Rhone. December 24th, 1924. (245,148.)

1926.

1,288. "Vacuum-producing apparatus of the mercury-vapour jet ejector type." Akt. Ges. Brown, Boveri et Cie. August 10th, 1925. (251,213.)

2,125. "Traffic signals and like light-projectors." British Thomson-Houston Co., Ltd. January 24th, 1925. (246,514.)

3,687. "Alternating-current motors." British Thomson-Houston Co., Ltd. February 9th, 1925. (247,232.)

The

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Electricity Supply Legislation.

ON June 3rd, after a fortnight's recess, Standing Committee C resumed consideration of the Electricity (Supply) Bill; on the same day there appeared in *The Times* a trenchant criticism of its proposals, signed by nine men in the front rank of the electricity supply industry, which we reproduce elsewhere in this issue. In the main the letter is identical in tenor with the views that we have expressed in these columns—that the cost of the proposals for general standardisation and interconnection would impose an additional burden upon the consumers of electricity, and that the Bill in its present form will not effect the desired result of developing the use of electricity. It is added that its provisions tend to diminish efficiency by unnecessary interference, to introduce further bureaucratic administration without financial responsibility, and to discourage private enterprise.

With the exception of Mr. R. A. Chattock, president I.E.E. and head of the Birmingham Corporation Electricity Department, all the signatories are chairmen or engineers representing important undertakings owned by companies. Mr. Chattock, it will be remembered, set forth his views at much greater length in a manifesto which was published in our issue of April 30th last (p. 719); he then pointed out that if there were just grounds for the complaint that the supply undertakings had not adequately developed the industry, it was rather due to hampering legislation than to the shortcomings of the undertakings, and he cited the delay in granting facilities for extensions of area and the difficulty in obtaining wayleaves for overhead lines as instances which called for remedy. The machinery of the Bill, he considered, would only aggravate the troubles of the existing situation, and he appealed for freedom from interference with undertakings owning big generating stations. His suggestion that the Central Board, as middle-man, should be content with purchasing energy from the existing large power stations and retailing it to outside distributing authorities was an important item of constructive criticism which should receive full consideration; it would go far to appease the opposition of the great power companies and municipal under-

takings, and would obviate the absurdity of buying energy and reselling it to the producers at a price in all probability higher than the purchase price. Mr. Chattock also endorsed our contention that whilst regional interconnection is desirable and economically sound, there is no justification for national interconnecting lines. A further valuable suggestion of his was that in a station of non-standard frequency, additional generating plant of standard frequency could be installed, which would serve the purpose of interconnection whilst sharing in the high economy of the whole station. His statement, as a whole, deserves the most careful attention, and if, as Lt.-Col. Ashley stated at the E.A.W. luncheon last Friday, the Government is prepared to consider any suggested improvement, with a view to obtaining the best possible Bill, it cannot do better than begin with this well-weighed essay.

We have already drawn attention to the important resolution adopted by the I.M.E.A. in special general meeting on May 28th, condemning both the Bill and the Weir Report; in view of the enormous interests represented by this Association and the Parliamentary influence exercised by the municipalities concerned, the resolution is certain to receive the serious attention of the Government. It is not without interest to recall that the whole trouble derives its origin from the legislation of 40 years ago, which was welcomed by the municipalities whose representatives are now, in chorus with the companies, declaiming against the Government's Bill.

One point upon which all, including supporters of the Bill, are agreed is that it is most important to put an end as soon as possible to the uncertainty created by the patchwork legislation of recent years; as Mr. R. P. Sloan remarked at the E.A.W. luncheon, when justifying the attitude of the opponents of the Bill, there has been excessive legislation and constantly recurring uncertainty in the past, and what the industry most needs is a rest, so that it can "get on with the job." The splendid development which has been accomplished in the North-East Coast area is ample vindication of his policy and authority for his right to offer constructive criticism. Mr. W. B. Woodhouse, in a recent article published in the *English Review*, has set forth his considered opinions, many of which are so closely in accord with those which we have expressed in these columns that to quote them would be tautological. We must refer also to the resolution of the Council of the Institution of Electrical Engineers, in concluding that it is abundantly clear that there is a mass of reasoned opposition to the Bill—in its present form—emanating from the whole of the electricity supply industry; a large number of manufacturers and many prominent business men are also opposed to its provisions, and its progress in Committee is marked at every step by detailed arguments of which, unfortunately, we can only find room for an outline. Those who wish to follow this very instructive discussion more closely will find it fully set forth in the "Official Reports" of the proceedings of Standing Committee C, which can be obtained from H.M. Stationery Office at trifling cost, a day or two after each sitting. Provided that the Government is sincere in its expressed willingness to improve the Bill by amendment—and it has already accepted a most important change in the relationship between the Central Electricity Board and the Electricity Commission—we have strong hopes that in the end a really useful measure will be placed on the statute-book. But we take this opportunity of again pointing out that amendment of existing provisions is insufficient; the omissions are no less important, and it is urgently necessary to insert additional clauses drastically changing the situation with regard to wayleaves, the powers of the Postmaster-General, and other obstacles to the extension of distribution networks. **The Bill, as we have previously said, deals only with generation, which represents but a small fraction of the total cost to the consumer; unless it is so framed as to reduce the cost of distribution, it can have but little effect on the ultimate cost, and that fact is the most damning of all—for it means that the Bill, as it stands, fails to effect its most fundamental purpose.**

State Ownership—or Public Control?

WHETHER it be a question of coal mines, electricity supply, transportation, or telephone service, the people who think, and are not, as the Americans say, "dead from the neck up," are unanimously concerned to-day in settling once and for all the vexed question of industrial ownership. The absence of clear thinking on the subject in this country is largely the cause of high taxation and low wages, resulting in strikes, unrest among all classes, and positive misery in some cases.

In our report of the N.E.L.A. convention on another page we quote some striking words by that eminent authority on industrial relationships, Mr. Owen D. Young, who is chairman of the General Electric Co. of America. Mr. Young, who has studied for thirty years the war that has been waged between "public ownership" and "private ownership," sums up his conclusions in no uncertain manner in the speech to which we have referred. He concludes that efficiency and economy of operation are best attained by private ownership, and that a Governmental organisation is an inefficient and uneconomical instrument to do public utility business. Moreover, where there are no economic checks, political expediency tends to lead to extensions as an uneconomic social act rather than as a result of investigations leading to a paying business proposition. The rapid advance of the light and power supply industry in the United States is the envy of every foreign country, and the benefit of such a development is found in the solution of labour problems. If human beings are made the controllers of power instead of the generators their earning power is so much increased as to make it possible to pay them not only a living wage, but a cultural wage.

The high standard of living of all classes in the United States is evident to the most casual observer, and the recent delegation of British Trade Unions saw that the reason lay largely in the extensive use of machinery and labour-saving devices and the initiative displayed in American business organisation. As Mr. Mellon, the Secretary of the Treasury at Washington, has said: "An industry cannot pay high wages even under threats of strikes unless that industry is prosperous. Labour, as well as capital, must think constructively and in harmony. By the investment of capital in labour-saving machinery the production per man is so much increased that increased wages may accompany increased profits." But this means operation on the grand scale, and as Mr. Mellon goes on to say: "Corporations are no longer owned by a small number of individuals. In the United States there are 19 million holders of stock in industrial concerns, many of them persons of small means, who can secure a better and surer return on their money through investment in some useful well-organised company than in any other way."

In this connection we noticed a short time ago that the American Telephone and Telegraph Co., which has 350,000 shareholders on its books with less than a hundred shares each, and over 100,000 holding less than five shares each, has recently issued additional stock which brings its total capital to over a thousand million dollars, and the efficiency of the telephone service in the United States controlled by this huge private enterprise is second to that of none in the world. The article by Mr. R. E. Turnbull on "Customer-Ownership," on p. 890 of this issue is also very pertinent to this subject.

Private initiative is at the foundation of America's prosperity to-day, and although there exist many Government agencies to protect the public against abuses, this is quite a different thing from Government ownership or subsidy.

As we said earlier, our greatest need is for clear thinking. The relative merits of municipal and private ownership of means of transportation should not be confused with the relative technical merits of tramcars and 'buses; nor in a dispute, whether on coal mines or telephones, should we assume that either disputant is entirely in the right. He probably never is. Let us

get it definitely established that an interested employé gives better service than a disinterested one, and that a combination of employers and employés forming an industry must stand or fall on its merits as the result of co-operative service to the public, and we shall have gone far towards reaching a settlement of some of our present-day industrial problems.

Safety First Records.

A REPORT received from the American Museum of Safety bears striking witness to the immense importance of accident prevention; it relates to the records of organised precautions against accident in the works of the United States Steel Corporation over a period of 20 years. The figures are, of course, imposing in their magnitude because of the enormous scope of the company's operations, and the large number of its employés, but after allowing for this factor it cannot be doubted that very great benefit has been derived by both employers and employed from the safety movement.

It is stated, on a statistical basis, that in 20 years 46,000 men have been saved from death or serious injury, and 322,000 from accidents which would have resulted in disablement; a very large saving in money has also been made. These data represent reductions of over 60 per cent. in the former class, and over 80 per cent. in the less serious class of accident. Nearly 10 millions sterling has been spent on measures to promote safety and sanitation in the last 14 years.

It is very significant that accidents due to hazards peculiar to the steel industry, such as hot metal and flame, accounted for less than 5 per cent. of the total, and only 4.9 per cent. were due to machinery; nearly half of the accidents were due to hand labour, which cannot be controlled by mechanical safety appliances. The inference is that, as is shown by our own records of accidents in coal mines, &c., a very large proportion of cases arise from carelessness and inattention, which can only be remedied by educating the workman to protect himself. The adoption of improved methods of lighting, heating, and ventilation also goes a long way to improve the safety records—bad lighting is one of the most potent factors in swelling the list of accidents in workshops.

By spending two millions on accident prevention in 10 years the U.S. Steel Corporation states that it saved three millions, apart from the enormous saving of life and limb.

Trade Difficulties.

IT is no easy task to make new suggestions of practical value regarding the development of our industries while they still lie under the heavy shadow cast by the coal dispute. For years past we have ransacked our own and others' brains in search of solutions of our problems, and pens have run dry setting forth reasons for this, criticisms of that, grounds for hope, and reproofs of pessimism. Committees have investigated and reported, trade and other associations have deliberated and acted, and then, years after, our spokesmen have delivered speeches containing practically the same ideas as we listened to from their predecessors when things were very different. The explanation seems to be that there is really very little new to say in spite of the altered times—practically everything has been said. That, we suppose, is why Mr. A. M. Samuel, M.P., the Parliamentary Secretary to the Department of Overseas Trade, in addressing the Iron and Steel Institute's members last week, reiterated once more the familiar remarks about the need for loyal and efficient labour to work hand in hand with sympathetic managers; for up-to-date equipment and wide-awake selling organisations; for the ingenuity of the technical expert, and the individuality and initiative of the business man; for increased attention to be devoted to research; for overseas agencies to be strengthened and methods of sale attended to; and for engineering firms to be in personal contact with customers abroad through representatives possessing knowledge of our products and armed with authority to act. Yet familiar as these points are, not one of them is of less importance to-day than it has been in the past. However substantial may have been the improvement made as the result of efforts of the past decade, there is still need for something more; probably there always will be. Sometimes we make changes which we genuinely regard as advances; perhaps experience proves them to be otherwise, or some new hand takes command and old ideas are revived and given a chance. Compared with foreign competitors we may or we may not have advanced in our method—such things are very difficult to measure, for we are all constantly changing. Really it is better to get on with the job than to sit talking about it. To be as efficient as possible in every department is what is required, but all such thoughts and ambitions must inevitably drive us back to the question of the cost of production, for we cannot continue to hold existing business or regain lost trade if we indefinitely shelter under the sentimental or the artificial. If the coal dispute is teaching the nation one thing more than another it is the inevitability of the economic truth that if we try to take out of an industry more than it will yield, that industry, like any little shop or other business, must shut down. The position of the general engineering trade, in which, as everybody recognises, the wages of skilled men are deplorably low, affords examples of the way in which some of the biggest concerns are being compelled to adjust their affairs in order to accommodate themselves to the circumstances of these trying years. While things so continue, it is impossible to force higher wages without further crippling the industry. It is unfortunate, and opposed to everybody's wishes that good work should be poorly paid, and no humane or social organisation can feel more deeply on the point than we do, but we believe that the truth regarding economic inevitabilities is becoming more widely recognised and both sides are more familiar with each other's difficulties. Now that the atmosphere is clearer than it was before the general strike, we ought all to be pulling together to bring our suffering industries round, but even these seem to be little better than idle words until the coal trouble is at an end.

Electricity in the Service of Women.

ON Friday last the first annual general meeting of the Electrical Association for Women was held and was followed by a luncheon to which were invited many distinguished men associated with electricity supply. The occasion was described by Alderman Mrs. Hammer (chairman of the Association) as its first official birthday, and we have the greatest pleasure in wishing it many happy returns; for the Association, which has for its object "the promotion of the wider use of electricity in the service of women," has another aspect, no less laudable—the wider use of women in the service of electricity, and from both points of view we heartily welcome it as a permanent and pleasing addition to the great electrical family.

The Association has made remarkably rapid progress during its short life of 18 months and, as Lt.-Col. Ashley observed, it is a very vigorous infant. The same speaker emphasised the fact that selling electricity was as important as generating it, and held that the reason why electricity in the home was a commonplace in the United States and Canada, whilst it was the exception here, was that in America the selling side of the business had been more efficiently conducted. That, as we have often pointed out, is the truth; and we look to the "E. A. W." to put a new face on the matter, by educating women in the art of utilising electricity to lighten labour and brighten the home. As Sir Hugo Hirst remarked, there is great scope for women not only to sell electrical home appliances to women, but also to carry on that continual *service* which is absolutely essential to success, and which will involve a serious course of training, but will ensure them remunerative employment.

The Association is in excellent hands, and will command success by deserving it.

Electricity Supply Undertakings.

The Effect of Load Factor.

(Communicated.)

During the current year two articles have appeared in these pages, analysing from different points of view the statistics of returns of the Electricity Commission for the year ended March 31st, 1923.*

The first article showed that on the average no clear decrease in coal consumption per kWh generated accompanied an increase of output beyond about 10 million kWh per annum, and the second indicated that very little difference in average price could be detected when the output rose above the same figure.

These two pioneer investigations, to which the present author is indebted for inspiration, were, quite naturally, a spur to further effort, and out of the mine of information contained in the statistics referred to, a

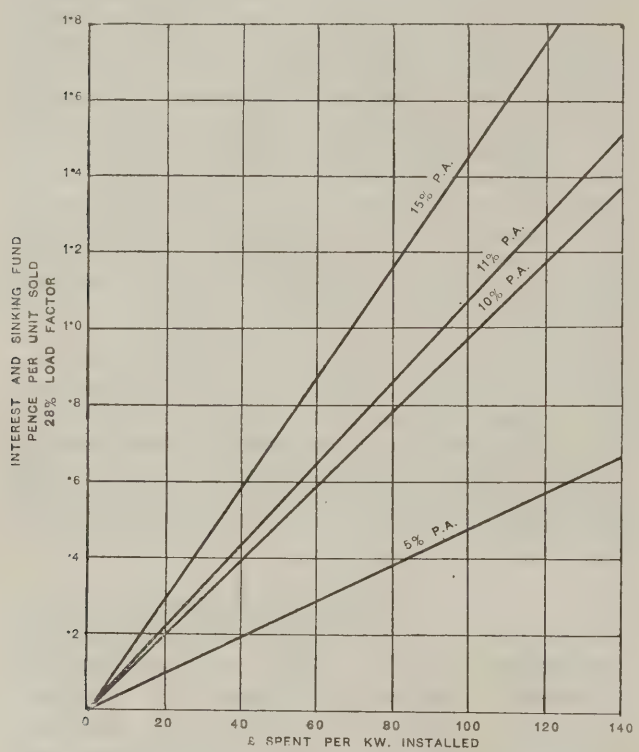


Fig. 1.—Cost of Plant and Capital Charges.

further search for instruction has been made. Following a preliminary investigation, it was decided, if possible, to trace the correlation, if any, of load factor and output as well as load factor and price per unit sold.

Load factor, it is perhaps needless to say, is the ratio of the mean to the maximum load observed upon any producing and/or distributing plant, be it either farm, factory, or electricity undertaking. The importance of cultivating. so far as possible, a full and continuous use of capital already expended, whether in the shape of farming implements, tools, steam, or electrical plant, and at the same time of arranging that all hands are well and effectively engaged, has, wherever prosperity is wooed, been fully recognised for generations. Such full use of capital and labour has for natural reasons some limitations, not the least being that man must sleep, and generally prefers to do so for 8 hours at night time.

Turning now to what may be expected in electricity undertakings, not only is load factor affected by natural causes, but it is found to be further influenced by working hours being normally concentrated within a part of the remaining 16 hours of the day. It must be remembered, too, that. although light, heat, and power are needed for purposes of recreation and pleasure, these agents are not called upon to render service with the same degree of intensity as in the process of creation and production.

* Elec. Rev., Jan. 1st, 1926, p. 5, and Feb. 5th, p. 204.

The cost of producing and distributing electrical power is itself a product of operating and capital costs, and both of these in turn are affected by load factor. As to operation, the lower the load factor the greater becomes the percentage of stand-by losses both in respect of coal and staff. Banking of boilers, radiation from steam pipes and steam plant may be cited as examples of heat losses, and unused attentiveness of skilled operators as an instance of the latter loss. The advent of pulverised fuel will, no doubt, greatly diminish the really serious operating charge of banking, but it is possible to conceive that even this may be done at too great a capital cost.

As to capital costs, these are the real and important burden, and no relief appears in sight. The value of individual savings collected and directed towards safe investment is not less than that indicated by a return of 5 per cent. on the money lent, and it is unwise at present to base any calculation of the return due to capital, in the shape of interest and of redemption, at less than 10 per cent. or 11 per cent., even when such capital is so well secured as in undertakings for the generation and distribution of electricity.

The total sum charged to capital account by electricity supply undertakings coming within the purview of the Electricity Commissioners' report was, up to 1923, approximately £158,000,000, the load factor being on the average about 28 per cent., the units sold 3,762 millions, and the total capacity of the generating plant installed about 3,100,000 kW. From this it is evident that the average cost per kW installed is £51, and the charge on each unit for capital purposes at this l.f. is not less than 0.5 of a penny (see fig. 1).

Since it is imperative to bring down the total cost of the unit, as made up of capital and operating costs, to very little over 0.5 penny, if the country is successfully to secure markets at home and abroad, the magnitude of the task upon which the electricity supply industry is engaged will be realised. It almost looks as if certain of our undertakings (unnamed) may shortly be faced with the necessity of reducing their charges for electricity and, as a consequence, will be faced with sacrifice of capital, or, alternatively, some of the interest thereon.

Reverting to the general question of load factor, one of the greatest obstacles in the way of decreasing the cost of electricity is the interest and sinking fund which must be found for capital lying idle so many hours of each day.

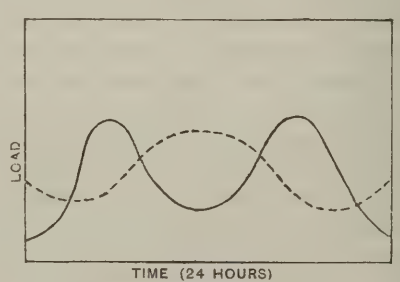


Fig. 2.—Diverse Load Curves.

The mean load, as is also well known, may in one industry be made up of demands varying in time and degree of intensity as compared with that of another industry, and although the same low load factor is found in each case when run separately, an improved result may be anticipated when they are run together. The curves in fig. 2 illustrate this point, the extent of the variation in time and intensity being commonly referred to as the diversity factor.

Turning, then, to the relation between load factor and output under examination, it might be supposed

that as a power station grew in size and the original early lighting supply was followed by power supply,

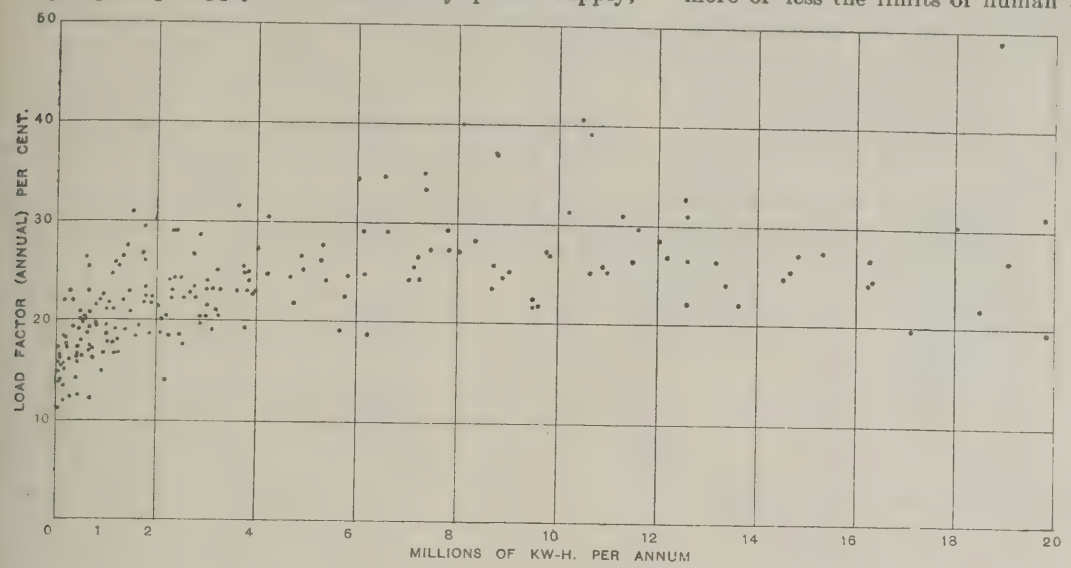


Fig. 3.—Relation between Load-factor and Output.

traction load, and delivery of electricity in bulk, quite a marked increase in load factor would follow. As a matter of fact, as will be seen from fig. 3, continued on fig. 4, no such marked change is to be noted. Certainly, between outputs of 200,000 and 6,000,000 units per annum there is a well defined rise, but for greater outputs ranging from the latter figure to 186,000,000 units, little material change can, in any definite way, be detected. The analysis, it is true, relates only to undertakings run by English local authorities, but it is sufficiently indicative and

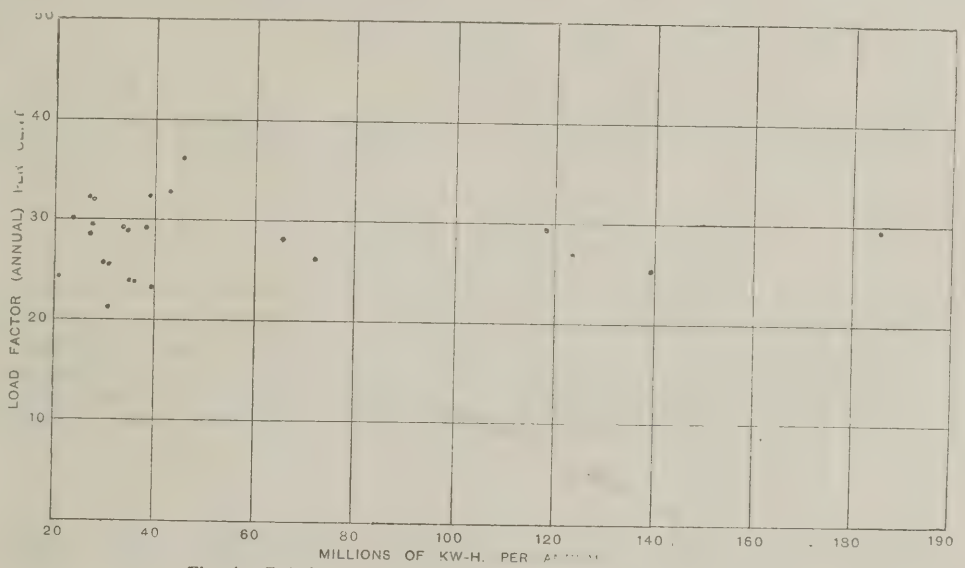


Fig. 4.—Relation between Load-factor and Output (Fig. 3 continued).

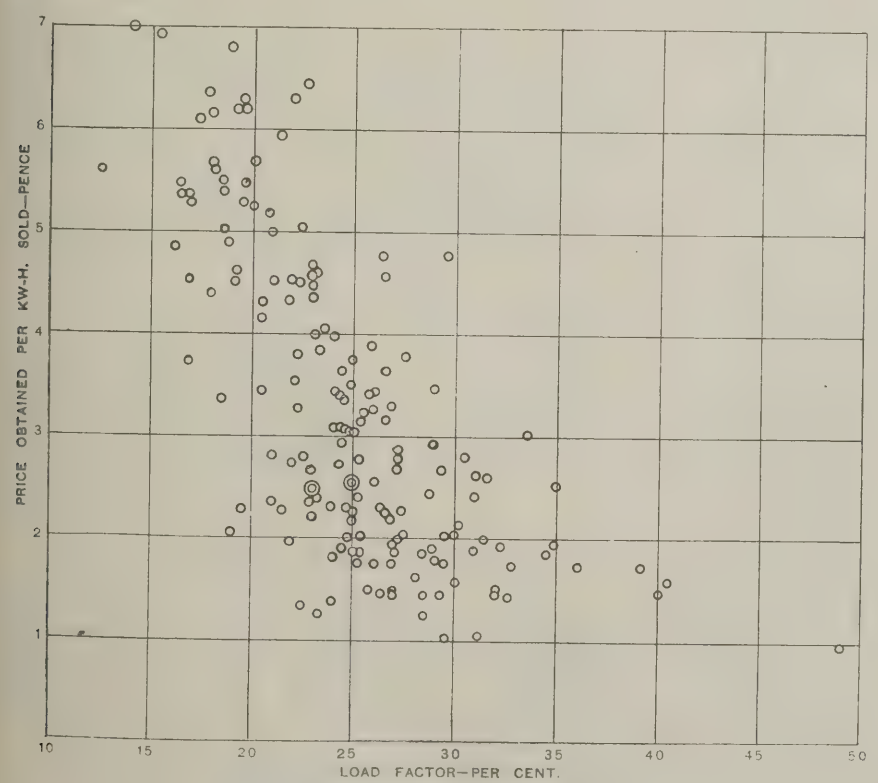


Fig. 5.—Relation of Load-factor to Selling Price.

no doubt reflects the true state of affairs not only of all local authorities, but also of company undertakings. This uniformity is interesting: can it be that there is a somewhat low limit to load factor following more or less the limits of human activity or endurance during a normal period of 24 hours? It would seem that unless hours of toil and amusement—especially the former — are materially extended, a maximum load factor of much over 50 per cent. and a mean of over 30 per cent. need not be expected. Such a high figure as 50 per cent. is to be found occasionally on suburban railway and tramway undertakings, but on the whole it would appear optimistic to expect throughout the length and breadth of the land anything above an average of 30 per cent. The reader must be left to draw his own deductions, but in extracting the figures determining the relationship under review, it should be recorded that no rise in load factor can be attributed positively to an increase in the ratio of electricity supplied for domestic plus public lighting requirements, to electricity supplied for power, traction and bulk supply, when such ratio is anything between 1 to 1 and 1 to 10. Apparently diversity of supply does not influence load factor as greatly as has hitherto been accepted. This is undoubtedly a matter of interest to engineers at the present moment, and raises a question as to the wisdom of effecting interconnection of two or more power stations operating in industrial centres placed in widely-separated parts of the kingdom, and in which it has been shown that, when individually operated, no increase in load factor has occurred with increases in output as made up of the many varieties of supply found in such centres. In other words, if load curves coincide the economies interconnection might introduce will be reduced to those of lessening the amount of spare plant required and some

minor economies in operation. As to the relation of load factor to selling price, as shown in figs. 5 and 6, although there is, as might be expected, great disparity in results, a gradual fall on expected lines does occur in selling price with increase in load factor. The limits of such an investigation must be acknowledged, for the price obtained is, of course, related to the market value, as well as to the cost of production. Yet something seems out of joint when at a 25 per cent. or 27½ per cent. load factor a difference in price of 350 per cent. occurs. This glaring discrepancy has no doubt been recognised and

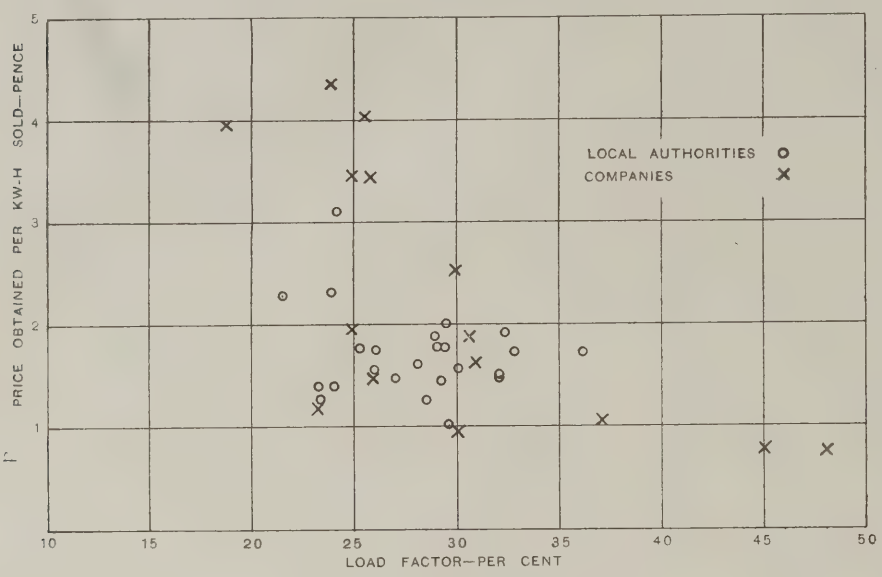


Fig. 6.—Relation of Load-Factor to Selling Price.

will, it is hoped, be provided against in the Government's new Electricity Bill when it becomes law. Undertakings having costs and prices of such "ignoble eminence" should no longer be allowed to scotch progress, and should be assisted, dutifully, to fade away.

Fig. 5 relates to *all* local authorities in England having outputs from quite small figures to nearly 50 million units per annum, but in fig. 6 a comparison of price and load factor has been made between companies and local authorities having outputs ranging from 10 million to 186 million units per annum. The Newcastle-upon-Tyne Electric Supply Company, with its Associated Companies, is not shown; it is singular as having an output of 443 million units per annum. It has the highest load factor—48 per cent.—and the lowest price at .76d. per unit sold; but it will be remembered that it is operating in a particularly favourable field.

The comparison (fig. 6) is singularly interesting as showing how much more consistent are the results of local authorities than those of the companies. The companies do not show up very well, the greatest variation in price on approximately the same load factor being: companies 360 per cent., and the local authorities 220 per cent.

A contemplation of fig. 6 may, it is suggested, prove instructive and helpful to the companies in so far as it may indicate to them the advisability of making some sacrifice in the interests of their consumers. It is perhaps unwise in early and development stages to curtail profit, for the spirit of adventure must be encouraged; but it would seem that, not only in the present state of the public supply of electricity, but also in the greatly extended and far-reaching sphere in which it is intended it shall function in the near future, some sliding scale whereby profits are allocated so as to ensure some definite relationship between dividends on capital and reduction in price should be applied, and would result in nothing but good in the end.

The Insulating Properties of Fused Basalt.

Basalt is a rock of volcanic origin, and is plentiful in many parts of the world, notably in England, France, Germany, and America.

The approximate constitution of basalt is: Silica, 55 per cent.; alumina, 12 per cent.; iron oxide, 22 per cent.; and small quantities of lime, soda, potash, and magnesia.

In its natural state basalt is extremely difficult to work, owing to its great hardness. It can, however, be fused at a temperature of 2,300 deg. F., and can then be cast in moulds of any desired shape. At this stage it resembles black glass and is extremely brittle, but if it is then subjected to a lengthy thermic process it becomes annealed and is restored to its original state.

The dielectric strength of the annealed basalt is 35,000 volts per ¼-in. thickness; it possesses a tensile strength of 18¾ tons per square inch, and withstands a compression stress of 18¼ tons per square inch.

The coefficient of expansion with temperature of basalt is comparable with that of iron; consequently iron parts may be incorporated in the molten basalt before solidification, thus doing away with the need for cementing, with all its disadvantages. This is particularly important for certain forms of switchgear insulators. Metal parts can, if desired, be screwed direct in the basalt.

A further great advantage of basalt is that, should an over-pressure, such as might be caused by lightning, occur, and the arc pierce the insulator, the basalt resolidifies immediately after the passing of the current, and the insulator will remain in service without damage.

Some interesting tests, which bring out this unique property of basalt, were made by the Laboratoire Central d'Electricité, of Paris, on April 13th, 1925 (Test No. 32,202). The tests were made on 10 anchorage insulators, the dimensions of which are shown in the accompanying sketch, fig. 1, with an alternating current having a frequency of 42 cycles.

The tests showed a first flashover at from 27,000 to 30,000 volts, whilst arcing commenced at from 32,000

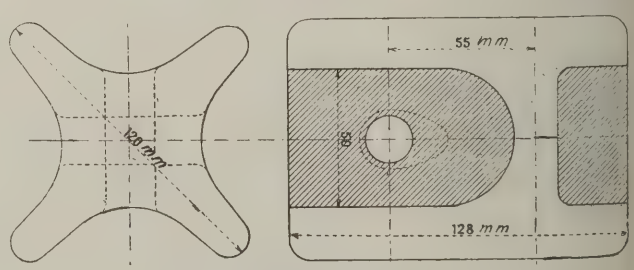


Fig. 1.—Basalt Anchorage Insulator.

to 37,000 volts. Each insulator was then immersed in oil and subjected to four consecutive piercing tests. The e.m.f. was gradually built up till puncture occurred. A second similar test was recommenced immediately after the first piercing, and likewise a third and fourth.

The following is an average result:—

First piercing occurred at		32,000 volts.
Second	ditto	35,000 volts.
Third	ditto	33,000 volts.
Fourth	ditto	33,000 volts.

It will be noticed that it took a greater e.m.f. for the second puncture than the first. This phenomenon occurred in most cases, either between the first and second or the second and third tests.

The chief advantages claimed for fused basalt over existing materials are:—

(1) Its high dielectric strength.

(2) It has no hygroscopicity, none whatever.

(3) Its resealing properties when punctured.

(4) The possibility of incorporating stalks, hoods, or any other metal parts in the insulator.

(5) It resists all atmospheric changes, and even acids.

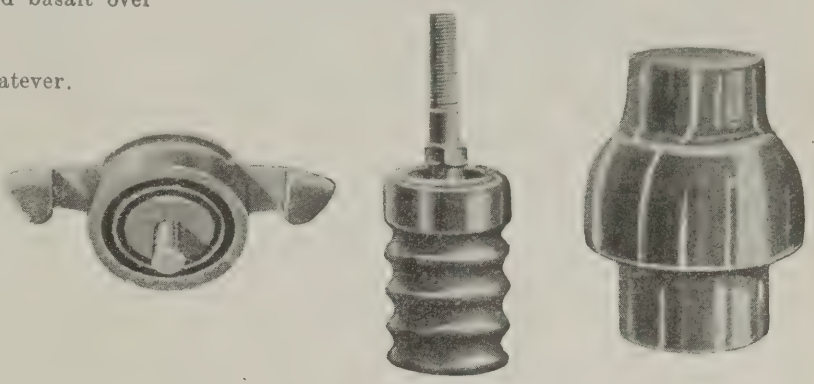
(6) It can be moulded to practically any shape.

(7) It is somewhat cheaper to produce than the porcelain now in common use.

(8) Comparing its strength with any known vitreous material, it possesses a very much greater tensile strength and will withstand a far higher compressive stress.

Fused basalt insulators are at present used extensively on the French electric railways, the P.L.M. alone having 75,000, and it is under test on several railways and tramways in this country.

Figs. 2, 3, and 4 illustrate some of the insulators which have been made from basalt.



Figs. 2, 3 and 4.—Types of Fused Basalt Insulators

The firm dealing with the manufacture of this new insulator in this country is Messrs. R. W. Blackwell and Co., Ltd., to whom we are indebted for the foregoing particulars.

CO_2 Records and their Interpretation.

By CHAS. F. WADE, A.M.I.Mech.E., A.M.I.E.E.

Careful and continuous observation of the percentage of CO_2 in the waste gases from any boiler plant is indispensable if the efficiency is to be maintained at its best figure, but what is equally essential is that the records obtained shall represent as nearly as is practicable what is the true state of affairs and that such records shall be correctly interpreted. The mere blind following of the records obtained from an instrument connected either to the main flue of a battery of boilers or at the back of a single boiler, without special precautions having been taken to ensure that the percentage shown will give a correct indication of the true average CO_2 content will, almost certainly, lead to erroneous conclusions which may have quite a serious effect upon the efficiency of the plant.

When we begin to study the question carefully, it is found that the extraction for analysis of a really representative sample of the gases is not such a simple matter as may appear at first sight, and the larger and wider the boiler becomes, so much more difficult is the problem to be solved. First, let us consider the various influences which will be at work on the type of plant found in the majority of power stations to-day, which will consist of water-tube boilers fitted with mechanical stokers and burning various grades and sizes of coal. In the more recent installations pulverised fuel will be in use, but in this case it will be much easier to obtain true and representative samples of the gases than with solid fuel firing owing to the homogeneous nature of the mixture of fuel and air to begin with. In this article the writer will confine his remarks to the question of solid fuel only.

The first influence upon the CO_2 indication will be the size of the fuel, whether it be mixed or screened, and also how it is fed into the stoker hopper, followed by its distribution over the firegrate. Secondly, the CO_2 percentage will be influenced by the nature of the fuel in regard to its relative percentage of fixed carbon and volatile matter. Next, the width of the grates will exert a considerable influence upon the tendency to stratification of the gases, this last also depending for its extent upon whether the tubes are staggered or otherwise. Air leakages into the gas passages will vary in their effect upon the accuracy of the record obtained by their position, *i.e.*, whether near to the point of sampling or otherwise. Another point to be considered is what the record is required for; if needed for the accurate regulation of fuel and air supplies only, a point for sampling must be selected as near to the firegrate as possible and only far away enough from it to ensure that at the point selected combustion has been completed, but the gases have had the least opportunity of being diluted with air by leakage through the settings. When an indication of the general state of the boiler is desired, including the condition of the brickwork settings, the correct position for the testing point is at the final exit, while a comparison of readings at the two positions referred to will give a good idea as to the extent of any air leakage which may be taking place.

Dealing with the effect which the size of the fuel will have upon the CO_2 record, with the usual arrangement of coal-gate on chain-grate stokers in which the contour of the gate allows greater thickness of fuel at the sides of the grate, provided that the weight of fuel is distributed evenly across the hopper, the CO_2 content of the gases will not vary to any appreciable degree across the gas path, for the additional thickness of fuel at the sides will burn more rapidly than at the centre owing to the effect of the proximity of the incandescent side walls of the arches. If ordinary fixed coal chutes are in use, the result will be that the increased opening at the sides of the coal gate will be neutralised by the decreased weight of the fuel in the hoppers at the sides so that the fires will not only burn out more rapidly, due to the effect of the hot side walls, but also because of the greater air access to the fuel caused by less close packing than at the centre of the grate. There will consequently be a tendency towards greater excess of air at the sides of the furnace than at the centre, this being aggravated by the diversion of the air from the centre and thicker fire, where it is mostly needed, to the sides where the supply should be, if possible, restricted. It does not by any means follow that the excess of air passed through the sides of the fire will mingle with the partly-consumed combustibles from the centre, the probable result being that the stratification of air and gases set up in the fire will be more or less preserved throughout the complete path of the gases through the boiler.

When mixed coals are employed, the sorting-out of the nuts and slack in the hopper will greatly accentuate the stratifying effect described above, and the use of

this class of coal is to be avoided wherever possible. As the grates become wider, the greater will be the difference in gas analysis between the sides and centre and in the middle chamber of a water-tube boiler there may be a variation from 9 per cent. to 15 per cent. of CO_2 in the gases from sides to centre respectively. Of course, every effort should be made to ensure even combustion right across the grate, but even with the best of precautions the likelihood of more or less stratification must not be overlooked when deciding upon the method to be adopted in sampling the gases for analysis. In the case of boilers with staggered tubes stratification will most certainly be reduced, but complete mingling of the gases cannot be relied upon even in such cases and, if the gases and air do become thoroughly mixed by the time they reach the dampers, the final mixture will not have been attained until active combustion has entirely ceased. Under these circumstances it will readily be appreciated that with fires which are not burning evenly across their width, it is quite possible to have a comparatively low CO_2 record at the dampers while the gases actually have an appreciable percentage of CO, CH_4, and H_2 left in them and representing serious waste of heat value of the fuel. Such a state of affairs would exist when the sides of the gas passages give a CO_2 percentage of 5 per cent., and the centre a reading of, say, 15 per cent., the resulting test of the mixture showing 10 per cent. of CO_2.

Where such stratification exists, however carefully we arrange our sampling pipes, whether in the form of a spider in the flue or of a series of pipes of different length, the simple CO_2 recorder or indicator will not necessarily give us a true idea of the conditions of combustion, especially in connection with a large modern unit. Even the inclusion of a CO record does not furnish data for accurate calculation of losses, although this will afford an indication that things are not as they should be. The CO originating from the centre core of the gases will probably be the percentage generated from a considerably smaller amount of coal consumed per hour than that burned at the sides with a much larger percentage of excess air, so that the CO will apparently indicate a more serious shortage of air generally than is actually the case.

The existence of air leakages will be another factor helping to increase the difference of analysis between centre and sides if the inleakage takes place through the side walls, as is usually found.

Two methods are in use for the purpose of obtaining as nearly as possible a true average sample of the gases across their path. One of these methods is to employ a spider pipe with its centre situated halfway between the wall and centre line of the boiler. If the spider has six legs or branches, care must be taken that one diametric pair of branches is vertical, so that in each vertical line the gases will be tapped at two points. If the spider is so set that a pair of its legs are horizontal, the result will be that samples taken at the centre and extreme side of the gas passage will only be half the amount of those extracted from the intermediate positions, so that the sample passed to the recorder will not be a true average of the whole. The other method is to use several horizontal pipes with their open ends in the flue equally spaced across half the width of the boiler, while the other ends are brought into a common pipe leading to the recording instrument. Although the collection of a fair sample of the gases, from which the state of combustion and losses can be calculated accurately, is practically impossible, yet either of the two methods of sampling described will result in the collection of a sample which will be as nearly correct as can be hoped for.

From time to time one reads very definite statements by various writers asserting that either some particular percentage of CO_2 cannot be exceeded without CO becoming manifest or, on the other hand, that quite a high percentage can be obtained without any danger of the presence of CO. One has to realise that the name "coal" is not one indicative of a substance of definite composition and properties, but covers a very great range of combustibles from semi-anthracite to sub-bituminous coals at opposite extremes of the scale, and including an equally wide variation in burning characteristics. In view of this fact, it is easy to see that the writers referred to in all probability have quite accurately stated their own experience, but have carried out their respective investigations with quite different varieties of fuel. Any pronouncement on CO_2 limitations will be of little or no value to other fuel users unless a description and proximate analysis are furnished at the same time. As illustrative of the above facts, some very interesting investigations have been carried out on the Continent with a view to ascertaining what is defined as either the "critical point" or "critical range" of combustion for fuels with differing burning characteristics, or the point at which CO becomes present in sufficient percentage to constitute a serious source of loss. It was found that with coals which are difficult to ignite and burn, *i.e.*, those low in volatile content, a well-marked point was reached at which, although the CO_2 content was low (12 per cent. to 13 per cent.), CO became manifest and increased very rapidly with attempts to reduce air supply or to fire more heavily; with such coals the presence of the least percentage of CO indicates a point where any attempt to increase the CO_2 percentage will be accompanied by a greater loss due to partly unconsumed combustible than the saving effected by reduction of sensible heat loss in excess air. On the other hand, with coals easy of ignition and burning, this critical point is only reached with a much higher CO_2 percentage, and at the same time the point is not at all definite. CO becomes manifest in small percentage, and increases so slowly with increase of CO_2 that the loss due to the unconsumed monoxide is balanced by the saving of heat due to reduced percentage of excess air; consequently there is no definite critical *point*, but there is a critical *range* instead. Once, however, the loss due to unconsumed combustible begins to outweigh the saving due to decreased excess air, the curve of percentage loss begins to rise rapidly. With the bituminous coals, which are those mainly used and which constitute the class having a more or less protracted critical range of combustion, it must be remembered that other effects which lead to loss may be introduced if working to a high percentage of CO_2 is adopted. The production of black smoke is the principal trouble which is likely to be experienced with the accompanying trouble of the heat insulating layer of true soot on various portions of the heating surface; this, unlike flue dust which lodges only on the upper surfaces of tubes, adheres to every portion of the surfaces with which it comes in contact. In the comparatively moderately-sized plants, where a battery of boilers is served by a common main flue and chimney, the localisation of the cause of black smoke is not always easy, and some sort of indicator is needed for picking out the offending boiler in a battery, the most simple

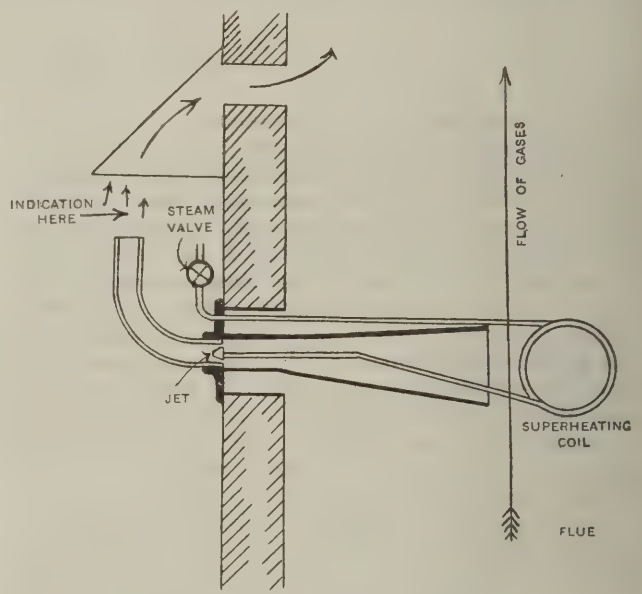


Fig. 1.—Carr's Combustion Indicator.

and effective device of this kind known to the writer being shown in the sketch. This appliance is known as Carr's combustion indicator, and consists of a small jet of superheated steam or compressed air which extracts a small sample of the gases from the middle chamber or other suitable point in the circuit, and discharges it either into the boiler ashpit, where it can readily be seen, or else by means of a suitable hood whence it came. When smoke is being produced, it is made instantly visible, the ideal conditions to work for being the least suspicion of visible smoke which indicates the nearest practical approach to perfect conditions of combustion in the particular furnace to which it is attached. Incidentally, this device does not appear to be nearly as well-known as it deserves, and it has given the most satisfactory results in the writer's hands, being easily comprehended by the most unintelligent of firemen.

From what has been said, it seems that in the case of large boiler units at least, two combustion records should be kept, the first being taken at the middle chamber and preferably including both CO_2 and CO charts for the observation and control of air and fuel regulation. while a plain CO_2 recorder installed at the point of gas exit will, by comparison with the first record, furnish evidence as to the physical state of the boiler settings with regard to air leakage and overall condition.

Bearing in mind the variation in critical point or range of combustion with various classes of coals, it is essential that the economical limit of maximum CO_2 percentage shall be carefully determined before setting any particular figure to be aimed at by the boiler-house staff, and this maximum will be somewhat variable if the coal used is not all of one class. In order to set about this, a close approximation to the carbon and hydrogen contents of the fuel used is necessary and is preferably obtained by regular ultimate analysis for these constituent elements, and this will provide the necessary data, together with the waste gas analyses and temperatures, to calculate accurately the percentage chimney loss under any conditions. It is also necessary that a boiler shall be put into as nearly perfect a condition as is possible with regard to cleanliness, baffling, and absence of air leakage, so that the limits it is desired to ascertain will be arrived at accurately when the particular coal under examination is used under the boiler. The actual calculations involved will not be described here, but once the ultimate analysis is known, a chart should be prepared showing the heat loss per pound of fuel under various conditions of CO_2 and temperature in the waste gases, and also a chart showing the additional loss for varying percentages of CO for the same coal. The test is made by gradually decreasing the amount of air admitted to the fires per pound of fuel burned and taking careful note of the CO_2, CO, and temperature of the waste gases, from which data subsequent calculation will determine the most economical CO_2 percentage and the highest permissible CO with minimum loss in the gases.

Since high percentage CO_2 is accompanied by high furnace temperatures, the permissible maximum will be largely influenced by the fusion temperature of the ash. With ash of a low fusing temperature, usually associated with the ferruginous ash of reddish or brown colour, high furnace temperature will cause ash fusion, which. in its turn, causes obstruction in the firegrate air spaces and results in incomplete combustion, while the light-coloured ashes are of much higher fusing point and permit of higher furnace temperature and more efficient conditions of combustion and radiant heat transmission. Incidentally, it is often a paying proposition to introduce steam jets beneath the firegrates when coal containing "low fusing" ash is obtainable at a price which makes the additional steam consumption worth while, as this will prevent the formation of masses of fluid clinker and enable full furnace temperature to be developed without risk of losses through incomplete combustion. The steam will also preserve the life of the firebars enormously, this being proved by the large number of patent steam-blown hand-fired grates which have not required firebar renewals for periods of years, although high-furnace temperature is one of the reasons for the economy in use of this class of furnace.

In conclusion, it may be as well to mention that CO_2 and CO records by themselves do not furnish all information as to losses which may be taking place, but only the degree of efficiency with which the fuel actually burned to the gases mentioned is used. Short circuiting of gases, excessive convection losses, blowing off. excessive blowing down, poor heat transmission due to dirty heating surfaces, combustible in the ash heap, &c., are all important sources of loss which the gas analysis tells us nothing about.

Concerning High-Tension Batteries for Radio Sets.

How to obtain Efficiency with Economy.

By PAUL D. TYERS.

Probably one of the greatest deterrents to the universal popularity of broadcast reception is the frequent necessity of replacing the high-tension battery. The high-tension difficulty has been partly solved by the marketing of various devices for deriving the high-tension supply from public electric light mains. Most of these devices, however, usually provide only one or two voltages, and are, therefore, not so readily adapted as the ordinary type of high-tension battery. Moreover, the alternating-current models particularly are apt to be expensive, and, accordingly, a vast majority of listeners still employ the more normal high-tension battery.

Probably few users and retailers realise the importance of employing a high-tension battery suitable for the particular set with which it is to be used. The power valve, which has been developed and popularised during the last two or three years, necessitates a greater demand for current upon the high-tension battery, and it is a well-known fact that the smaller the rate of discharge the longer is the probable life of the high-tension battery. Batteries are now made in two or three capacities, the larger-sized cells probably having a life of two or three times that of the smaller sizes for any given discharge.

It is interesting to note that one well-known battery manufacturer is now indicating on the batteries the type of sets or valves for which they are really suitable, and the dealer would do well to point out this fact to his purchasers. The man with a seven- or eight-valve set, including perhaps two power amplifying valves, will receive little satisfaction from employing the ordinary small type of high-tension battery, although, no doubt, thousands are using them. If the dealer points out the benefits which will be derived from purchasing the larger type of cell he will do much to gain the confidence of his customer. Although it means that he will not have the opportunity of replacing the high-tension battery for a much longer period, he is not only

selling a much higher-priced article, but he is also giving more satisfaction, which is a point that should not be overlooked.

Nothing can be more deceptive than many of the cheap foreign high-tension batteries. It is not meant that foreign batteries as a whole are inefficient, but out of quite a large number tested by the writer they have been found to be inefficient when compared with our own productions. Although the cheaper types of battery may be more attractive from a selling point of view, their use appears to be false economy, since they do not last as long as the better class of battery, and several which the writer has tested have given trouble due to faulty cells developing.

Another factor very materially determining the life of a high-tension battery is that of insulation, and steps should be taken to guard against loss due to leakage. High-tension batteries should on no account be kept in damp places, while it is also important that they should not be exposed to too high a temperature. It is also a very wise policy to disconnect the high-tension battery from the receiver when not in use, as this not only eliminates the possibility of leakage in the set, or by wires connected to it, but also minimises the chances of the inter-valve transformers breaking down.

Efficiency in dry-battery high-tension supply can briefly be summarised as follows: Use a battery which is composed of cells sufficiently large to supply sufficient anode current without exceeding the useful discharge rate consistent with capacity. Use cells of good quality only. Maintain adequate insulation of the battery. Disconnect the battery when not in use.

The Electricity Policy of the French Government.

The Functions of the Electrical Committee.

By THEODORE RICH.

At the present moment, after our Government has forced through the second reading of the Electricity Bill with the argument that this country is behind the rest of the world, it is worth while to study the laws and policy of some Governments in countries where the conditions are not too far removed from those obtaining in our own land.

France is one of those countries where the climatic and social conditions do not differ very materially from ours, but it appears that the gross consumption of electrical energy per head per year from public supply is sensibly greater than in this country. If one can judge by the French technical Press, by the published laws and regulations, and by opinions expressed by men of standing, then apart from factors which hardly exist in our country, such as millions of horse power which can be developed from water flow, France, at the present day, cannot to any material extent be said to owe her position to the adoption in the past of any drastic policy such as that recommended to us by our Government.

The system adopted has worked very well; it has undoubtedly produced results. It is not the product of any political "stunt" legislation, and successive governments of different political complexions have supported it and improved it from time to time. The public as a whole realises that while the cost of many commodities has gone up about five times since August, 1914, the cost of electricity has gone up very much less, and is, therefore, satisfied. There are certain features connected with the densely populated Paris area, and certain arrangements which follow naturally from the development of water power without reservoirs of capacity equivalent to many weeks' power supply, which have certain similarities to some proposals in "The Bill," but they are not to the same extent applicable to our conditions.

France is still mainly agricultural in character, and despite that obstacle she owes her electrical progress very largely to factors that our Bill makes no serious attempt to touch upon—namely, the comparatively simple and inexpensive procedure for the obtaining of concessions, and the facilities for distribution at low capital cost. If one can judge from interviews with men of prominence in France, the absurdity and unfairness of contrasting California, Sweden, or Shanghai with England as a whole seem to be perfectly manifest; and the extraordinary way in which evidence was selected for the Weir Report, which report has been closely examined in some quarters on the other side, is not likely to improve the reputation of the British Government or of the parties responsible for it.

Common-sense Laws and Regulations.

The present policy in France is to a large extent based on the law of 1906, which has been modified somewhat to suit the conditions obtaining since 1914. Under this law an Electrical Committee was formed to advise the Ministry of Public Works, and in certain circumstances other Ministries, regarding practically all fundamental matters relating to electricity supply; its composition was such that political party influences were minimised, and Ministers soon realised that in accepting the advice of the Committee, they were relieving themselves of responsibilities of a highly technical and often very complicated character, and that in doing so in accordance with the spirit of the law of 1906, they were protecting themselves to a material extent against trumped-up attacks in Parliament regarding their actions.

For many years past, not merely in the case of electricity, the French Government has had sufficient far-sightedness to realise that if someone comes forward with a project for the provision of public services, the benefit to the community resulting from such services is likely to be considerable. Therefore, in legislation and in concession conditions, instead of putting in drastic penalties and pin-pricking obstacles, facilities are given so that in suitable cases the undertaking can be declared a "Public Utility;" it can then enjoy certain privileges analogous in some directions to those enjoyed by the Government Public Works Department itself. It goes so far, when so recommended by the Electrical Committee, where two public utilities are concerned, even if one is the Government Postal Telephone Service and the other is a mere money-making power company, that even if the former has been first on the field, it must give way if the interest of the public makes it desirable to do so.

When considering the legislative and administrative situation in France regarding electricity supply matters, one must remember that admirable as the arrangements are in many respects, owing to the differences in the Constitution, differences in local government (for instance, the existence of prefectoral supervision), and the fact that nearly all the electricity supply in France is in the hands of private enterprise, it would be undesirable, if not impracticable, to adopt the French system in our country *en bloc*. There are, however, numerous points of practical value, and subject to modifications and safeguards there is much in the French system worthy of adoption.

The Electrical Committee.

The Electrical Committee forms a sort of Parliament, Advisory Board, and Court of Technical Appeal for electricity supply and power matters. There are thirty

members, half nominated by representatives of the Ministries of Public Works, Interior, Commerce, Industry, Posts and Telegraphs, War, and Agriculture. Fifteen members are drawn from various representative professional and business bodies concerned with electrical matters, being as a matter of form nominated by ministerial decree on the recommendation of the Ministries of Public Works, Commerce, Industry, Posts and Telegraphs. As a matter of fact, as the Government genuinely desires to be on friendly terms with, and to co-operate with, the leading bodies in the electrical industries, several such bodies are invited to send forward a list of members of the executive in order of recommendation, and the required number from each body is almost invariably selected from the top of the list.

The secretary and assistant secretaries are chosen from the engineering staff of the Ministry of Public Works, men who have had a high-class engineering training at the College of the "Ponts et Chaussées" with practical experience to follow. At present the president of the Committee is M. de la Brosse, Inspector-General of the "Ponts et Chaussées," with vice-president M. Legouez, who is president of the Union of Electrical Societies. Among the members are to be found an Inspector-General of Road Services; the Head of the Roads, Lighting, and Sanitary Services of the City of Paris; the chief engineer of the Midi Railway Co.; a representative of the Union of Electricity Distributors; the general manager of the Lyons Gas and Electricity Co.; a General-in-Command of the Transport Services of the Army; a Colonel-in-Charge of the Electrical Branch of the French sappers; and representatives of electrical manufacturers and various power and tramway undertakings.

The Committee gives its advice in numerous cases laid down by the law, and has to assist public departments when required; some of its functions are analogous to those of our Electricity Commissioners, but it has nothing like the same compulsory powers; for instance, it does not claim the right to veto the extension of plant in any steam station, neither has it any right whatever to meddle in the selection of plant for private installations. The members of the Committee as such are unpaid, its offices are unpretentious, and the cost of electricity control to the different supply authorities is relatively small. In France Government officials are usually expected to give their services to other departments without extra pay, and apparently membership of the Committee is looked upon as an honour like membership of the Councils of some of our leading institutions. The Electrical Committee does not proclaim that electricity supply in France is so badly conducted that the Government is forced to make a huge monopoly of it, and the policy of the members is to assist rather than to dictate.

In the twenty years of its existence, the Committee has functioned in a harmonious manner. Those who find that certain regulations and rules are acting harshly and are tending to clog progress can appeal to the Committee usually through the Ministry of Public Works without a lot of legal expenses. Details of accidents which take place have to be reported to it, and in suitable cases it recommends prosecutions for infractions of regulations.

Other Committees.

Although strictly speaking without statutory powers, so that the Ministries concerned are not compelled to consult them, certain other committees have been formed, among them one connected with the distribution of electrical energy made up of twelve representatives from different Ministries, twelve from various branches of the electrical industry and professions, and twelve from Chambers of Commerce and similar bodies. There are also two committees relating to water power, one dealing with its scientific study, and the other with matters relating to its utilisation.

The N.E.L.A. Convention at Atlantic City.

By PHEIDIPPIDES.

The forty-ninth convention of the National Electric Light Association, held in Atlantic City, N.J., May 17th to 21st, proved to be a record gathering. Close on ten thousand delegates and friends attended from all parts of the United States to take part in the technical and commercial discussions of the numerous committees and to hear important speeches from men prominent in the electrical industry and political life of the United States. Even this immense gathering, however, was no very serious tax on Atlantic City, with its huge hotels and spacious piers. The headquarters for the meetings and social events was the main hall on the Million Dollar Pier, which accommodated the entire convention, whether as an auditorium during the day time or as a ball-room in the evening. The covered part of the pier also provided, in addition, a space of a hundred thousand square feet into which upwards of three hundred exhibitors had collected a remarkable display of electrical apparatus and machinery.

The guests were received on the evening of May 17th by the President of the Association and Mrs. Davidson. After the reception there followed a concert by the famous Vincent Lopez Orchestra from New York, and dancing continued to a late hour.

On the Tuesday morning the first general session was held under the chairmanship of President J. E. Davidson; the principal speakers were Mr. M. S. Sloan, of the Brooklyn Edison Company, and Mr. Owen D. Young, chairman of the Board of the General Electric Co. and Radio Corporation. It will be recalled that Mr. Young co-operated with Vice-President Charles P. Dawes in the drafting of the Dawes plan for the settlement of war reparations. In his speech, Mr. Young made an earnest plea for the private ownership of public utilities. He said that a quarter of a century of close observation of Government operation of utilities had convinced him that its efficiency was markedly less than that of the private companies. "I have seen too many instances," Mr. Young said, "where no one but the Government would have dared to give such inadequate and inefficient service." He showed how political influences interfered with the progress of electrical development, and called for support in the full adaptation of new inventions and new engineering, not only in the physical plants, but also in the social sciences, in order to attain the goal of maximum public service.

Public ownership and public relations were the chief points under discussion at this session, and the President's address was a stirring call to arms, that the industry might continue work of the character which had given it its present happy position. Though the light and power industry had lowered costs, increased standards of service, and established an enviable credit standing, it was still necessary to carry out the responsibilities of utilities in order to give good service.

In a vigorous and telling address, Mr. M. S. Sloan directed attention to public relations. Public opinion, he said, was now favourable to the industry, and this was due to the efficient work which had been done by the Association on this subject. He pleaded, however, for continued executive support, as the problem was not completely solved, and co-operation between public utility information bureaus was as necessary now as ever it was. Other speakers were Messrs. R. H. Ballard,

Southern Californian Edison Co., and W. C. L. Eglin, Philadelphia Electric Co.

On the third day of the Convention the Honourable Andrew Mellon, Secretary, U.S. Treasury, delivered a broadcast address, in which he showed that mass production, inventive genius, elimination of class hatred, and recognition by capital and labour that only a prosperous industry could pay high wages, were among the principal factors which had contributed to the high level of industrial development and the prosperity obtaining among all classes in the United States. "It is," said he, "organised industry that has brought about the present unprecedented development in this country. America has adjusted herself to the economic laws of the new industrial era, and has evolved an industrial organisation which can maintain itself, not only because it is efficient, but because it is bringing about a greater diffusion of prosperity among all classes."

The Honourable James John Davis, Secretary, U.S. Department of Labour, made a stirring appeal to the Convention to promote better lighting and more cheerful surroundings in factories so that workmen might be saved from accidents, goods saved from spoiling, and production increased. When science discovered that, by means of electricity, it was able to flood our homes and shops and streets with a light as brilliant as that of the sun, creation widened to man's view. "No wonder," said Mr. Davis, "that Diogenes failed in his quest for an honest man—his lantern was much too dim. Light has a strong tendency to make men honest, and the flooding of our streets and shops with electric light does more to discourage the burglar than all the police in the world."

Mr. G. E. Creed, chairman of the Water-Power Development Committee, said that twenty-three new hydro-electric plants put into operation during 1925 had increased the hydro-electric service of the United States by 2,352,537 kilowatt-hours, bringing the total up to 22,322,000,000 kilowatt-hours. Steam plants, he said, increased that to over 65,800 million kilowatt-hours, an increase of 11.5 per cent. in one year.

On the 19th, Mr. Thomas A. Edison visited the Convention, and during the day inspected the various exhibits. At the dinner in the evening one speaker remarked that the electrical industry was still interesting to the man who started it, and the remark evoked such continued applause that Edison, who has consistently refused to broadcast, was compelled to say a few words into the microphone. At the evening session the Charles A. Coffin Medal was awarded to Mr. Samuel Insull, president of the Commonwealth Edison Co., of Chicago, and other prizes ranging in value up to $2,500, for accomplishments resulting in higher standards of lighting, were awarded to various organisations.

Mr. Guy E. Tripp, chairman of the Westinghouse Electrical & Manufacturing Co., addressing a general session of the Convention on the 20th, dealt specifically with industrial electrification and the value of electricity to the farmer, who in America at the present time is having a struggle against the costs of commodities. He asserted that only by decentralisation of American industries, combined with an increased application of electric power, could the farmer be lifted to a plane of profitable existence. He found occasion for considerable optimism in the fact that such decentralisation was proceeding on an increased scale. The chief obstacle to the electrification of farms, Mr. Tripp said, was the high cost of bringing electric service to them. It usually did not pay to take care of the relatively small demand of a few scattered farms, but it frequently did pay to do these things to serve an industry; and, when once a service connection was made and a line was built, neighbouring farms could be supplied with electric power at reasonable cost. Hence, as rural industries developed, more and more farms would be electrified.

On Friday, May 21st, the closing day of the Convention, the principal speaker was Mr. William L. Green, president of the American Federation of Labour at Washington. He pointed out that production due largely to the application of electricity had increased by between 25 and 50 per cent. during the past twenty-five years. "Electrically driven machinery has lightened the burden of employment," he said, "and relieved the workers of the drudgery and hardship of human toil. Life has been made more tolerable, living conditions improved, and the workers have been permitted to enjoy the blessings and benefits of modern life."

Election of officers for the ensuing year brought the Convention to a close, but special mention should be made of the high order of excellence of the gigantic electrical exhibition held in conjunction with the Convention. We have already indicated the size of the exhibition, which was one of the greatest displays of electrical devices ever organised. It was a third larger than the one arranged by the N.E.L.A. two years ago, and would have contained still another 100 exhibits if space had permitted. The British public is perhaps inclined to look a little askance at electrical domestic appliances, but the large number of electrical washing machines and refrigerators shown at Atlantic City—there were over a dozen different makes of the latter on view—show that such conditions do not hold in the United States.

A curious new device shown in the development stage was a machine for "seeing" smoke, which can be utilised to give warning of fire, and to control lighthouses during foggy weather.

A good many "organisation" exhibits were packed with valuable suggestions for the electrical education of the public. The National Electric Light Association itself, for example, had one illustrating the advance of super-power development, and another showing the evils of defective lighting in the home. At numerous points in the exhibition moving pictures were employed to show how the device worked, and one exhibitor had actually a talking picture which created considerable interest in the operation of a particular domestic refrigerator. We noticed that the salesman in the case was as bright and interesting at the end of the exhibition, after having told his tale perfectly some hundreds of times, as he was on the opening day. This cannot always be said of the exhibition salesman.

Another centre of attraction throughout the exhibition was a life-size wax figure of Venus, which visitors were invited to paint with light through the operation of a score of switches controlling a large number of colour combinations. A prize was given for the attempt most nearly in agreement with the opinion of a committee of lighting experts.

Throughout the period of the Convention a six-page newspaper was furnished gratuitously to all delegates by the *Electrical World*, with lists of members, and daily programmes of business and social functions, and interspersed with incidental and humorous Convention news.

In every possible way the Convention this year was an outstanding success. After 24 hours of storm encountered by the early arrivals, the weather was delightful; the exhibition was of outstanding interest, the social functions were well organised and fully enjoyed, and above all the business sessions were well attended and appreciated by the great majority of the ten thousand delegates. The officials and voluntary workers of the National Electric Light Association are to be congratulated on achieving a masterpiece of organisation.

Maintaining the Supply at Manchester.—The Manchester Electricity Supply Department reports that during the general strike the whole of the men employed by the Department remained at work, with the exception of nine bricklayers employed in the Building Section. Electricity supplies to the Department's consumers were maintained continuously without interruption. The failure to run a tramway service was not in any way attributable to the Electricity Department. The current was kept on the overhead lines continuously throughout the night of May 3rd and all day on May 4th, until a communication was received from the Tramways Department announcing that there was no immediate prospect of resuming the service. The lines were then made "dead," but everything was kept in readiness for resuming the supply at the request of the tramway authorities. The Electricity Committee, at a meeting on May 19th, adopted the following resolution:—"That this Committee desires to place on record its recognition of loyalty to the public service of its employés during the period of the general strike."

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.—Along with the issue of the ELECTRICAL REVIEW for June 25th we shall publish the first of a series of four Quarterly Supplements of Electrical Trade Names. These will contain the names and addresses of manufacturers and suppliers of a large number of electrical products and materials which bear special Trade Names. Each Supplement will be distributed free to every one of our 13,000 readers at Home and abroad, and will enable them to get into direct touch with the maker of any article included in the List.

Proposed Amendments to Company Law.—The Committee appointed by the Board of Trade in January last year to consider and report what alterations were desirable in the Companies Acts has made a number of recommendations. Among these are proposals that the "hawking" of shares from house to house should be prohibited, and that certain particulars should be compulsorily furnished by those who offer shares by means of circulars. It is also suggested that the amount of discount upon new share issues should be limited to 10 per cent. of the market value of similar existing shares; and that undischarged bankrupts should only become directors of companies by permission of the Court. Other matters with which the report deals are the remission of stamp duty in the reconstruction of a company involving the transfer of property to a new company; the keeping of proper accounts; companies outside Great Britain; and the issue of redeemable preference shares.

Local Exhibition.—WEST HAM.—The chief engineer and manager of the municipal electricity undertaking (Mr. F. W. Purse) informs us that an electrical exhibition is being held at the Town Hall during the whole of next week.

New Private Businesses.—The following new businesses have recently been registered under the Business Names Act:—

Paddington Electrical Supplies, electrical and radio engineers, 327, Edgware Road, W.2.

Eastern Wireless Battery Supply, radio goods, 147, Roman Road, Bow, E.3.

C. D. Appleton & Co., electrical factors, 11, Marsden Square, Manchester.

West of England Radio, radio dealers, 99, Newport Road, Barnstaple.

Phœnix Electrical Co., electrical and radio supplies, contracting and heating, Picturedrome Buildings, Water Street, Radcliffe, Manchester.

F. Westbrook & Co., electrical and radio engineers, 14, Cross Street, St. Leonards-on-Sea.

The British Electrode Co., welders and manufacturers of welding electrodes, Deptford Park, S.E.8.

New Metro-Vick Signal Company.—The Metropolitan-Vickers Electrical Co., Ltd., has recently entered into arrangements for the sole manufacturing rights, for Great Britain and the Dominions, of the General Railway and Signal Company, of Rochester, U.S.A., and accordingly a new company, under the title of Metropolitan-Vickers-G.R.S., Ltd., has been registered. The new company is preparing to manufacture at the Metropolitan-Vickers works at Trafford Park all types of railway signalling apparatus, including the all-electric interlocking system, embodying the use of the well-known "dynamic indication" principle, of which, it is claimed, the General Railway Signal Company was the pioneer, its experience in the art of signalling having extended over thirty years. The company will also specialise in automatic train control of the intermittent inductive auto-manual type and the continuous inductive type; the absolute permissive block system for signalling on single lines; low-voltage point-operating machines for remote locations; car retarders for gravity marshalling yards, and many other systems and appliances.—*Modern Transport.*

Cheap Power in New Zealand.—A company formed for the manufacture of special steels is starting operations, says a message from Christchurch, New Zealand. The Dunedin municipal authorities are supplying electric power at one-third of the price paid in Sheffield. The company will manufacture all those parts of machinery which formerly were forged and now are cast by a new process. It will probably supply most of the requirements of the New Zealand railways and other big businesses, to the exclusion of British manufacturers.—*Financial Times.*

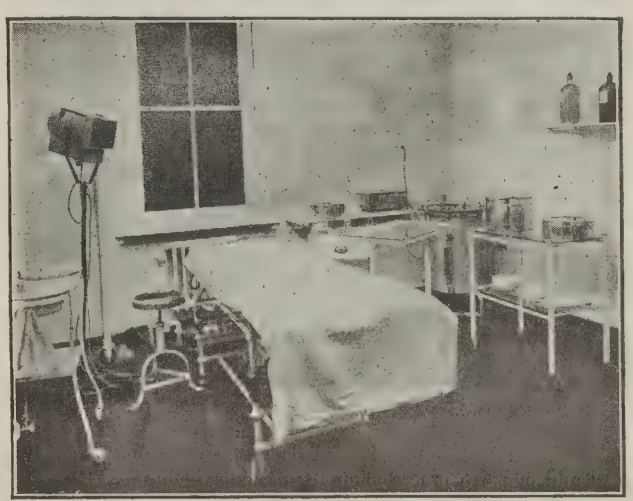
United States Import Prohibition.—According to the *Board of Trade Journal*, the United States authorities have prohibited the importation of synthetic phenolic resin of Form C and articles made of this, wholly or partly, on the ground that certain articles made of synthetic phenolic resin have been imported and sold in infringement of the Bakelite Corporation's patent rights.

British Radio Exhibit in Jugo-Slavia.—*Commerce Reports*, dealing with the Zagreb (Jugo-Slavia) Spring Fair, says that for the first time there was a complete radio exhibit and great interest was shown in this section in view of the projected erection of a broadcasting station in the district. The best display was from England; others, in order of their importance, were from France, Switzerland, Italy, Austria and Germany.

French Customs Decisions.—The *Board of Trade Journal* reports that the French Customs authorities have decided that electro-medical lamps for producing ultra-violet rays are to be classed as electro-technical apparatus (No. 524 *bis*). Incandescent lamps or mercury-vapour lamps, not mounted, are dutiable separately as such. Electric transformers are also dutiable separately. Loud-speakers ("Selectron" and the like) for gramophones and wireless are classed under "Accessories and detached parts of gramophones" (No. 604).

Electrical Development in the United States.—Some up-to-date statistics relating to electricity supply in the United States were given by Mr. J. E. Davidson, president of the National Electric Light Association, at that body's recent annual convention. He said that at December 31st, 1925, there were 13,460,000 wired homes, 2,750,000 commercial customers, and 675,000 industrial consumers. The total investment in the electricity supply industry was $7,350,000,000, and the gross income for 1925 was $1,425,000,000. The total number of customer-owners was 1,322,367, and they held 9,775,572 shares. The amount of energy generated during 1925 was 60,250,000,000 kWh. The population of the United States was given as 116,000,000, and Mr. Davidson stated that electric motors throughout the country were doing every day as much work as could be accomplished by 170,000,000 men. Electrical service cost less to-day than it did at the beginning of the war. The number of domestic consumers of the electric light and power companies had doubled in the last six years, but there were still more than 10,000,000 homes waiting for electrical service.

Operating Theatre Lighting.—The operating theatre of the Rugby Infirmary has recently been equipped with a "B.T.-H." lighting installation. The operating table is lighted by means of six "Glassteel" diffusers, each of which contains a 300-W "Mazda" daylight gasfilled lamp. The units are arranged in such a manner as to concentrate their



The Rugby Infirmary Operating Theatre.

light upon the table, which is illuminated to an intensity of about 80 foot-candles. The excellent effect can be gauged from the accompanying reproduction of a photograph taken at night solely by the light of the diffusers. The "Glassteel" unit consists of a "Mazdalux" reflector fitted with a glass diffuser which completely conceals the lamp and eliminates glare and deep shadows, producing the conditions which are essential in such an application as an operating theatre.

Brazilian Railway Electrification.—The May *Monthly Review* of the Bank of London and South America reports that the Government of the State of Sao Paulo (Brazil) has appointed Mr. A. C. Cardoso, a Brazilian engineer, to study the most up-to-date railway electrification schemes in the United States and Europe. Upon his return Mr. Cardoso will be in charge of the electrification of the lines of the Sorocabana Railway. His report, together with specifications, &c., will be delivered not later than August next to enable the railway to call for tenders forthwith for the execution of the electrification works. In order to assist firms who may be interested in the scheme, several publications have been issued giving full technical data and the broad lines on which the works will be carried out. Copies of these have been sent to leading electrical concerns and institutions in Great Britain, Germany, the United States, Switzerland, and Sweden, including the British Engineers' Association. The electrification of the Paulista Railway continues rapidly. It is intended to inaugurate a further extension of electric line from the Tatú station to Rio Claro before the end of 1926. The Rio Claro-Ityrapina section will then be taken in hand.

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Municipal Trading at Sydney.—The Sydney (N.S.W.) City Council has been informed by its legal advisers that it is within its powers to proceed with the proposed scheme for the sale of electrical appliances and the wiring of premises. It has accordingly reaffirmed its decision to carry the scheme through. Alderman Mostyn (vice-chairman of the Electricity Supply Committee) said that it was the intention of the Council to break the monopoly which enabled firms to charge 35s. for electric irons which were imported at a cost of 12s. and to prevent other apparatus being sold at similar profits. The Council is to set aside £10,000 for the purpose during the current year and it is stated that every opportunity will be given to manufacturers to send goods on consignment to the demonstration rooms. In the meantime the Electrical Employers' Association continues to attack the scheme. It is stated that the venture will result in a loss and will adversely affect the electrical traders who have done much to increase the use of the electricity supplied by the City Council. It is suggested that the whole matter should be referred to Mr. Forbes Mackay, the city electrical engineer.

Spanish Railway Electrification.—It is stated that the Bilbao-Santander Railway Company is about to convert its line between Bilbao, Las Arenas and Algorta to electric traction and that the order for the electrical equipment, including the transformer station, has been given to the A.E.G., Berlin.

Siemens-Xcel Cooking Demonstrations. — To demonstrate the efficiency and economy of "Xcel" cooking equipment, the Siemens & English Electric Lamp Co., Ltd., has arranged a model kitchen at its Upper Thames Street premises, where contractors or their clients may see actual cooking carried out. The kitchen is a well-lighted, airy apartment, and the "Xcel" equipment consists of two cookers. One is type H. 1040, consisting of an oven and a hob-plate mounted on legs of a convenient height. Above the oven is a hot cup-



The "Siemens-Xcel" Kitchen.

board and beneath it is a shelf for utensils. The oven has six 350-W elements fitted in the sides, while the hob-plate contains two boiling plates (1,800 and 1,500 W) and a grill (1,500 W). The various parts are assembled to facilitate cleaning or replacements. The elements are all of the plug-in type, and all connections and fuses are enclosed, thus eliminating any risk of harm to the user. The other cooker is of type H. 1010, and consists of the oven described in connection with the H. 1040 equipment on shorter legs and bearing a hob-plate with two boiling plates and grills.

An electricity meter is fitted in a prominent position near the cookers to enable visitors to see for themselves how much energy is consumed in cooking a meal. An efficient lady demonstrator is in charge of the kitchen. A view of the room appears in the accompanying illustration. Demonstrations are arranged as required, and intending visitors should notify the company before going.

Trade Announcements.—MESSRS. E. PINCOTT & Co. have removed from Market Street to 91, Queen Street, Exeter, where they wish to receive electrical catalogues, &c.

MESSRS. ARCHIBALD J. WRIGHT, LTD., have removed from City Road to 131, Bunhill Row, London, E.C.1. Telephone No.: "Clerkenwell 4439."

An electrical branch at 19-23, Park Street, has been opened in connection with the business of STEDDY & THOMPSON, LTD., 82, High Street, Ashford, Kent.

MESSRS. CHARLESWORTH, PEEBLES & Co. have removed their Glasgow office to larger premises at 276, St. Vincent Street, where they have their own warehouse. Telephone number unaltered: "Central 3537." The firm's head office is now situate at 5, Eden Street, Hampstead Road, N.W.1.

The Manchester branch of MESSRS. C. A. VANDERVELL & Co., LTD. (Bridge Street) has been transferred to that of Joseph Lucas, Ltd., 277, Deansgate, Manchester, where stocks of all radio apparatus are held.

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. and Messrs. James & Shakespeare report, June 8th: No change in copper and lead prices.

Messrs. Edward Till & Co. report, June 8th: India-rubber, Para fine, 1s. 8d., ½d. dec.

Catalogues and Lists.—HIGGS MOTORS, Witton, Birmingham.—June stock list of a.c. and d.c. motors, with full details and prices.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38 and 39, Upper Thames Street, E.C.4.—Catalogue No. 96, containing illustrated details and prices of cookers, fires, irons, washing machines, and other "Siemens-Xcel" domestic electrical appliances. Also the company's monthly general price-sheet for June.

MESSRS. JOSEPH KAYE & SONS, LTD., 93, High Holborn, W.C.1.—An illustrated price list of oil cans, funnels, pumps, &c.

ST. HELENS CABLE & RUBBER CO., LTD., Slough.—An illustrated pamphlet dealing with the company's "U-Seal" system of corrosion-proof fittings for "C.T.S." in positions exposed to corrosive conditions.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue of electric fans. Illustrated and priced.

FRANCIS LAMP LOCKS, LTD., 83, Pall Mall, S.W.1.—A folder describing the company's lock for preventing the theft of electric lamps.

MESSRS. FALK, STADELMANN & Co., LTD., 83-93, Farringdon Road, E.C.1.—An illustrated price list of "Antarctic" electric fans.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—June blotter advertising the company's open protected hotplate.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—Book 109, containing illustrations and details of electric cranes and lifts.

MESSRS. FERRANTI, LTD., Hollinwood, Lancs.—Pamphlet Ta. 159/2, describing a 300,000-V testing installation in a porcelain factory. Also a leaflet dealing with the company's radio transformers.

MESSRS. WOOTTON & Co., LTD., High Street, Ponders End, Middlesex.—A card announcing reduced prices of plywood meter boards and backboards.

DELCO-REMY & HYATT, LTD., 111, Grosvenor Road, S.W.1.—A list of the company's official service agents in various districts.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—List No. 909, illustrating and describing the "Cambridge" versatile galvanometer for numerous a.c. and d.c. measurements.

MESSRS. JOHN MOORES & Co., Ravald Street Works, Salford.—A price list of insulating fabrics, ebonite, mica, micanite, fibre, &c.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, W.C.2.—A descriptive pamphlet (No. 1024) containing illustrations and details of the company's induction motors.

Private Arrangements.—M. JAMIESON, Richmond, Surrey, radio and electrical dealer.—A meeting of creditors was held on June 3rd at Anderton's Hotel, E.C., when the chair was occupied by Mr. P. Houston (Messrs. Sydney Revill & Co.), who reported that about 10 months ago the debtor took over a business at The Arcade, Richmond. He started on a borrowed capital of £500, which was paid over to the outgoing owner of the business. The £500 was borrowed from his father-in-law and the latter was an unsecured creditor for that amount. According to the approximate statement of affairs the liabilities totalled £948 and the assets £810. In reply to a question, it was stated that there was no offer at present; the debtor, however, was desirous of carrying on the business. It was decided that the debtor should execute a deed of assignment in favour of Mr. W. A. J. Osborne, of Messrs. Corfield and Cripwell, Balfour House, Finsbury Pavement, E.C., as trustee, together with a committee of inspection consisting of the representatives of the Sloan Electric Co., the Westminster Electric Co., and Mr. E. H. Hawkins, representing creditors. The following are creditors:—

	£		£
Sloan Electric Co.	34	Fada Radio	28
Cahill, P.	32	Westminster Electric Co. ...	33
Princes Electric Co.	24	Watson, H.	22
Turpitz & Co.	24	Solicitors	20

Bankruptcy Proceedings.—ERNEST ARTHUR PYE, motor and electrical factor, 4, Oxford Mews, Edgware Road, W.—The first meeting of creditors was held on June 2nd at the London Bankruptcy Court, a receiving order having been made on May 6th upon a creditor's petition. No statement of affairs was lodged, but the debtor roughly estimated his liabilities at £1,500 against book debts of the value of £20. The debtor stated that in March, 1921, he and a partner took premises in Paddington and started business as motor and electrical factors under the style of Pryce & Co. In November, 1922, they converted their business into Pryce & Co., Ltd., with a nominal capital of £2,000. Each partner received £500 in shares and debentures for £750 were issued. The trading was not successful and in March, 1923, the debenture holder appointed a receiver and manager, who has dealt with the assets, no return being made to the shareholders. The debtor recommenced business alone in September, 1923, as an electrical factor, and was later joined by a partner. He attributed his position to the failure of his last partner to provide capital as promised, or to repay £637 which, he alleged, that partner owed him. The estate was left in the hands of the Official Receiver, to be wound up in bankruptcy.

C. H. PATRICK, 132, Much Park Street, Coventry, electrical contractor and wireless dealer.—The receiving order in this matter was made on May 14th on debtor's own petition. The statement of affairs shows liabilities of £1,315 and net assets of £299, leaving a deficiency of £1,016. Debtor attributes his failure to domestic expenses, costs of legal proceedings, depreciation in value of wireless accessories, and fall in trade in that class of goods. He commenced business without capital at his present address in 1920. He was unsuccessful, and in October, 1922, an arrangement was made with his creditors for payment of a composition of 10s. in the £, for which purpose an advance of nearly £300 was made by a relative, this amount still being outstanding at the time of the proceedings. The relative in question also provided £100 to discharge debtor's overdraft under a guarantee, and this remained unpaid. In consideration of this advance, however, debtor gave a bill of sale over his household furniture. Debtor states that he has been aware of his position since the middle of 1922. The following are creditors :—

	£		£
Accumulators of Woking, Ltd. ...	21	Jones, W. H.	375
Coventry Electrical Accessories, Ltd.	33	London Electric Wire Co. ...	34
Cable Accessories Co., Ltd. ...	33	Philips Lamps, Ltd.	31
Electro-Mechanical Supplies Co.	76	Stringer, J.	26
Hands, A. C.	65	Westlake, T. E.	30
		Jones, W. J.	40

J. MACFADDEN, 177, Higher Hillgate, Stockport, electrician.—The public examination of this debtor was held recently at the Court House, Stockport. The statement of affairs showed ranking liabilities of £243, and there was a deficiency of £234. Debtor attributed his failure to lack of capital and keen competition. In 1924 he took a lock-up shop and commenced business as an electrician with £50 borrowed capital, but he was unsuccessful. The examination was closed

M. BREINGAN, electrical manufacturers' agent, 57, Robertson Street, Glasgow.—A dividend is payable on June 29th at the offices of Mr. E. H. Stanley Craig, 128, Hope Street, Glasgow.

J. N. DAVENPORT (separate estate), electrical engineer and contractor, 39, Hill Top Avenue, Cheadle, Hulme (lately carrying on business with L. A. Hackett as Davenport, Hackett and Co. at 36, Spring Gardens, Manchester).—First and final dividend of 20s. in the £ payable at 21, Spring Gardens, Manchester.

Company Liquidations.—B.M.A.S., LTD., Ashburton Road, Old Trafford, Manchester, manufacturers of electrical ignition apparatus, &c.—The winding up order in this matter was made on a creditor's petition. The statement of affairs shows liabilities of £25,012, while the assets are estimated at £10,828, from which a sum of £1,229 has to be deducted in respect of preferential claims, leaving an amount of £9,599, which is insufficient by £14,803 to meet the loans on debentures of £24,401. The issued share capital of the company amounts to £22,200, so that there is a deficiency as regards the shareholders of £47,212. The failure of the company is attributed to the falling-off in the demand for accessories. The title of the company is derived from "Battery Magneto Accessory Services," and it was incorporated as a private concern in January, 1925, with head office and works at Trafford Park and depôts for sales and repairs at eleven other addresses. The company was formed to continue the business previously carried on by the Runbaken Magneto Co., Ltd. It appears not to have derived any working cash capital from its issue of shares, and any such capital was obtained from book debts taken over and a bank overdraft of £24,401. On January 29th, 1926, the bank appointed a receiver, who took possession of the assets. He has closed all the depôts, but is carrying on the head office and works at Trafford Park with a small staff. A full set of books has been kept. The company was first sued for debt in January, 1925, and in all the company has been sued by 33 creditors; 16 of these creditors with claims amounting to £619 have been paid, and 17 claims totalling £920 remain unpaid. The failure of the company appears to have been contributed to by the lack of working capital, and by the heavy charges for wages, salaries, commissions, and travelling expenses. The Official Receiver is of opinion that further inquiry is desirable into the formation of the company and the conduct of its business.

FOSTER CONSTRUCTION CO., LTD., electrical, &c., engineers, 60, High Street, Plaistow, E.—The report of Mr. E. T. A. Phillips, Official Receiver and Liquidator of this company, has been issued. The winding up order was made last January and accounts have been lodged showing total liabilities of £16,843 (unsecured £4,896), assets of £1,153, after allowing for the payment of preferential claims (£630), and debenture bonds (£2,316), and a total deficiency of £21,189 with regard to contributories. The company was formed as a private company in December, 1914, with a nominal capital of £5,000, subsequently increased to £40,000, of which £17,697 has been issued. The object was to acquire from Walter and Arthur Foster (trading as W. Foster & Son), a business carried on by them, the consideration being agreed at £4,555 in cash and shares. The failure is attributed to insufficient capital, lack of up-to-date machinery; to taking contracts which the company could not profitably handle, and other causes.

MIDDLETON ELECTRIC TRACTION CO., LTD.—A meeting of members is called for July 12th, at the Electrical Federation Offices, 88, Kingsway, W.C., to hear an account of the winding up from the Liquidators, Messrs. T. Bower and T. H. Underhill.

REFLEX RADIO CO., LTD.—First meeting of creditors and contributories, June 14th, at Carey Street, W.C.

CAR LIGHTING & IGNITION CO., LTD.—A meeting of creditors was held yesterday, June 10th, at the offices of Messrs. Bradford & Gale, 584, Christchurch Road, Boscombe. (This meeting was purely formal. All creditors have been or will be paid in full.)

JOSEPH OXLEY (SHEFFIELD), LTD.—Voluntary liquidation resolution passed May 28th. Meeting of creditors, June 14th, at 46, Bank Street, Sheffield. Liquidator, Mr. C. L. Widlake, 9, Paradise Square, Sheffield.

Dissolutions of Partnership.—TAYLOR & ODDY, electrical engineers and metal workers, Kiln Hill, Slaithwaite, Yorks.—Mr. F. Oddy and Mr. F. Ramsden have dissolved partnership. Mr. Taylor will continue on his own account as electrical engineer at Belmont Works, Slaithwaite, and Mr. Oddy as sheet metal worker at Kiln Hill.

ANKH INSULATOR CO., manufacturers of mouldings for electrical work, Merritt Mews, Merritt Road, and Courtney Works, Kneller Road, Brockley, S.E.—The partnership between Messrs. H. C. Bryson, B. Purdy, A. Purdy, and J. Purdy has been dissolved by order of the High Court. Debts will be attended to by Mr. S. W. Revill, Cromwell House, Fulwood Place, High Holborn, W.C., the Receiver appointed by the High Court on April 13th, 1926.

A. G. WALL & CO., wireless dealers, motor-cycle agents, &c., Brighton Road, Purley.—Mr. A. G. Wall and Mr. W. J. Boxall have dissolved partnership Mr. Boxall will attend to debts and continue the business.

R. WRIGHT & CO., electrical engineers, Tyson Street, Cheetham Hill, Manchester.—Mr. R. J. Wright and Mr. J. E. Connell have dissolved partnership. Debts will be attended to by Mr. Wright, who will continue the business under the same style.

Belgian Engineering Wages.—It is reported that an increase of 5 per cent. in their wages has been granted to employés in the Belgian engineering industry by a commission appointed to deal with the matter.

Swiss Electrical Exports.—The past year witnessed a further development in the foreign trade of electrical engineering concerns in Switzerland, the exports during 1925 having attained a value of approximately £2,355,600, as compared with £2,160,600 in 1924. Details of last year's exports are given below :—

	£
Dynamos and machinery	1,123,080
Electrical apparatus and instruments	897,440
Copper cables	109,000
Incandescent lamps	92,160
Electric locomotives	85,640
Telephone and telegraph apparatus	23,280
Accumulators	12,400
Porcelain insulators	6,960
Electrodes and carbons	5,640
	£2,355,600

Italy and Germany were the best customers for Swiss dynamos and motors, followed by Japan, Poland, Holland, Spain, Brazil and France. For electrical apparatus and instruments France was responsible for the major portion (16 per cent.), followed by Spain, Great Britain, Belgium and Italy. France and England were the best markets for cables, while France and Sweden took the majority of the electric lamps; Germany and Brazil led as regarded accumulators, and France and Belgium took the bulk of the insulators.

A German Electrical Company's Report.—The Bergmann Electricity Works Company, Berlin, whose financial results were recorded in our issue of May 21st, states that a steady revival in business took place in the first half of 1925, which, however, was succeeded by a diminution in the orders in the later months of the year. The measures of economy adopted by industrial works and public authorities contributed towards the decline in sales. As a consequence of the high rate of interest the construction or extension of hydro-electric works was of rare occurrence, although the company participated in the establishment of long-distance transmission lines and transformer works. In the turbine branch the home sales were small, but success was obtained by the transformer and switchboard branches. Owing to the unfavourable situation of the heavy iron and steel trades the sale of electric furnaces was unsatisfactory; otherwise the industrial department received large orders from the paper, chemical, sugar and food products branches. The railway department felt the decline in orders placed by the Reich railway authorities, although the overhead line section obtained contracts from the Austrian and Dutch railways. In the case of cables for heavy currents the turnover considerably increased, and the diminution in State orders for telephone and telephone cables was compensated for by other orders. Improved export trade is reported, orders having been booked for central station turbines and for the electrification of sugar works in the Dutch East Indies, despite foreign tariffs and severe competition. With regard to the current year it is stated that the decline in orders has ended and a slight improvement has taken place.

Unemployment.—The number of persons registered at the Employment Exchanges on May 24th was 1,597,000. This total was 15,044 less than that of May 17th, but 411,178 more than on May 25th, 1925. In addition, claims had been presented by 307,000 persons thrown out of work on account of the lock-out in the coal industry.

British Traders in Australia.—According to the fifteenth annual report for the year ended December 31st, 1925, the membership of the Australian Association of British Manufacturers and their Representatives at the close of last year numbered 1,082, composed of 544 British manufacturers and 538 Australian representatives of British manufacturers, an increase of fifty-nine during the year. Mr. R. W. Knox, President of the Association, has arrived in London, and will be pleased to see members and others interested in Australian trade, by appointment, at the offices of the Association, Room 605, Australia House, Strand, London, W.C.2. (Telephone, City 9880.)—*Board of Trade Journal.*

Stoker Contract.—MESSRS. E. BENNIS & CO., LTD., have received from Messrs. Charles Macintosh & Co., Ltd., of Manchester, an order for five sprinkler stokers and five independent bucket elevators, for their set of five Lancashire boilers.

A Deserving Cause.—We are asked to draw attention to the Diamond Jubilee of Dr. Barnardo's Homes—a national charity whose funds, like those of many other excellent institutions, suffered severely through the General Strike. We commend this very worthy object to the generous support of our readers. The celebration takes place on June 26th, the Duke of York presiding.

New French Company.—A company has lately been formed in Paris (13, Rue du Quatre Septembre), with a capital of 500,000 fr. and the title La Société Electro-Chimique Phœnix.

The Norwegian Domestic Electrical Market.—From an article upon the above subject in a recent issue of *Commerce Reports* it is gathered that practically all Norwegian homes are equipped with electrical appliances of some sort or other. Cooking equipment and washing machines are not in general use, although hot-plates are very commonly found. The market is satisfied to a great extent by native or Swedish manufacturers. The imported appliances are mainly German or American. The Norwegian manufacturers of electrical appliances have retail distributing shops or sell directly to retail hardware shops and electrical equipment stores.

Conditions in Central America.—The Department of Overseas Trade has published a series of reports upon conditions in Central American states. Mr. H. Apfel, acting British Consul-General at Guatemala, reports that in that republic the demand for electrical appliances is increasing owing to the development of hydro-electric power. In the supply of these goods the United States and Germany predominate, but there should be an opening for British manufacturers, provided that prices are competitive and the requirements of the market are carefully studied. Unsuitable representation is often the cause of loss of orders. The shortage of reliable local agents could be overcome by the co-operation of manufacturers or shippers of non-competitive lines, and local representation should be strengthened by periodical visits by travelling salesmen. Punctual delivery is essential, as that is one of the advantages gained by the United States, owing to its proximity. During the past year a contract for the installation of an automatic telephone system in Guatemala City was awarded to the A.E.G., Berlin. Competition in the Republic of Honduras is mainly American; Germany has recovered the market which she lost during the war in cheap goods, but she offers little competition to British goods, according to Mr. A. H. King, British Consul at Tegucigalpa. In Salvador (states Mr. H. C. Swan, acting Consul at San Salvador) there is a bias in favour of American products, but an appreciation of United Kingdom manufactures is not lacking, and there is no reason why the imports of British goods should not be increased. Manufacturers are warned to be careful of their choice of representatives. The 1923 import statistics (the latest available) show electrical machines to the value of $69,280 (as against $70,495 in 1922). Great Britain supplied motors, boilers, and turbines to the value of $5,508, electrical material valued at $273, and electrical machinery valued at $41. A report on Costa Rica, by Mr. F. N. Cox, British Consul at San Jose, shows that during 1924 electrical goods to the value of £54,780 were imported by the Republic. The reports on Guatemala, Honduras, and Salvador are combined, and can be obtained at 2s. net from the Stationery Office. The report on Costa Rica is combined with one on Panama, and costs 1s. net.

New Italian Companies.—Among the new electricity supply undertakings lately organised in Italy are the Società Elettrica Centro Lario, Milan, capital, 600,000 lire, and La Società Elettrica Teramo, Genoa, capital, 2,000,000 lire.

Book Notices.—"Faraday House Journal."—In the summer term issue of this well-produced organ, Mr. H. Rainford deals with "Flameproof Mining Electrical Apparatus"; Mr. B. J. Rowe writes on the "Protection of Alternators"; and Mr. H. E. M. Kensit indicates the "Financial Value of Education." Some of the students seem to have enjoyed their experience as volunteers during the general strike, the effect of which has been to prolong the term to July 27th.

The *Journal* of the South African Institution of Engineers. Vol. XXIV, No. 10. May, 1926. Price 2s.

"House Telephone Systems."—A recent revised issue of "Technical Pamphlets for Workmen," by the Post Office Engineering Department. H.M. Stationery Office. Price 6d. net.

"The *Transactions* of the South African Institute of Electrical Engineers." Vol. XVII, Part 4; April, 1926. Price 2s.

Social Event.—The Union Cable Co., Ltd., entertained a party from the Borough of Kingston-on-Thames Electricity Works, on their Sports Ground at Dagenham, on Saturday, 5th inst. Both sides were strongly represented, and keenly contested the cricket and lawn tennis matches that were played. Mr. T. A. Kingham, A.M.I.E.E., borough electrical engineer of Kingston, and Mr. J. Snow Huddleston, M.I.E.E., general manager of the Union Cable Co., were present.

Views on Australian Protection.—The recent statement by Sir John Monash (reported in our last issue, p. 831) that the high tariffs on imported articles handicapped the extension of the use of electricity, has aroused a storm of protest from Australian electrical manufacturers. One of them states that, on the contrary, protection has led to reductions in prices. He quotes electricity meters as an example and avers that immediately a local industry started the prices fell by 50 per cent. It is also stated that in a recent competition for a switchgear contract in New Zealand, an Australian manufacturer was able to underquote competitors in Great Britain and the United States. Another manufacturer says that in 1925 the prices of Australian electrical apparatus compared favourably with those for similar appliances in other large industrial countries, and that it is not the cost of appliances but the cost of electricity which is the handicap. The secretary of the Australian Industries Protection League stated, according to the Melbourne *Herald*, that Sir John Monash did not seem to grasp the fact that his undertaking (the Yallourn electricity scheme) could not succeed without the establishment of secondary industries, and that that could only be done by the protection afforded by the tariff. "The more people there are engaged in industry the greater demand there will be for electricity for lighting, and there will be a greater demand for electrical appliances, thus leading the way to mass production. Then, as in the case of other locally-made products, there will be a reduction of prices, and all will benefit."

Imperturbable Lamps.—On Friday last week the showrooms of the Edison Swan Electric Co., Ltd., Queen Victoria Street, E.C.4, were severely damaged by a loaded 12-ton lorry which got out of the driver's control and crashed into the windows. The concussion was terrific, but in spite of it the "Ediswan" lamps in the window continued to burn.

For Sale.—The Director of Army Contracts invites offers for one G.E.C. 150-kW rotary converter, with starter, &c. (See our advertisement pages to-day.)

Lighting and Power Notes.

Australia.—MELBOURNE.—The *Electrical Engineer of Australia and New Zealand* states that the City Council is making arrangements with the Victorian Electricity Commission to take further bulk supplies of electricity to the extent of 2,000 kW. At present the Council is taking a minimum of 10,000 kW and a maximum of 11,000 kW. Its own generating plant has a capacity of 27,000 kW.

CLARENCE RIVER.—The first report on the County Council's Nymboida hydro-electric undertaking, for the year ended December 31st last, shows a total revenue of £11,747, and working expenditure of £4,976. After meeting capital charges, there was a net deficit of £2,337. The sales of electrical energy amounted to 720,809 kWh and the capital expenditure was £161,000. The engineer and manager of the undertaking is Mr. H. V. S. Wilton.

Basingstoke.—OPPOSITION TO SCHEME.—The Rural District Council and the Town Council have given notice of opposition to the application of the Aldershot Gas, Water, and District Lighting Co. for a Special Order to supply electricity in the parishes of Newnham and Natly Scures. The Town Council has asked the Commissioners to postpone the hearing of the application so as to give the Corporation time to study the figures as to the cost of supplying the parishes named from its own undertaking. The Rural District Council has asked the Corporation to state definitely within three months whether it intends to supply the parishes in question.

Canada.—ELECTRICAL DEVELOPMENT.—The Shawinigan Water and Power Company has recently completed arrangements with the Duke-Price Company for the supply of 100,000 h.p., which, it is understood, will be transmitted to the City of Quebec or the immediate vicinity.

What will be the highest voltage transmission line in Canada, and one of the longest in America, will be installed between Ile Maligne and Quebec in the course of the summer. This line will be about 150 miles in length, and the voltage will be 150,000. It is expected that the construction of the new line will be completed early in 1927.

The Premier of Ontario has announced that the Government has authorised the completion of an agreement for the delivery by the Gatineau Power Company at the inter-provincial boundary, in the vicinity of Ottawa, of from 230,000 to 260,000 h.p. of hydro-electric energy at a price of $15 per h.p. Delivery will commence with a supply of 80,000 h.p. in 1928, and the total delivery is to be completed in 1931. The contract is for 30 years, dating from 1928. The energy will be transmitted at a point near Ottawa to connect with the Niagara system near Toronto. The transmission lines will be approximately 230 miles in length, and will require an expenditure of from $10,000,000 to $15,000,000. Construction of these lines will be commenced immediately.

A $500,000 estimate for preliminary work was voted during the recent session of the Ontario Legislature.

An agreement has been completed under which the International Paper Company will develop Grand Falls on the St. John River, producing approximately 50,000 h.p.

Chester.—LOAN SANCTIONED.—The Electricity Commissioners have given sanction to the borrowing by the Corporation of £20,000 for mains and additional works in connection with the distribution of electricity.

Continental.—SWITZERLAND.—Negotiations are proceeding between the St. Gall-Appenzell Electric Power Co., and the authorities of the Canton of Glarus, for the construction of a large hydro-electric power station to utilise the water power of Lake Muttern, the Limmern Falls and the Upper Linth River in East Switzerland. The scheme has been under consideration for some years, the original idea being to establish, in two stages, only a winter-period generating plant, the first stage providing for an output of 22½ million kWh, with a later extension to 39 million kWh. A new scheme has now been drawn up which provides for a 115,000-h.p. station, capable of being run the whole year round. Lake Muttern would supply the water in winter, with the Limmen Falls intake as a supplementary feeder, while the River Linth would furnish the power in the summer. The conduit pipes will all be concentrated on a single generating station which will be built at Tierfeld, near Linthal. The cost of the installation is estimated at £2,058,400.

FRANCE.—Some interesting particulars of the hydro-electric development in France are given in a recent issue of the *Revue Industrielle*, which estimates that water power to the extent of 10 million h.p. is available. It is also estimated that whereas the capacity of the hydro-electric plants in operation prior to the war was only 550,000 kW, it now amounts to over 2 million kW, of which 1,233,000 kW is furnished by plants of a capacity of more than 1,000 kW. At the present time work is in hand on the establishment of new stations representing a total of about 350,000 kW.

Halifax.—LOAN.—The Corporation Electricity Committee is seeking sanction to the borrowing of £30,000 for extensions to the electricity mains and the erection of a tramway shelter at Shelf.

Kingston-on-Thames.—YEAR'S WORKING.—We have received from Mr. T. A. Kingham, borough electrical engineer, a copy of his report, together with the statement of accounts for the year ended March 31st last. The trading account shows a total income of £56,388 and working expenditure of £22,444, leaving a balance of £33,946, which was transferred to profit and loss account, together with items from other sources of revenue, making a total of £36,703. After meeting capital and other charges there was a net surplus of £6,672, which was carried to appropriation account, together with a balance from the previous year of £10,896, making a total of £17,568 available, of which £3,000 was contributed to the borough fund and £14,568 carried forward. The capital expenditure during the year amounted to £24,994 and included £14,211 for mains and services. A new 3,000-kW turbo-alternator and a new boiler were put into commission during the year, and the conversion of the system of supply from single-phase to 3-phase was continued.

Liverpool.—LOAN SANCTIONED.—The Electric Power and Tramways Committee has received sanction to the borrowing of £2,616 for mains and services in connection with the supply of electricity to the Springwood housing estate.

Manchester.—PROGRESS DURING APRIL.—During the month of April the Corporation electricity undertaking showed an increase in connections of 2,626 kW, bringing the total to 282,194 kW; and the number of applications received for supply, including consumers for additional supplies, was 767, representing a total of 2,365 kW. The number of hired cookers connected increased by 116, bringing the total actually on circuit to 1,612. Applications for the hire of cookers totalled 129.

Mid-Cheshire.—PROPOSED CHANGE-OVER.—The Mid-Cheshire Electricity Supply Co., Ltd., is to apply for consent to change over its system of electricity supply in certain districts from 3-wire d.c. at 220 V to a.c. 3-wire, 50 cycles, 220 V.

Newport Pagnell.—ELECTRICITY SUPPLY.—The Rural District Council has consented to the Northampton Electric Light Co. erecting overhead h.p. lines from Wolverton to Bletchley, and to the erection of l.p. overhead distributing mains at Water Eaton.

New Zealand.—ELECTRICAL DEVELOPMENT.—According to the *Electrical Engineer of Australia and New Zealand*, owing to the increasing demand for electricity, the Dunedin City Council has recently approved proposals for considerably increasing the capacity of its hydro-electric power station. Two alternatives were investigated: one involving the raising of the dam to a height of 110 ft., the construction of a tunnel 4¾ miles in length, and the building of an entirely new power station, and the other providing for utilising the increased head made available by the raising of the dam from 40 ft. to 60 ft., and extensions to the existing power plant. The latter proposal was accepted, as the capital expenditure was less than for the former, and also because the development is to be progressive, and certain of the new plant will be put into service at a comparatively early date. The adopted proposals provide for the immediate construction of a subsidiary power station of 3,000 kW capacity just below the dam at Waipori Falls; the cutting of a second tunnel from the weir to the existing surge chamber and the laying of a new pipe line from the surge chamber to the power house; the replacement of the six present 1,000-kW sets in the power station by 3,000-kW sets, and the construction of a further tunnel and 3,000-kW subsidiary power station. The complete scheme will provide an installed capacity of 27,000 kW.

The Public Works Department proposes to construct main transmission lines that will undoubtedly link up the Waipori Falls station with the Lake Coleridge development in the north and the Lake Monowai development of the Southland Power Board in the south. A 110,000-V line that will form part of this link is at present under construction by the Department from Lake Coleridge to Oamaru.

POVERTY BAY.—The ratepayers of the Poverty Bay Electric Power Board's district have sanctioned the raising of a loan of £280,000 for the electrification of the district from the Government power station at Waikaremoana.

Northern Ireland.—BELFAST.—The accounts of the city electricity undertaking (engineer: Mr. Johnstone Wright) for the year ended March 31st last record a total revenue of £355,753, as compared with £341,253 in the preceding year. The cost of production was £144,467, an increase of £678, leaving a gross profit of £211,286 (£197,913). After providing for capital and other charges there was a net surplus of £62,402 (£64,961). Reductions equivalent to a revenue of £10,000 were made in the charges for electricity during the year. The sales of electricity amounted to 45,086,797 kWh, an increase of 4,879,237, as compared with 1924-25. In his report for the year, Mr. Wright proposed further reductions in the charges, but advised that the date for putting the new scale in operation be left in abeyance until the full effect of the coal dispute was ascertained.

Nuneaton.—INQUIRY.—On June 1st and 2nd, Colonel T. C. Ekin conducted an inquiry, on behalf of the Electricity Commissioners, into an application by the Corporation for consent to extend its generating station. Mr. R. A. Willes, barrister, for the Corporation, said the Leicestershire and Warwickshire Electric Power Co., Ltd., had for some time past been supplying electricity in bulk to the Corporation, and notice to terminate the agreement was given by the latter some time since. The company had made certain offers to the Corporation. He gave figures showing the respective costs of local generation and bulk supplies up to the year 1933. Mr. E. M. Lacey, consulting engineer, said the estimated capital expenditure on the extensions was £77,550. He was convinced it was cheaper to generate locally than go to the company for a supply in bulk. The extensions would ensure an additional 3,000 kW. Mr. S. C. Gibson, electrical engineer to the Corporation, said that several of the largest consumers were asking for more reasonable terms, and had hinted that unless these were conceded they might set up their own installations or remove their works to other districts. He thought the proposed extension would tend to cheaper production. For the company it was stated that its reason for opposing the Corporation's application was that it considered it could supply electricity more cheaply. If the Nuneaton works were extended, the site would not be sufficient in a few years' time. The Commissioners will give their decision in due course.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

CHELMSFORD.—*The Electric Supply Corporation, Ltd.*—From 10½d. to 9d. per kWh. During the continuance of the restriction in the use of electricity the minimum charge will not be enforced.

WORTHING.—Lighting: 6d. per kWh. Heating and power: 1½d. per kWh. Kinemas, &c.: 4d. per kWh.

Plymouth.—NEW PLANT.—The Electricity Committee has obtained sanction to the extension of the existing generating station at Prince Rock, by the installation of one 7,500-kW, 3-phase, 50-cycle turbo-alternator, together with the necessary auxiliary plant. The Committee has authorised cable extensions at a cost of £4,500.

Reigate.—LOAN.—The Town Council has applied for sanction to a loan of £18,000 for a fourth engine and alternator, switchboard, &c., and the cost of replacing the three 4-cylinder engines by three 6-cylinder engines.

Retford.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £33,580 in connection with its electricity scheme for the district.

Sheffield.—ELECTRICITY EXTENSIONS.—During April the Corporation Electricity Committee approved extensions and works and extensions of mains for general distribution purposes, at an estimated cost of £20,116.

South Africa.—WITBANK.—Shortly before midnight on April 30th, No. 1 20,000-kW generating set at Witbank was connected, *via* step-up transformers, to the 132-kV transmission circuit for test purposes. All being in order, the set was shortly afterwards paralleled with the Victoria Falls Power Co.'s system at the Brakpan end, and carried a small load for a short time. On May 3rd the set commenced commercial operation, and, according to the *S.A. Mining and Engineering Journal*, there is an appreciable amount of extra load awaiting the company, notably the additional ten tube mills in the Government areas, so that set No. 1 Witbank will be called upon for its full output as soon as it has passed through its probation period, and its connection to the Witwatersrand system, hitherto without spare generating plant, will be a source of relief and satisfaction to consumers and station operatives alike. Although other sets of similar size and speed are already in operation, No. 1 Witbank is a representative of the largest units running at 3,000 r.p.m. in the world.

Southport.—ELECTRICITY IN BULK.—After considering an application from the Birkdale District Electric Supply Company, Ltd., for a reduction in the charges for the bulk supply of electricity to the company, the Electricity Committee has provisionally agreed on reduced charges to be embodied in a new agreement.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the following authorities:—The Crewe Corporation, to extend its area of electricity supply so as to include certain parts of the rural district of Nantwich; the Cranleigh Gas and Coke Co., Ltd., to supply electricity in parts of the rural district of Hambledon; and the Midland Electric Light and Power Co., Ltd., to supply in certain parishes in the rural districts of Lutterworth and Rugby.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Rural District Council of Plympton St. Mary to supply electricity in the rural district.

Stoke.—EXTENSION OF SUPPLY.—The Electricity Committee has decided to lay cables to the Abbey Hulton Estate at a cost of £5,000, and to erect a sub-station at a cost of £2,000.

Sutton Coldfield.—EXTENSION OF SUPPLY.—The Town Council is to extend its electricity supply to Little Aston and Streetley and to erect a new sub-station at Streetley, at a cost of £11,560.

Torquay.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £1,000 for transformers and switchgear for Newton Abbot power station.

Wakefield.—LOANS.—The Electricity Committee is applying for sanction to the borrowing of £10,000 for sub-stations and transformers, and £6,000 for meters.

Wimbledon.—LOAN.—The Electricity Committee is to apply for sanction to a further loan of £10,000 for the purchase of electrical domestic appliances to be let out on hire.

York.—"ALL-ELECTRIC" HOUSE CHARGES.—The Housing Committee has accepted the terms of the Electricity Committee in connection with the supply of electricity to the "all-electric" houses as follows:—Standing charge of 9d. per week, plus .675 per kWh, equalling, on an estimated consumption of 60 kWh, a total charge of 4s. 1d. per week per house.

LOAN.—The Electricity Committee is applying for sanction to a loan of £17,000 for mains and services.

Tramway and Railway Notes.

Bradford.—TRACK RENEWALS.—At its specially-convened meeting, on May 28th, to consider whether it should carry out the scheme for relaying the Manningham Lane tramway track, at a cost of £27,715, or suspend it in favour of a modified scheme of patching up until such time as the tramways could be gradually changed over to motor-'bus services, the City Council decided that renewal of the track in full should proceed forthwith. There were protests from the Bradford Chamber of Commerce, the Chamber of Trade, the Property Owners' and Ratepayers' Association, and a petition signed by traders in Manningham Lane.

The Tramways Committee has decided to recommend the Council to rescind its decision to renew a portion of the tramway track from Four Lane Ends to Allerton. It had been decided to replace the single track on this route by a double track at an approximate cost of £20,000.

Burnley.—TRACK RENEWALS.—The Tramways Committee proposes to spend a sum of £14,000 on relaying a portion of the tramway track.

Colne.—NEW CARS.—The Ministry of Transport has sanctioned the borrowing by the Town Council of £6,305 for the purchase of three new tramcars and two new tramcar trucks.

Continental.—BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux, of Brussels, is electrifying about 14 miles of its steam local railways in the Louvain district, a first section having recently been completed and put in operation.

SWITZERLAND.—The Swiss Federal Railway authorities in Berne have recently voted a credit of £592,000 towards the cost of electrifying the railway between Yverdon, Biel, and Olten, a distance of about 78 miles.

Huddersfield.—TRACK RENEWALS.—The Corporation is to relay the tramway track between the top of Viaduct Street and Blacker Road.

Irish Free State.—DUBLIN AND LUCAN TRAMWAY.—The Dublin United Tramways Co. has informed a deputation representing the unemployed in Dublin and Lucan that the laying of the tramway to Lucan, which is expected to provide work for 600 men, will be undertaken as soon as possible. The Tramways Company estimates that, owing to the unsuitable gauge, worn-out rolling stock, and an obsolete power station, an expenditure of £70,000 would be needed to put the Lucan line into working order. The company, however, has decided to open the line, provided that the Borough Commissioners and the Councils in the towns grant an extension of their leases of the line in the city. The City Commissioners, the Dublin County Council, and the Blackrock Urban District Council have agreed, but the Rathmines, Pembroke, Kingstown, and Dalkey Councils still withhold their consent, the obstacle being the payment by the company of a road grant.

Manchester.—DEPOT EXTENSIONS.—The Corporation is to provide increased tramcar depôt accommodation, at a cost of £300,000.

South Shields.—LIGHT RAILWAY ORDER.—The Minister of Transport has made an Order in favour of the South Shields, Marsden, and Whitburn Colliery light railway scheme.

Sunderland.—TRAMWAY IMPROVEMENTS.—The Tramways Committee has decided to double the present single tramway track from Spelter Works Road to the Grangetown terminus, at an estimated cost of £7,000.

Telegraph and Telephone Notes.

International Telegraph Union.—PROGRESS IN 1925.—In a recent issue of the *Journal Télégraphique*, the official organ of the International Telegraph Union, a brief summary is given of the extension of the world's telegraph system during 1925 and of the progress of the Union. Thus it is stated that Southern Rhodesia and the Tanganyika Territory joined the Telegraph Convention and that Ecuador and Colombia are following their example; Lithuania, the French Somali Coast, and the Republic of Honduras also joined the Wireless Telegraph Convention. Among the new submarine cables brought into use during the year were one between England and Spain, one between New York and Bay Roberts, one between Bay Roberts and London, one between Victoria in British Columbia and Suva (Fiji), one between Emden and the Azores, and one between Marseilles and Phillipeville. The most important new service of the year was, however, that inaugurated by the Compagnia Italiana dei Cavi Telegrafici Sotto-Marini between Italy and North and South America; this company inaugurated a service between Spain, the Azores, and America in January, 1925, and between Anzio and New York in February, and between Italy and Brazil, Argentine, Uruguay, and Chile in September. The Italian-South American cable covers a distance of 7,250 miles in the following sections:—Anzio-Malaga, 990 miles; Malaga-Las Palmas, 850 miles; Las Palmas-St. Vincent, 937 miles; St. Vincent-Fernando de Norontia, 1,476 miles; Fernando de Norontia-Rio de Janeiro, 1,687 miles; Rio de Janeiro-Montevideo, 1,202 miles; and Montevideo-Atalaya, 108 miles. In addition, Anzio is connected with Rome by two land lines (37 miles) and Atalaya with Buenos Aires by a single land line (78 miles).

As regards international wireless telegraphy, the report states that last year communication was established between Poldhu (England) and Milverton, near Cape Town; between Holland and the Dutch East Indies; between Italy and the United States; between Italy and Egypt; between France and China; between Belgium and the Belgian Congo; and between Panama and Barbados. It is added that notwithstanding the increased use of wireless telegraphy, the extensions of submarine cables that are taking place would appear to indicate that radio-telegraphy is not looked upon as taking the place entirely of wired telegraphy.

Police Telephones.—CONSTABLES' KIOSKS.—The Reigate Watch Committee is considering the adoption of the police telephone box system. By the recent adoption of this system in Newcastle it has been estimated that the town will make a saving on the rates of £13,000 through the substitution of 51 telephone kiosks for six out of the nine police stations now in use.

United States.—THE CAPITOL'S TELEPHONES.—To such an extent has the use of the telephone increased in the halls and offices of Congress and the Supreme Court that it has been necessary to increase the facilities by installing a new switchboard and associated apparatus. The Capitol's central telephone office is now of sufficient size to serve a city of about 15,000 population; it is known as "Main 3120" and has 120 trunk lines connected with the Washington offices of the telephone company and 80 direct lines to other private branch exchanges of the Government. Ultimately it is expected that this exchange will require about 200 trunk lines and 120 direct lines. Service is continuous throughout the 24 hours of the day; women serve as operators during the business hours, while men are on duty during the evening and night. The present switchboard consists of 18 positions, but is so arranged as to accommodate 17 additional units which will be sufficient to provide service for 3,000 telephones, says *T. & T. Age*. During the present session of Congress the Capitol office is handling about 27,000 calls daily, and this figure is constantly increasing.

Radio Notes.

Colombia.—PROPOSED STATION.—A broadcasting station with a range of 800 kilometres and a wave-length of 275 metres is planned in Colombia. According to *Commerce Reports*, bids have been called for the erection of the station.

India.—NEW COMPANY.—Prominent Bombay business men have floated the Indian Broadcasting Co., Ltd., with a capital of £112,500 in 10-rupee shares, of which 60,000 shares will be issued at present. The company will build stations at Calcutta and Bombay, which, says the *Daily Mail*, it is anticipated will be ready to transmit programmes next December.

Mexico.—NEW EQUIPMENT.—The installation of new 500-watt equipment was completed at the radio station in Chapultepec Park, Mexico City, last month, and will greatly increase the efficiency of communication, says *Commerce Reports*. The new station will use reduced-size antennæ of about 45 ft. in height. The old towers at this station are being dismantled, recut to size, and sent to various parts of Mexico for similar stations. At the Chapultepec Radio Laboratories work is progressing on a transmitter, similar to the one described above, which is destined for the city of Campeche.

Panama.—BROADCASTING INAUGURATED.—A broadcasting station was recently inaugurated at Balboa in the Panama Canal zone, and has resulted in a demand for crystal receiving sets.

Salvador.—RADIO DECREE.—The President of the Republic of Salvador has issued a decree setting forth new radio regulations; it abrogates one of May 1st, 1923, which has heretofore been the basis of radio control. Some of the principal provisions of the new regulations are that broadcasting shall be a Government monopoly, and that owners and managers of places of public entertainment may be required to permit the broadcasting of their performances. Foreigners will be permitted to operate receiving sets only when they renounce the right to present claims through diplomatic channels. An initial charge of 5 colones is made for receiving licences, and in addition thereto a monthly payment of 3 colones is required. The Government will install receiving sets for 30 colones; sets capable of regeneration are prohibited.

The B.B.C.—2LO BREAKDOWNS.—The London station of the British Broadcasting Co., Ltd., (2LO) experienced some trouble last week, apparently due to an insulation fault, and the old transmitter at Marconi House had to be brought into use for a time. It was also used on June 7th when 2LO again developed a fault.

Turkey.—BROADCASTING PROJECT.—A French company is negotiating for land at Yeni-Bagtche, below Stamboul, on which to erect a broadcasting station, according to *Commerce Reports*. Programmes from European stations will be relayed.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Asia Minor.—BAGDAD.—June 28th. Direction Générale des Chemins de fer d'Anatolie. One electrically-driven semi-portal crane. (A.X. 3191.)*

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 2528.)*

August 23rd. 10-in. disk suspension insulators. B.X. 2614.)*

June 16th. Victorian Government Railways. One heavy-current motor generator set. (B.X. 2527.)*

July 14th. A.c. power interlocking machine. (B.X. 2596.)*

September 1st. Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

June 16th. City Council. Turbo-alternator, exciter and condensing plant.*

August 11th. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

August 10th. Telephone exchange indicators. (B.X 2597.)*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast. — June 12th. Electricity Committee. D.c. switchgear for sub-stations and transformer kiosks. (May 28th.)

Belgium.—June 26th. Belgian Post and Telegraph Authorities, La Salle Madeleine, Brussels. Telephone cable for Mons, Ath, Gramont and Hal. Particulars (Cahier des Charges Special No. 3-187) for 7½ fr.

Bentley-with-Arksey (near Doncaster). — June 22nd. Urban District Council. Tubing, wiring and electrical fitting of 32 houses and 16 bungalows on Jossey Lane housing site. Mr. P. C. Woodhall, engineer, Council Offices, Bentley.

Brazil.—PORTO ALEGRO.—July 8th. Municipal Council. Electrical material for street lighting. (B.X 2571.)*

Bristol.—June 14th. Electricity Department. Additions to the premises at Feeder Road generating station. (May 28th.)

Burnley.—June 26th. Joint Hospital Board. Electric lighting system at the Sanatorium, Marsden Road (June 4th.)

Colchester.—June 15th. Education Committee. Electric lighting installation at North Street schools. Mr. W. Frisby, borough electrical engineer.

Dublin.—June 24th. County Borough Commissioners. Arc lamp, carbons, electric cookers, and h.p. and l.p. circuit breakers. (See this issue.)

June 28th. One steam turbo boiler feed pump, three air filters, two electric vehicles, and steam and water meters. (See this issue.)

Dundee.—June 18th. Electricity Department. L.p. cable. (June 4th.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537.)*

June 19th. Minister of Education. Dynamo and motors.*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

Epsom.—June 14th. Electricity Department. Removal of boilers and setting them up as fuel tanks, overhead travelling crane, two 300-kW Diesel engine-driven generators and accessories, oil-purifying plant and cooling tower. (May 28th.)

Glasgow.—County of Dumbarton Education Authority. Electrical work, &c., and additions, &c., at Twechar Public School. Mr. B. P. Gibb, Master of Works, 18, Park Circus, Glasgow.

June 19th. Corporation. Electric light installation at Child Welfare Clinic, Tollcross. Forms from Office of Public Works, Cochrane Street.

Govan.—June 12th. Clyde Navigation Trust. Electrical stores, &c., from July 1st, 1926. Superintendent of Stores, No. 1 Graving Dock, Govan.

India.—June 15th. India Store Department. 70,000 (approx.) copper bonds for track rails. (May 14th and 21st.)

July 2nd. E.h.p. armourclad switchgear. (See this issue.)

Leeds.—June 18th. Highways Department. One 550-V, d.c. motor, with switchboard, switchgear, &c. (See this issue.)

Lepton (near Huddersfield).—June 19th. Electrician's work required in alterations, &c., to Coloms Wesleyan Sunday school. Quantities from Stocks, Sykes & Hickson, architects, 4, St. Peter's Street, Huddersfield.

London.—METROPOLITAN ASYLUMS BOARD.—June 16th. Installation of electric cable for arc light treatment apparatus at St. Luke's Hospital, Lowestoft. (May 28th.)

June 16th. Installation of electric lighting at the Hut Building, Pinewood, Wokingham. (June 4th.)

H.M. OFFICE OF WORKS.—June 14th. Incandescent electric lamps. (June 4th.)

BERMONDSEY.—July 15th. Borough Council. Electrical installation for lighting, heating, and power at the baths and washhouses, Grange Road. (See this issue.)

Lurgan.—June 21st. Urban District Council. Oil engines and generators, motor-driven pumps, main switchboard, and underground and overhead mains. (June 4th.)

Manchester.—July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plant and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (June 4th.)

July 5th. 33,000-V trunk feeders, pilot cables, and telephone cables. (See this issue.)

New Zealand.—AUCKLAND.—June 21st. Electric Power Board. L.p. insulators, &c.*

Public Works Department. July 20th. Phase transformer for Mangahao electric power scheme.*

New Zealand Railway Department. June 16th. Electric motors.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

CHRISTCHURCH. — October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plants. (A.X. 3215.)*

WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana Electric Power Scheme (BX 2608).*

Rhyl.—June 16th. Electricity Department. 1,000 yd. l.p. armoured cable, 1,915 yd. 11,000-V feeder cable, and switchgear equipment. (May 28th.)

South Africa.—June 21st. South African Railways and Harbours. Track bonds for the Cape Town Suburban Railway electrification scheme. (May 28th.)

July 8th. Telegraph material, poles, cross arms, &c. (A.X. 3173.)*

Ulverston.—Wiring High Carley Fever Hospital, for electric light installation. Mr. H. S. Pursey, consulting engineer, Electricity Department, Theatre Street, Ulverston.

Uruguay. — MONTEVIDEO. — July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres of rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—MELBOURNE.—State Electricity Commission of Victoria. Accepted:—

Headworks, races, power-station buildings, &c., Sugarloaf-Rubicon hydro-electric scheme (approx. £155,083).—Sir W. G. Armstrong, Whitworth Pty., Ltd.

SYDNEY.—New South Wales Railways. Accepted:—

12 D.K. 55-h.p. traction motors (£4,307).—English Electric Co. of Australia, Ltd.

D.c. switchgear for St. Leonards and Hornsby sub-stations (£8,738).—Australian General Electric Co., Ltd.

—*Tenders.*

Belgium.—One Dutch, one British (Clark, Chapman and Co., Ltd., Gateshead), and five Belgian firms submitted tenders last week to the municipal authorities of Antwerp for the supply and erection of three electric cranes at the docks. The lowest offer was that of a Belgian concern.

Birkenhead.—Electricity Committee. Accepted:—

Cable.—Macintosh Cable Co., Ltd. (£2,648); W. T. Henley's Telegraph Works Co., Ltd. (£4,514); W. T. Glover & Co., Ltd. (£1,038).

500-kW rotary converter (£2,440).—Metropolitan-Vickers Electrical Co., Ltd.

Bolton.—Tramways Committee. Accepted:—

870 tons of Sandberg silicon steel tram rails.—Cargo Fleet Iron Co., Ltd.

Electricity Committee. Accepted:—

Steam meter.—Geo. Kent, Ltd.

Bradford.—Great Horton Industrial Society. Accepted:—

Electrical equipment at new branch stores.—Sackville Electrical Co.

Tramways Committee. Accepted:—

Six miles of round copper trolley wire (£569).—British Insulated Cables, Ltd.

75 tons of round mild steel (£694).—Whitehead Iron & Steel Co., Ltd.

Bury.—The Town Council has entered into an agreement with the Lancashire Dynamo & Motor Co., Ltd., in connection with the supply of the necessary plant for the change-over from direct to alternating current at Mossfield Mills.

Doncaster.—Electricity and Tramways Sub-Committee. Recommended:—

1,000-kW motor-converter and switchgear (£5,295).—Bruce Peebles & Co., Ltd.

Eastbourne.—Electricity Committee. Recommended:—

Feeder switch cubicles (£191).—Switchgear & Cowans, Ltd.

Fleetwood.—Corporation. Accepted:—

2,000-kW turbo-generator, one 20,000-lb. boiler, and the auxiliary plant.—J. Howden & Co., Ltd.

Glasgow.—

Electric lighting installation in connection with the restoration of West U.F. Church, Helensburgh.—Haddow & Co., Ltd.

Halifax.—Accepted:—

Wiring for electric lighting Corporation houses: Nursery Lane site (£200), Boothtown site (£200).—A. Higginbotham & Sons.

Hull.—Telephones Committee.

Silicum bronze wire:—

R. Johnson & Nephew, Ltd.	£428
British Insulated Cables, Ltd.	407
General Electric Co., Ltd.	419
T. Bolton & Sons. (Accepted.)	**382**
F. Smith & Co.	405
W. F. Dennis & Co.	359

Switchboards:—

Peel-Conner Telephone Works	173
Standard Telephones & Cables, Ltd.	189
British L. M. Ericsson Mfg. Co., Ltd.	162
Sterling Telephone & Electric Co., Ltd. (Accepted.) ...	**158**
J. McMillan & Co.	191

Ilford.—The Urban District Council has accepted the tender of the Metropolitan-Vickers Electrical Co., Ltd., for a 1,000-kW La Cour motor converter (600 revs. per min.) for £3,377, including specified spares. The Electricity Committee reported that it had received nine tenders from six firms. Particulars of four of these tenders were printed in the Council agenda, but the details were for some reason or other blacked out. It is reported that the committee recommended the acceptance of the tender of a Belgian company at between £300 and £400 less than the British offer, but this recommendation was not endorsed by the Council. We think that the blacking out of the particulars of tenders calls for some explanation. Councils or Library Committees sometimes think it their duty to black out betting news or matter not calculated to promote public morality, but is information relating to prices for public contracts to be placed in that category? A correspondent informs us that among the unsuccessful tenders were offers at £5,293 by the General Electric Co., Ltd., at £4,469 by Bruce Peebles & Co., Ltd., and at £3,000 by the Ateliers de Constructions Electriques de Charleroi.

India.—With further reference to our note on page 838 of last week's issue, *Indian Engineering* states that the contract received by the General Electric Co. (India), Ltd., for the complete equipment of a new power house for the East Indian Railway at Lucknow consists of:—Four 600-kW alternators; two Belliss engines for driving two of the above alternators; one 300-kW Belliss engine and alternator; one 12-panel h.p. switchboard; one l.p. switchboard; two 150-kW transformers, with condensing plant and other accessories. The value of the whole order amounts approximately to £22,000.

Leeds.—Electricity Committee. Accepted:—

Cable.—W. T. Henley's Telegraph Works Co., Ltd. (£5,135); Macintosh Cable Co., Ltd. (£3,516); Enfield Cable Works, Ltd. (£1,224); Hackbridge Cable Co., Ltd. (£1,095).

Leicester.—By 31 votes to 21 the City Council has accepted the tender of the Oerlikon Co., Zurich, for a 15,000-kW turbo-alternator at a cost of £28,000, rejecting an amendment that the lowest British tender be accepted. The debate was a keen one, and aroused some feeling. Councillor A. H. Swain, the chairman of the Electricity Committee, moving the adoption of the report, explained that ten tenders were received, eight being from British firms and two from Swiss manufacturers. He said that an examination of the British tenders "revealed the remarkable absence of free competition, while subsequent events proved that the prices were fixed by a combination of British manufacturers." The best two British tenders showed the minute difference of £50 per annum in the cost of producing 50 million units of electricity. The best tender was at £47,400, and an annual working cost of £16,035. The next was from the British Thomson-Houston Co., Ltd., at £45,761, and an annual cost of £16,035. The Swiss firm's price was £28,000, and the annual working cost £14,700. Calculated over 20 years, the period allowed by the Electricity Commissioners for the cost, the Swiss tender meant a saving of £46,100. Mr. Swain added that two further machines would have to be purchased during the next two or three years, so that had to be taken into consideration. As the Committee was anxious to give the work to British firms if it could, it took the step of permitting the British tenderers to reconsider their figures, and the matter was discussed with the British Electrical and Allied Manufacturers' Association. The principal points urged by the opposition were that the acceptance of the Swiss tender would tend to increase unemployment in this country and would seriously damage the prestige of British manufacturers. An attempt was made, without success, to secure the appointment of a special committee to go into the whole subject again.

Leigh.—Corporation. Accepted:—

One 750-kW rotary-converting plant.—Electric Construction Co., Ltd.

Maidenhead.—Town Council. Accepted:—

Extension of the h.p. switchboard (£315).—British Thomson-Houston Co., Ltd.

Plymouth.—Electricity Committee. Accepted:—

Transformers.—Metropolitan-Vickers Electrical Co., Ltd.

Meters.—Ferranti, Ltd., and Metropolitan-Vickers Electrical Co., Ltd.

Reigate.—Town Council. Accepted:—

H.p. switchboard, &c. (£1,739).—General Electric Co., Ltd.

Seaham Harbour.—Urban Council.

The following tenders were accepted in connection with the electricity scheme:—

Overhead line and l.p. switchgear.—Gray Bros.

H.p. cable.—F. Reid Ferens & Co.

H.p. switchgear.—Watson-Norie, Ltd.

Wiring houses on the Carr House site.—Harrison Bros.

Sheffield.—Tramways Committee. Accepted:—

1,000 tons of steel rails (£10 12s. 6d. per ton).—Steel, Peech & Tozer.

1,000 pairs of fishplates, at 16s. 6d. per cwt.; 250 pairs, at 12s. 6d. per cwt.; and 1,000 sole plates, at 12s. per cwt.—Cammell, Laird & Co.

19 tons of mild steel bars (15s. 6d. per cwt.).—Hadfields, Ltd.

Copper bonds.—British Insulated Cables, Ltd.; T. Bolton & Sons, Ltd.

4⅛ miles bronze trolley wire.—T. Bolton & Sons, Ltd.

Electricity Committee. Accepted:—

750-kW automatically-operated traction sub-station equipment (£3,753).—English Electric Co., Ltd.

Two 500-kVA Scott-connected sets; one 250-kVA set; six 150-kVA 3-phase transformers; and twelve 100-kVA single-phase transformers (£4,013).—British Electric Transformer Co., Ltd.

Steam-operated air ejector, &c. (£520).—English Electric Co., Ltd.

South Africa.—JOHANNESBURG.—Union Tender Board. Accepted:—

Telegraph material.—Standard Telephones & Cables, Ltd.; H. Davies and Co., Ltd.

Municipal Council. Accepted:—

25 miles h.d. bare aluminium wire (£227).—Saaler & Franks, Ltd.

2½ miles twin cable (£242).—J. C. Ferguson.

Current transformers (£356).—Metropolitan-Vickers Electrical Co., Ltd.

Fifty 50-h.p. tramcar motors and spares (motors by Westinghouse Electric and Manufacturing Co.) (£8,219).—Paul Gregson, Urquhart & Co.

DURBAN.—Municipal Council.

5 tons bare copper wire (£407).—T. Barlow & Sons, Ltd.

1 mile 3 core h.p. cable (£387).—Bartle & Co., Ltd.

1 mile twin h.p. cable (£164).—W. T. Henley's (S.A.) Telegraph Works Co., Ltd.

8 sets Merz-Price protective gear for sub-stations (£339).—Metropolitan-Vickers Electrical Co., Ltd.

—*South African Engineer.*

Stockton-on-Tees.—Electricity Department. Accepted:—Material for 12 months:—

L.p. cables.—W. T. Glover & Co., Ltd.

H.p. cables.—British Insulated Cables, Ltd.

A.c. meters.—Metropolitan-Vickers Electrical Co., Ltd.; Ferranti, Ltd.

House-service cut-outs.—W. T. Henley's Telegraph Works Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—

Circulating pump (£376).—Mather & Platt, Ltd.

Forthcoming Events.

Physical Society of London.—Friday, June 11th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary meeting.

Salford Technical and Engineering Society.—Saturday, June 12th. Visit to the works of Messrs. Ferranti, Ltd., Hollinwood.

Faraday Society.—Monday, June 14th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 2.30 p.m. Discussion on "Explosive Reactions in Gaseous Media."

Royal Institution of Great Britain.—Friday, June 14th. At 21, Albemarle Street, S.W. At 9 p.m. Lecture on "The Spectrum of the Aurora," by Prof. J. C. McLennan, F.R.S.

Incorporated Municipal Electrical Association.—June 14th to 19th. At Glasgow. Annual convention.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

STORA GEYSER electric water heater.
I.T.E. circuit breaker.

Notes.

The Electrical Engineers' Ball.—We are pleased to learn from the secretaries of the Electrical Engineers' Ball (Messrs. A. M. Sillar and W. S. Lonsdale), that owing to the great success of the Ball held on February 12th last, the Committee at a general meeting on June 3rd was able to distribute out of the surplus fund the sum of £65 each to the Institution of Electrical Engineers' Benevolent Fund and the Electrical Trades' Benevolent Institution. It will be remembered that with the Ball of 1925 the twenty-first anniversary of the event was celebrated, and it is very gratifying to be able to record that the total amount distributed to electrical engineering benevolence since the beginning has reached £1,280.

Board of Trade Committee on Patents.—The Board of Trade has appointed a Committee consisting of Mr. J. Whitehead, K.C. (chairman), Mr. H. A. Gill, M.A., Mr. A. J. Martin, O.B.E., Major-General Sir Philip Nash, K.C.M.G., C.B., and Mr. J. Swinburne, M.Inst.C.E., F.R.S., to inquire into and report whether any, and if so, what change is desirable in the practice of the United Kingdom of (*a*) dating and sealing patents applied for under Section 91 of the Patents Acts, 1907 and 1919, as of the date of the application in the foreign State; (*b*) dating and sealing other patents as of the date of application, as provided by Section 13 of the Acts. The Secretary to the Committee is Mr. B. G. Crewe, Patent Office, 25, Southampton Buildings, London, W.C.2, to whom all communications relating to the work of the Committee should be addressed.

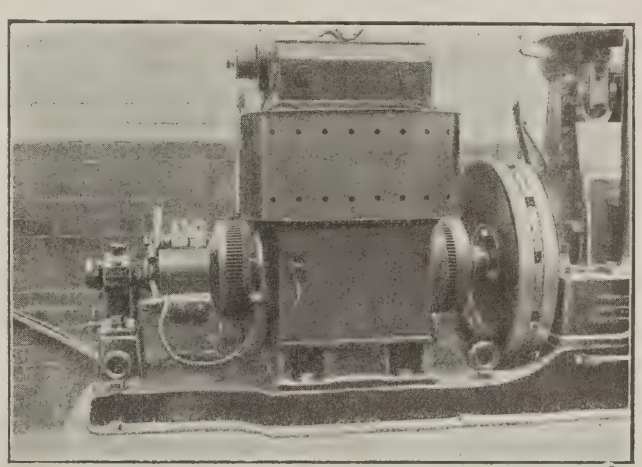
Electricity in Agriculture.—In France, according to *The Implement and Machinery Review*, the Department of Agriculture is giving particular attention to rural electrification, which is expected to serve the double purpose of attracting labourers to the farm and of supplying agriculturalists with a cheap and convenient form of motive power for all their farm operations. At the recent agricultural show in Paris, for example, there was held a series of conferences on the employment of electricity for ploughing and for other work, the object being to encourage husbandmen to use machinery wherever it may permit of increased production, and to convince the farmer of the economies to be realised with the aid of electricity. Lectures are being given in schools and elsewhere upon the practical side of electricity for farm work, with the idea of creating an interest amongst young people in electrical equipment.

The Department of Agriculture has instituted an inquiry into rural electrification with the view of ascertaining exactly what it is still possible to do. The work has been entrusted to an expert in each department, and in the Isère, which is the great centre of hydro-electrical distribution, a particularly interesting report has been prepared showing that out of the 564 communes no fewer than 480 are already being electrified. So great is the demand for electric power that in some of the mountainous districts a number of villages are defraying the cost of installation. The motors employed for farm machinery, such as chaff cutters, root pulpers, circular saws and pumps, range from 2 to 3 h.p. In the mountainous regions each farmer usually has his own thrashing machine, contrary to the usual practice in the agricultural districts where thrashing is more often done by contract. The power of the motors is from 4 to 5 h.p. Obviously, they must be employed for other purposes besides the thrashing of grain. It is reported that in the Isère the employment of small thrashing machines is increasing, apparently on account of the facilities offered for driving them electrically. As giving some idea of the cost of electric current supplied to farmers it may be mentioned that one company charges 60 centimes per kilowatt-hour, with an annual minimum of 60 francs per kilowatt.

Strike News in America.—A report by Sir Philip Gibbs on the electrical situation in London during the recent general strike, which is commented on and abstracted in the *Electrical World*, appears to rather exaggerate the facts of the case. The report suggests that in nineteen power stations in the metropolitan district the "crews" came out on strike and were replaced by men from warships. This does not harmonise with our own information, which is to the effect that in only a few cases were naval men employed, and these were obtained by the request of the undertakings concerned. In the majority of the stations independent volunteers were employed. It must also be understood that "crews" cannot mean the whole personnel of the stations; the technical staffs in all cases remained loyal to their undertakings and supervised the volunteers and naval ratings, and in some instances the whole of the manual workers did not strike.

Illumination Research.—A pamphlet on "Illumination Research" has recently been issued by the Department of Scientific and Industrial Research, and gives an indication of the wide range of the investigations on the proper utilisation of natural and artificial light which the department is conducting under the supervision of its Illumination Research Committee. Such matters as the relation between illumination and speed and accuracy of work in the printing and other trades; the design of reflectors; the access of daylight in picture galleries; and the effect of colour, distribution of light, and "flicker" on ease of work are being considered. In view of the enormous amount which is being spent annually in this country on lighting, the need for experiments in order to ascertain the best methods of using light and to encourage true methods of economy is evident. Good lighting is a subject of interest to the whole community, and there is no one who is not to some extent dependent upon it in his daily work. Copies of the pamphlet may be obtained from the above department, 16, Old Queen Street, Westminster, S.W.1.

Old Dynamos at Dover.—The accompanying illustration shows a Brush "Falcon" dynamo that has been in regular use at the Dover Electricity Works for over 30 years, during which period the repairs cost has been nil. This and a similar machine were part of the original equipment installed by the Brush Electrical Engineering Co., Ltd., and were designed by Mr. E. Kilburn Scott, M.I.E.E. The machine is rated at 190 A, 65 V, 250 r.p.m., and the following particulars of design, taken from the test sheet dated December, 1894, may be of interest to designers of to-day. The armature core is 12 in. in diameter and 18½ in. long; it is wound with 176 conductors, each 0.138 in. by 5 in., connected at the ends with copper strips 0.025 in. thick, shaped in a volute to pack closely. The commutator has 88 segments. The shunt winding has 2,368 turns of 0.127-in. double-cotton-covered wire, eight turns of 1-in. by 0.25-in. wire comprising the series winding. The swivel bearing has two endless chains which were introduced as the result of experiments by Mr. Scott after seeing some Mohler bearings which were lubricated by a ring cut on the shaft. A swivel bearing with loose rings looked so clumsy that it was decided to use endless chains.



An Early "Brush" Dynamo at Dover.

The idea of using planished steel to protect the field coils came from Mr. Raworth, who designed the driving engine, which is fitted with electrical governors. The catalogue of these machines shows a range from 11 kW at 1,200 r.p.m. to 270 kW at 460 r.p.m., and it is interesting to know that these two sizes were priced at £110 and £990 respectively.

The Electrical Disturbances in Nerves.—According to *Science*, Dr. Adrian, of Cambridge University, has, by means of new radio apparatus, been able to obtain for the first time records on a rapidly-moving photographic plate of the electrical disturbance caused in a nerve fibre by the passing of messages down the nerve. The experiment was undertaken on a frog and it was found possible by stretching a muscle to stimulate a single nerve fibre. The impulses were all of the same size, but as the muscle was stretched, their frequency was increased from ten to fifty per second. The results of this experiment have opened up a new field of neurology, and no doubt they will hasten forward the time when it will be possible to read the types of messages entering and leaving the nervous system.

Silvanus Thompson Memorial Lecture.—The new date of this event has been fixed for Monday, June 28th, when Mr. C. A. Darling will lecture on "The Rise of Atomic Physics" with experiments, in the Dr. Thompson Lecture Theatre at Finsbury Technical College, Leonard Street, E.C.2. The chair will be taken by Mr. Llewellyn B. Atkinson at 8.0 p.m. Admission free by ticket only which can be obtained from Mr. R. O. Grant, c/o Messrs. Bloxam & Scuffels, Ltd., Engineers, 30, Bedford Row, W.C.1.

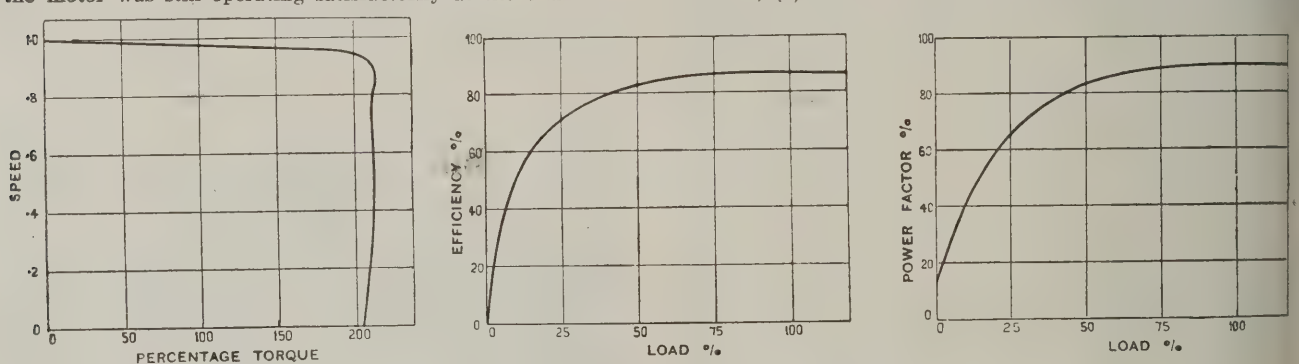
Earthing Resistances for Alternator Protection.—CORRECTIONS.—In connection with the article on this subject by Mr. B. Nuttall which appeared on pp. 822-4 of our last issue, the following corrections should be made:—Author's title, for A.M.I.E.E. read A.A.I.E.E.; in table on p. 824, for I/I read I/I_e; seventh line below the same table, for I read I_e.

Fuel Economy.—At a Council meeting of the Institution of Fuel Economy Engineers, held in London on May 28th, it was decided that the following observations be forwarded to the hon. secretary of the proposed Institute of Fuel Technology :—

"The Council is unanimously of the opinion that professional qualification for full membership of a national fuel Institution is vital for the existence of such an Institution as an authoritative body on this essential industrial problem. For this reason the question of any merger must stand aside until you have finally decided upon your constitution. The Council hopes that on fuller consideration you may revise your present opinion on this essential point."

At the same meeting further applications for membership were passed, and the Council was pleased with the high status of many of the new members. Definite plans are now in hand for organising the autumn session, and the full programme will be available for members in good time before the session starts. The secretary will be pleased to receive suggestions.

Metropolitan-Vickers C.K.B. Motor.—The curves reproduced below have been taken from a 10-h.p., 3-phase, 50-period motor running at 1,460 r.p.m. on 415 volts, and are striking testimony to the excellence of both the starting and running characteristics of this motor. The C.K.B. motor has an improved form of double squirrel-cage rotor, and the curves show that there is practically no sacrifice in running power factor, nor has there been any sacrifice of mechanical robustness to obtain these electrical results. A motor taken from stock was recently put on the test plate and given 720 reversals per hour over a period of eight months for a varying number of hours per day till it had accomplished over 1,000,000 reversals. At each reversal the blow delivered on the periphery of the rotor amounted to 320 lb. In spite of this severe treatment, during which the temperature of the rotor rose to 111 deg. C., the motor was still operating satisfactorily at the end of the test, and the slip and general performance remained unchanged. Careful resistance measurements showed that its electrical condition was precisely the same as at the start.



Metropolitan-Vickers "C.K.B." Motor Characteristic Curves.

An Electric-Steam Locomotive.—Mr. W. P. Durtnall draws attention in *Commercial Motor* to the "Paragon" heat transformer he has devised with which experiments are said to have been successfully concluded on a standard six-wheel coupled goods locomotive, as a result of which it is claimed that the thermo-dynamic efficiency has been raised from 5 per cent. to nearly 20 per cent. Mr. Durtnall claims the "Paragon" electric-steam locomotive to be an improvement enabling steam locomotives to operate on electrified railways with higher electric dynamic efficiency even than that of the ordinary types of electric locomotives. The new locomotives, when descending grades or stopping, will, it is stated, regenerate and return to the supply lines no less than 40 or 50 per cent. of the electrical energy consumed in ascending the same grades at the same speed and load.

Combined Coal and Electric Ovens.—Some particulars have reached us from Switzerland of what is known as a "combined oven." This oven employs both electricity and coal indifferently; it is of no special construction, and the usual baker's oven is suitable. In the oven itself, or in the masonry, special heating elements are placed. The elements are only switched on during the night periods when electricity in Switzerland is cheap, and the ovens are coal fired during the day. It is calculated that 20 kWh is consumed per sq. metre for a night's baking, which includes two batches of bread with the full supply on, and light pastry which is cooked by the residue heat after the second batch is removed, the supply being switched off.

Greenwich Observatory.—The annual visit to the Royal Observatory, Greenwich, by the president of the Royal Society and the other members of the Board of Visitors took place on June 6th, when the Astronomer Royal, Sir Frank Dyson, read his report. The gradual advance of the Southern Railway's electrified train service through New Cross and Lewisham has so interfered with observations of magnetic declination that such observations as are being taken are of little value. "The complete electric train service is expected to be working from the middle of July next," said Sir Frank, "and magnetic observations at Greenwich will then cease." The Observatory has established a new station at Abinger, in Surrey, where the work will be continued.

Appointments Vacant.—Instructor in electrical installation for the Kingston-on-Thames Technical Institute; deputy engineer (£600), for the Windsor Electrical Installation Co., Ltd., and the Slough and Datchet Electric Supply Co., Ltd. (See our advertisement pages to-day.)

The Electricity Bill.—The following letter appeared in *The Times* of June 3rd, and is referred to in our leading columns to-day :—In view of the resumption next Thursday of the consideration of the Electricity (Supply) Bill by the Committee of the House of Commons, we desire to point out that although the Government has agreed to make certain amendments with regard to the status of the proposed Central Electricity Board and to constitute a Tribunal of Appeal, the impression which is being encouraged that therefore all is well with the Bill is not in our view justified.

We are not opposed to the principle of standardisation and interconnection, but we are satisfied that the cost of general standardisation of frequency has been seriously underestimated by the technical advisers of the Government and could not be borne by the electricity supply industry without imposing a burden upon the users of electricity. We are anxious to support any measures that are calculated to spread the use of electricity, whether by reducing the cost to the consumer or in other ways, but we have very serious doubts whether the methods proposed by the Bill will achieve this end. On the contrary, a careful study of the Bill in its present form has forced upon us the conviction that its provisions are inimical to the economic development of electricity supply.

It would make this letter too long to specify in detail the further amendments we consider imperatively necessary—they are being put before the Parliamentary Committee. We will content ourselves with adding that the Bill, unless further amended, will tend: (1) to diminish efficiency by unnecessary interference with responsible management through duality of control; (2) to introduce further bureaucratic administration without financial responsibility; (3) to discourage enterprise, the terms of compulsory expropriation being unfair to investors, and the prospects of earning a fair return on capital being endangered.

We are, Sir,
Yours faithfully,

J. B. Braithwaite, Chairman, City of London Electric Lighting Company, Limited.
R. A. Chattock, President of the Institution of Electrical Engineers.
James Devonshire, Chairman, North Metropolitan Electric Power Supply Company.
E. Garcke, Chairman, Shropshire, Worcestershire and Staffordshire Electric Power Company.
J. S. Highfield, Consulting Engineer to South Wales and Cornwall Electric Power Companies.
R. P. Sloan, President, Incorporated Association of Electric Power Companies.
C. G. Tegetmeier, Chairman of seven Electricity Supply Companies.
P. D. Tuckett, Chairman, Edmundsons Electricity Supply Corporation, Limited, and Cornwall Electric Power Company.
W. B. Woodhouse, General Manager and Chief Engineer, Yorkshire Electric Power Company.

Lubricating Oils for Heavy-Oil Engines.—At a meeting of the Diesel Engine Users' Association on May 28th the President, Mr. E. W. Johnston, gave an account of the work which had been done by the Committee in connection with the preparation of specifications for lubricating oils for heavy-oil engines, which it was proposed that the Association should adopt, in the hope that they would be used by the members. Following independent analyses of a considerable number of lubricating oils used by its members, and with the assistance of a well-known analytical chemist and authority, the Association's Committee has prepared two specifications which embody characteristics which will ensure first-class lubricants without including any highly expensive features and which it will be practicable for the great majority of oil suppliers to provide without difficulty. At the conclusion of the investigations the Committee invited representatives of the principal suppliers in the country to express their opinions on the specifications, described as "A" and "B," adopted for lubricating oils for 2- and 4-stroke cycle heavy-oil engines, the first being for engines of speeds from 100 to 240 r.p.m., and the second for engines of speeds above 240 r.p.m.

Broadcasting during the Strike.—The absence of newspapers during the recent general strike added much value to the augmented news service which was maintained by the British Broadcasting Co.'s stations; in this connection it is of interest to record that the Radi-Arc Electrical Co., Ltd., was requested by the Government to install a "Liberty" 8-valve supersonic heterodyne receiver on the Horse Guards parade ground, operating two large loud-speakers, so that the Government news bulletins could be broadcast to the general public.

Strike Items.—At Edinburgh during the recent general strike most of the manual workers in the generating station and sub-stations left their posts. The supply was maintained by the technical staff, with the assistance of volunteers from the Heriot Watt College and local engineering firms; 589 employés left work and 94 volunteers were engaged. During the early part of the strike it was thought desirable to ask certain large consumers to curtail their consumption, but as things became better organised, this request was modified.

All the employés of the Greenock Electricity Department remained loyal, and no interference with, or curtailment of, the supply took place. Since the commencement of the coal dispute the undertaking has been using oil-fuel-burning equipment, with which many of the boilers were fitted during the 1921 coal strike.

A normal full supply was maintained at Blackburn, although a very large proportion of the employés at the main generating and distributing stations left work without notice. The station technical staff was assisted by members from the other departments.

A Local Lecture.—At a meeting of the Gosport Rotary Club on May 27th, when Mr. W. A. Homewood presided, Capt. W. H. Upton Marshall, M.I.E.E., delivered a lecture dealing with the electricity supply industry in this country. He outlined the advances which had been made during the past 20 years, and referred to the legislation which had been passed to ensure an adequate supply of electricity to all consumers. Referring to the recent proposals for shutting down the inefficient stations and interconnecting the large ones, he said that in the London and Home Counties alone some 500,000 tons of coal could be saved annually as the result of such reorganisation.

Institution Notes.

Institution of Electrical Engineers.—MERSEY AND NORTH WALES (LIVERPOOL) CENTRE.—The Committee's annual report for the 1925-26 session shows that eight committee meetings were held and six ordinary meetings, at which the average attendance was 98, excluding the attendance at the Faraday lecture. The number present at the annual dinner was 76; the reunion with the North-Western Centre which was to have taken place at Chester in May had to be postponed. The membership remains the same as last year, 467, and the number transferred to other districts, or removed from the list, was 89, as compared with 73 in the previous year. The total expenses of the session amounted to £283, including the Students' Section total of £17, which section is in a more thriving condition. The 1926-27 Committee is as follows:—*Chairman*: P. J. Robinson; *vice-chairmen*: Prof. F. J. Teago and S. E. Britton; *ordinary members*: A. G. Barnard, L. Breach, T. Cornfoot, H. Dickinson, P. M. Hogg, Prof. E. W. Marchant, T. B. Morgan, E. L. Morland, G. H. Nisbett, A. J. Pratt, P. Priestly, and A. S. Wilson.

The Faraday Society.—ANNUAL MEETING.—At the annual meeting on June 2nd, Prof. F. G. Donnan, F.R.S. (president), referred to the loss which the Society had sustained by the sudden and lamentable death of Mr. F. S. Spiers, the secretary of the Society, and also of the Institute of Physics. Mr. Spiers, he said, was practically the Faraday Society, and but for the work which he had done from the very beginning the Society would probably not now be in existence. The meeting marked its sense of the loss the Society had sustained by standing in silence.

The annual report of the Council for 1925 shows that 30 new members were elected during the year, and at the end of the year the membership was 426 members and 6 students, as against 416 members and 9 students in 1924. Regret is expressed that the membership is growing at such a slow rate, although there is a growing increase, from all over the world, in the sales of the *Transactions* to non-members. Reference is also made in the report to the formation of the Electroplaters' and Depositors' Technical Society during the year; the original idea was to form an electroplaters' section of the Faraday Society, but this was not thought desirable on general grounds, and as it was also found that a Plating Section would not serve the purpose in view, the new Society was formed practically under the wing of the Faraday Society. Prof. Donnan expressed the hope that there would be co-operation in every way between the two societies. The financial position at the end of 1925 was a debit balance of £187 due to commitments in the past, there being an actual excess of income over expenditure during 1925 of £332. By restricting the number of general discussions, for which the Society has achieved quite a reputation, to two per annum a considerable reduction in the expenditure is contemplated and, indeed, this is one of the reasons for the more satisfactory position at the end of 1925. On the other hand, it is intended to issue the *Transactions* bi-monthly in future, instead of three times per annum as in the past.

The report and accounts were adopted, the president expressing the hope that the membership would increase materially.

Prof. C. H. Desch, F.R.S. (Head of the Metallurgical Department of Sheffield University), was elected president for the coming year in succession to Prof. Donnan.

Prof. F. G. Donnan then delivered his presidential address, which consisted of an account of work done by himself and Prof. T. Thorvaldsen when they were both at Liverpool in 1912-13 upon electrical potential differences at air-water surfaces. This is the first time an account of this work has been given, the delay being due, in the first instance, to the fact that Prof. Donnan removed to London and Prof. Thorvaldsen took up a post in Saskatchewan, and then to the war period preventing publication. Subsequently Prof. Donnan wrote to Prof. Thorvaldsen to send his notes and documents over. These did not arrive until comparatively recently, hence the delay. The work dealt with the position as it stood in 1912 and 1913, although other workers had carried matters further since; it concerned the measurement of electric potential differences in thin films of liquid, a subject of great interest to colloid chemists. It was claimed that they established for the first time that electrical potential differences at air-water surfaces varied with the concentration of the substances and with the surface tension of the liquid.

Institute of Wireless Technology.—EXAMINATION.—We have received a copy of the regulations relating to the examination of candidates for membership of the Institute, together with application forms. The next examination will be held in October, and applications should reach Mr. Y. W. P. Evans, hon. secretary, 71, Kingsway, London, W.C.2, not later than August for Great Britain, and a month earlier for foreign candidates.

Institution of Heating and Ventilating Engineers.—SUMMER MEETING.—The summer meeting will take place at Scarborough from June 21st to 23rd.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

According to a *Reuter* report from Montreal, Mr. A. E. POLLARD, of the Department of Overseas Trade in London, has been appointed British Trade Commissioner in Vancouver in succession to Mr. L. S. BEALE, who has been transferred to New Zealand.

Mr. P. H. RIGGS has resigned his position of Scottish representative of Messrs. Richard Garrett & Sons, Ltd., Leiston, to join the Alton Battery Co., Ltd., Alton, Hants., as London representative.

Mr. CHARLES PARCELL, employed by the Liverpool Corporation Electricity Department as leading fitter, has been appointed assistant engineer in the electricity supply department (salary £300 per annum).

The Belfast City Council last week approved the recommendation of the Electricity Committee to send the City electrical engineer and manager (Mr. JOHNSTONE WRIGHT) to the United States to study electricity supply development in that country in general, but in particular power-station boiler-house practice and equipments utilising pulverised fuel, &c.

Mr. J. SIMS, assistant electrician at Broxburn Oil Works, has been appointed resident electrical engineer by Grange-over-Sands Council.

Mr. F. H. BLAXLEY, of Dovedale, Penns Lane, Erdington, Birmingham (late of the New Gutta-Percha Co.), has just been appointed Midlands representative of the Walsall Hardware Manufacturing Co., Ltd.

To fill the vacancy caused by the death of Mr. C. H. FRYER, Mr. W. H. SCAGELL, who for many years represented Messrs. Houghtons, Ltd., in Scotland and the north of Ireland, has now been appointed manager of their Glasgow depot at 70-78, York Street.

An Australian newspaper report states that Mr. JAMES CLARKE, sales manager of Standard Telephones and Cables (Australasia), Ltd., left on April 28th for England, the Continent, and the U.S.A. to study the latest methods of telephone manufacturing organisations, with the object of applying them to the Australian concern on his return there at the end of the year. It is remarked that the Company will be manufacturing telephone parts in Australia in the near future.

Last week the Halifax Town Council, by 22 votes to 20, adopted the Electricity Committee's recommendation that the salary of the borough electrical engineer be increased from £1,140 to £1,200.

Obituary.—MR. ROBERT TAYLOR.—We briefly mentioned last week the death of Mr. Robert Taylor, at the age of 71 years. The funeral took place at Manchester on May 21st (which date was given last week as that of his death). Mr. Taylor, who was the founder and a director for 25 years of the Liverpool Electric Cable Co., Ltd., had a long and interesting career in the cable manufacturing business, having been connected with its growth from the earliest stages. He was born at North Woolwich in 1855, and started work at the age of 10½ years. After a few months he got work with the India Rubber, Gutta Percha, &c., Co., on the winding of jute yarns for certain sub-

marine cable work, and in the coiling tanks, and then when the order was finished he went to W. T. Henley's galvanising shop, where he remained until he was about 14 years of age. At that time there were no Factory Acts, and boys could be worked overtime and at night; they worked alternate weeks, day and night shifts, each being for 12 hours. In some notes left by Mr. Taylor he says :—" No mealtimes were allowed so that we had to take food as best we could. It frequently happened that one's relief did not turn up so that we had to do a 36-hour shift. It is interesting to remember this when we think of the present-day conditions in the factory." He left the galvanising department on account of the fumes affecting his throat, and found a post again at the India Rubber, Gutta Percha, &c., Works. After a few months coiling in the tanks he was moved into the telegraph shop, where submarine cables were being insulated with vulcanised rubber. A fire destroyed the cable shop and in the course of other changes Mr. Taylor once again returned to Henley's, where he stayed until the end of 1872, and, after the troubled period, the foundation of the present prosperous business of W. T. Henley's Telegraph Works Co. was laid, with Mr. (now Sir) George Sutton as secretary. Towards the end of 1882 Mr. Taylor left Henley's and introduced the manufacture of vulcanised rubber cables to Johnson & Phillips, remaining there 5½ years. He then joined the Telegraph Manufacturing Company, Helsby, and commenced to manufacture rubber cables. Two years later he introduced to W. T. Glover & Co. the manufacture of rubber cables and took charge of the factory as works manager. After eleven years with Glover's, Mr. Taylor resigned and along with his son, Mr. W. S. Taylor, and the late Mr. Samuel Hartford, established the Liverpool Electric Cable Co., Ltd. Mr. Taylor was of a very reserved disposition, but he was well known to electrical men of an earlier generation. Of late years he was not able to take the place in the industry that he would have liked to occupy.

MR. F. C. OSBORNE.—The death occurred suddenly on May 25th of Mr. Frederick Charles Osborne, who was an engineer at the Colchester Borough Electricity Works. He was 53 years of age.

MR. W. T. EDWARDS.—The death took place as the result of a motoring accident at Brixworth, Northants, on May 30th, of Mr. William Thomas Edwards, who was partner with his father in the firm of Herbert Edwards & Son, radio engineers, of Clapham Park Road, London, S.W. Deceased was 22 years of age.

MR. W. P. THOMPSON.—We regret to learn from the columns of the *Mechanical World* that the death occurred on May 25th of Mr. William Phillips Thompson, patent agent, Liverpool. Mr. Thompson founded the firm of W. P. Thompson & Co., chartered patent agents, at Nottingham, in the early seventies of last century; he then opened at Liverpool, with, later, branches in Bradford and London.

MR. E. WARREN.—The death occurred on May 27th, at the age of 39 years, of Mr. Ernest Warren, who was engaged in the business of his father, Mr. W. H. Warren, electrical and radio engineer, High Street, Huntingdon. During the war he served in the electrical department of the Royal Engineers in German East Africa, and was in charge of the wireless apparatus.

New Companies Registered.

Mota Signs, Ltd. (214,053).—Private company. Registered May 31st. Capital, £250 in £1 shares. Objects: To carry on the business of dealers in all kinds of goods, apparatus and devices relating to electric or automatic signs for commercial advertising, &c. The first directors are:—S. Hamaguchi, 1, St. John's Wood Park, Hampstead, N.W.; Ivy P. Weaver, 1, Bisson Road, Stratford, E.15; J. T. Magee, 36, Leigh Road, Highbury; A. E. Weaver, 1, Bisson Road, Stratford, E.15 (all permanent, subject to each holding 10 shares). Qualification of ordinary directors, 5 shares. Registered office: 54, Gracechurch Street, E.C.3.

William Simms & Co. (Felixstowe), Ltd. (214,072).—Private company. Registered May 31st. Capital, £4,000 in £10 shares. Objects: To acquire the business of electrical engineers and contractors carried on by W. Simms and C. W. Barker at Felixstowe and elsewhere as " William Simms & Company. The directors are:—W. Simms, 2, York Road, Felixstowe, electrical engineer; C. W. Barker, " Binfield," Manning Road, Felixstowe, electrical engineer; C. R. Simms, 2, York Road, Felixstowe, electrical engineer. Qualification, 1 share. Solicitors: Kersey & Tempest, 15, Tower Street, Ipswich. Registered office: 92, Hamilton Road, Felixstowe.

Kemps Mills, Ltd. (214,040).—Private company. Registered May 29th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio apparatus and electrical materials of all kinds, manufacturers of and dealers in metals, engineers, metal workers, hardware merchants, &c. The subscribers (each with one share) are:—B. S. Bernstein, St. Hilary, Long Lane, West Kirby, Cheshire, manufacturer; E. J. Davenall, 48, Lea Road, Wolverhampton, radio engineer; A. G. Allen, 21, Legge Street, Parkfield, Wolverhampton, production engineer. The first directors are not named. Qualification, £1 share or stock. Secretary: F. E. Franks. Solicitor: F. W. Jackson, 57, Moorfields, Liverpool. Registered office: Pountney Place and Stewart Street, Wolverhampton.

W. Yuill & Co., Ltd. (24,165).—Private company. Registered in Edinburgh May 27th. Capital, £3,500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless sets, parts and appliances, optical and scientific instruments, pianofortes and musical instruments of all kinds, &c. The subscribers (each with one share) are:—W. Yuill, 20, Southern Avenue, Burnside, Glasgow, commercial traveller; A. Reid, Kilmory, High Road, Stevenson, Ayrshire, clerk. The first directors are not named. Qualification, 200 shares. Secretary: J. J. B. Gilmour, 83, Princes Street, Ardrossan.

McWhirr, Paterson & Co., Ltd. (214,065).—Private company. Registered May 31st. Capital, £1,000 in £1 shares. Objects: To acquire the loose stock, stock in trade and other goods and chattels (1) in connection with the business of McWhirr and Paterson, carried on by Mrs. J. D. Andrews at 20, Keen's Yard, St. Paul's Road, Highbury Corner, N.1, and (2) in connection with the business of George Paterson & Son (including the goodwill thereof) carried on by G. G. Paterson at 107, Clerkenwell Road, E.C., and to carry on the business of manufacturers of and dealers in screws, nuts, terminals, washers and all other wireless parts, components, accessories and sets for use for or in connection with the electrical and wireless trades, importers, exporters and manufacturers of brass parts, and fittings for builders, merchants, cabinet makers and general engineers, &c. The first directors are:—G. G. Paterson, 88, Belsize Lane, Hampstead, N.W.3, engineer; Mrs. J. D. Andrews, 43, Ilfracombe Road, Southend-on-Sea. Qualification, 1 share. Registered office: 7 and 8, Keen's Yard, St. Paul's Road, Highbury Corner, N.1.

Alphian Wireless, Ltd. (213,974).—Private company. Registered May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of wireless sets and accessories, &c., and to adopt an agreement with Maude E. Adey. The permanent directors are:—H. O. H. Maude (chairman), 13, Rodney Court, Maida Vale, W.9; H. W. Adey, 10, Lambolle Road, Hampstead, N.W.3. Manager: H. W. Adey. Solicitors: Maude and Tunnicliffe, Arundel House, Arundel Street, W.C.2. Registered office: 99, Mortimer Street, W.1.

R. Falshaw, Ltd. (214,108).—Private company. Registered June 2nd. Capital, £5,000 in £1 shares. Objects: To acquire the business of an electrical engineer now carried on by R. Falshaw at 1, Albert Street, Harrogate, as " R. Falshaw," and to carry on the business of manufacturers of and dealers in wires, lamps, fittings, accumulators, batteries, dynamos, magnetos, indicators, bells, switches, controls, valves, telephonic and telegraphic instruments and apparatus, wireless goods, &c. The subscribers (each with one share) are:—R. Falshaw, The Lodge, Weeton, electrical engineer; Mrs. F. A. Falshaw, The Lodge, Weeton. R. Falshaw is first and permanent governing director and chairman. Qualification, £100 shares. Remuneration, £50 each per annum. Secretary: A. Depledge. Solicitors: Titley & Paver-Grow, Harrogate.

Official Returns of Electrical Companies.

Burndept Wireless, Ltd.—Charge on certain freehold and leasehold properties at Blackheath and Willesden, and the company's other assets, including uncalled capital, dated May 4th, 1926, to secure all moneys due or to become due from the company to Coutts & Co., not exceeding £100,000.

Frank Thornton, Ltd.—Agreement accompanying deposit of deeds dated May 11th, 1926, charged on garage and engineering works in Cannon Street, Burnley, with fixed plant, machinery, &c., to secure all moneys due or to become due from the company to Manchester and County Bank, Ltd.

Central Electric Supply Co., Ltd. (53,080).—Capital, £100,000 in £5 shares. Return dated March 9th, 1926. All shares taken up. £100,000 paid. Mortgages and charges, £1,300,000.

Kensington and Knightsbridge Electric Lighting Co., Ltd. (26,193).—Capital, £350,000 in 50,000 ordinary, 10,000 first preference, and 10,000 second preference shares of £5 each. Return dated April 1st, 1926. 21,000 ordinary, 10,000 first preference, and 10,000 second preference shares taken up. £179,840 paid on 15,968 ordinary, 10,000 first preference, and 10,000 second preference. £25,160 considered as paid on 5,032 ordinary. Mortgages and charges, £140,000. Ditto guaranteed by this company and the Notting Hill Electric Lighting Co., Ltd., under powers of the Kensington and Notting Hill Electric Lighting Co.'s Act, 1899, £300,000.

Oxford Electric Co., Ltd. (34,685).—Return dated March 24th, 1926. Capital at date of return, £175,000 in 20,000 ordinary and 15,000 preference shares of £5 each. 20,000 ordinary and 11,000 preference shares taken up. £121,000 paid on 13,200 ordinary and 11,000 preference, and a further £1,550 paid on 310 ordinary shares forfeited. £34,000 considered as paid on 6,800 ordinary. Mortgages and charges, £110,000. On March 26th, 1926, it was resolved (*a*) to split each existing £5 share into five of £1, (*b*) to increase interest on the cumulative preference shares from 5 per cent. to 6 per cent. as from June 30th, 1926, and (*c*) to increase the capital to £250,000 by creating 75,000 new 6 per cent. cumulative preference shares of £1 each.

Burma Electric Supply Co., Ltd. (till recently known as " Burmah Electric Tramways and Lighting Co., Ltd.") (75,090).—Capital, £250,000 in 100,000 ordinary and 150,000 preference shares of £1 each. Return dated December 16th, 1925. 100,000 ordinary and 120,000 preference shares taken up. £100,000 paid on 100,000 preference. £120,000 considered as paid on 100,000 ordinary and 20,000 preference. Mortgages and charges, nil.

Bogota Telephone Co., Ltd. (69,059).—Capital, £150,000 in 125,000 preferred and 25,000 deferred shares of £1 each. Amended return dated December 11th, 1925 (filed April 28th, 1926). 125,000 preferred and 18,607 deferred shares taken up. £131,107 paid on 125,000 preferred and 6,107 deferred. £12,500 considered as paid on 12,500 deferred. Mortgages and charges, nil.

Consolidated Signal Co., Ltd. (71,141).—Capital, £425,000 in 220,000 preference and 205,000 ordinary shares of £1 each. Return dated February 25th, 1926. 214,195 preference and 150,548 ordinary shares taken up. £52,839 paid on 24,999 preference and 27,840 ordinary. £311,904 considered as paid on 189,196 preference and 122,708 ordinary. Mortgages and charges, nil.

Bray, Markham & Reiss, Ltd. (74,871).—Capital, £20,000 in £1 shares. Return dated December 1st, 1925. 17,080 shares taken up. £16,080 paid. £1,000 considered as paid. Mortgages and charges, nil.

Lancashire United Transport and Power Co., Ltd. (till recently known as " Lancashire United Tramways, Ltd.") (87,044).—Capital, £200,000 in £1 shares. Return dated March 9th, 1926. 192,878 shares taken up. £7 paid. £192,871 considered as paid. Mortgages and charges, £546,500.* Deferred debenture stock issued having no charge over the company's assets, £83,330. (*A further £40,000 of this stock has been deposited as security for possible advances.)

Mansfield and District Tramways, Ltd. (91,130).—Capital, £180,000 in 80,000 preference and 100,000 ordinary shares of £1 each. Return dated March 8th, 1926. 80,000 preference and 44,834 ordinary shares taken up. £80,609 paid on 62,767 preference and 17,842 ordinary. £44,225 considered as paid on 17,233 preference and 26,992 ordinary. Mortgages and charges, £67,611.

London Electric Wire Co. & Smiths, Ltd. (101,353).—Capital, £1,250,000 in 750,000 ordinary and 500,000 preference shares of £1 each. Return dated April 14th, 1926. 644,070 ordinary and 400,000 preference shares taken up. £350,035 paid on 35 ordinary and 350,000 preference. £694,035 considered as paid on 644,035 ordinary and 50,000 preference. Mortgages and charges, nil.

Mather & Platt, Ltd. (60,387).—Capital, £2,500,000 in 40,000 preference shares of £10 each and 2,100,000 ordinary shares of £1 each. Return dated March 12th, 1926. 40,000 preference and 1,363,660 ordinary shares taken up. £630,660 paid on 29,200 preference and 338,660 ordinary. £1,333,000 considered as paid on 10,800 preference and 1,025,000 ordinary. Mortgages and charges, nil.

Clarke, Chapman & Co., Ltd. (39,045).—Capital, £550,000 in 7,000 preference shares of £10 and 480,000 ordinary shares of £1. Return dated March 19th, 1926. 6,985 preference and 444,060 ordinary shares taken up. £100,210 paid, being £10 on 4,435 preference, £1 per share on 55,360 ordinary, and 5s. per share on 2,000 ordinary shares. £413,700 considered as paid, being £10 per share on 2,550 preference, £1 per share on 386,700 ordinary, and 15s. per share on 2,000 ordinary shares. Mortgages and charges, nil.

Hindhead and District Electric Light Co., Ltd.—Issue on May 20th, 1926, of £50 debentures, part of a series already registered.

Reading Electric Supply Co., Ltd. (35,651).—Capital, £152,200 in £1 shares. Return dated April 29th, 1926. 152,125 shares taken up. £147,775 paid. 4,350 considered as paid. Mortgages and charges, £93,400.

Newmarket Electric Light Co., Ltd. (44,450).—Capital, £30,000 in £10 shares. Return dated May 3rd, 1926. 2,656 shares taken up. £26,560 paid. Mortgages and charges, £14,200.

New Phonopore Telephone Co., Ltd. (44,654).—Capital, £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. Return dated, December 23rd, 1925. 7,141 ordinary and 1,000 founders' shares taken up. £6,781 paid on 6,741 ordinary, leaving £10 in arrears. £1,400 considered as paid on 400 ordinary and 1,000 founders'. Mortgages and charges, £2,566.

Electric Sign Co., Ltd. (45,610).—Capital, £5,000 in £1 shares. Return dated April 28th, 1926. 2,000 shares taken up. £1,000 paid. £1,000 considered as paid. Mortgages and charges, nil.

City and General Radio Co., Ltd.—Debenture dated April 6th, 1926, to secure £500, charged on the company's property, present and future, including uncalled capital. Holder: F. Featherstone, 79, Cannon Street, E.C.4.

Harrow Electric Light and Power Co., Ltd. (44,529).—Capital, £50,000 in 6,667 ordinary and 3,333 preference shares of £5 each. Return dated March 4th, 1926. All shares taken up. £50,000 paid. Mortgages and charges, £25,000.

Power and Lighting Supplies Co., Ltd. (174,477).—Capital, £5,000 in £1 shares. Return dated February 11th, 1926. 2,125 shares taken up. £500 paid. £1,625 considered as paid. Mortgages and charges, nil.

Reason Manufacturing Co., Ltd. (64,701).—Capital, £52,500 in 200,000 preference and 10,000 ordinary shares of 5s. each. Return dated December 30th, 1925. 92,000 preference and 10,000 ordinary shares taken up. £2,349 paid on 9,397 preference shares. £23,150 considered as paid on 82,603 preference and 10,000 ordinary shares. Mortgages and charges, £13,000.

British Electric Transformer Co., Ltd. (76,351).—Capital, £1,000,000 in 300,000 preference and 700,000 ordinary shares of £1 each. Return dated April 8th, 1926. 300,000 preference and 325,000 ordinary shares taken up. £539,821 paid on 290,776 preference and 249,045 ordinary shares. £85,179 considered as paid on the remainder. Mortgages and charges, £20,000.

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Capital, £130,000 in £1 shares. Return dated April 14th, 1926. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges, £282,150.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,228).—Capital, £160,000 in £1 shares. Return dated April 8th, 1926. All shares taken up. £96,150 paid. £63,850 considered as paid. Mortgages and charges, nil.

Newcastle and District Electric Lighting Co., Ltd. (28,022).—Capital, £300,000 in £1 shares. Return dated April 2nd, 1926. All shares taken up. £300,000 paid. Mortgages and charges, £317,960.

Thames Valley Electric Supply Co., Ltd. (185,597).—Capital, £100 in £1 shares. Return dated April 29th, 1926. All shares taken up. £100 paid. Mortgages and charges, nil.

Continental Automatic Telephone and Electric Co., Ltd. (184,764).—Capital £10,000 in £1 shares. Return dated December 31st, 1925 (filed March 9th, 1926). 1,302 shares taken up. £302 paid. £1,000 considered as paid. Mortgages and charges, nil.

Gayton Park Electricity Co., Ltd. (184,208).—Capital, £3,000 in £1 shares. Return dated March 15th, 1926. All shares taken up. £3,000 considered as paid. Mortgages and charges, nil.

Sennybridge Electric Supply Co., Ltd. (174,920).—Capital, £1,500 in £25 shares. Return dated June 30th, 1925 (filed May 18th, 1926). 48 shares taken up. £1,200 paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Callender's Cable and Construction Co., Ltd.

The annual meeting was held on June 3rd, Sir J. Fortescue Flannery, Bart., M.Inst.C.E. (chairman of directors) presiding. After apologising for the delay in the holding of the meeting, due to the intervention of the General Strike, the chairman, in moving the adoption of the report and accounts (*vide* ELECTRICAL REVIEW, May 28th, p. 803), said that it was unnecessary to enlarge upon the General Strike, which was, happily, ended, but they had, unfortunately, still many troubles to overcome and much more work to do before the wheels of industry ran smoothly, but they were confident that that would, in due course, be accomplished. On the Tuesday morning following the declaration of the General Strike they were informed that their power would be cut off, and within an hour that took place. On endeavouring to start their afternoon shift they found all their plant and machinery dead, as the electrical energy had been deliberately cut off. It therefore became necessary to close the factory, and they were unsuccessful in endeavouring to obtain a supply until the following Tuesday, when a small supply was given them, which, however, on the termination of the strike, was immediately increased so as to meet their demands. Their workmen returned, and were given employment as far as possible. A large number of their men volunteered for various services, and in many cases the technical knowledge which they possessed was of great value to the community. Referring to the Electricity Bill, the chairman said that the uncertainty of the issue had had the effect of holding up the development of electrical enterprise in many directions. If the intentions of the promoters were realised and a substantial increase in the employment of electricity was rendered possible, it would undoubtedly mean an increase in the use of cables of all kinds. The directors were, however, of the opinion that the high expectations of immediate advantage which had been formed by the general public were greater than the future would justify. It seemed to be forgotten that in many of the large industrial areas of the country most of the objects of the Bill had already been fully attained by the power companies, and that in any event it would take some years before a substantial decrease in the cost of electricity to outlying areas and their consequent large development could take place. The method of linking up stations, and many other provisions of the Bill, were likely to be of great service to the community. In the meantime, however, the Bill had retarded progress. They hoped that progress would not be further hampered by the Bill being referred to committees to investigate all points. Regarding the report and accounts, the accounts submitted indicated a conspicuous advance. The company's prosperity was due very largely to the fact that it had always been in the forefront of the industry, by reason of new and improved machinery, the leadership of Sir T. O. Callender—supported by an excellent band of trained and willing workers—and the sound financial policy adopted. Keen competition existed, and although a very large business has been done, the profit on each individual item was relatively small. Large financial resources were necessary in order to carry on that ever-increasing business, and the nominal capital of the company was no guide whatever as to the sums which they had at their disposal and from which the profits and dividends resulted. It had sometimes been suggested that the company and some similar concerns were making unreasonably high profits, whereas that was far from being the case. The capital of the company had been increased by the creation of 200,000 ordinary shares, of which 100,000 were issued during the past year. Over 99 per cent. of that amount was subscribed by the shareholders direct in response to this invitation, and, of the remainder, somewhat less than 1,000 shares, applications for 86 times that amount were received from would-be subscribers. In making the allotments for those shares the directors gave special consideration to applications received from the employés. It was proposed to distribute by way of bonus £200,000 in fully paid-up ordinary shares to the present holders at the rate of one new share to every three now held. That would bring their book capital more in accord with the amount really employed in the business. To do that it would be necessary to increase the ordinary share capital, and the directors thought it desirable while doing so to take powers to make that issue larger than was at present required. The additional 200,000 was not to be offered for subscription at present, but it would be available when the increasing business and the fresh developments of the industry rendered it necessary to do so. The new shares would participate equally with the old shares in the final distribution of 10 per cent. The payments would be subject to income-tax at the rate of 3s. 11d. in the £. After adding the amount brought in from last year, there was a balance of £611,338, as against £462,664 brought in. As regarded the prospects for the current year, before the General Strike and present difficulties the directors had every reason to be satisfied with the outlook; but it was idle to deny that the convulsion which had shaken the industry of the country must have had its effect upon operations. Provided, however, that the troubles were cleared away in a satisfactory manner, the shareholders could expect with reasonable confidence the continuance of the same dividend even on the enlarged capital. The company had extended its operations in several parts of the world. The Okonite-Callender Cable Co. in the United States, whose works were now in regular operation, was producing cables of the same type as those which the company manufactured in England, for which there was a large demand in America. The Anchor Cable Co. had had a good year, the result of which had assisted the profits of the company. The outlook for the rubber wires which the Anchor Co. manufactured continued satisfactory.

Sir T. O. Callender, J.P., in seconding, supplemented the chairman's remarks on the strike, and expressed his appreciation of those men who had stood by the firm in the most loyal manner. They were looking forward to returning to the regular quantity of business at an early date. In the one or two instances where it had not yet been found possible to resume, they would do so as soon as complete transport facilities existed—which were, at present, wanting—and as soon as power was available to the fullest extent. The prospects for the year were, otherwise, excellent, and the company was looking forward to a large volume of business, especially in the higher grades of cables. As regards the company's operations abroad, these had been extended in a number of directions. India still remained their best customer, and in Bombay they had a well-run office with an adequately equipped staff. They had now started a new department in India, for the company had secured a contract for the overhead equipment for the electrification of some 24 miles of railway for the Bombay, Baroda and Central India line. That work was the beginning of some very large contracts in other parts of the country. The company had just finished the electrification of the Peninsula of Aden, and they had a large amount of work to do in the Malay Peninsula in connection with the Borneo Company, whilst in Khartoum and the Sudan they were working at full pressure on the important contract to which reference was made last year. Around the East Coast of Africa and various other parts of the world they were doing a large amount of work. In China they had had a very useful experience of what their men could do. During the period when Shanghai was suffering severely from strike fever and revolutionary ideas, the company laid through the main streets of that city a complete set of underground cables for the Tramway Company without any casualty whatever. Even Zanzibar was

buying a considerable quantity of material from them, and from Sydney, New South Wales, they had just secured one of the largest contracts for "super-tension" cable ever placed in this country or elsewhere. The Okonite-Callender Co. was now enjoying the benefit of the parent company's long experience, and had had the assistance of some of their best men, with the result that it had now one of the finest businesses on the Western side of the Atlantic.

The report and accounts were adopted, and at a subsequent extraordinary meeting the increase in the company's capital was approved.

Brush Electrical Engineering Co., Ltd.

The report for the year ended December 31st last states that the balance remaining at the credit of the profit and loss account in the preceding year (£76,190) has been carried to an undivided profits account, and does not, therefore, appear in the report. After providing for general charges, maintenance, debenture interest, &c., the net profit for the past year is £62,197. From this amount it is proposed to transfer £5,544 to general reserve; to pay a dividend of 10 per cent.; and to pay a further 4 per cent. interest on the prior lien second debenture stock; leaving £8,751 to be placed to the credit of a proposed co-partnership scheme suspense account. It is stated that consultations have taken place with the staff and workpeople, the trade unions concerned, and the Engineering Employers' Federation. A definite co-partnership scheme has not yet been formulated, but discussions are still proceeding, and there is a prospect of a satisfactory result. A tentative scheme has been drawn up and submitted to the shareholders for their provisional approval. The general reserve now amounts to £233,633. The sum of £3,180 was spent on capital account during the year. It is stated that during the year there was an improved demand for Brush-Ljungström turbo-generators and other engineering plant manufactured by the company, and important installations were carried out at home and abroad. The rolling stock department has been kept busy in the manufacture of electric tramcars and motor omnibuses, and the current year's prospects for further contracts are satisfactory. Meeting: June 14th.

Shanghai Electric Construction Co., Ltd.

The annual meeting was held on June 2nd Mr. L. W. Hawkins, presiding in the absence of the chairman (Mr. J. S. Haskell), said that the year under review had been one of anxiety and difficulty owing to the serious disturbances in Shanghai. Not only had the company's revenue been affected, but development was retarded postponing a return upon the new capital which had been raised in the preceding year. The fact that the board had been able to declare a dividend of 10 per cent. on the increased capital was testimony to the company's stability and vitality. The continuous growth of the business, coupled with the permanently increased cost of labour and materials, would render inevitable in the future larger appropriations for renewals than had been made in the past. The company had 37 trolley omnibuses in service which were producing satisfactory results; the board's experience pointed to the desirability of opening new routes gradually. It was expected that 60 new 'buses would be in service by the end of the current year, and the board believed that as the traffic developed it would be expedient to increase the number from time to time. In conclusion Mr. Hawkins referred to the bugbear of depreciation of the subsidiary coinage with which the company was always burdened. The report and accounts were adopted.

Ever-Ready Co. (Great Britain), Ltd.

Mr. C. H. C. Moller presided at the annual meeting on June 1st, and in presenting the report and accounts (*vide* Elec. Rev., May 14th and 21st, p. 774). said that the past year had been a record one, the increase extending to every department of the company's activities. Furthermore, in spite of the general strike, the figures for April and May showed a considerable increase over those of the corresponding period of 1925. The directors felt that they should be in a position to issue further capital in case of need and resolutions providing for that were to be submitted. In the event of future issues the present shareholders, as on previous occasions, would be given the first opportunity to increase their holdings. The chairman mentioned that £30,000 had been invested in War Loan and that the number of shareholders now exceeded 1,500. After the ordinary meeting special meetings were held at which resolutions approving the creation of 250,000 ordinary shares of £1 were passed. This raises the nominal capital of the company to £750,000.

Dubilier Condenser Co. (1925), Ltd.

Speaking at the annual meeting on June 1st, the chairman (Sir Arthur Dickinson) said that the board as at present constituted had taken over the affairs of the company in June last year, and, unfortunately, had had to contend with an entirely unexpected depression in the radio industry. In the case of the company the effects of the depression were aggravated by the fact that it had recently moved into new premises at North Acton and this necessarily added to the overhead expenses. It was the company's policy to keep abreast, or ahead if possible, of all developments and improvements in the radio industry and other lines emerging from it; such developments on sound and conservative lines were the life-blood of a concern like theirs. While the results of trading must be considered disappointing, they were perhaps better than might have been expected in the circumstances. Mr. W. H. Goodman (managing director) spoke of the company's activities and made particular mention of the installation of mica condensers at the Rugby radio station, which, he said, were the largest ever made. The report and accounts were adopted.

United River Plate Telephone Co., Ltd.

The directors' report for the past year states that the revenue was £2,023,002 and the expenses were £1,618,858, leaving a balance of £404,144. After deducting debenture interest and preference and interim ordinary dividends there remains £266,644, which it is proposed to distribute as follows:—Final dividend of 5 per cent. on the old ordinary shares (making 8 per cent., free of tax); a dividend of 5s. per share on the last issue of ordinary shares, free of tax; leaving £38,644 to be added to the amount brought forward and carried to the current year's accounts. The progress of the company is satisfactory, although delays in the delivery of plant have retarded the rate of connecting up subscribers. Sufficient equipment is in course of manufacture to enable the company to meet the demands of the public. Further capital will be needed and it is proposed to create 200,000 shares of £5 each, raising the nominal capital to £6,000,000; it is not intended to make an immediate issue. The meeting was held on Tuesday last.

Electric Construction Co., Ltd.

This company's report for the year ended March 31st last records a net profit of £37,250, to which is added £21,411 brought forward, making £58,931. Interim dividends absorbed £11,197, and it is proposed to allocate the balance (£47,734) as follows:—Final dividend on the 7 per cent. preference shares, £2,197; final dividend at the rate of 9 per cent. on the ordinary shares, making 7½ per cent. for the year, and a bonus of 2½ per cent., £21,000; £3,000 to staff superannuation fund; leaving £21,537 to be carried forward. The report says that the general depression in trade reacted on the electrical manufacturing industry, and severe competition continued to prevail. Export business showed some contraction, but in the circumstances the directors consider the results satisfactory. The death of Sir Henry Mance is recorded, as is the appointment of Mr. W. M. Furniss, manager of the Wolverhampton works, to the board. The meeting was to be held yesterday (Thursday).

French Companies.

The *Compagnie Continentale Edison* proposes to pay a dividend of 37.50 fr. per share out of net profits of 1,626,000 fr. for 1925, as compared with 35 fr. in the previous year.

The accounts of the *Compagnie Française Thomson-Houston* show, after provision for depreciation, net profits amounting to 11,754,000 fr. for 1925, as compared with 14,940,000 fr. in the previous year.

The *Société Petrier, Tissot and Raybaud*, Lyons, maker of electrical apparatus, records net profits of 526,000 fr. for 1925, as compared with 675,000 fr. in the preceding year; it is proposed to maintain the dividend at 15 fr. per share.

The *Société des Appareils Electriques et Compteurs Garnier*, Lyons, reports net profits of 402,000 fr. for 1925, as against 390,000 fr. in 1924, permitting of the payment of a dividend at the rate of 75 fr. per share, as against 65 fr. in 1924.

The *Compagnie Générale de Télégraphie sans Fil* records net profits of 7,308,000 fr. for 1925, as compared with 7,250,000 fr. in 1924; the dividend is again at the rate of 45 fr. per share.

The *Société d'Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine* reports a net profit of about 9,000,000 fr. as compared with 8,000,000 fr. in 1924. The dividend is at the gross rate of 45 fr. per share as against 40 fr.

The *Société des Magnetos* states that the turnover in 1925 appreciably increased and this development has induced the directors to proceed with an extension of the works constructed two years ago. The net profits at 2,912,000 fr. are greater than in the previous year and the dividend is 26 fr. per share.

German Companies.

The directors of the *Felten and Guilleaume Company*, Cologne-Mulheim, recommend a dividend of 6 per cent. for 1925, as in the previous year.

The *Saxony Works, Light and Power Company*, Dresden-Niedersedlitz, reports a turnover of 24,000,000 marks in 1925, being a large increase over the previous year. After writing off 685,000 marks for depreciation, it is proposed to pay a dividend of 6 per cent. and carry 54,000 marks forward.

The *Land and Sea Cable Works Company*, Cologne-Nippes, states that the works were busy in the first half of 1925, but in the second half the orders received considerably declined, and this condition has continued this year. The net profit was 337,000 marks, as compared with 315,000 marks in 1924, the dividend remaining at 10 per cent.

Swiss Company.—The *Alioth Electricity Company*, Basle, which has become a holding company and is in close relations with Brown, Boveri and Co., Baden, records net profits of 346,000 fr. for 1925, and a dividend at the rate of 5 per cent. on the share capital of 6,000,000 fr.

Clayton & Shuttleworth, Ltd.—The accounts for 1925 show a further loss of £13,071; the preceding year's deficit was £106,203, making a total of £119,274 for the two years, which is slightly reduced by the credit balance from 1923 (£2,196). The company's liability to the Government has

been reduced from £73,295 to £47,500, and £30,000 is to be paid in the current year, necessitating fresh arrangements with the company's bankers. The directors propose a re-organisation of capital. The works and plant have been valued at £208,586, or within £19,000 of the book value, which is considered satisfactory. The sum at the credit of the suspense account includes the concession made by the Government, and the total of that account, £75,749, will be available for depreciation and to set against the debit balance. Meeting: June 15th.

British Electric Traction Co., Ltd.—The directors report that the gross profit for the year ended March 31st last amounted to £300,544, as against £286,587 in 1924-25. After deducting general expenses and loan and debenture interest there remains £171,538, which the directors recommend should be dealt with as follows:—Dividend of 6 per cent. (3 per cent. already paid) on the cumulative participating preference stock; dividend of 8 per cent. (3 per cent. paid) on the ordinary stock; and £22,493 to undivided profits account, making that account £294,490. The amount standing to the credit of the reserve account is £520,000. The average revenue from investments rose from 5.52 to 5.91 per cent. Sir E. C. K. Ollivant has resigned from the board and Viscount St. Davids has been appointed a director. Meeting to-day (Friday).

Madras Electric Supply Corporation, Ltd.—The net profit for 1925 was £45,386, an increase of £12,407, and to this is added £6,185 brought forward, making £51,571. It is proposed to pay a final dividend of 5½ per cent., free of tax, again making 8 per cent., tax free, for the year; to transfer £10,000 to general reserve; and to carry forward £5,550. The rate of increase of sales was retarded by the closing down of two bulk supply consumers, but otherwise progress was satisfactory. The tramways showed a balance of £21,515 (against £24,124 in 1924), after providing for debenture interest, &c. A dividend of 6 per cent., free of tax, has been declared on the ordinary shares and a balance of £7,515 is carried forward. Meeting: June 16th.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The gross revenue for the year ended December 31st last amounted to £1,953,927, and the balance, after deducting £691,003 for ordinary expenses and £256,514 for maintenance, &c., to £1,006,410. After meeting taxation and debenture interest and adding £409,141 brought forward, there remains £1,263,435, from which £450,000 has been transferred to the general reserve. The dividends, totalling 10 per cent., free of tax, for the year, absorb £400,000, leaving £413,435 to be carried forward. The duplication of the Cocos-Fremantle section was successfully completed in March last. The meeting was held yesterday (Thursday).

Cawnpore Electric Supply Corporation, Ltd.—The directors report a surplus of £58,874 for 1925. The deduction of debenture interest left £45,743, to which was added £1,248 brought forward, making £46,991. After transferring £10,000 to depreciation and renewals reserve and £3,000 to general reserve, writing off £2,560 from share issue expenses, &c., and paying the preference and interim ordinary dividends, there remained £15,460. A final dividend of 7 per cent. on the ordinary shares (making 10 per cent.) and directors' commission, absorb £11,760, and £3,700 is carried forward. The meeting was held on Tuesday last.

Prospectus.—*Lancashire United Transport & Power Co., Ltd.*—This company, formerly known as the Lancashire United Tramways, Ltd., has this week invited subscriptions to an issue of £250,000 six per cent. first mortgage debenture stock at 93 per cent., principally to provide the money required to redeem the outstanding balance of £202,671 prior lien debenture stock. The list is to close to-day (Friday) or earlier.

Submarine Cables Trust.—Sir John Denison-Pender, G.B.E., presided at the annual meeting last week, and in presenting the report stated that the profit for the past year had been sufficient to cover the 6 per cent. interest, free of tax, to the certificate holders, and to enable them to redeem 210 certificates, leaving 330 outstanding. After the next drawing of certificates, probably in May, 1927, the trustees hoped to be able to take the necessary steps to terminate the trust which was started in 1871. During its existence the value of its holdings had doubled.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted:—

Newcastle-upon-Tyne Electric Supply Co.—550,000 ordinary shares of £1 each, fully paid, Nos. 1,762,682 to 2,312,681.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Electrical Finance and Securities Co., Ltd.—76,162 shares of £1 each, fully paid, Nos. 1 to 76,162.

Madras Electric Supply Corporation, Ltd.—23,600 5½ per cent. (free of income tax) cumulative preference shares of £1 each, fully paid, Nos. 303,201 to 326,800.

Colombo Electric Tramways and Lighting Co., Ltd.—The accounts for the year ended December 31st last show a net profit of £108,416. After providing for debenture interest, &c., and adding the balance brought forward, the amount available is £128,591. From this £39,933 is transferred to general reserve and renewal fund, which after certain writing-off amounts to £250,000. A dividend of 15 per cent., free of tax, is recommended; this will leave £69,029 to be carried forward.

Iron Trades Employers' Insurance Association, Ltd.—The premium income for 1925 was £543,447, and sundry additions, including the balance brought forward, give total receipts of £672,552. Of this £468,855 has been set aside for compensation and incidental expenses and £64,808 for management expenses, &c. A return at the rate of 20 per cent. of the workmen's compensation premium for 1925 is recommended. Sir J. E. Thornycroft, K.B.E., has taken the place of Sir John Dewrance, K.B.E., on the board, and the appointment of Mr. F. J. West as a director is recommended.

China and Japan Telephone and Electric Co., Ltd.—The accounts for 1925 show a net profit of £18,639; to this is added £8,162 brought forward, making £26,801. It is proposed to transfer £10,000 to reserve, to pay a dividend of 20 per cent. and a bonus of 10 per cent., both free of tax, and to carry forward £4,873. The sale of the company's undertaking in the Hong Kong area to the Hong Kong Telephone Co. was completed in July, 1925. The Hong Kong Co. has declared a dividend for the six months at the rate of 8 per cent. per annum. The meeting was to be held yesterday (Thursday).

Ruston & Hornsby, Ltd.—The accounts for the year ended March 31st last show a credit balance of £152,551, and an available sum of £80,170, after deducting depreciation and debenture interest. The addition of £69,887 brought forward gives £150,057. From this are deducted preference dividends paid to December 31st, 1924, and it is proposed to pay one year's dividend on the two classes of preference shares, and a dividend of 2½ per cent. on the ordinary shares, leaving £28,307 to be carried forward.

J. G. White & Co., Ltd.—This company, which operates through subsidiary concerns, records a net profit of £8,156 for the year to February last. Out of this £7,367 is written off in respect of investments, leaving £789, which is placed against a debit balance of £244,789 brought forward, reducing it to £244,000. The debit balance is due to the writing-off of advances to two subsidiary companies. The directors are considering a scheme for the reorganisation of the company's capital and hope to put proposals forward at the annual meeting on June 14th.

West African Telegraph Co., Ltd.—The net revenue for the past year was £14,318, and after providing for income tax and adding £2,030 brought forward there remains £13,374. The directors propose to transfer £3,000 to general reserve, to pay a dividend of 4 per cent., free of tax (as in 1924), and to carry forward £1,131.

Havana Electric Railway, Light and Power Co.—The gross earnings for 1925 amounted to $15,309,372 and the net earnings to $7,242,060. Dividends of 6 per cent. have been paid on the preferred and common stock and $5,059,845 is carried forward.

Stanton Ironworks Co., Ltd.—The directors recommend a final dividend of 6 per cent., free of tax, on the ordinary shares, making 10 per cent., free of tax, for the fifth year in succession.

New Issue.—*Ericsson Telephones, Ltd.*—The recent issue of 99,980 seven per cent. cumulative preference shares at £1 each was considerably over-subscribed. Letters of allotment and regret in respect of the issue were posted on Monday.

Anderston Foundry Co., Ltd.—Out of a profit of £13,076 the directors propose to pay a dividend of 7s. 6d. per share, as compared with 9s. in 1924-25.

Pennsylvania Water and Power Co.—A dividend of $2 per common share has been declared in respect of the quarter ending June 30th.

British Thomson-Houston Co., Ltd.—The directors propose to pay (on July 1st) a dividend in respect of the half-year to June 15th on the 7 per cent. cumulative preference shares.

Canadian General Electric Co., Ltd.—A dividend of 1¾ per cent. has been declared on the preference stock in respect of the quarter ending June 30th.

Guest, Keen & Nettlefolds, Ltd.—A final dividend of 1s. per ordinary share has been declared, making 10 per cent., free of tax, for the year 1925-26, as in the preceding year.

Quebec Power Co.—Dividends of $1¼ per common share and $1¾ per preferred share have been declared in respect of the quarter ending June 30th.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets are developing upon firm and satisfactory lines. Satisfactory, that is to say, to the present holders of stocks and shares, who view with pleasure the way in which prices steadily advance week by week. There can be no doubt that the reason for the increase of business and of confidence that has come to the markets is due to the collapse of the General Strike, and to the greater feeling of security now felt by the capitalist, large and small. It seems practically certain that for some time past there has been at the back of people's minds an uncomfortable fear of what a General Strike might mean if it should be called. The worst has happened, and the General Strike has shown itself to be

a failure from the principal point of view of holding up the nation and strangling industry.

Relieved of the apprehension, money is going into all sorts of securities, more particularly those of the best-class order. The lists of stocks and shares which are printed here, testify to the favour in which sound Industrials are held by the public. Cable stocks are uniformly harder. There has been a good deal of inquiry for electricity supply shares, though the changes in prices hardly reflect this. In the group of manufacturing and construction shares, the feature is the maintenance of the remarkable advances that have occurred during the past four weeks. New issues are commanding a very general degree of success. It is only necessary for good stock to be offered at a reasonable price for it to be eagerly taken, and for the subscription lists to close very promptly.

The Submarine Cables Trust is coming to an end in the near future and Sir John Denison-Pender, at the company's meeting the other day, mentioned that the market value of the various holdings shows an appreciation of nearly 100 per cent. over the original cost price. Holders have done very well during the fifty-five years of the Trust's existence, and they are likely to receive a handsome bonus at the final redemption of the certificates.

Home Railway stocks are inclined to be dull, as is natural, though the falls are slight and insignificant. The Southern Railway's ambitious suburban electrification scheme, which, it will be remembered, ran into eight million pounds, has now reached its final stage. Underground Electric ordinary shares are 5s. down and the shilling issue, at 10s. 6d., have lost 1s. Districts weakened to 52½. Central London Assented stocks are scarce.

South London Electric Supply are a harder market at 2½. London Electric preference show a modest gain. County of London have parted with some of their recent strength: Bournemouth and Poole are also easier. There is a fair line of Electric Supply Corporation 6 per cent. preference shares on offer at 21s. 3d., with January and July dividends. The yield comes to £5 13s. per cent. on the money. Several thousand English Electric 6 per cent. preference can be obtained at 19s. 3d., to pay 6¼ per cent. on the investment. Dividends in this case are in April and October. British Automobile Traction 8 per cent. preference are available at 25s. 6d. These rank for a further 2 per cent. after the ordinary have received 8 per cent. The preference are in regular receipt of this extra 2 per cent., and, allowing for this, a buyer gets 7⅞ per cent., dividends in February and August.

Rises amongst cable stocks have lifted the prices of Anglo-American preferred and deferred, and all the ordinary stocks and shares in the Eastern list. Following upon the excellent Eastern Telegraph report, the "China" Company issues a statement in which, although the net profit is a trifle less than that of a year ago, the shareholder cannot fail to find satisfaction. The West African Telegraph Company repeats its 4 per cent. tax-free dividend. Marconis have strengthened to 25s., and Marconi Marines are 2s. 6d. up, at 21s. 3d., in sympathy partly with the advancing parent shares—partly on account of the better feeling that characterises the market for shipping shares.

British Electric Tractions are again higher, at 133½, at which the yield on the money is modest at 6 per cent. Foreign traction varieties are steady. The healthier tendency of Mexicans continues to be noticeable. Brazilian Tractions just manage to keep in three figures. Anglo-Argentine Tramways first preference are changing hands in fair quantities around 62s. 6d., the speculative investor being attracted by the yield of 8¾ per cent. on the money. Colombo Electric Tramways declares a dividend of 15 per cent. tax-free on the ordinary shares.

If the manufacturing shares do not exhibit any special advances, the market in them is, nevertheless, so hard as to provoke a jobber to complain that prices are too good. This is a market lament at quotations having reached a level which renders new buyers cautious, though the companies are doing well enough to preclude any desire to sell on the part of holders. British Insulated, Callenders and India Rubber shares are better. General Electrics and Siemens have drooped. At the recent meeting of the Siemens Company, the chairman spoke with hopefulness of the outlook, provided that operations continue as at present, without interruption. On the same day, the British Thomson-Houston chairman referred to a lowering in the margin in his company's profit, owing to the keenness of competition. British Thomson-Houston 7 per cent. preference stand at 23s. 6d. and the 7 per cent. mortgage debenture stock (redeemable) at 105½.

Babcock & Wilcox attract a good deal of business around 52s. Other shares in the iron and steel market are dull, owing to the coal position and the effect of the Armstrong report. The rubber share department is stagnant, business having fallen into humdrum and uninteresting lines by reason of the quietude of the market in the raw material.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom. £	Dividend. 1924	1925.	Price June 7 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	56/-	—1/-	5 0 0
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref. ...	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15		58/3	—⅛	5 12 8
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	23/6	—	5 19 2
do. 7% Pref.	1		7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13½	—	5 11 1
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5⅛	+⅛	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	20/6	—	5 17 1
Newcastle-on-Tyne Ordinary ...	1	7	7	22/-	—	6 7 3
do. 5% Pref. ...	1	5	5	18/-	—	5 11 1
do. 7% Pref. ...	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.... ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	16⅝	—	5 8 6
South London...	1	15	15	2½	+⅛	6 0 0
South Metropolitan Pref.	1	7	7	25/6	—	5 9 10
Urban Ordinary	1	4	7	1⅛	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44/6	—	6 16 0
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	19/6	—	7 18 10
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	65½	—	7 12 8
do. District	,,	8½	8½	52½	—½	8 18 4
Underground Electric Ordinary ...	10	Nil	Nil	3½	—½	Nil
do. do. "A" ...	1/-	Nil	Nil	10/6	—1/-	Nil
do. do. Income ...	Bonds	6	6	100	—	*6 0 0

Telegraphs and Telephones.

		Dividend. 1924	1925.			
Anglo-Am. Tel. Pref.	Stock	6	6	104	+2	5 15
do. Def.	,,	1½	1½	24	+½	6 5 0
Automatic Telephone	1	8	6	2½	—	4 0 0
Chili Telephone	5	6	5	6¼	—	*3 12 9
Cuba Sub. Ord.	10	5	5	7	+¼	7 2 10
Eastern Extension	10	10	10	17⅛	+⅛	*5 11 11
Eastern Tel. Ord.	Stock	10	10	177½	+2	*5 12 8
Globe Tel. and T. Ord.	10	10	10	17⅞	+⅛	*5 11 11
do. do. Pref.	10	6	6	10⅞	+⅛	5 10 4
Great Northern Tel.	10	22	20	28	—	7 2 10
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi...	1	10	10	1½	+1/16	8 0 0
Marconi Marine	1	10	7½	21/3	+⅛	7 1 2
Oriental Telephone Ord.	1	12	12	43/9	—	*5 9 7
United R. Plate Tel....	5	8	8	8⅞	+⅛	*4 19 3 3
Western Telegraph	10	10	10	17½	+½	*5 14 8

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8⅜	—	8 16 0
do. do. 2nd Pref. ...	5	6	6	2⅜	—	10 18 2
do. do. 5% Deb. ...	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord. ...	,,	7	8	133½	+1	6 0 0
do. do. 6% Pref. ...	,,	6	6	111	—	5 8 1
Brazil Traction	100	4	5	100	—	5 0 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	86½	—	5 17 0
do. do. Preferred ...	,,	96/-	126/9	109½	—	*5 16 0
do. do. Deferred ...	,,	129/5	8	131	—	*6 2 2
do. do. Deb.	,,	4½	4½	76	+1	5 11 10
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	6/-	—	Nil
London United Tram. Deb. ...	Stock	4	4	49	—	8 3 4
Mexico Trams 5% Bonds	—	5	5	65½	—	7 12 6
Mexican Light Common	100	Nil	Nil	33½	+1	Nil
do. Pref.	100	Nil	Nil	78½	—	Nil
do. 1st Bonds	—	5	5	71½	—	6 19 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

Manufacturing Companies.

Babcock & Wilcox	1	12	13	52/-	—	*5 0 0
British Aluminium Ord.	1	5	10	2⅜	—	5 0 0
British Elec. Transformer Pref. ...	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅛	+⅛	4 18 4
Brush Ord.	1	10	10	27/-	—	7 5 6
Callenders	1	15	15	4⅛	+⅛	3 12 9
do. 6½% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	8/3	—	4 17 0
do. 5% Deb.	Stock	5	5	83	—	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
,, Ord.	1	5	7½	29/9	—1/-	5 0 10
Henley	1	16	20	4	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber...	1	5	5	23/-	+6d.	*4 6 11
Johnson & Phillips	1	10	17½	3⅜	—	5 15 8
Met.-Vickers Ord.	1	8	8	25/-	—	6 8 0
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	7½	7½	1½	—⅛	5 0 0
Telegraph Construction	12	20	10	27½	—	*4 7 8

*Dividends paid free of Income Tax.

Windmill Electricity Generators.

(*Summary of a Report by the* INSTITUTE OF AGRICULTURAL ENGINEERING, UNIVERSITY OF OXFORD.)

HITHERTO no attempt has been made in this country to investigate systematically the various details of design for the generation of electricity by wind-power, or to offer means whereby manufacturers might obtain authoritative figures bearing on the general problem, or on their designs. Accordingly, the investigations originally undertaken by the research branch of the Ministry of Agriculture and carried out at the Harpenden windmill experimental station of the Institute of Agricultural Engineering* should serve as a contribution to the solution of the problem.

Apart from the purely technical side of the subject, there is the equally important economic side; users of other forms of motive power have reliable figures at their command on which to base their forecasts as to the cost of their generated electricity, but users of windmills are quite in the dark in this respect. In spite of the makers' endeavours to give reliable figures, a windmill is generally installed on a hit-or-miss principle, and there is no doubt that the consequent pausity of reliable data is the main cause of many prospective users deciding to reject this form of power.

Similar vagueness exists with regard to the amount of available winds throughout the year, the critical periods of calm, &c. It is hoped by the collection of data on wind conditions to put all these factors on a more certain footing, so that it will be possible to plan a windmill generating installation with the same security as that which already applies to any other system.

Wind-speed fluctuates with marked rapidity, the range being two or three m.p.h. in low winds and as much as 20 or 30 m.p.h. in high winds. Another fact which the tests established is that the wind-speed is never coincidently the same at two different points, and also becomes greater as the height above ground is increased. If the blade were of the correct stream-line shape, not only would there be no detraction from the pressure on the front of the blade, but there would be a suction effect on the back which would help the front pressure. It is thus seen how important it is to have stream-lined blades, in order to obtain greater outputs from a given-sized wheel. A further consideration must, however, be made; the formation of any eddies, even for quite a distance behind the blade, is fatal to stream-line flow, and any structure behind the wheel is bound to lead to the formation of eddies. Less harm is done by a structure in front of the wheel, and in all mills where completely stream-lined blades are used, the wheel is placed behind the structure, which has the additional advantage of not requiring any direction control, since the wind-pressure on the wheel is behind the pivoting centre, and the wheel is kept in a position facing the wind-stream. It might be thought that, tending as they do to higher efficiency, stream-lined blades would be employed exclusively, but as there is no fuel cost and attention is entirely directed to cutting down first costs and maintenance charges, most manufacturers will remain conservative until stream-lined blades can be more easily and conveniently produced.

One essential component of a windmill generating plant is the storage battery, and while attempts have been made to dispense with this costly item, there is little doubt that any system of windmill generation must include a battery to obtain satisfactory working. An efficient cut-in should operate with a minimum rise of the generator voltage over that of the battery voltage, say, two volts, and should cut out when, and not before, the charging current has reached zero, thus preventing flashing. Usually small sets of, say, ½ kW, have a generator designed to give a constant efficiency of about 60 per cent. over the whole load range; for larger sets a generator is usually employed with an efficiency up to 80 or 90 per cent. at full load; at light loads the efficiency of such a generator will be low, about 30 or 40 per cent. For the voltage range to be as small as possible the field system in smaller sets is usually designed to work on the top part of the magnetisation curve, giving early saturation of the field; in larger sets compounding is introduced, while in still larger sets up to 10 kW, where the greater size justifies more supervision, field-regulating resistances may be fitted. One particular set includes a pressure regulator which keeps the voltage absolutely constant, but the losses in this device are so great that the method is being abandoned.

Seven sets of plant have been tried, representing five makes, as follows:—

No. 1 *Airolite* (Telford, Grier and Mackay, Ltd.). Wheel diameter 14 ft., 18 single concave blades; 1.5-kW, 120-volt, bevel-geared generator.

No. 1a. Same as above, with new wheel, 12 ft. 6 in. diameter, with 12 outer and 18 inner blades.

No. 2 *Garty-Apex* (Glasgow Electrical Engineering Co., Ltd.) Wheel diameter 8 ft., 15 single concave blades; 400-watt, 50-volt, spur-geared generator.

No 2a. Same as above, with new wheel.

No. 3. Similar to No. 2.

No. 4 *Ventimotor* (Patent Lighting Co., Ltd.) Wheel diameter 8 ft. 6 in., 4 semi-stream-lined blades; 250-watt, 50-volt, double-reduction, chain-driven generator.

No. 5 *Aerodynamo* (Aerodynamos, Ltd.) Wheel diameter 29 ft. 5 in., 4 stream-lined blades; 10-kW, 220-volt, double-reduction (2 sets internal), spur-geared generator.

No. 6 *Agricco* (Young, Osmond & Young, Ltd.) Wheel diameter 22 ft., 5 semi-stream-lined hollow blades; 5-kW, 150-volt, double-bevel, spur-geared generator.

No. 7. Similar to No. 4.

The results of the investigations are divided into (*a*) economic, showing the cost per kWh supplied by each plant over a period of one year; (*b*) technical, with curves showing the power developed at each wind-speed, and subsidiary curves derived from these; and (*c*) meterorological, with tables showing the wind conditions throughout the year. The financial charges incurred during the year include interest and depreciation based on the capital cost of the plant and battery, and maintenance; the total output of the generator cannot, for the purposes of these calculations, be accepted as the net available output, since there is necessarily a loss in storage due to the inefficiency of the battery. The figures given as to the cost per kWh produced only hold good provided that the utmost use is made of all the available power. In most cases, however, the plant is larger than is necessary for its load, and as there will be long periods of high winds during which the battery is being overcharged, with consequent waste, a higher charge will be thrown on the units which are actually consumed.

The only true basis of wheel efficiency is that of output/cost and not output/input as is usual. The disk area basis of calculation gives the multi-bladed wheels the highest position, whereas on the blade-area basis the highest points are taken by four- and five-bladed wheels. One four-bladed wheel (No. 5, "Aerodynamo") stands out clearly above the others, even at low wind-speeds, and this margin is so great that it enables the cost per sq. ft. of constructing these blades to be much higher than that of the next best, and yet to maintain the highest efficiency on the output/cost basis. The next highest type on the blade-area basis is No. 6 "Agricco," but it is closely followed (and surpassed at low wind-speeds) by No. 2a "Garty-Apex" with improved wheel (outer trailing-edge of each blade rounded off). No. 7, identical in design to No. 4, is superior to No. 6 and No. 2a at higher wind-speeds, but it is inferior to them at low speeds. No. 1a is fitted with a new "high-efficiency" wheel. No. 1 (the old wheel) and No. 2 (the old "Garty-Apex" wheel, identical with No. 3) are approximately the same. The larger sets (Nos. 1, 5 and 6) have an additional advantage at higher wind-speeds inasmuch as they have a higher generator efficiency than is practicable with the smaller sets, but in the case of Nos. 5 and 6 the results given are not necessarily accepted as final.

The following figures represent the cost per kWh of electricity produced by each mill:—

No. 1.	Capital outlay	£343 0 0
	Annual charges	£48 8 11
	Total output per year	1,370 kWh
	Available output per year	1,028 kWh
	Cost per kWh	11.3d.
No. 1A.	Total output per year	1,780 kWh
	Available output per year	1,336 kWh
	Cost per kWh	8.7d.
No. 2.	Capital outlay	£130 0 0
	Annual charges	£18 2 8
	Total output per year	608 kWh
	Available output per year	456 kWh
	Cost per kWh	9.5d.
No. 2A.	Total output per year	912 kWh
	Available output per year	684 kWh
	Cost per kWh	6.4d.
No. 3.	Capital outlay	£118 0 0
	Annual charges	£16 13 6
	Total output per year	421 kWh
	Available output per year	316 kWh
	Cost per kWh	12.7d.
No. 4.	Capital outlay	£120 0 0
	Annual charges	£15 15 8
	Total output per year	435 kWh
	Available output per year	326 kWh
	Cost per kWh	11.6d.
No. 5.	Capital outlay	£900 0 0
	Annual charges	£130 13 4
	Total output per year	10,195 kWh
	Available output per year	7,646 kWh
	Cost per kWh	4.1d.
No. 6.	Capital outlay	£415 0 0
	Annual charges	£59 4 8
	Total output per year	4,768 kWh
	Available output per year	3,576 kWh
	Cost per kWh	4.0d.
No. 7.	Total output per year	491 kWh
	Available output per year	368 kWh
	Cost per kWh	10.3d.

To the question: Does the cost per kWh of electricity produced by wind power compare favourably with the electricity available from other sources? it may be directly replied that

*Oxford: Clarendon Press, Bulletin No. 1, price 2s. 6d. net.

the wind-mill method of power production does stand in a favourable position. Although at a first glance it would seem that the cost per kWh in the case of the smaller sets is high, it is obviously wrong to compare the results from 250- and 400-watt sets with those from larger plant of other types, and it is questionable whether any other form of electricity-generating plant, of the same rating, will bear comparison with small windmill sets on the score of the cost per kWh of energy produced. The medium-size plant gives figures that will compare favourably with the lighting rates of all but extremely happily situated supply companies, while the cost of the power produced by the larger sets is lower than most lighting rates, and almost as low as the power rates of several public companies. The cost, therefore, of windmill-generated electricity, either for small lighting or for small power purposes, is quite reasonable and such as to justify a wider use. When it is said that the costs compare well with those of supply companies, it is not implied that this form of power should be preferred to public supply: it would be absurd to neglect connection to a main supply line if at all possible.

Reliability and continuity of supply are in very many cases more important than cost, and any satisfactory settlement of doubts on this head will do more to encourage a wider use of windmills than any phenomenally low cost per kWh. Continuity of supply throughout the year will be assured, provided that care is exercised when selecting a plant to plan the load to suit the set at all seasons of the year. It may then be safely taken that there will never be a hitch in the working, except under extremely exceptional conditions, the chances of which are little greater than in any other form of power production. Care should also be taken to select a site in which there is nothing to interfere with the prevailing winds; at the Harpenden station the S. and W. winds, during the period of observation, constituted 75 per cent. of the total hours of wind per year. As regards amount of wind, the Harpenden site is perhaps above the average for lowland country, but in higher and more coastal districts better performances might be expected than those recorded in the report.

Those who, already owning an engine generating set, desire to supersede or supplement it, should have little hesitation in adopting wind-power. All over the country there are engine sets which have had a useful life and are now hardly fit for regular running, but could be used occasionally to charge the battery. The windmill set would provide the bulk of the supply, while the engine could make good any occasional deficiency, thus enabling a smaller plant to be chosen than would otherwise be necessary.

The Electrical Imports of Spain.

The following figures, showing the imports of electrical goods into Spain in 1925, are taken from the recently issued trade statistics. The totals for 1924 are given for purposes of comparison, but it is not possible to show the shares of the supplying countries in that year:—

	Quantities. 100 kilogs.
Dynamos, motors, transformers, switchgear, &c.—	
Total imports (1924)	54,973
(1925)	52,902
of which from:—	
Germany	14,817
United States	10,163
France	7,300
Great Britain	5,311
Sweden	2,392
Belgium	2,388
Switzerland	1,851
Self-contained generating sets—	
Total imports (1924)	3,626
(1925)	3,397
of which from:—	
Germany	1,334
France	1,264
Great Britain	348
United States	154
Switchboards—	
Total imports (1924)	1,402
(1925)	1,332
of which from:—	
Germany	383
United States	274
France	240
Great Britain	173
Electrical fittings (switches, lampholders, &c.)—	
Total imports (1924)	4,513
(1925)	7,810
of which from:—	
United States	2,981
Germany	1,816
Great Britain	1,219
Electrical measuring instruments and parts thereof—	
Total imports (1924)	1,817
(1925)	1,991
of which from:—	
Germany	1,243
France	251
Switzerland	379
Great Britain	44
Stoves, heaters, cookers, irons, &c.—	
Total imports (1924)	460
(1925)	568
of which from:—	
Germany	157
Switzerland	230
Accumulators, dry batteries, and parts—	
Total imports (1924)	4,961
(1925)	7,618
of which from:—	
Denmark	1,672
Germany	1,121
Great Britain	1,036
United States	966
France	917
Norway	501
Wires and cables—	
Total imports (1924)	6,563
(1925)	13,037
of which from:—	
Great Britain	4,926
Germany	4,293
France	1,542
United States	880
Telegraph and telephone switchboards and apparatus—	
Total imports (1924)	1,633
(1925)	3,647
of which from:—	
France	979
Belgium	655
Germany	598
Great Britain	534
United States	397
Sweden	355
Incandescent electric lamps—	
Total imports (1924)	601
(1925)	666
of which from:—	
Holland	411
Great Britain	77
France	5
Electric mercury vapour lamps, searchlights, &c.—	
Total imports (1924)	85
(1925)	82
of which from:—	
United States	33
France	12
Arc lamps and parts, &c.—	
Total imports (1924)	21
(1925)	15
of which from:—	
Germany	10
France	3
Holland	1
Carbons, other electrodes, &c.—	
Total imports (1924)	4,103
(1925)	3,486
of which from:—	
United States	1,181
Great Britain	1,002
Germany	773
France	44
Insulating tapes, fabrics, and tubes—	
Total imports (1924)	206
(1925)	8,159
of which from:—	
United States	4,906
Germany	3,127
Great Britain	22
Switzerland	13

A Topical Exhibit.—In collaboration with the Telephone Development Association, the Automatic Telephone Manufacturing Co., Ltd., principal manufacturer of the Strowger system now in process of installation for the British Post Office throughout Greater London and the provinces, has presented to the Science Museum, South Kensington, actual specimens of typical components of the system. The exhibit, which will be displayed in the Telegraph, Telephone, and Wireless Section of the Museum, comprises four items, separately mounted and arranged for convenient inspection by the public.

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 811.)

THE Standing Committee of the House of Commons resumed consideration of the Electricity (Supply) Bill, which was adjourned during the Whitsuntide recess, on Thursday, June 3rd. Sir Robert Sanders presided.

Discussion was begun on clause 2, which deals with the general powers and duties of the Central Electricity Board, set up under Clause 1.

Mr. G. BALFOUR (Hampstead, U.) moved an amendment to provide that the duties of the Board should be to consider and settle schemes prepared under Clause 4 of the Bill. He said that his amendment merely followed the modification which was agreed to by the Minister in charge of the Bill on the second day of the Committee proceedings. That modification changed completely the character of the Bill. It provided that the duties which were originally intended to be carried out by the Board should be carried out by the Electricity Commissioners. The object of the amendment was to try and carry out in a non-contentious manner that which had been agreed on by the Minister. The Board originally was to frame schemes, but now it was to be constituted as a tribunal to consider schemes which were submitted to it by the Electricity Commissioners. He was simply endeavouring to put into this clause the appropriate words to give effect to the changes already agreed upon; to define the new duties of the Board as agreed by the Committee. If his amendment was carried, he intended to move a further amendment providing that the Board, instead of supplying electricity, should co-ordinate the supply of electricity.

Sir DOUGLAS HOGG, the Attorney-General, said that the Government was not prepared to accept the amendment. There appeared to be some extraordinary misapprehension in the mind of Mr. Balfour. He had repeatedly referred to something which had been "agreed upon" on the second day of the proceedings under which the whole scheme had been completely altered, and to which he contended that effect would be given to by his amendments, under which the duty of supplying electricity was to be no longer one of the functions of the Board. Never had there been a suggestion in the minds of the Government to agree to anything of the kind, and it regarded the duty of supplying electricity as one of the cardinal features of the Bill. The amendment was wholly unnecessary. The clause purported to define the general powers and duties of that Board, and began by saying that the Board should be charged with the duty of supplying electricity, and that the further powers and duties of the Board should be such as were provided under the Bill. One of those further powers consisted of the duties laid down under Clause 4 with regard to the preparation of schemes. But the essential and permanent function of the Board was to carry out the duty of supplying electricity. Before that could be done, schemes had to be settled in order to carry out the plan of the Bill, and for that purpose powers were given in Clause 4, when they came to it, and were referred to in Clause 2.

Mr. ATTLEE (Limehouse, Lab.) opposed the amendment, which he described as a wrecking amendment, and one which would destroy the whole object of the Bill.

Sir J. MARRIOTT (York, U.) said that he had listened with astonishment and dismay to the speech of the Attorney-General. He did not for a moment suggest that there was anything in the nature of an agreement in Clause 1 in the sense in which the word "agreement" was often used in the House, but he did suggest that on Clause 1 such a fundamental change was made in the texture of the Bill, with the assent of the Government, that some members felt that they would be compelled to adhere to Mr. Balfour's present amendment and his consequential amendment. Was it suggested that the Bill was not a Socialistic measure? He was under no misapprehension as to the purposes of the Bill.

Sir JOSEPH NALL (Manchester, Hulme, U.) contended that the Attorney-General let the cat out of the bag when he said that the chief function of the Bill was to set up a State Electricity Department.

Sir FRED. HALL (Dulwich, U.) declared that they were being asked to support a Socialistic measure introduced by a Unionist Government, and Unionist members were being asked to assist in making the Bill appear as innocent as possible. He and many members of the Unionist party were bitterly opposed to the Bill.

Mr. BALFOUR asked the Attorney-General whether he did or did not agree that the functions of the Commissioners and of the Board had been turned round. The Minister of Transport definitely said so at a previous sitting. If that was so, did not the Attorney-General agree that one of the principal functions of the Board would be to consider and settle schemes prepared under Clause 4?

Sir DOUGLAS HOGG: "So far as Clause 4 is concerned, I agree that before the adjournment for Whitsuntide I agreed that, instead of the Board preparing the scheme and putting it up to the Commissioners, the Commissioners should prepare the scheme and put it up to the Board, but it is no more the essential or main duty of the Board to settle schemes than it was previously its main duty to prepare them. The main and permanent features of the Board are to carry out and administer schemes when settled, and that will involve supplying electricity. So far as Clause 4 is concerned, the amendment is unnecessary unless you are going to carry the consequential amendment to provide that the Board should only co-ordinate the supply of electricity, and that the Government regards as vital and as involving the destruction of the Bill."

The amendment was negatived by 37 votes to 13.

Mr. CLAYTON (Widnes, U.) then moved Mr. Balfour's second amendment, to provide that the Board should co-ordinate the supply of electricity, and not supply electricity. The object of the amendment, he said, was to obviate making it obligatory on the Board to supply electricity. There was nothing in the amendment to prevent the Board supplying electricity if no other suitable sources of supply were available.

Sir DOUGLAS HOGG opposed the amendment, which, he said, would take from the Board the duty of supplying authorised undertakers with electricity. Such a proposal went right to the root of the Bill.

Sir JOSEPH NALL, who supported the amendment, said that the main function of the Board would be to interfere with every existing undertaker in the country. In no other country was such a system in force, nor had it been tried, except in Ontario. What was the case for encumbering the electricity supply of this country with the machinations of this new Department? The figures in the Weir Report, on which the Bill was based, were deliberately misleading. The whole case for this attempt at State Socialism in the supply of electricity was founded on a table of consumption of units per head of the population contained in the Weir Report—one of the most obviously misleading documents ever produced. That table had been manipulated so as to prejudice the position of Great Britain. If it was to be the business of the Board to supply electricity, then it would have to charge the distributing undertakers something more on the current distributed than the actual cost at which they generated. If that scheme was carried out, obviously the big industrial areas were going to have to carry, in addition to their own costs, a figure to cover the loss incurred in extending distribution in rural and undeveloped urban areas. He maintained that the existing electricity supply in this country was as efficient as that in any other country. If a State authority of this kind was to interfere with the great undertakings in this country, it was obvious that electrical development was going to be held up for a long time. The great municipalities, no less than the company undertakings, could not proceed with schemes of development during the passage of the Bill, and the time taken for the consideration of schemes framed under the Bill. Hence, at least a year or two must elapse before development would proceed.

Mr. WADDINGTON (Rossendale, U.) declared that the chief need of Lancashire was a cheap supply of electricity, and he doubted whether the Bill would achieve that end.

Mr. SANDEMAN (Middleton, U.) contended that the price of electrical energy would be increased by the expenses of this very costly Electricity Board.

Mr. E. HARMSWORTH (Thanet, U.), in opposing the amendment, said that anyone who had business in Canada and America knew that that business would be impossible to work were it not for a supply of cheap electricity. It was only when one compared America with this country that one realised how far behind British electrical undertakings were. Although the Bill was not perfect, it was a step in the right direction.

Mr. P. J. HANNON (Moseley, U.) said that there was a feeling in the industrial areas that they were not getting served with cheap electricity as well as they might be under some such comprehensive scheme as was contemplated in the Bill.

Mr. G. BALFOUR gave a number of facts and figures to show the growth of electrical development in this country, and asked: "Why gull the country with the cry of 'Electricity for all at a penny per unit'?" His understanding of the functions of the Board was that it should be a judicial body of arbitrators, to whom the Commissioners would submit complete schemes for analysis. He agreed that if there was any hold-up of development anywhere then, in the last resort, the Board must be clothed with full powers to overcome that obstacle. He did not agree that one of the functions of the Board should be to supply electricity.

Mr. LAMB (Stone, U.) said that agriculturists in this country had not a cheap supply of electricity comparable with the supply available in other countries. There was a genuine demand from the rural areas for cheap electricity for power and light. He opposed the amendment, which he did not think would lead to that demand being met. Under present conditions the rural areas had not had a fair chance.

The amendment was negatived by 37 votes to 13.

Mr. KELLY (Rochdale, Lab.) moved an amendment to delete from Clause 2 the words "but shall not, save as hereinafter expressly provided, themselves generate electricity." He explained that he did so in order to ensure that the Board would

be able to engage in the generation of electricity where desirable.

Col. ASHLEY, the Minister of Transport, said it had already been stated that this was not a Socialist Bill, but the amendment was an attempt to extend the scope of the Bill that would make it into a Socialist Bill by allowing the Board perfect freedom to generate electricity. The intention of the Bill and of the Government was that the generation of electricity, as heretofore, should remain, under the Bill, if at all possible, in the hands of private companies or the municipal authorities which were now generating. The Government hoped that in 99 cases out of 100 that would be so, and that private or municipal enterprise would not be interfered with any more than was absolutely necessary to secure co-ordination.

Sir JOSEPH NALL said that in a later clause it was laid down that the Board would not be able to undertake generation unless it satisfied the Electricity Commissioners that it was unable to enter into an arrangement with any authorised undertakers to operate it on reasonable terms. That was rather anomalous, for the Board was the superior authority and not the Commission. He opposed the amendment.

Mr. ATTLEE thought that the Board should be able to take over generating stations and pointed to the London scheme of co-ordination as a precedent.

Mr. G. BALFOUR said that the position of the London undertakings was entirely different from what Mr. Attlee imagined. There was no question of "taking over." The companies came forward voluntarily for powers to group, and many difficulties were encountered.

Sir FRED. HALL said he was entirely in favour of bulk production. It was only by bulk production and super-stations that they could hope to generate and distribute electricity on the most economical lines. But he was sure that no undertakers would refuse to carry distribution lines into areas where there was reasonable prospect of return. Private enterprise had developed the undertakings in the past as rapidly as possible.

The amendment was rejected by 30 votes to 11.

Sir PHILIP DAWSON (Lewisham, W., U.) moved to allow the Board to enter into arrangements with any authorised undertakers or other bodies without first obtaining the approval of the Electricity Commissioners.

Col. Ashley accepted the amendment, which was carried by 32 votes to 12.

The Committee then adjourned until June 7th.

(To be continued.)

Radio-Communication.

Mr. C. F. Elwell on its Past, Present and Future Aspects.

(Abstract of Paper read before the ROYAL SOCIETY OF ARTS.)

IN his recent paper before the above-named Society, Mr. C. F. Elwell reviewed some of the signal services which radio-communication had rendered in the past, and possible future uses. Dr. W. H. ECCLES, F.R.S., who presided, in introducing the author, referred to his past work and achievements, pointing out that, especially during the war years, the genuineness of his improvements in wireless engineering was amply substantiated. Mr. Elwell had supplied large arcs and high masts to various Allied Governments; for instance, at Rome he had erected for the Italian Government, during the war, a station containing two arcs of about 200 kW each and three masts more than 700 ft. high in the record time of about four months, which was a wonderful achievement when one considered the war-time conditions which prevailed and the limitations with regard to materials and labour.

Mr. C. F. ELWELL did not confine his remarks to the achievements of radio-communication alone, because it had helped other arts which, in their turn, had helped radio-communication with its problems. For example, the debt which telephone engineers owed to radio-engineering was now being repaid by the assistance which telephone engineers were giving in the solution of the problem of commercial two-way transatlantic radio-telephony

Dealing first with radio-telegraphy, he divided it into three classes:—(*a*) Communication over distances where wires or cables could not be laid; for example, with moving ships, trains, aeroplanes, motor-cars, &c.; (*b*) communications over distances which otherwise could only be spanned by means of expensive cables, for instance, with submarine cables; and (*c*) communication over distances which otherwise would be served by means of overhead wires or underground cables, *e.g.*, in competition with wire lines. Naturally, radio-telegraphy experienced no serious competition in the first class, and it was along these lines that it rendered its most valuable services. There were to-day about 16,500 ships equipped for the transmission and reception of radio-telegrams, and, to give them adequate service, some 1,600 land stations were being maintained.

The second class was a natural sphere for radio-communication, because of the great expense of laying long submarine cables and their liability to interruption. For a fraction of the cost of a submarine cable a practically uninterrupted service could now be given by two radio stations, which also had the great advantage of being able to communicate with many points. Greater efficiency of transmission was claimed for cables because messages could be sent to the ends of the earth with the aid of a few batteries, whereas the radio engineer in the past had been compelled to use many hundreds of kilowatts to accomplish the same end, but it could not be assumed that this condition of affairs would exist much longer, and it might not be long before the cable companies' strongly entrenched position would be assailed. For already established economic reasons radio could give a very good commercial service more cheaply than cables; the radio stations at San Francisco and Honolulu had caused a reduction of the ordinary message rate from 1s. 6d. to 1s. per word, and of the Press rate from 8d. to 1d. per word. The direct result of the reduction of the Press rate was an immediate increase in the quantity of world's news transmitted to Honolulu, the daily average of about 100 words having been increased to an average of about 1,500. Another example was the admission by the President of the Western Union Cable Co. in his annual report for 1924 that radio was responsible for 30 per cent. of the traffic across the Atlantic. The strategic value of radio to the Empire was in itself enormous. It could not be said that radio had made such an impression in competition with wire-line telegraphy, but it had exerted a healthy influence on the lowering of rates. In times of storm, too, radio had rendered signal services in maintaining communication.

The future possibilities of radio-telegraphy in class (*a*) had not yet been fully developed. The cost of telegrams from ship to shore and ship to ship was excessive, and this class of communication should not be kept on the plane of emergency telegrams only. In class (*b*) advances in radio-communication methods and apparatus should continue to cause reductions in the cost of maintaining communication with distant countries. In class (*c*) the increasing use of underground cables should tend to relieve radio, with its somewhat restricted gamut of wavelengths, for more useful service in the other two classes.

Radio-telephony might in time eclipse radio-telegraphy, and was subject to the same classification. The possibility of employing the ordinary subscriber's apparatus to talk to ships at sea had already been proved, and relaying of wire-line telephony had even been done after the speech had been transmitted 5,500 miles. It was possible to telephone over much greater distances by radio than over submarine cables, and the recent radio-telephone experiments between London and New York showed how close was its commercial application.

Miscellaneous applications included direction-finding, beacons, leader cables, echo depth-recording, time signals, weather reports, and systems for the amplification of speeches to large audiences. Approximately 260 British ships alone had been equipped with direction-finding apparatus, and 85 stations had been equipped for emitting signals of such a nature as to assist ships in locating their position, or to assist aeroplanes in landing. The echo depth-recording system could be used for depths up to 4,000 metres.

A number of problems still open to the radio engineer for solution were mentioned, and, in conclusion, Mr. Elwell urged that, in order that progress might continue, serious amateur investigators should be accorded liberal treatment.

Discussion.

Capt. R. H. RANGER (engineer to the Radio Corporation of America, who is in charge of picture transmission across the Atlantic) said that during the strike he had been swamped with demands to send pictures from this country to America; in fact, it was almost a question whether the transmission of words or pictures should take precedence. He saw the world as nothing but a small room; a signal from a "beam" station went round the earth and came back and echoed eight times, "so that we are in a small room, and the echoes from the wall disturb us." The combination of the radio compass with the gyroscopic compass was a great advance and had made feasible commercial navigation in and out of San Francisco, where fogs were tremendous.

Dr. W. RUSHTON-PARKER asked whether echo depth-recording could be made continuously from a ship steaming at ordinary speed.

Mr. MENZIES (secretary of the Royal Society of Arts) asked whether the use of the two-electrode valve in connection with the precipitation of dust might not have some practical application in the home.

Lieut.-Colonel H. P. T. LEFROY referred to the possible applications of radio in the navigation of aircraft, where drift was very great, and to the importance of developing methods of preventing collisions of aircraft, in view of the great speed at which two aeroplanes approached each other. There were possibilities in the use of the cathode ray, which would give instantaneous warning of danger approaching.

The CHAIRMAN emphasised the fact that high-frequency engineering traversed all sides of physics, and upon it, therefore, all branches of physics and all applications of physics reacted.

Mr. C. F. ELWELL indicated that he would reply fully to the discussion in writing.

Kolster Radio Compasses.—Arrangements have been completed between the Federal Telegraph Co. and the U.S. Coast Guard Service for the installation of Kolster radio compasses on six more of the coastguard vessels, which will make a total of 17 vessels of the coastguard service equipped with such compasses as an aid to navigation.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

Another "PM" Valve.

One of the latest additions to the "PM" group of valves manufactured by the Mullard Radio Valve Co., Ltd., is a low-impedance pattern which is very suitable for loud-speaker operation. Its constants are as follows:—

Filament voltage	1.4-1.8 volts.
Filament current	0.15 amp.
Anode voltage	50-100 volts.
Total electron emission	20 mA.
*Anode impedance	8,750 ohms.
*Amplification factor	5.4.
*Mutual conductance	0.62 mA/volt.

(*At anode volts = 75 and grid volts = zero.)

The valve and its characteristics are shown in figs. 1 and 2; it is primarily a low-frequency amplifier, and is suitable for



Fig. 1.—Mullard "PM2" Valve.

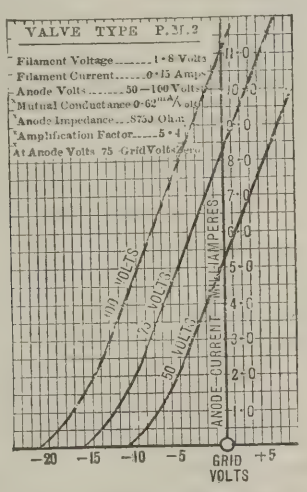


Fig. 2.—"PM2" Power Valve Characteristic Curves.

use when followed by l.f. transformers, loud speakers, or any low-impedance circuit, and negative grid bias voltages of 4, 7 and 10 V should be applied with anode voltages of 50, 75 and 100 V respectively.

When used as a detector the grid return lead should go to the positive limb of the filament and when used for high-frequency amplification an anode voltage of from 50 to 100 may be used. The valve will respond readily to reaction, and its filament is practically invisible when run under correct working conditions; the low working temperature preserves the ductility of the "V"-shaped filament and lengthens its life. Besides the low current consumption another advantage is the large grid swing available; with 100 volts h.p. the grid bias is roughly 20 volts and this permits the valve to deal with strong signals.

The "Remocon" Coil Stand.

A coil stand that has advantages not found in the usual forms of holder is shown in fig. 3, the illustration being self-explanatory. It is marketed by the Economic Electric Co., Ltd., and is used chiefly in American type receiver cabinets,

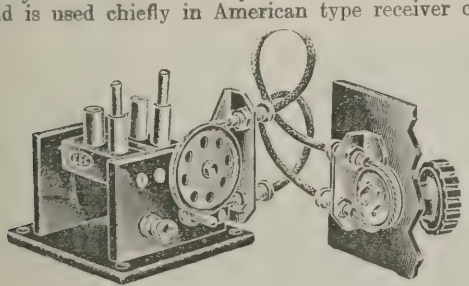


Fig. 3.—The "Remocon" Coil Stand.

the coil stand being fixed in the most convenient position and the control knob mounted remote therefrom elsewhere on the panel without interfering with the working, the movement being transmitted without back-lash by sheathed wires as indicated.

An Hotel Installation.

The wireless distributing scheme which is being installed in the Hotel Cecil London, provides for broadcast reception in the sitting rooms of the different suites of rooms in the hotel. The apparatus is capable of picking up any of the Continental stations in addition to British stations, the super-heterodyne set being used with either frame aerial or outside aerial, the latter having been erected on the roof. A power amplifier raises the volume energy to a level that enables distribution to be made by lead-covered cable throughout to receiving points (of which there are 20) consisting of two single-earpiece lorgnette type receivers and associated key box. The receiver is the well known 7-valve set manufactured by Standard Telephones & Cables, Ltd., will receive on any wave-length between 300 and 3,000 metres, and is simple to operate as there are only two variable adjustments, one being in the aerial circuit, the other in the oscillator circuit. The setting of these two variable condensers is very critical, but the delicate gearing makes the set easy to use. "Wecovalves" are used with bayonet sockets and in order to avoid direct coupling between stages owing to stray magnetic fields, each stage is completely shielded. There are six tuned circuits in the set, of which only two are variable and the frame aerial has its centre point connected to the earth side of the set, which has the desirable effect of improving its directional properties and so increasing the selectivity of the set as a whole. The set is, however, also provided with a special tuning unit which enables it to be used in conjunction with a standard outside aerial.

The two-stage amplifier has a dial switch for controlling the energy delivered into the system and a step-down transformer is provided in order that the output impedance of the amplifier shall balance the impedance of the load into which it works. The power valves need 6 volts for the filament circuits and 120 volts for the anode circuits. Two main feeder cables supply each floor, terminating at small distributing boxes and at the amplifier end on a terminal board arranged so that testing the main cables is an easy matter. The main cables (of which there are ten) consist of No. 18 S.W.G. twisted-twin v.i.r. and l.c. cable. From the distributing boxes on each floor similar lead-covered twin cable extends to each of the receiving points, the cable used for this purpose being No. 22 S.W.G. twin enamelled d.c.c. and l.c. cable. The reason for the use of two distributing boxes on each floor is that should a fault develop in any part of the system on the cabling, it will only be necessary to cut off one-half of one floor whilst such a fault is traced and repaired. The receivers normally hang upon hooks on the wall and a small key box is also provided at each receiving point which contains a switch so that when the receivers are disconnected from the line, in place of them a resistance is connected of such value that it is equivalent to the joint impedance of the two headphones in parallel. The actual load on the system, therefore, is the same whether the key is in the operating or non-operating position, and the volume of sound received at any particular receiver point will be the same irrespective of the number of receiving points in use. The whole of the apparatus in use throughout the system has been supplied by Standard Telephones & Cables, Limited.

Universal Coil Holders.

Coil holders that will appeal to "constructors" on account of their applications are illustrated in figs. 4 and 5, being a product of the Igranic Electric Co., Ltd. The spacing between the contact pin and socket may be varied from 9/16 up to 2 in., rendering the holders suitable for accommodating standard plug-mounted coils, or low-loss coils having widely spaced contacts, such as Igranic "XLLOS" coils, in which the spacing of the contacts may be varied in a similar manner. The pin



Figs. 4 and 5.—Igranic Coil Holders.

and socket are separated by an air space which confines the self-capacity of the holder to a low value. The contact pin may be removed by unscrewing, thus providing for mounting coils having two contact pins. The limbs being independent units, one, two, or three of them may be used as single, two-way, or three-way holders. Ebonite extension handles which facilitate operation and obviate hand-capacity effects are supplied with the two-way and three-way combinations, and the metal parts are nickel plated.

A.T.M. Contributions to Liverpool Hospital.—During the year ended May 29th last the employés of the Automatic Telephone Manufacturing Co., Ltd., raised, by means of a "Saturday fund," £405 for the Liverpool Hospital. Since the fund was instituted in 1912, £2,055 has been contributed to the hospital.

An Experiment in "Customer-Ownership."

Success of a Recent Stock Issue in Canada.

By R. E. TURNBULL.

"CUSTOMER-Ownership" means the owning of the shares in a public utility company by local residents. The advantages of this system are that it is the best method of maintaining the goodwill of the public. If the shares of a company are held by the people who every day make use of the services of that company, it becomes something in the nature of a co-operative society. The public take a greater interest in it and know they are benefiting by any profits it makes. It relieves the company of many false accusations of profiteering. If a man possesses even one share it gives him a sense of ownership and a feeling of pride and patriotism when he sees the business is worked efficiently and on a paying basis.

The idea has of late years become very popular in the United States and Canada, and it was for the reasons given that, a few months ago, the British Columbia Electric Railway Company, Ltd., turned its attention to this method of raising fresh capital.

Readers of the ELECTRICAL REVIEW have long been familiar with the operations of this company, but a few words here about its status will be of interest: It was incorporated in 1887, and has since grown to be a very large undertaking. It supplies transportation, electric light, heat and power and gas, over a territory of 1,500 square miles on Vancouver Island and on the lower mainland of British Columbia in the vicinity of Vancouver and district. The capital expended in the province already amounts to about £14,000,000. The company has 3,000 employés, 87,000 light and power customers, and 30,000 gas customers. There are seven hydro-electric power plants with a total capacity of 202,000 h.p., and it is principally for the purpose of increasing this power capacity and developing the Bridge River site, where a further 700,000 h.p. is available, that fresh capital is required.

Hitherto, the difficulty in selling stocks or shares of the B.C.E. Railway Co. in British Columbia has been the fact that the company is an English company, with its capital in pounds sterling, and its dividends and income subject to English income-tax. For this reason, a subsidiary of the railway company was incorporated in British Columbia and called "The British Columbia Electric Power and Gas Co., Ltd."

The railway company had in the past owned the capital stock of a number of subsidiary companies, such as the Vancouver Power Co., Vancouver Gas Co., Victoria Gas Co., B.C. Rapid Transit Co., &c. The capital stock of all these subsidiary companies was purchased by the new company for $15,248,012, in return for which it issued to the B.C.E. Railway Co. common stock for the same amount. The new company then made an issue of $5,000,000 of 6 per cent. cumulative preference shares whose dividends were guaranteed by the parent company. Of this amount, only $2,250,000 was offered to the public, $1,500,000 being underwritten by a syndicate of bondholders, and the remaining $750,000 (about £150,000) allotted to employés of the company, either to buy for themselves or sell to local residents. The price was $99 to the public. Applications for shares were restricted to 50 shares each, and had to be from residents of British Columbia.

The advertising campaign was scheduled to begin on March 19th, and the selling on March 20th, but news of the impending issue aroused such interest that the forms had to be released on March 15th. On the first day, almost the entire original allotment to employés had been sold. The prospectus stated that the subscription list would be closed on March 31st, but it had to be closed on March 20th, and the company had to request employés to do no more canvassing.

When the final results were complete, it was seen that the company, which had expected to sell $750,000 shares through its employés, had received applications for $5,650,000, and that the employés had subscribed for no less than $602,000 themselves.

The outcome of the "customer-ownership" campaign is that many records have been broken, not only for Canada, but for the whole of the North American continent. Only two companies on the continent are known to have more "customer-owners" in proportion to their customers, and then only after several years of effort. Another record for the first sale is that 47 per cent. of employés of all branches on the permanent pay-roll now own shares in the company. This wonderful response to the issue may be attributed to the high reputation for efficiency, progress, and good service which the company has attained among the residents of B.C. and the fact that a spirit of courtesy has been encouraged among its employés when dealing with the public. The company has lowered its rates repeatedly whilst the large amount of capital spent in the province has been a great help to industry and general development.

The B.C. Electric will now have 11,000 shareholders in the province of British Columbia. These shareholders are not "capitalists" in the ordinary sense of the word, but small investors, such as clerks, labourers, school-teachers, artisans, professional men, &c., who have invested their savings in this local business, and will watch its progress with added interest.

Commenting on the issue and its result, Mr. George Kidd, president of the B.C.E. Railway Co., Ltd., writes:—"W timidly thought of asking our patrons for $1,000,000, or po sibly $1,500,000, and ultimately, with some misgiving, fixe on $2,250,000. But what has happened? In less than week applications for $7,155,400 were in our hands, and whe we closed the list they were still pouring in. Our succes has been almost embarrassing. We really do not need a this money just now, but, rather than disappoint our friend more than is absolutely necessary, we decided to accep $5,000,000. And now a word about our employés. For th confidence so abundantly displayed by the public, we are i a large measure indebted to the efficiency and courtesy of ou employés. The goodwill which has been built up, largel by the employés themselves, enabled them, when asked t sell $750,000 of our shares, to bring in 10,245 applications fo $5,655,900. Surely an astonishing record!"

The Water-Power Resources of Canada.

THE annual review of the water power resources of Canada issued by the Dominion Water Power and Reclamation Ser vice of the Department of the Interior, states that the yea 1925 witnessed the unprecedented increase in Canada's hydro electric installation of 718,984 h.p., bringing the total installa tion for all purposes to the imposing total of 4,290,428 h.p., o 465 h.p. per 1,000 of population. While actual construction during 1925 was confined to only four of the provinces, British Columbia, Manitoba, Ontario and Quebec, considerable acti vity preliminary to construction was evidenced in other pro vinces. While it is hardly to be expected that 1926 wil witness activity equal to that of the past year, there is suffi cient construction under way or in prospect to maintain the high average of recent years. That the limit of individual plant capacity has not been reached even by the great stations recently constructed is indicated by the inception of a plant on the Saguenay River of 800,000 h.p. ultimate capacity, while plans for an enterprise of almost equal ultimate capacity on the Bridge River in British Columbia involving the develop ment of a series of sites are in course of preparation. The known available water power in Canada, from all sources and within the limitations outlined, is 18,255,000 h.p. for conditions of ordinary minimum flow and 32,076,000 h.p. ordi narily available for six months of the year. It is believed that these are conservative estimates since an analysis of the water power plants scattered from coast to coast concerning which complete data are available as to turbine installation and satisfactory information as to stream flow, gives an average machine installation 30 per cent. greater than the ordinary six-month flow power. Applying this, the figures quoted above, therefore, indicate that the present recorded water power resources of the Dominion will permit of a turbine installation of 41,700,000 h.p. The present turbine installation represents only 10¼ per cent. of the recorded water power resources. The following table shows the distribution and development of hydro-electric resources:—

Province.	Available 24-hour power at 80 per cent. efficiency. At ordinary min. flow, h.p.	At ordinary 6-months flow, h.p.	Turbine installation h.p.
British Columbia	1,931,142	5,103,460	414,702
Alberta	475,281	1,137,505	34,107
Saskatchewan	513,481	1,087,756	35
Manitoba	3,270,491	5,769,444	183,925
Ontario	4,950,300	6,808,190	1,784,842
Quebec	6,915,244	11,640,052	1,747,386
New Brunswick	50,406	120,807	44,631
Nova Scotia	20,751	128,264	65,327
Prince Edward Island ...	3,000	5,270	2,274
Yukon and Northwest Territories	125,220	275,250	13,199
Available and developed water power in Canada: Totals ...	18,255,316	32,075,998	4,290,428

During 1925 the new installation in Quebec was 438,300 h.p., of which 360,000 h.p. was contained in a single station on the Saguenay River. In Ontario practically 200,000 h.p. came into operation, of which nearly three-quarters was due to the efforts of the Hydro-Electric Power Commission, leaving a substantial remainder to the credit of private enterprise. In Manitoba no new stations were established, but an existing plant was enlarged by 22,000 h.p. In British Columbia water power activities were marked and nearly 90,000 h.p. was installed.

The 4,290,428 h.p. at present installed throughout the Dominion is apportioned to the following uses:—3,466,422 h.p. (80.8 per cent. of the total) in central electric stations for general distribution; and 481,971 h.p. (11.2 per cent.) installed in pulp and paper mills. In addition pulp and paper mills purchase about 275,000 h.p. from central electric stations, making a total of nearly 757,000 h.p. used in the manufacture of pulp and paper. 342,035 h.p. (8.0 per cent.) is installed in industries other than central electric stations and pulp and paper mills.

At the present time there are 297 hydro-electric central stations in Canada, and of this total 209 stations, with a combined capacity of 2,230,848 h.p., are owned by commercial organisations, while municipal or other public organisations operate 88 stations with an aggregate possible output of 1,235,574 h.p.

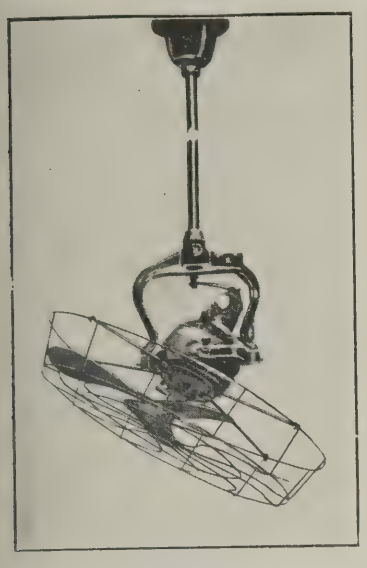


Fig. 1.—Ceiling Fan.

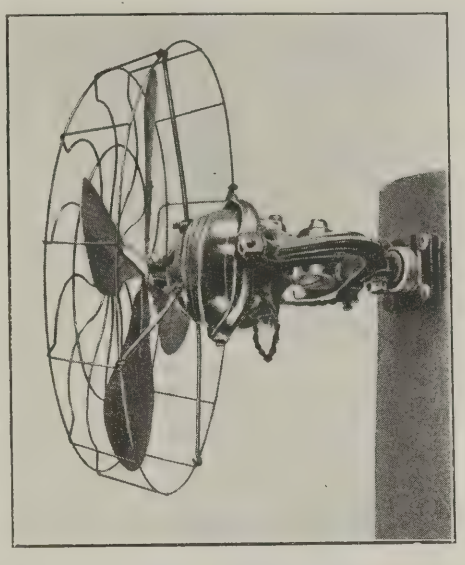


Fig. 2.—Wall Fixing.

The fortunate existence of enormous supplies of pulp wood in close proximity to the water powers, which are readily developable and sufficient to furnish the large quantities of power demanded by this industry, has placed Canada in the favourable position she occupies in this direction. A recent development of interest affecting the power consumption of this industry is the rapid adoption of electric boilers as a means of transforming any surplus of available electric energy into steam for pulp cooking, drying, heating, &c.

The modern development of water power in Canada began with the last decade of the nineteenth century by the end of which approximately 170,000 h.p. had been installed. Since then there has been an ever-growing rate of progress which brought the total to 4,290,428 h.p., culminating in the record installation of 1925. With new uses for electricity constantly appearing there is every reason to believe that the past growth will not only be continued, but accelerated. Chief among these new uses may be enumerated the electrification of steam railroads, the application of electric heat to manufacturing processes, the extension and use of electric boilers for process steam, electric refrigeration, and the many other domestic and commercial uses constantly appearing. A conservative estimate of the capital investment in Canadian water powers amounts to $815,723,890.

Electric Fans.

The Production and Dispatch of the Orbit Oscillating Fan.

With the approach of the summer months the electrical manufacturing and contracting industries are directing their energies to meet the anticipated demand for electric fans, which increases by leaps and bounds every year. We have received from Messrs. Veritys, Ltd., some particulars of the special steps which they have taken to deal with the demand this year, both at home and abroad. A complete range of the new "Orbit" 1926 elliptical oscillating fans (patented throughout the world) is being marketed. The majority of oscillating fans at present on the market travel backwards and forwards in a horizontal plane; but there is a demand for a fan covering a larger fanning area, and it is to meet this demand that the "Orbit" has been produced. It is claimed that the oscillating movement of this machine is unique. It is partly vertical and partly horizontal, resulting in an elliptical movement with an increased area. The fans are suitable for desk, bracket, or ceiling fixing. For the ceiling fans, fig. 1, the oscillating movement is slightly different, being more circular than elliptical, and an angle of 30 deg. from the horizontal is maintained by the fan blades. A special shoe into which the fan securely locks is provided for low ceilings, a downrod and shackle being provided for high ones. In addition a tilting device allows the operation to be directed to different parts of the room, if required, without disturbing the fixing arrangements. This fan, it is claimed, works equally well when fixed to a wall, fig. 2. No brushes or electrical contacts are employed in connection with the movement, and the fan should prove particularly suitable for places where it is not convenient to use the pedestal type. An important feature in the distribution of their products is the employment by the makers of a special means of packing. Each fan is packed separately and fully assembled in a strong cardboard box, fig. 5, so that it arrives at the consumer's end ready for immediate use. No straw or similar packing is used and the internal dimensions of the box are only just sufficient to accommodate the fan. Very consider-



Fig. 3.—Packing Department.



Fig. 4.—Fan-Assembling Shop.



Fig. 5.—The "Orbit," Packed.

able thought has been given to the packing of these fans, and many experiments were carried out before it was considered that a desk fan could be dispatched complete in a cardboard box ready for re-distribution. It is realised that prompt delivery in the fan trade is as important as low prices, and arrangements have been made to keep large stocks of fans for all voltages and periodicities ready for immediate dispatch the same day as they are ordered.

The whole of the fans are made throughout at Messrs. Veritys' Aston Works, Birmingham, where special fans are built to suit the particular requirements in different parts of the world. Fig. 4 is a view of the assembly shop at these works and fig. 3 shows the packing department.

Russian Notes.

The Pskoff Province.—The authorities of the Pskoff province have prepared a five-years' scheme of works of electrification, comprising the construction of hydro-electric works in Pskoff and Novorsjevsk. A hydro-electric works has just been completed in Ostroff. Ten peasant associations are also being formed for the execution of electrical schemes.

The Quality of Manufactures.—As a result of complaints made by the Commission for Ways and Communications and of other large customers concerning the inferior quality of certain electrical manufactures, an investigation is being made by the General Electrical Commission assisted by experts. The inquiry has already extended to the Moscow Cable Factory and the United Lamp Works, and the turn of the Insulator Works is about to arrive. It is proposed to exercise control over the quality of manufactures as a consequence of the investigation.

Inferior Electric Lamps.—The Central Laboratory of the Leningrad Electric Current undertaking has carried out a series of tests with lamps made by the Svetlana factory and the Moscow works of the State Electrical Trust. As a result it has been found that nearly all the lamps require double the quantity of energy which they should consume. The inferior quality of the lamps is attributed to the bad condition of the wolfram filaments. In these circumstances the factories concerned have been asked either to take measures to remedy the evil or to discontinue manufacture.

Works Managers in Conference.—During May a conference took place in Moscow of the managers of the different departments of the works embodied in the amalgamated heavy electrical engineering undertakings known as the State Electrical Trust. It was pointed out that many manufactures, which in pre-war times were imported from abroad, as for instance lamps, h.p. insulators, and large generators and transformers, were now turned out at the works of the amalgamated trust. This fusion has made possible the more economical use of the technical resources, but much remains to be done in this direction. In the course of further development it is considered necessary for a more systematic exchange of experience to be made with other countries and also between the different works in Russia. It was stated that the capacity of the home market considerably exceeded the growth of the production, particularly with regard to standard three-phase and d.c. machines. At the same time it was admitted that the quality of some manufactures turned out was low and improvement was essential.

The Donetz Anthracite Mines.—According to information received by the Donetz Coal Trust, the works being carried out at the Shteroff generating station are approaching completion and the station will be able to afford a supply of energy in September or October. The sub-stations are in an advanced state and the overhead lines have been erected, while the mines are being equipped with electric motors, centrifugal pumps, &c. Altogether the anthracite pits of four mining managements will be electrically equipped by next year.

The Coal Trust and the North Caucasian District Planning Commission are now in negotiation with a view to the construction of a large generating station in this region.

Turbine Construction.—The Leningrad Machine Trust has placed before the Industrial Bureau a statement concerning the construction of turbines, which was commenced at the works of the trust in the year 1922-23. Since then the trust has completed and erected 12 turbines of from 500 to 10,000 kW and of a total capacity of 28,750 kW. At present the trust has in hand 17 turbines of a total of 48,000 kW, while inquiries have also been received for a further 84 turbines. In order to meet the requirements the trust states that it is necessary to extend the works at a cost of 4,866,000 roubles, the extension being spread over three years.

Hydro-Electric Power for Leningrad.—According to a report presented to the Electric Planning Commission by M. A. I. Fidman in connection with the growth of the consumption in Leningrad, the stations supplying that city down to the time of the war used English coal as fuel, but at present they are working on wood, naphtha, and peat. It is considered that the future supply should be obtained from water power; the river Sver offers the greatest facilities for the purpose as it would permit of the erection of three stations of a total of 150,000 h.p. and thus be able to assist in meeting the requirements of Leningrad until 1934.

Pulverised Coal.—The Electric Planning Committee has authorised an expenditure of 17,000 roubles for the purpose of experiments in the consumption of pulverised coal at the "first" Leningrad generating station.

Railway Electrification.—The Council of Labour and Defence has approved a scheme of railway electrification prepared by the State Planning Commission for a period of five years, leaving the financial provision to be settled at the beginning of each budgetary year. A total expenditure of 101,000,000 roubles is contemplated in the five years, of which 4 millions is being spent this year; 13¼ millions is proposed for next year, 22 millions in 1927-28, 27 millions in 1928-29, and 35 millions in 1929-30. Besides the suburban lines in Moscow and the North, which have been referred to on former occasions, the project includes the conversion of the Leningrad lines, and those at Alexandrovsk, Kursk and Nischni-Novgorod.

Railway Construction.—It was recently announced from Baku that the construction of the Sabunchi electric railway was approaching completion. The overhead line between Baku, Sabunchi, and Surachani was ready, and the opening of the railway was expected to take place in February.

Electricity from Finland.—It is announced from Leningrad that the question of purchasing energy from the hydro-electric works now being established on the River Vuoxen, Finland, has been settled. Negotiations are now proceeding with regard to the time of delivery and the construction of the transmission line of a length of about 132 miles. The station in question is to be completed by the end of 1927 and according to the agreement entered into, a supply to Leningrad is to be effected at the beginning of 1928, the demand being 40,000 kW, increasing later to 60,000 kW. The transmission line and technical equipment will be defrayed out of funds provided by the Supreme Council of National Economy.

A Large Station.—It is reported from Kharkoff that preparatory works have been completed for the construction of a large generating station in the town of Chugueve, which will supply energy in the district of Kharkoff. The initial capacity will be 32,000 kW, and will subsequently be increased to 82,000 kW. It is said that the necessary machines have already been ordered from abroad, and that 2,000 men will be employed on the erection of the buildings this summer.

Budget Assignments for Electrification. — The State Planning Commission has approved the method of allotting the total sum of 69,100,000 roubles assigned in the budget for 1925-26 for works of electrification. Of this total the sum of 40 millions is proposed to be devoted to the extension of the regional stations of primary importance, 9,710,000 roubles to the secondary stations, and the balance to other works.

The Productive Programme.—As the highest controlling authority in the matter, the Council of Labour and Defence has just approved the productive programme of the electrical manufacturing industry as submitted by the Supreme Council of National Economy. According to this programme, the output of the industry is to exceed by 63 per cent. in 1925-26 that of the past year. But even the realisation of the scheme will still leave it impossible fully to satisfy the requirements of the country, as the absorbing capacity of the market is now twice that which was manifested in the pre-war period. The value of the gross production in 1925-26 is estimated at 104,900,000 pre-war roubles. The capital expenditure will be 13,000,000 roubles, almost all of which will be devoted to the extension and re-equipment of the existing manufacturing works. With the object of reducing the exceptionally high costs of producing machines and apparatus, the obligation has been laid upon the Supreme Council to see that mass production is undertaken and to take steps to ensure the development of the supplies of raw and semi-finished materials for the electrical industry. At the same time measures are to be taken to increase the efficiency of labour which is said to be disproportionate to the rates of wages which are now paid.

The Volkhoff Hydro-Electric Works.—Having returned from a lengthy stay abroad, Mr. Graftio, the chief engineer of this works, is reported to have stated that he had ensured the delivery of the plant ordered abroad. All accounts had been regulated with the Vickers Co., which had executed the orders given, but had held back the delivery. The works would be ready next December; the erection of seven turbines and four generators had been completed. It was expected that energy would be available from two sets in September.

Telephone Development.—According to a report presented by the electrical section of the Commission on the Restoration of Capital in Industry, the increase in telephone apparatus amounted to 16 per cent. in 1923, 16.3 per cent. in 1924, and 27.5 per cent. in 1925. In order to meet the demand in the present year it will be necessary for the Low-Pressure Trust to manufacture 85,000 telephones and 40,000 line switchboards. The further expansion comprises the production of 100,000 telephones in 1926-27 and 60,000 line switchboards, and 110,000 and 70,000 respectively in 1927-28. At the end of five years the output of telephones must be 125,000, while it is foreshadowed that the manufacture of telegraph apparatus will be diminished in that period.

The Krivoi-Rog Ore District.—A scheme is under the consideration of the Southern Mining Trust for the construction of a works of a capacity of 30,000 kW for the purpose of supplying power and light to the iron ore mining district of Krivoi-rog. By way of a beginning it is proposed to install two 10,000-kW generating sets.

A New Form of Electric-Hydraulic Steering Gear.

By Dr. H. S. HELE-SHAW, F.R.S., and T. E. BEACHAM, B.Sc.

(*Abstract of a Paper read before the* INSTITUTE OF MARINE ENGINEERS.)

THE paper describes some improvements which have recently been introduced in the electric-hydraulic system of steering for ships.

The electric-hydraulic system has been successfully adopted in the Merchant Service, not only for motor vessels but for steamships, and has also been employed by most of the principal navies of the world. No matter what success an invention may have, experience is sure to lead the way to further improvement, and in the new steering gear the following new features have been adopted :—A new, and it is believed, greatly improved variable stroke pump; a control valve for obviating the necessity of reversing the pump itself; and an automatic valve for preventing shocks from the action of the waves on the rudder causing any injury to the structure of the ship.

The pump, which is of the radial, central-valve type, is an improvement on the original Hele-Shaw pump in its application to the steering gear. In place of the rotary cylindrical valve taking the thrust on the cylindrical surfaces, the valve of the new pump runs on roller bearings. Instead of the pressure necessitating two different metals of unequal expansion to secure proper wearing action, the two parts can be made of the same metal (say, cast-iron), and thus very little clearance is necessary, assuring at all temperatures a minimum of leakage or slip. When the steering gear runs for a long period in the zero position, the danger of heating and abrasion of the cylindrical valve is entirely obviated. Thus it is not then necessary to arrange for leakage of oil (often considerable) to ensure lubrication. Another great improvement is in the greater silence of the new pump. The cause of the disagreeable buzzing sound in the old pump has now been discovered, and is entirely obviated in the new pump.

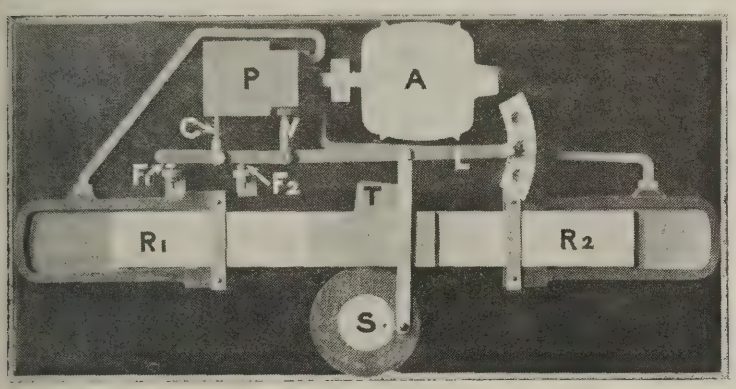


Fig. 1.—Model of Hele-Shaw Steering Gear.

The control valve does not rotate, but has merely a movement in the direction of its axis, enabling a working fit to be obtained, and resulting in an almost complete absence of leakage. The movement of the valves takes place from the central position; while the flow from the pump is always in the same direction before it reaches the valve, its flow from the valves to the two ports for the rams can be reversed. The stroke of the pump is governed by means of the pump spindle on one side of the zero position. Fig. 1 represents a working model, A being the electric motor, P the pump, R_1 R_2 the rams operating directly on the tiller T, and so producing the required movement of the rudder post S, L is the floating link, F_1 F_2 the two fulcrums. It will be easily seen that the two fulcrums produce exactly opposite movements on the pump spindle and control valve spindle respectively. A steering gear of this type has been made for a motor yacht and will replace the hand steering gear now in operation.

The new valve for preventing shocks on the rudder from being communicated to the deck of the ship is arranged to act when the rams by their reversed motion, provide a pressure of less than half the maximum in the cylinders

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Economy and the Minimum Charge.—The recent order made by the Mines Department called for a reduction in the consumption of coal, electricity and gas. As most electricity authorities have instituted a minimum charge to (*inter alia*) encourage the greater use of energy, an interesting point is raised, *viz.*:—Will consumers, who naturally endeavour to reach the minimum consumption, be encouraged to economise if the minimum charge is still insisted upon? The only effort to meet the situation which has so far come to our notice is that of the Electric Supply Corporation, Ltd., at Chelmsford, which has decided not to enforce the minimum charge during the continuance of the coal stoppage. It is probable, however, that the matter is engaging the attention of other suppliers.

Legal.

False "Characters" Charge.

BEFORE the Lancaster Borough magistrates, on May 30th, R. C. Milner, an electrical engineer, recently employed at the Upton Mental Hospital, Hoole, near Chester, was summoned under the Servants' Characters Act, 1792, for making false representations in that he unlawfully pretended to Major G. C. Milnes, electrical engineer to the Lancaster Corporation, that he had been in the service of the Bolton and Salford Corporations, whereas he had never actually so served. Two summonses had been issued, and defendant, who was represented by Mr. J. P. Elsden, barrister, Chester, pleaded guilty.

The Town Clerk of Lancaster (Mr. R. M. Middleton) who prosecuted on behalf of the Lancaster Corporation, said that the information was originally laid in August, 1925, but there had been difficulties in serving the summons because the defendant absolutely denied he was the man concerned. In July, 1925, Major Milnes advertised in the ELECTRICAL REVIEW for a shift charge engineer. Twenty-five applications were received, amongst them one from the defendant, signed "R. C. Milner." The application was very striking, and defendant interviewed Major Milnes, who told him that his face was familiar. Defendant suggested that he might have seen him in the Engineers' Clubs in Manchester or London, but Major Milnes was not a member of either club. Major Milnes then recalled an interview with a "Rollo Milton" in 1923 regarding an application for the position of mains superintendent. He came to the conclusion that they were the same person. Further inquiries disclosed that Milner did not possess the experience claimed in his application, and the testimonials were not from the people he pretended they were from. He had never been in the service of Bolton, Salford, or Eccles. With reference to a statement that he was three years senior engineer with the Leicestershire and Warwickshire Electric Power Co., he was only there three weeks. When the company doubted his competence and called for his original testimonials, he said he would go to Manchester for them, but never returned. The Town Clerk said that a serious state of affairs was revealed. Had this man been placed in charge of a plant valued at £100,000 the whole of the town's electrical undertaking might have been in jeopardy. A long statement was received from the Electrical Power Engineers' Association, which the Town Clerk contended should be read in the interests of the public service, but the Bench would not admit it.

Major G. C. MILNES, borough electrical engineer, Lancaster, gave evidence, and said that he placed defendant on his short list purely on his paper qualifications when he applied for the position.

Mr. W. J. H. WOOD, electrical engineer at Bolton since 1913, said he had never seen the defendant before, and he had never given the defendant the testimonial produced. The statement that he was in the department four years was incorrect.

Mr. J. COLLINGE, works superintendent of the Salford Electricity Department since 1901, said he had never seen defendant, and had never given the testimonial produced.

Mr. ELSDEN, while agreeing the offence was serious, said the suggestion that the works might have suffered by the defendant's employment had not been supported by evidence. Defendant applied for membership of the Electrical Power Engineers' Association, but did not pay his subscription. He thought because he was not a member of that association he was being victimised, and conceived the idea of applying for a job in an assumed name.

The magistrates fined defendant £10 in the first case and £5 in the second, and ordered him to pay £5 5s. costs, or in default two months. He was given time to pay.

Reduction of Telephone Manufacturing Co.'s Capital.

IN the Chancery Division, on June 1st, Mr. Justice Romer heard a petition for sanction to a scheme of arrangement which involved the reduction of the capital of the Telephone Manufacturing Co., Ltd.

For the company, Mr. BISCHOFF said the company, with a capital of a million pounds, had had considerable success, and required further money for the business; the proposed scheme had been prepared for that.

On behalf of two shareholders, Mr. JOHNSTON said he opposed the petition, because there was nothing in the nature of arrangement about the scheme.

His Lordship approved the scheme, subject to certain variation, and dismissed the opposition.

Nelson Electric Co., Ltd.

IN the Companies Winding Up Court, on June 1st, Mr. Justice Romer heard a petition for the compulsory liquidation of the Nelson Electric Co., Ltd., presented by Mr. Eugene Durand, trading as C. Melin & Co., and Eugene Durand & Co., judgment creditor.

Appearing for the petitioning creditor, Mr. GEOFFREY HOWARD said the debt was for £763 9s., which was in part

for goods sold and delivered and in part for bills of exchange given for goods, and since judgment had been obtained on May 14th further bills had matured; the total amount now due to the petitioning creditor was £1,100. A list of other creditors had been handed in, representing a total of indebtedness of the company of £2,369. It appeared that shortly before one of the bills fell due debentures of £1,000 were created, and on April 23rd a receiver was appointed for £600 worth of those debentures, and had since carried on the business of the company.

For the company Mr. MOULD opposed a winding-up order, and read an affidavit of Sir William Henry, director and chairman of the company, from which, said counsel, it appeared that the company's complaint was that it was being made to pay for goods for which it was not liable and that it had not got full value for stock which it had bought. The company had been mishandled in the past, but there was confidence, now, of arranging a scheme to liquidate the company's liabilities in full.

Counsel, therefore, asked that the petition be allowed to stand over, and his Lordship granted an adjournment.

Compensation Awarded to Irish Electric Supply Co.

AT the Circuit Court, Killarney, County Kerry, before Judge E. J. McElligott, K.C., recently, Messrs. Mortimer Shea and John Sheehan, trading as the Kenmore Electric Supply Co., applied for £500 compensation in respect of a portion of machinery and plant of the concern that was destroyed on March 8th last at Gortahinny. After hearing the evidence, the Judge gave a decree for £60, to be levied of the Kenmore and Cappagh electoral divisions of the County Kerry, and allowed £4 4s. expenses.

Electrical Engineer Sentenced.

CHARLES B. SMITH, described as an electrical engineer, of Plymouth, was sentenced to three months' imprisonment by the local magistrates last week on five charges of theft and false pretences.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

The Resistance and Heating of Plunger-type Lampholders.

The comment made by Messrs. A. P. Lundberg & Sons in their letter in your issue of May 28th, and the article on page 689 in your issue of April 30th on the above subject, are very interesting to us, and we venture to suggest that the remedy to overcome this difficulty and the other weaknesses of plungers is to dispense with the plungers. In the J.K.W. Solid Contact Lampholder this is done without material alteration to general design, method of wiring, or appearance.

The J.K.W. Manufacturing Co., Ltd.
J. WILSON, *Director.*

Middlesbrough, *May 28th*, 1926.

Earth Tubes in Radio Sets.

I have read with interest Mr. Killingworth Hedges's letter in the "Correspondence" columns of the REVIEW for June 4th, in connection with my article on earth tubes in radio sets.

I quite agree with Mr. Killingworth Hedges that the efficiency of an earth pipe is as dependent upon its specific conditions as that of a connection made to a water pipe, and although I did not actually state this in so many words, I think I implied it in the latter part of my article.

I am afraid that I am not exactly clear as to the actual construction of the hollow earth pipe referred to, and the exact manner in which it functions during the dry weather. What is necessary, of course, is that the earth tube, plate, or whatever is used for the earth connection should be permanently in electrical contact with a large area of moist ground in the immediate vicinity of the aerial, and preferably directly beneath it. The statements in my article are based entirely on results obtained from water pipes, earth plates, mats, and the ordinary type of earth tube driven into the ground, the data having been obtained from a number of different localities, where various types of subsoil and ground conditions were available.

I note Mr. Killingworth Hedges's remarks concerning the particular tube, and I should certainly be very pleased to test one of these devices, which, I understand, are made by the G.E.C., should an occasion present itself.

Paul D. Tyers.

Watford, *June 7th.*

[The earth tube devised by Mr. Hedges was described in the ELECTRICAL REVIEW of May 3rd, 1918, and May 30th, 1924.—EDS. ELEC. REV.]

The Electrical Association for Women.

Annual Meeting and Luncheon.

THE first annual report of the Association, presented at the annual general meeting on June 4th, states that it was inaugurated in 1924 to interest and serve the cause of women in things electrical. The idea was first mooted by Mrs. M. L. Matthews, a member of the Women's Engineering Society, and that Society undertook the work of organisation. Great strides have been made since its inception, three branches having been formed—at Glasgow, Manchester, and Birmingham respectively. Other branches are in process of formation in S. Wales and Newcastle. Lectures and visits to places of interest were arranged for members throughout the year, including visits to power stations, electrical showrooms, and the E.L.M.A. Lighting Service Bureau, and lectures on the replacing of fuses, &c. The Association also arranged during the year a special course of evening lectures for saleswomen engaged in the electrical industry. These lectures proved to be a great success, and will be repeated in the coming autumn.

The Association is assisting in organising a big women's meeting in Glasgow on June 17th, in connection with the I.M.E.A. Convention. Dr. Christina Barrowman will lecture on the "Remedial Uses of Electricity."

The Association has received support from such bodies as the Institution of Electrical Engineers, the British Electrical Development Association, the Cable Makers' Association, and many other important electrical organisations. It has also been in touch with many electrical organisations in America, and sent a delegate to the National Electric Light Association's Convention at Atlantic City in May.

The Association gave evidence before a Committee set up by the Electricity Commissioners, on the Development of Domestic Electricity, this being the first time the Government heard the woman's point of view on matters electrical.

The immediate development of the work of the Association is the issue in June of a quarterly magazine to be called "The Electrical Age—for Women." This magazine will deal with practical matters of interest to women in the home and electrical housecraft generally.

At a luncheon following the meeting, Lady Cowan, vice-president (in the unavoidable absence of the president, Lady Astor, M.P.), presided over a large gathering of members and guests. After the loyal toast, Lt.-Col. Wilfrid Ashley, M.P., Minister of Transport, proposed "Electricity in the Service of Women," and described the Association as a very vigorous infant, 18 months old. Selling electricity was, he said, as important as generating it; that branch of the industry had not been pushed as well in this country as in the United States and Canada, where electricity in the home was a commonplace—here it was the exception. He used nothing but electricity to warm his own house. Let them all co-operate in putting the Electricity Bill through in the best possible form at the earliest possible moment—continued uncertainty was not good either for the industry or for the country, and the Government was willing to consider any suggested improvement in the Bill.

LADY COWAN, supporting the toast, said that electricity if properly used would relieve the burden of women and other workers, and the E.A.W. was going to remedy our backwardness by creating a demand for electrical and mechanical devices. Electricity, as she had recently seen, was a great help in the United States. The all-electric house ideal was nearer now owing to the interest of women in the subject.

SIR HUGO HIRST, proposing "The Electrical Association for Women," pointed out that British manufacturers, having to cope with 40 or 50 different systems of supply, could not avail themselves of mass production, and it was not their fault if electricity could not be supplied or goods manufactured as cheaply as they should be. He welcomed the Bill and hoped for the results that were so important to the Association. Men were not so well qualified as women to sell apparatus for the home to women; but this was not merely a question of selling, it was a question of service. To give that, the members must undergo training, and it was certain that if they took the matter seriously, they would find opportunities for remunerative employment. The servant question was going to be as prominent here as in the United States, and women would have to use labour-saving apparatus.

Responding, LADY BROOKS, C.B.E., J.P. (president of the Birmingham and Midlands Branch), said the E.A.W. came into existence at the right moment. The Birmingham Corporation undertaking was going ahead rapidly owing to the opening of showrooms; the work of women would hasten the process. They had to convert the conservative-minded working women to new ideas.

Alderman Mrs. HAMMER (chairman, E.A.W.) proposed "Our Guests," remarking that it was the first official birthday of the Association, which was growing rapidly. There were many all-electric houses in England, and more to come, as well as a "university" for training women. The Association had many good friends, and all were united in the common aim.

Mr. R. P. SLOAN, C.B.E., responded, and remarking that he had been accused of obstruction to the Bill, said that nothing was further from his desire. *Some* legislation should be carried through, and the opposition was constructive, not destructive. The phenomenal growth of the business in the North-East Coast area showed that he was out for the most

rapid development that was possible. A Bill was necessary, but the results would be disastrous if it were not framed on proper lines, and very important amendments were required. The excessive legislation in past years had bred constant uncertainty; they wanted a rest, and to get on with the job. He deprecated interference with private enterprise; the Bill, if passed in its present form, would hamper development. The experience of the recent strike had shown users of electricity that they could rely on a continuous supply. If all worked together, in a few years they would be up to the level of the United States and Canada—Bill or no Bill.

Reviews.

The Red Club. By H. R. TAUNTON. Pp. 282. London: Hurst & Blackett, Ltd. Price, 7s. 6d. net.

In this well-written and highly imaginative novel, Mr. Taunton, who is an electrical contractor and an old contributor to our pages, paints the possible consequences of the election of a Bolshevist House of Commons with such obvious sincerity and with such plausibility that the reader is relieved to find at the end that there is still hope for Britain and that red revolution is a bogey and nothing more. Michael P. Schwartz, a German-American millionaire, has matured a plan to wreck the British Empire when he finds an unexpected obstacle in John Sydney, a candidate for Parliament in the coming election that is to return a Bolshevist Government. Sydney's opponent is a follower of Schwartz and organises riotous scenes during the canvassing, the result of which may or may not come as a surprise to the reader. How Sydney falls in love at first sight with Schwartz's ward, how he is kidnapped by the Reds, and how his friends try to save his life in time to rescue the charming ward from captivity and possible death, form the main plot of the story. This is not, however, simply a love story and nothing more. It is true that some of the incidents are too melodramatic and, it is hoped, too impossible for England; but they owe their exaggeration to Mr. Taunton's earnest endeavour to warn the patriotic Briton against the very real dangers to which his easy-going trustfulness has always laid him open.

Broadcast Reception in Theory and Practice. By J. LAURENCE PRITCHARD, F.R.Ae.S. Pp. xii + 259; figs. 163. London: Chapman & Hall, Ltd. Price, 8s. 6d. net.

Mr. Pritchard tells us in opening his preface that "this book is intended for that large and growing class of wireless enthusiasts who wish to do a little more than construct wireless sets from given instructions." It has thus at the start a distinct advantage over many books recently published on radio telephony in that it is written for one definite class of readers, and, as the author is Technical Editor of "Harmsworth's Wireless Encyclopedia," it has the additional advantage of having been written by one who knows the wants of that class of readers, and how their wants can be adequately met.

Provided "the wireless enthusiast" has an elementary knowledge of mathematics, the principles of electricity, and the use of tools, he cannot fail to be benefited by a study of this book, generally as a text book, or more narrowly as a book of reference in those times of doubt or trial, the inevitable crosses of all enthusiasts.

The contents of the book cannot be summed up better than in the words of the title, and the amateur experimenter will find in its pages a self-contained, accurate and up-to-date exposition of the theory and practical application of the principles of broadcast reception.

It is interesting, and possibly prophetic, to find that Mr. Pritchard, like Sir Oliver Lodge in his latest book on wireless, recommends the student to use units of length for capacity and inductance, and it is refreshing to find that he strongly recommends the use of really good transformers and ample batteries, as there is certainly a tendency at the present time for experimenters to spoil their work by ill-advised economy on these two important items in their installations.

In addition to many illustrations, much useful information is given in the form of tables and curves.

This is a book which we hope will be welcomed, as it deserves to be, by a large circle of serious amateur experimenters.

Insulated Electric Cables. Part I. Materials and Design. By C. J. BEAVER, M.I.E.E. Pp. 264; figs. 71. London: Ernest Benn, Ltd. Price 36s. net.

Mr. Beaver needs no introduction to our readers. For many years he has been one of the leading authorities on questions affecting the design and manufacture of cables, and has made valuable contributions to our knowledge of the subject. He has now laid both cable makers and cable users under a further debt of gratitude by putting before them in a concise form the results of long and active experience in the industry. He has produced a valuable book of reference which we think will be the standard work on cables for a long time to come.

The volume which we have received is the first of two, and deals with materials and design. Vol. II, which will appear later, will be devoted to manufacture, testing and use.

In Vol. I the author first traces briefly the development of electric cables over the past 30 or 40 years, and then devotes half the book to a very able and detailed examination of the wide range of raw materials employed as conductors, insulators, and for protective purposes in modern cable manufacture. Design problems, which constitute the second half of the volume, are similarly divided; but, owing to the complicated nature of dielectric knowledge, the greater part of this space is devoted to the consideration of different types of dielectrics, their various electrical, physical, mechanical and chemical properties, and to the several important factors controlling voltage rating.

The book is well illustrated, and contains a mass of valuable data embodied in the form of tables and curves. The diagrams are well drawn, though we must take exception to fig. 31 on p. 170. In plotting the connection between the viscosity and temperature of different cable compounds the author has made the abscissae, instead of the ordinates, the dependent variable. These curves would also have been of greater value if they had been carried to lower temperatures, but we suspect that the limitation was not lack of appreciation of the point so much as difficulty in measuring the values with the particular viscometer used. We feel, too, that it might have been wiser in connection with Table VI of lead analyses, on p. 109, not to have given so many decimal places in the impurity content. The table, as it stands, will give users a wrong impression of the accuracy of ordinary everyday analyses.

Generally speaking, the information contained in the volume is well up-to-date, and shows that the author has kept a watchful eye on the mass of material which has appeared during the past few years. This flood of new developments must have embarrassed him during the preparation of the chapters, and we see that, although he has caught copper cadmium, on p. 53, he has himself been caught by the price of rubber on p. 90.

The very complete treatment of raw materials is evidently based on a long experience, and many readers will find the tracing of the materials back to their origin an absorbing study. There will be some, however, who will feel that the author has gone further back and into greater detail than is justified by the title of the book. The refining of copper and aluminium, for instance, are dealt with very fully, and we fear that, interesting as these origins are, the seeker after cable knowledge may be distracted rather than helped. The shape of the bed in a paper hollander is a long way removed from cable manufacture, and the inclusion of detailed information on the sizing of paper or on the manufacture of wagon grease is evidence rather of the cathocity of the author's interests than of their importance to the subject in hand.

The author is not always strictly logical. For instance, he says on p. 168 that the chief object of using a wood-pulp paper is economy in first cost, bearing in mind, presumably, his own test results shown in the curves on pages 246 and 247, and then proceeds to talk of the futility of comparing the properties of papers on the basis of composition when texture may be the deciding factor. We can scarcely think that the widespread and growing feeling against manila paper is due to the cause laid down by the author on p. 57. The results of electrical and ageing tests made by other investigators are surely more probable reasons than any question of foreign competition.

To carry our criticism over to the opposite side, we feel that in some respects the author is too modest. The reader wonders, for instance, why, on p. 21, he quotes two out-of-date authorities where he might give his own view at the time of writing, and in discussing the merits of rosin oil and mineral oil on p. 67, he withholds his own personal opinion on their relative merits.

In the matter of nomenclature the opening of Section III—Design—with the valuable and spirited attack on philological inexactitudes and other enemies to clearness in discussion, was a happy thought. What a pity, then, that the author from page 1 to page 128 vacillates between the use of the names resin and rosin for the same material!

A striking feature of the book is the evidence in every chapter of the author's practical knowledge of the subject. Good examples are the interesting and chatty pages 102-105 on varnished cambric cables, and pages 154-156 on shaped conductors. Again, on page 175, Mr. Beaver fulfils the function of an authority by dispelling errors with no uncertain hand. The inter-action of the copper conductor, its tinned coating, the rubber, and the sulphur, in a rubber cable are very much misunderstood, but the author's explanation puts the matter very clearly; in fact, the entire chapter on rubber dielectrics being so concise will prove a welcome addition to the existing literature.

Chapters IX and X, on dielectric properties and voltage rating, constitute a valuable summary of a wide and difficult subject showing the author's extensive knowledge of the work published and his appreciation of the limitation of existing theories.

The absence of any mention of the design of dry-core telephone cables strikes us as a serious omission in view of the broad title of the book, particularly as, by the adoption of a paper less than 7 mils thick for the present 264 pages, a chapter on this subject might still have been squeezed in without reducing the dignity of the volume with its 3 lb. 5 oz. avoirdupois and high price, or cutting out the twenty-four pages of advertisements which get in the way whenever the index is required.

In addition to producing a valuable technical treatise Mr. Beaver has rendered a great service to the British cable industry by showing the extent to which attention is given to detail in the production of British cables and, although his publishers

have seen fit to include a foreign manufacturer among the advertisements, we feel that cable users reading the book will be quite satisfied that in placing their orders for cable in this country they are reaping the benefits of the highest scientific and technical skill.

We shall look forward to the appearance of Vol. II with a lively interest.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

Third Readings.—In the House of Lords on June 3rd, the Colwyn Bay Urban District Council Bill and the Kidderminster and Stourport Tramways Bill were read a third time and passed. The Ascot District Gas and Electricity Bill was read a third time in the House of Commons on June 4th.

Post Office Tube.—On June 4th, Col. DAY asked the Postmaster-General if he would state the amount already spent on the work in connection with the Post Office tube railway; the estimated cost for the completion of the scheme; and when it was anticipated that the railway would be ready for operation.

Sir W. MITCHELL-THOMSON said that the amount expended to date was £1,420,000, and it was estimated that about £260,000 would be required to complete the undertaking. It was hoped that the railway would be available for traffic in the autumn.

Breach of Contract by Public Works Employés.—On June 7th, Sir EVELYN CECIL asked the Home Secretary if he would state what steps his department took under Section 4 of the Conspiracy and Protection of Property Act, 1875, and Section 31 of the Electricity (Supply) Act, 1919, for breach of contract against persons employed in the public supply of gas, water, or electricity; and how the posting-up of a notice of these sections in the works as required by law was ensured.

Capt. HACKING, the Under Secretary to the Home Office, said that the matter did not fall within the scope of the Home Office. It was open to any person who was aggrieved to take action if an offence was committted.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from the dates mentioned. In the case of foreign applications, the name and address of the British representatives are also given :—

May 19th.

Design only. No. 457,156. Class 8. Portable instruments and apparatus for use in radio-telegraphy and telephony.—Pell, Cahill & Co., Ltd., 64, Newman Street, W.1.

Resistoflex. No. 468,353. All goods in Class 8.—Spicers, Ltd., 19, New Bridge Street, E.C.4.

Rubite. No. 468,725. Class 8. Electric cables.—W. Brown & Co. (Engineers), Ltd., 89, Douglas Street, Glasgow.

May 26th.

Lewcos. No. 464,502. Class 8. Electric coils. Lewroidal. No. 468,849. Class 8. Coils for use in radio-telegraphy and telephony.—London Electric Wire Co. & Smiths, Ltd.

Orion. No. 465,674. Class 8. Electrical appliances of all kinds.—Magyar Wolframlampa-Gyar Kremenezky Janos Reszvenytarsusag, Budapest. (Dicker and Pollak, 20-23, Holborn, E.C.1.)

Cossor. No. 466,824. Class 8. Thermionic valves, electric lamps (philosophical), vacuum tubes, electric signs, X-ray tubes and apparatus, electric batteries, meters, resistances, switchboards, contact breakers, induction coils, transformers, radio-telephonic and telegraphic apparatus, electric furnaces (experimental), &c.—A. C. Cossor, Ltd.

Weilo. No. 468,248. Class 8. Transformers and radio-telegraphic and telephonic appliances.—H. Wieland, Berlin, S.W.61. (W. Bryson, 29, Southampton Buildings, W.C.2.)

Ivric. No. 463,852. Class 50. An electrical insulating material made principally of ground bone and casein in rods and sheets, and electrical insulators made of such material.—Completion Syndicate, Ltd., 136-138, Bishopsgate, E.C.2.

Linerfex. No. 468,584. Class 50. Insulating material for electrical purposes.—The Ioco Rubber & Waterproofing Co., Ltd.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

28,000. "Electromagnetic mechanisms." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. November 22nd, 1924. (Addition to 195,824.) (251,317.)

1925.

2,413. "Electric batteries." British Battery Co., Ltd., and J. W. H. Reynolds. January 27th, 1925. (251,328.)

2,527. "Radio-receiving sets." C. C. Blackmore. January 28th, 1925. (251,332.)

2,534. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (L. J. J. Schreiber). January 28th, 1925. (251,335.)

2,614. "Directional radio-receiving system." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.). (Western Electric Co., Inc.). January 29th, 1925. (251,337.)

2,617. "Electrical driving mechanism for rotary tools for use in the tre ment of leather and hides or skins." Etablissements Reynier (Soc. Ano and C. Szmukler. March 27th, 1924. (231,434.)

2,622. "Electrically-operated point or switch machines for railways S. L. Glenn and E. E. Pierce. January 29th, 1925. (251,339.)

2,669. "Lamp signalling devices, particularly for use in controlling traffic F W. C. Bilby. January 30th, 1925. (251,340.)

2,685. "Electric secondary batteries or accumulators." H. F. Joel, a January 30th, 1925. (Addition to 230,184.) (251,342.)

2,797. "Electric telephones." M. Walker. January 31st, 1925. (251,349

2,936. "Electric condensers for use in wireless receiving apparatus." A. Peplow. February 2nd, 1925. (251,358.)

2,954. "Current transformers." E. Pfiffner. February 2nd, 1924. (228,57

3,210. "Impulse transmitters for use in telephone or like systems." Au matic Telephone Manufacturing Co., Ltd. June 7th, 1924. (235,136.)

3,214. "Sound-radiating means suitable for use with loud-speaking te phonic receivers and other sound producing or reproducing apparatus." E. Graham. February 4th, 1925. (251,365.)

3,520. "Electric circuits supplied by electric generators driven by win mills." L. Constantin and P. Fortier-Beaulieu. February 12th, 192 (229,291.)

3,891. "Electrical circuits for wireless telegraphy, telephony, or the like C. A. Cleghorn. February 11th, 1925. (Cognate application 8,340/2 (251,374.)

3,958. "Electric discharge devices." Westinghouse Electric & Manufactu ing Co. February 20th, 1924. (229,654.)

4,417. "Electrical connector." L. F. Summers. February 17th, 192 (251,377.)

5,211. "Trunk offering final selectors for use in telephone systems." Sta dard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) a L. P. Lowry. February 25th, 1925. (251,385.)

5,688. "Automatic or semi-automatic telephone systems." Standard Tel phones & Cables, Ltd. (formerly Western Electric Co., Ltd.) and J. R. Goul March 2nd, 1925. (251,387.)

7,016. "Holders for thermionic valves." H. Terry & Sons, Ltd., and A. Terry. March 16th, 1925. (251,397.)

7,777. "Electric differential control system." E. Granat and Compagn des Forges et Acieries de la marine et d'Homecourt. April 19th, 192 (232,571.)

7,902. "Thermionic valves." Edison Swan Electric Co., Ltd., and T. Price. March 24th, 1925. (251,406.)

8,171. "Detectors for high-frequency electrical oscillations." H. Wa (Carborundum Co.). March 26th, 1925. (251,408.)

8,247. "Control of electric switches operated by impulses." Siemens Bro and Co., Ltd., and H. E. Humphries. March 27th, 1925. (251,410.)

8,470. "Illuminated signs." E. C. R. Marks (Wayne Tank & Pump Co. March 30th, 1925. (251,414.)

8,964. "Control of dynamo-electric machines." British Thomson-Houst Co., Ltd. April 3rd, 1924. (231,891.)

9,594. "Headlamps suitable for use on motor-cars." G. Herbert. Apr 14th, 1925. (Cognate application 12,176/25.) (251,417.)

10,276. "Detecting devices for electric circuits." British Thomson-Houst Co., Ltd., H. C. Wheat, and F. M. Cocksedge. April 20th, 1925. (251,425.)

11,046. "Method and device for detecting and locating ores by electr magnetic means." E. C. R. Marks (Aktiebolaget Elektrisk Malmletning April 28th, 1925. (251,429.)

12,428. "Electric motor-starting switches." Brookhirst Switchgear, Ltd and J. A. Hirst. May 13th, 1925. (251,440.)

13,137. "Shades or reflectors for electric lamps." R. R. Palmer. Ma 20th, 1925. (251,445.)

14,846. "Electrical generators." D. Mendelson. June 8th, 1925. (251,461

16,778. "X-ray tubes." Naamlooze Vennootschap Philips' Gloeilampe fabrieken. July 23rd, 1924. (237,580.)

16,843. "Electrical regulator systems and devices." Metropolitan-Vicke Electrical Co., Ltd. October 14th, 1924. (241,523.)

17,648. "X-ray apparatus." Dr. W. Moppett. July 9th, 1925. (Conve tion date not granted.) (251,477.)

17,922. "Electric furnaces." E. C. R. Marks (Scovil Manufacturing Co. July 13th, 1925. (251,484.)

17,928. "Thermionic valve holders." W. H. Dovey. July 13th, 192 (251,485.)

18,121. "Mercury lamps." H. Nagaoa, T. Asada, and T. Machida July 15th, 1925. (251,486.)

18,814. "Plates for electric storage batteries or accumulators." G. F Judd and W. A. Millington. July 23rd, 1925. (251,487.)

18,815. "Electric storage batteries or accumulators." G. F. Judd an W. A. Millington. July 23rd, 1925. (251,488.)

18,816. "Electrodes for electric storage batteries or accumulators." G. F Judd and W. A. Millington. July 23rd, 1925. (251,489.)

19,474. "System for transmitting electrical impulses, particularly for us in automatic telephone exchange systems." A. Barnay. November 8th, 192 (242,594.)

20,434. "Electrode holders for electric furnaces." D. M. Crist. August 14th 1925. (251,497.)

22,017. "Electrode-holder for electric furnaces." Studien Ges. fur Wirt schaft U. Industrie. September 5th, 1924. (239,522.)

22,026. "Control of polyphase crane-driving or like motors." J. W. Kirk land (Allgemeine Elektricitats-Ges.). September 3rd, 1925. (251,503.)

22,132. "Electric connecting devices provided with automatic cut-outs." E Blattmann. September 4th, 1925. (251,504.)

23 754. "Thermostatic switches for electric heating elements." M Klettner. September 23rd, 1925. (251,510.)

24,365. "Bushings for electrical apparatus." British Thomson-Houston Co., Ltd. September 30th, 1924. (240,839.)

25,241. "Wireless antennæ." J. M. Clark. October 9th, 1925. (251,521.)

25,409. "Switches for electric pocket-lamps and portable electric hand-lamps." Elektrotechnische Fabrik Schmidt & Co. Ges. February 28th, 1925. (248 322.)

26,926. "Fixing device for the magnet of an electricity meter." Soc. Genevoise d'Instruments de Physique. February 3rd, 1925. (247,151.)

26,927. "Ferraris electricity meter." Soc. Genevoise d'Instruments de Physique. July 4th, 1925. (251,536.)

27,093. "Reactive component indicating meter or wattless component energy meter according to the induction principle." Landis & Gyr Soc. Anon. December 24th, 1924. (245,074.)

27,723. "Apparatus for selectively cutting-out a rectifier when flashing-over occurs therein." Akt. Ges. Brown, Boveri et Cie. August 31st, 1925. (251,539.)

28,062. "Insulators." M. F. H. Gouverneur. November 11th, 1924. (242,983.)

28,139. "Arrangement for cooling the stators of electrical machines." Thyssen & Co., Akt. Ges., A. Glaubitz, and R. Simeith. November 9th, 1925. (251,542.)

28,624. "Radiating antenna systems." British Thomson-Houston Co., Ltd. November 25th, 1924. (243,706.)

31,932. "Electrically-actuated horns and the like." G. Ingrassia. December 18th, 1924. (244,798.)

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1926.

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4,802. "Vacuum electric tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. December 31st, 1924. (Divided application on 251,673.) (251,572.)

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Lessons from the United States.

IN his presidential address to the I.M.E.A. on Tuesday last, Mr. R. B. Mitchell, finding little on this side of the Atlantic likely to form a cheerful subject, turned his mental vision westward, and told his audience what he had observed during his recent tour in the United States as a delegate to the I.E.C. Conference. An abstract of the address appears on a later page.

Naturally, Mr. Mitchell was impressed with the large sizes of the generating sets in vogue—conforming, of course, to the dimensions of the power stations; when a station is designed for an output of 400,000 kW, the most suitable size of set is in the neighbourhood of 50,000 kW, the number of sets installed being preferably between, say, 6 and 10. When, and where, a demand of this order exists, stations of corresponding magnitude must be erected; in the neighbourhood of Chicago an installation of 1,000,000 kW is contemplated, in which the generating sets will be rated at 100,000 kW each, but there is no justification on the score of economy, or of first cost, or otherwise for using any set of more than 50,000 kW capacity in this country. As Mr. Mitchell points out, the cost of stations per kilowatt installed is comparatively high in the United States, in spite of the use of large sets. We do not follow his suggestion that when interconnection becomes more general in this country larger sets will be required; it will always be cheaper to carry coal to the load centres than to transmit very large blocks of power over long distances, at the load factors which are conceivably attainable.

Mr. Mitchell was especially interested in the use of steam at very high pressure, which is being developed in America, the high-pressure turbines exhausting into the main steam ranges of plant working at ordinary pressures. As he points out, by this means the economic life of our existing plant may perhaps be extended at moderate cost; a saving of 7 per cent. of fuel is claimed for the system against which must be set the capital charges on the additional plant, probably of costly construction. The use of pulverised fuel he regards as inevitable when larger boilers are required. His reference to the completion of the plant at Lakeside, Milwaukee, is of special interest; this plant is of the type described in our issue of Sept. 11th, 1925, the invention of Mr. S. McEwen, A.R.S.M., in which pulverised coal is stripped of its volatiles by a stream of hot gas and is thus converted into pulverised coke, suit-

able for boiler firing. We pointed out in our issue of Aug. 21st, 1925, that this process offered the hope of utilising coal to the best advantage, including the recovery of the by-products.

Mr. Mitchell does well to dispel the impression that the price of electricity in the United States is materially less than in this country, and his references to the extent to which the ordinary consumer uses electricity in the household are interesting; but unfortunately he falls into the same error as the Weir Committee—that of comparing a most highly developed area (Chicago) with the whole of this country, in respect of energy consumed per head of population. If we reversed the process, we could claim that, as Sir Joseph Nall stated before Standing Committee C of the House of Commons on June 3rd, the urban district of Stretford has a consumption of nearly 800 kWh per head per annum—nearly double the rate of consumption in the whole of the United States; hence the latter is far behind this country in electrical development!

Very significant are Mr. Mitchell's comments on the extensive use of showrooms, the remarkable development of the hire-purchase system, and the attention given to the provision of service to the consumer. All these points, which he considers worthy of imitation, we have constantly pressed upon the notice of our readers as essential factors in the development of the domestic load. The enormous potentialities of that class of business have been recognised by American supply authorities, and are engaging the earnest attention of all progressive undertakings in this country. That is the most hopeful avenue not only to the prosperity of the electrical industries in general, but also to the cheapening of electricity all round, for it offers the best prospect for the improvement of load factor and the consequent reduction of distribution costs, which form by far the largest proportion of the total cost to the consumer, and are much more important than the cost of fuel.

A Domestic Campaign in the Autumn.

The news that a great campaign for developing the domestic load is being planned for next autumn and winter will be welcomed by the entire electrical industry. The immense scope for progress in this branch of electricity supply in the United Kingdom and the benefits that are bound to follow for all sections of manufacturing and installation work are some of the most prominent amongst our present ideas. What we have to do is to find a most attractive way of making an effective appeal to millions of householders. The British Electrical Development Association, maintaining its reputation for looking well ahead and preparing appropriate measures, has decided to carry out an extensive publicity campaign jointly with the Lighting Service Bureau of the Electric Lamp Manufacturers' Association. From October next until the following April this campaign will proceed under the title "Wiring the Homes of Britain." Its popular appeal will take the form of a competition feature offering prizes to non-electrical readers who will study advertisements published in newspapers and journals having an aggregate circulation of 14,000,000 copies, read a book that is being produced by B.E.D.A., and engage in a ballot, particulars of which will be published later in the year. When it is mentioned that the first prize will take the substantial form of a valuable electric house, that the second will be some hundreds of pounds' worth of electrical equipment, and that there will be many other prizes of less value, it will be gathered that the competition will be on such a scale as to be worthy of the organisations that are behind it. There will be conjoint local efforts by B.E.D.A. and E.L.M.A., local exhibition electric houses, meetings and so forth, all of which it is hoped, will excite widespread inquiring interest on the part of the public.

We need do no more at the moment than announce that the organisation of the work is proceeding, and that a very large amount of money is to be expended upon it from the lately-increased funds of B.E.D.A., supplemented by a handsome additional contribution by the Electric Lamp Manufacturers' Association.

A Matter of Price.

Elsewhere in this issue a contributor discusses whether "cheapness" in connection with electrical products and electrical service, in comparison with gas products and gas service, is not receiving too much attention. The superiority of electrical service in the home is one of the publicity man's biggest talking points, of course, but it must not be forgotten, when we appeal to the millions, that the amount of money in the householder's pocket has much to do in many cases with settling his final course of action. While there may be something to be said for our contributor's criticism, it would be idle to question the need for securing low selling prices without sacrificing efficiency of product, giving, at the same time, ample facility for securing prompt assistance with renewals at reasonable prices, and other service accommodation such as gas companies make a practice of giving. It is almost impossible to exaggerate the importance of service—using the word in its wider sense—whether it be that of an electricity department or that of a supplier of apparatus. We must give greater attention to the need for removing vexatious obstructions from the path of the consumer. The electrical way should be made the easy way.

The Railways and the Bill.

On Thursday last week Standing Committee C of the House of Commons accepted an amendment to the Electricity (Supply) Bill, exempting railway power stations operated by railway companies from inclusion in the scheme as "selected stations."

It is true that in most cases such stations are of 25-cycle frequency and are not suitable for immediate connection to stations of other frequencies, but that is a condition which, as we have pointed out, may prove to be only a temporary obstacle; moreover, the use of frequency-changers, though costly, and hardly justifiable in the case of stations of similar load factor, would be perfectly proper in this instance, for the combination of a heavy and continuous traction load with a public supply load is highly desirable.

We have expressed our regret that the Government has made no provision in this Bill to encourage and facilitate the electrification of our railways generally; and our regret is intensified by the apparent intention of the Government even to go out of its way to exclude the railways from the scheme, without obvious necessity. Sir Douglas Hogg, it is true, uttered a pious hope that the railways would some day be good enough to patronise the Central Electricity Board's establishments—but that sort of thing "cuts no ice."

What we wish to emphasise is that the omission of the railway load from the working of the scheme may be fatal to its economic operation, whereas the combination of the two classes of demand would render success practically a certainty.

Electrical Contractors at Brighton.

At the moment of going to press there is every reason to hope that in spite of the difficulties of the times, the first annual Convention of the Electrical Contractors' Association at Brighton will be well attended. The programme of papers and events, which was published in our issue of April 23rd, p. 679, will be adhered to. Delegates will assemble at the Royal Pavilion, Brighton, on Wednesday evening for the reception by the president, Mr. T. E. Alger, followed by a dance. On Thursday the delivery of the presidential address and two papers on "Co-operation and Apprenticeship" will form the more serious part of the proceedings, while on Friday the subjects to receive attention will be wiring rules and registration. With the large attendance of contractors that is expected, and with a table fully loaded with such substantial food for thought and discussion, the E.C.A. should be in for a profitable and enjoyable time.

Glasgow Corporation Electricity Supply.

Dalmarnock Generating Station Developments.

The Glasgow Corporation Electricity Department was inaugurated in 1890, the city in that year agreeing to acquire an undertaking with 300 kW of plant installed and about 30 consumers. By 1893 the Department had bought ground at Waterloo Street and built a new generating station there, which supplied direct current at 100/200 volts.

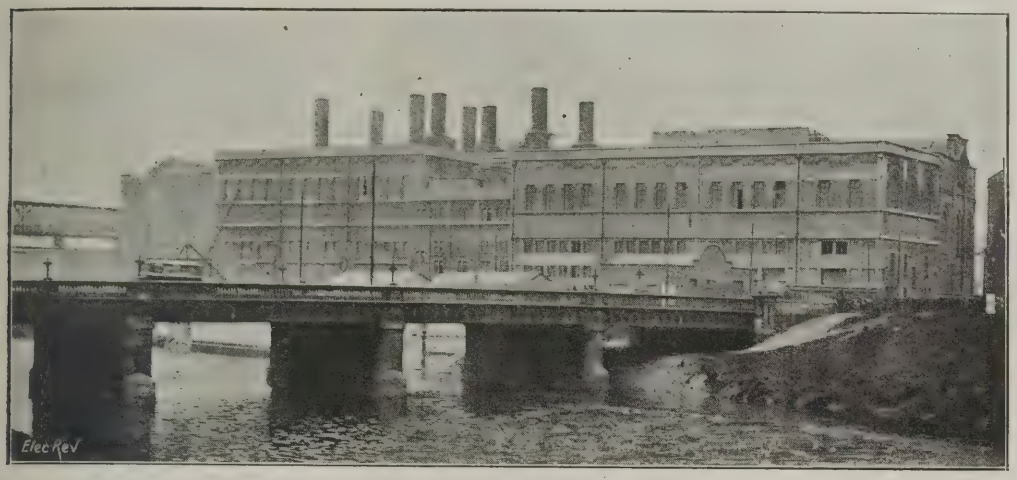


Fig. 1.—The Completed Building from Left Bank of Clyde.

It was soon realised that the demand for electricity would rapidly increase, and suitable sites for power stations were obtained at Port Dundas and Pollokshaws Road. Important installations, which served the city well, were erected at these points during the period when Mr. W. A. Chamen was the city electrical engineer. About that time the Board of Trade altered the regulations for public supply, and the city boldly adopted the pressure of 250/500 volts d.c.—the highest limit allowed. Mr. Chamen resigned in 1905, and was succeeded by Mr. W. W. Lackie, under whose energetic leadership the undertaking continued to make rapid progress until he accepted appointment as one of the Electricity Commissioners.

Mr. R. B. Mitchell, M.I.E.E., is the fourth ruler in the Glasgow electrical succession, and his reign, which commenced in 1920, is worthily marked by the growth of Dalmarnock, the fourth and by far the largest of the stations designed for the Electricity Department; it now carries the bulk of the city's demand for industrial power and lighting, and last winter the peak load of the station was 85,000 kW.

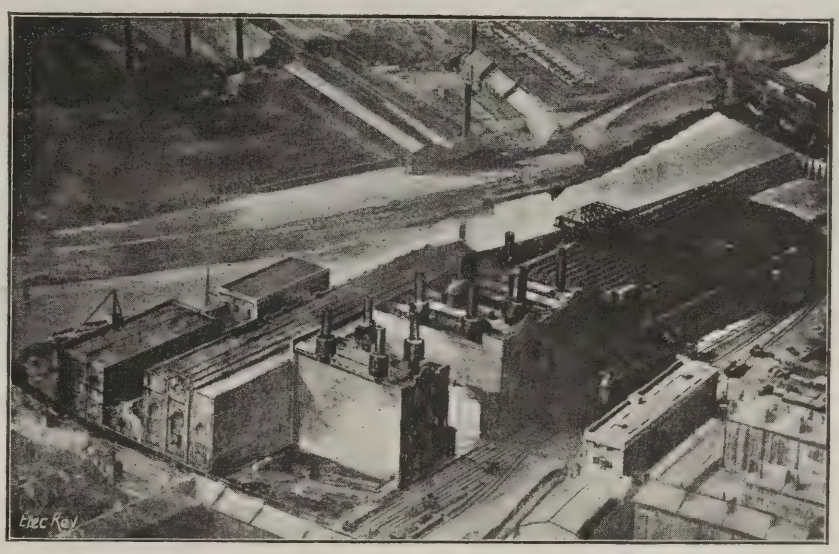


Fig. 2.—Aerial View of Dalmarnock Station.



Fig. 3.—One of the Boiler Rooms.

Glasgow, by process of continued expansion, acquired ready-made central stations at Kelvinside, Govan, and Partick; these have now been relegated to the position of sub-stations. At the end of the last financial year there were 32 important sub-stations in active operation and another three nearing completion; in addition, there were 101 completed sub-stations on consumers' premises. The sub-stations are

of the static type for d.c., and have rotary converters for d.c. distribution.

The total quantity of energy generated for the year at the time of the last (1925) annual report was 220,040,292 kWh, and of this amount 174,917,610 kWh was sold to private consumers. The remainder was expended on lighting 4,030 public lamps and in distribution. The gross revenue for the year amounted to £1,242,119.

The Glasgow Corporation was a pioneer in the encouragement of the all-electric house movement, and has successfully operated an assisted-wiring scheme for small houses. The wiring is done by contractors at agreed rates, and payment by the consumer is spread over a number of years. Over 2,000 separate premises have been fitted under this scheme to March this year. The displacement of gas by electric cookers is making rapid progress, and there is a special rate of ¾d. per unit for domestic cooking and heating, which is attained after 730 hours' use per annum of the maximum demand for lighting. The ordinary domestic lighting rate is at present 4½d. per kWh. An alternative "two-part" rate is available to domestic consumers. The parts are: (A) A fixed service charge per annum; and (B) a charge of ½d. per unit for all energy consumed.

The Electricity Department is extending its showrooms, and has a capable staff specially devoted to publicity and demonstration purposes. Recently an attractive lighting bureau, largely supported by the Corporation, was inaugurated in central Glasgow, and has proved most successful. At the new refuse destructor plant now being installed by the Corporation at Govan electro-magnetic separators will be used for fuel section, and the steam generated will be utilised in conjunction with frequency rectifiers.

Dalmarnock Generating Station.

The Dalmarnock station is on the north side of the River Clyde, with easy access to abundant water supplies; it was designed for an ultimate capacity of 200,000 kW. The switch-house buildings and annexe screen the greater part of the works when viewed from the south bank of the river, as is evident from fig. 1. In the centre of the switch-house buildings is the administrative block, with a battery room in the basement; the 250-volt battery contained therein is used chiefly for excitation. On the top floor the control room is placed, and from this ordered and quiet apartment the giant

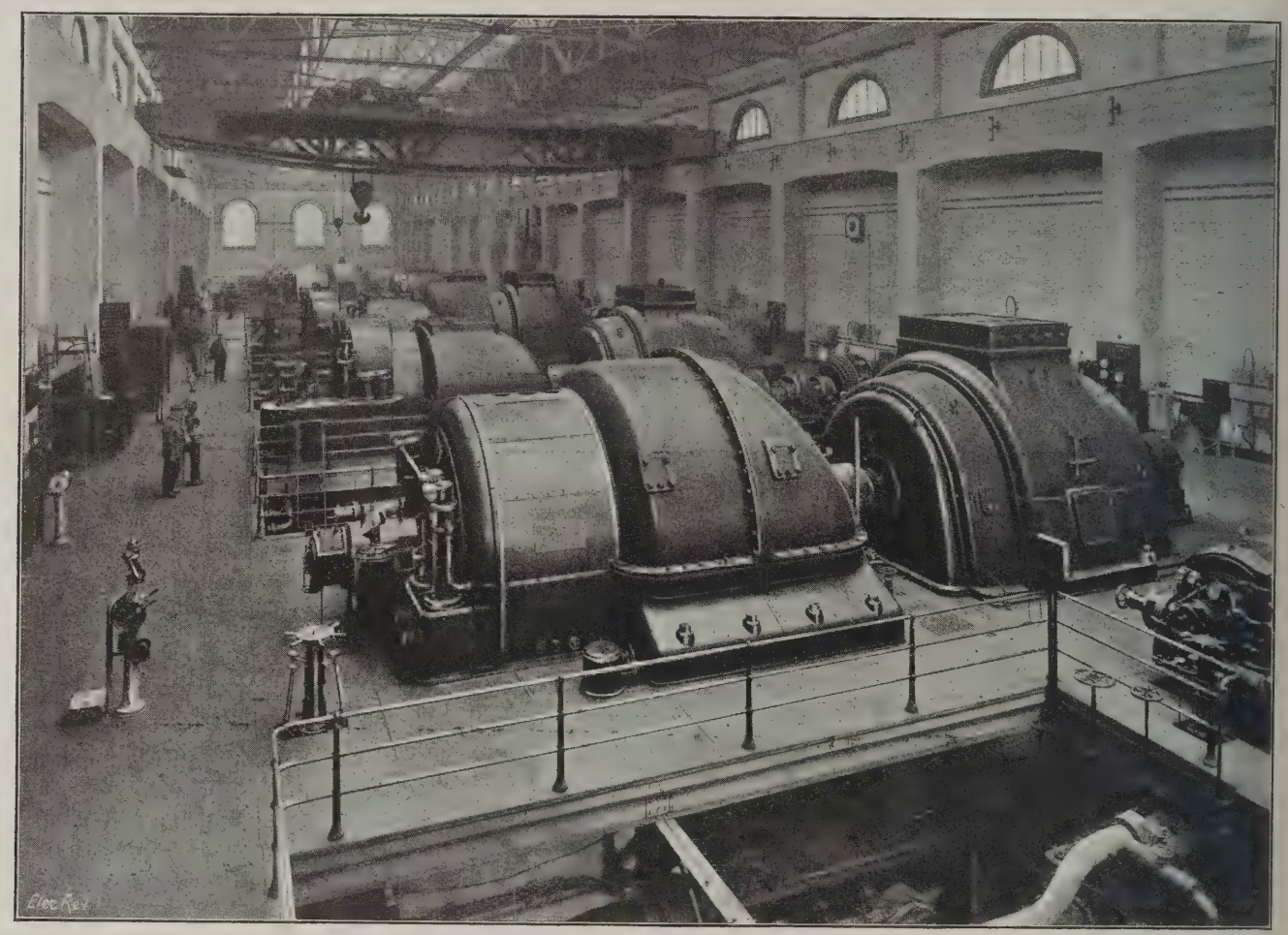


Fig. 4.—The Turbine Room, Dalmarnock Power Station, Glasgow.

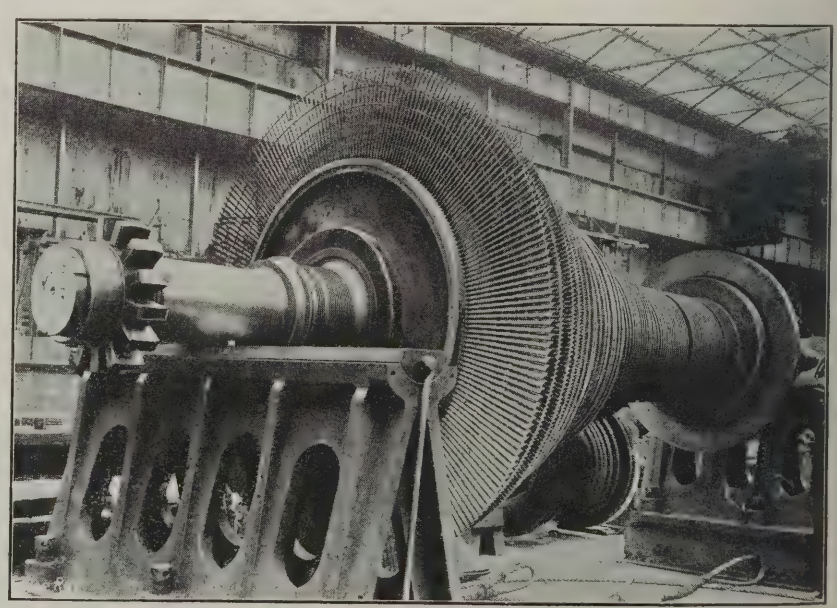


Fig. 5.—A Completely Bladed "Parsons" Turbine Rotor.

switches are operated and the whole electrical control of the station is carried out. A gangway opening from the control room leads to a balcony overlooking the turbine room.

Switch Houses.

The generator and outgoing feeder switchgear is of the metal-boxed, oil-immersed type, and is designed to attain a high degree of safety. The bus-bars are compound-surrounded and completely and continuously metal-clad. The step-up transformers, which raise the generated voltage of 6,500 V to 20,000 V, are housed below the 20,000-volt switchgear.

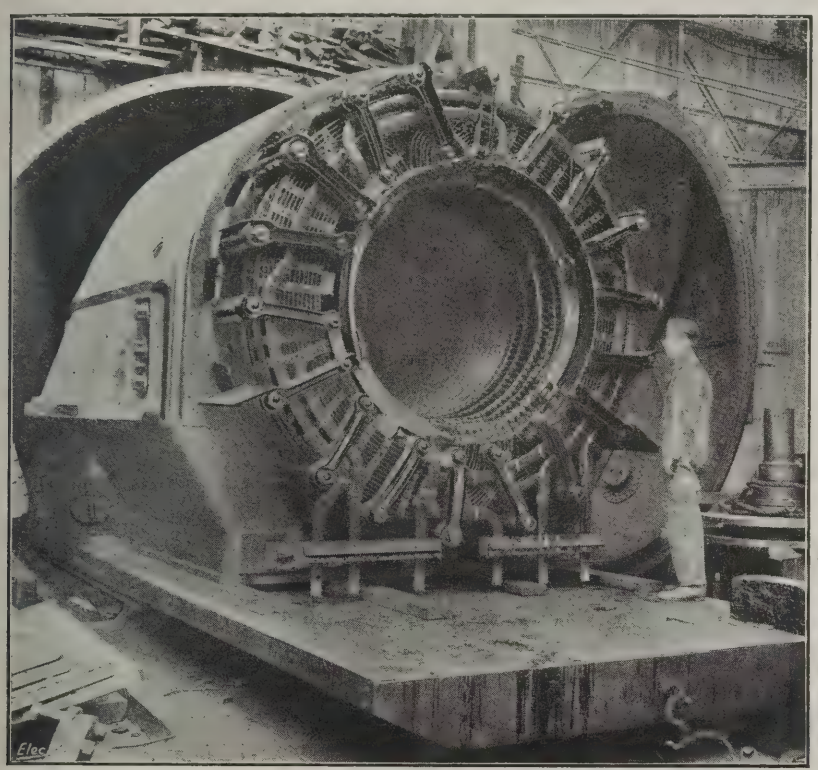


Fig. 6.—A "Parsons" Stator entering the Vacuum Oven.

Each of the large 6,500-volt alternators has its own bank of three single-phase transformers. The individual transformers are rated at 7,800 kVA, single-phase, 25 cycles, and the bank of three forms a 3-phase unit of 23,400 kVA. The n.p. and l.p. windings are sleeved with cambric, and the coils are insulated and spaced by shaped sheets of Fullerboard.

Each transformer is contained in a stout boiler-plate tank adapted for forced oil cooling. Water is circulated to the oil coolers, and relief valves are provided and adjusted so that the oil pressure is in excess of the water pressure. Should leakage occur, the balance ensures that the water cannot leak into the oil.

The transformers have a full-load efficiency of 98.89 per cent. and a half-load efficiency of 99.06 per cent.

Between the switch-house building, which contains these transformers, and the turbine house is a culvert 11 ft. wide, running the entire length of the building. This is being constantly filled from the Clyde, the water being first cleansed from *débris* by barred gratings, endless perforated metal bands, and ingenious rotating disk screens. The water from this culvert is pumped through the turbine condensers and passes to a similar discharge culvert on the other side of the turbine house. Each turbine set requires about one-and-a-quarter million gallons of water per hour.

The Boiler Houses.

The boiler houses, which have their axes at right angles to the turbine house, are clearly shown in fig. 2, which is an aeroplane view of the station. Each room contains eight boilers of the Babcock marine type, and they are arranged four on each side of a room, as shown in fig. 3, which also illustrates the chain-grate stokers. The feed water is heated to a temperature of 150 deg. F. by turbine steam before entering the boilers. The boilers are fitted with integral superheaters designed to increase the steam temperature to a total of 700 deg. F. Green economisers are employed, housed on the floor above the boilers, where also are the induced-draught "Sirocco" fans. Each boiler has a normal evaporation of 50,000 lb. per hour with a hot-well temperature of 150 deg. F., the calorific value of the fuel being taken at 10,500 B.th.u. per lb. The station standard steam conditions are 270 lb. per sq. in. gauge pressure at the turbine stop valves, 700 deg. F. total temperature, and there is an exhaust vacuum at full load of 29.1 inches (barometer at 30 inches).

Two of the boilers now being installed are fitted with Murray tubes, and their performance will be noted with interest in these days of striving for greater thermodynamic efficiency. Each pair of boilers is served by one steel chimney. Until now the ash has been dealt with by suction methods, but the latest boilers are provided with sluicing channels and pits.

The coal storage and handling arrangements are specially extensive and complete, and both electric and fireless steam locomotives are employed for shunting in this department.

The Turbine House.

Coming back to the turbine house, we note that generally the steam from a nest of four boilers passes through two 12-in. diameter pipes to a receiver in the basement, and this receiver is connected to a turbine by a 16-in. pipe. The receivers are themselves interconnected through two 12-in. pipes. The turbo-alternators are each continuously rated at 15,000 kW and generate at 6,500 volts. The condensers and their gear are placed in the basement, as indicated in the foreground of fig. 4, which is a general view of the turbine room.

No. 1 set, in the foreground, is by Messrs. Fraser and Chalmers, with a Metropolitan-Vickers alternator, and has a Mirrlees ejector condenser.

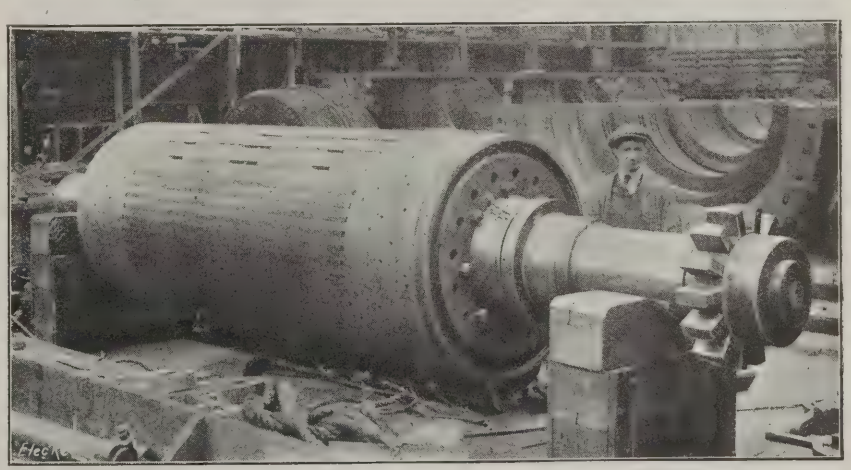


Fig. 7.—The Completely Wound Rotor.

Nos. 2 and 3 are Metropolitan-Vickers turbo-alternator sets with an M.-V. rotary air pump condenser on No. 2 and a Westinghouse-Le Blanc condenser on No. 3.

Nos. 4 and 5 are complete English Electric units, No. 4 having a Mirrlees condenser. This make of condenser has also been adopted for the most recent sets, installed by Messrs. C. A. Parsons & Co.

The Parsons Turbo-Alternators.

These two new sets, Nos. 6 and 7, have single-cylinder turbines of pure reaction design, while the five earlier turbines are all of the impulse type. Fig. 5 is a photograph of the turbine rotor with the mild-steel blades all fixed in position. For the first twelve expansions, axial clearance or "end-tightened blading" is adopted. (This efficient type of blading was described in the ELECTRICAL REVIEW of July 9th, 1920.)

Owing to the large diameters of the steam rotors at their last expansions, and the consequent difficulty of forging in one piece, the necessary diameters have been made up by the use of bolted annular disks so butted that vibration is impossible.

Following Messrs. C. A. Parsons's practice with similar machines, the centre of the shaft has been pierced along its axis to ensure that the forging is free from flaws.

The new alternators have, like the earlier units, direct-coupled exciters, and the voltage regulation is carried out entirely on the shunt field circuits of the exciters.

The stator is illustrated in fig. 6. The core conductors are of "Parsons" helically-stranded coreless cable manufactured in the required D shape.

The rotors are of barrel type, with the windings of copper strip having mica insulation. Fig 7 illustrates a completely wound rotor.

The alternators are provided with the Parsons closed-circuit ventilating system, using surface air coolers. This method is very efficient, and improves the external appearance of the sets, which have a clean and pleasing outline. These sets are designed for 18,750 kW (23,450 kVA), 6,600 volts, 2,050 amperes, at 0.8 p.f., 25 cycles, at the speed of 1,500 r.p.m. They are expected to give highly effective service.

Steel Works Modernisation.

The Electrical Equipment of the New Plate Mill, of the Consett Iron Co., Ltd.

ONE of the most important examples of steel works reconstruction completed in recent years is the plate mills of the Consett Iron Co., Ltd.

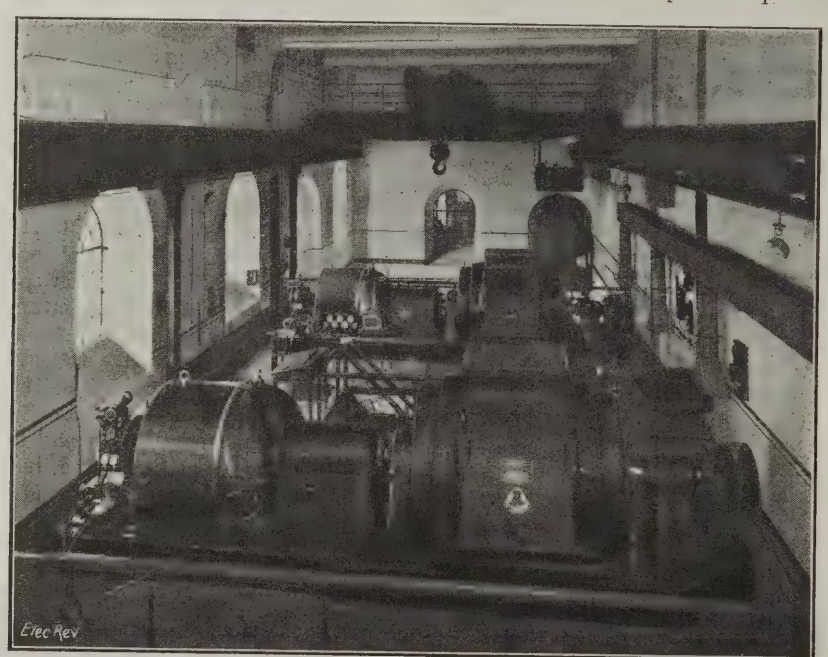


Fig. 1.—Part of the Steel Works Electricity Generating Station.

The site of the original mills having been entirely cleared, new buildings and plant have been installed throughout, the aggregate capacity of the main and auxiliary machinery supplied by the English Electric Co., Ltd., amounting to some 60,000 kW; since 1906 this Company has been responsible for the installation of over 300,000 h.p. of main rolling-mill drives.

The Consett Iron Co.'s new plant consists of: 40-in. two-high reversing slabbing mill with 8 ft. 6 in. rolls; 42-in. two-high reversing plate mill with 9 ft. 6 in. rolls; 32-in. three-high light-plate mill with 6 ft. 6 in. rolls; 30-in. chequer-plate mill with 6 ft. 6 in. rolls.

The slabbing mill is designed for dealing with ingots up to 10 tons in weight, and its product is passed in the form of slabs to both the large-plate and the light-plate mills, the former rolling down to approximately 9/16 in. thick, and the latter to 7/16 in. as averages; a proportion of the light-plate mill product passes on to the chequer mill. Electrical drives have been used throughout for the main and auxiliary machinery, the latter including live rolls, manipulators, screw-downs, shears, skids, cranes, &c. The Consett Iron Co. has equipped a generating station with two 3,000-kW, 3-phase, turbo-generators and a 1,000-kW, d.c., geared turbo-generator, in addition to three 1,500-kW rotary-converter sets for d.c. auxiliary power. As an additional source, a parallel supply is taken from the Newcastle-upon-Tyne Electric Supply Co., which can be either utilised as 3-phase power or converted by the above-mentioned rotary converters to direct current.

Each of the "English Electric" alternators (fig. 1) has an output of 3,000 kW, 3 phase, 40 cycles at 3,300 volts; the geared set consists of a 3,000-r.p.m. turbine driving a 1,000-kW, 550-V, d.c. generator at 600 r.p.m. The converter house (fig. 2) contains two 1,500-kW rotaries; the incoming voltage to the transformers is 3,000 V, and the d.c.

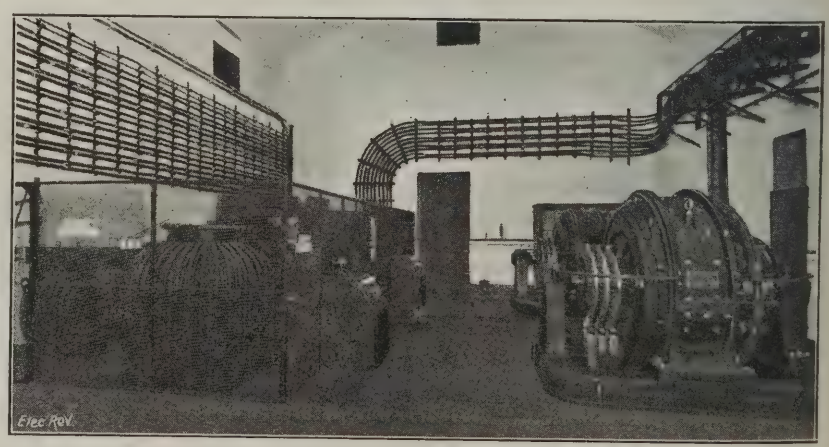


Fig. 2.—The Rotary Converter House.

output is at 480/525 V, the machines being level compound-wound within this voltage range. The third converter (of similar power) is housed in the same building

as the main flywheel-equaliser sets, and is shunt wound. This difference in windings was decided upon as the latter machine is much closer to the auxiliary machines which it supplies, and the falling characteristic of its shunt winding corresponds to the drop in voltage in the longer leads from the level compound-wound machines.

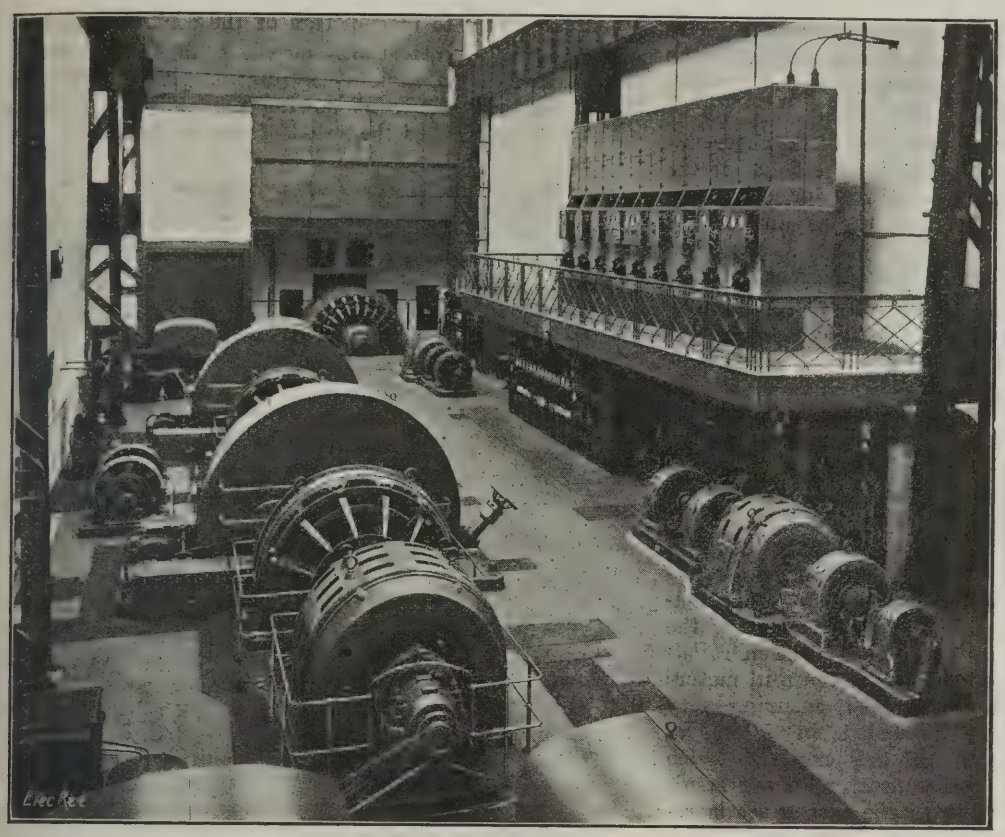


Fig 3.—Motor Room and Switchboards.

All three embody roller bearings and "tap" starting. The 40-in. slabbing mill and the 42-in. plate mill are both two-high and driven by reversing motors which take their power from two flywheel equaliser sets illustrated in fig. 3; the incoming 3,000-V switchgear is on the platform on the right, below which is a d.c. distribution board for pumps, fans, &c. On the left are the two flywheel sets mounted in line together by means of a flexible coupling. The two exciter sets appear partly under the switchboard gallery, whilst in the foreground is one of the automatic slip regulators which maintain the input to the motors of the flywheel sets approximately constant by varying the speed of the set. On the extreme left in the centre of the flywheel sets can be seen a small motor-generator barring set, the duty of which is described later.

The reversing motors are duplicate machines of the double-armature type (fig. 4) designed for a peak power of 14,000 h.p. at 50 r.p.m. and a speed range of 0/50 r.p.m. at constant torque and of from 50/100 r.p.m. at approximately constant horse-power. The massive construction of these machines is illustrated by their leading particulars:

Weight of each complete motor, 180 tons.
Weight of two armatures, 80 tons.
Diameter of shaft extension, 26 inches.
Overall length, 324 inches.
Overall width, 211 inches.

The two halves of each machine are exact duplicates, and the shaft is extended at the remote end so that should any accident happen to the shaft end at present being used for driving, the armatures can be interchanged. The bearings are ring lubricated, but in addition a motor-driven pump provides flood lubrication if desired; forced ventilation is employed, filtered air being blown by motor-driven fans through ducts in the foundations up into the centre portion of the machines, whence it is distributed through the amatures and frames and finally blown out over the commutators. No through shaft is employed; each armature is fitted with its own stub shaft, and the connection between the two is formed by a steel ring which registers on coned extensions of the spiders; keys take the drive between the two machines, so relieving the coupling bolts from any shear strain.

The d.c. for each reversing motor is provided from a flywheel equaliser set, consisting of a 3-phase induction motor of 3,000 h.p. driving two variable-voltage generators, between which is mounted a built-up cast-steel flywheel, 48 tons in weight and 11 ft. 3 in. in diameter. The flywheel sets are duplicates of one another and are arranged in line so that they can be coupled together for further equalisation of the load, the coupling between the two machines being of a "flexible" type, made by the Wellman Bibby Co., designed to transmit momentary peak loads up to approximately 14,000 h.p. Each set is approximately 40 ft. long, but the use of solid couplings and five bearings has not introduced bearing difficulties whatever. The flywheel bearing lubrication pumps work to about 150 lb. per sq. in., under which conditions the flywheels float on a film of oil, making it possible to start the set with less than half load on the motor; double lubrication is employed, pumps belted to the

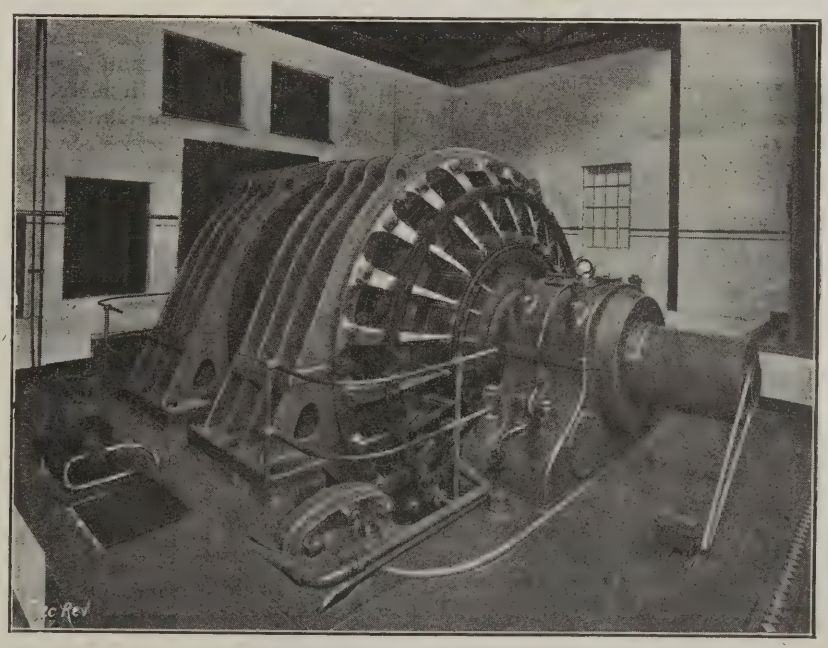


Fig 4.—Large-plate Mill Reversing Motor; 14,000 h.p.

flywheel shaft being in use when the set is running, while motor-driven pumps are used during the starting and shutting down periods and as a standby.

The motor driving each of the flywheel sets is of the 3-phase induction type, wound for an incoming pressure of 3,300 volts, 40 cycles, and drives the set at a synchronous speed of 600 r.p.m.; the working speed range is between 590 and 470 r.p.m. The generators in series supply the mill motors, and as they are subject to the peak demands have specially strong cast-steel frames, armature spiders, and commutator centres.

The control of the direction and speed of the reversing motors is brought about by adjusting the fields of the exciter machines which provide power for the fields respectively of the mill motors themselves and of the generators supplying them with power. The exciter sets consists of five machines (owing to the fact that the driving motor in the centre is synchronous, for which d.c. excitation is required) as follows:—Bucking exciter for mill-motor field; main exciter for mill-motor field, and for exciting the other exciter machines; synchronous driving motor for power-factor correction; exciter for fields of variable-voltage generators; and exciter for synchronous motor.

The employment of synchronous motors for driving the exciter sets was decided upon with a view to bringing approximately to unity the power factor of the complete plant, including the two flywheel sets, the light-plate mill motor, and chequer-mill motor. Each machine can provide 800 wattless kVA, a total for the two of 1,600 kVA. The use of quick excitation resistances for reducing the time constant of the mill motors and variable-voltage generators, thus ensuring very rapid acceleration, has been discarded in favour of special compound windings on the exciters which avoid loss of energy in resistances, with the result that the size of the motor driving the exciter set is reduced by about one-half, and in the present instance only approximately 110 h.p. is required for the purpose.

On the switchboard a panel is fitted with recording instruments to enable test readings to be taken of the operation of any equipment; throw-over switches allow the instruments to be inserted in either the slabbing mill motor or the plate mill equipments. The main controllers for the reversing motors, which regulate the exciter fields, are not on the control platforms in the

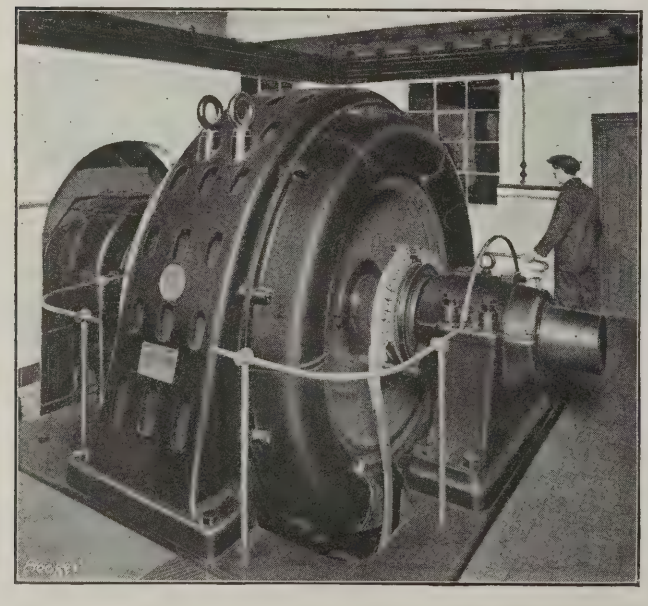


Fig. 5.—Light-plate Mill Induction Motor; 2,500 h.p.

mill where they would be subject to metallic dust and bad atmospheric conditions generally, but placed in the flywheel house reasonably adjacent to the exciter sets. The only connection between the control lever on the mill platform and the controller itself is a single play-pipe (filled with alcohol and water solution) ending in a diaphragm mounted in the pedestal of the control lever at the one end and in a similar diaphragm attached to a rocking valve lever at the controller end; movement of the control lever displaces the diaphragm from the central neutral position, synchronous movement taking place of the diaphragm at the controller, opening a valve which admits pressure oil to an operating servo-motor, which in turn sets the controller arm corresponding to the position of the control lever.

The mill driver stands adjacent to the instrument desk, so that the various instruments give him information as to the current flowing to, and the speed of, the mill motor and the speed of the flywheel set; a red

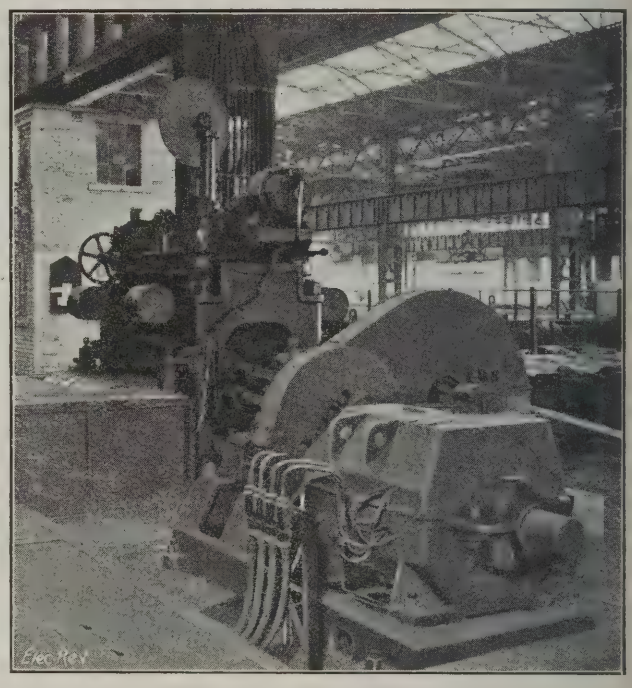


Fig. 6.—Plate Mangle Motor; 100 h.p.

lamp also warns him if the speed of the flywheel set has been reduced below the lower working limit, while "stop" and "start" push buttons enable him to close a relay circuit which opens or closes the field of the main exciter.

The various master controllers mounted in the background operate contactor gear which controls the screw-down motors, manipulator gears, and live rolls, while the automatic slip regulators have spring balancing devices for the moving blades in a soda solution in the tanks. The position of the blades in the tanks determines the resistance in the rotor circuit of the motor driving the flywheel set and consequently regulates its speed; the extent to which the blades are immersed is determined by a torque motor which drives the blade spindle through a chain, and the power of the torque motor is obtained from the input current to the flywheel motor. So long as the current to this motor remains at the desired value, any tendency to rotate on the part of the torque motor is counterbalanced by the weight of the blades. With increasing current the torque motor overcomes the counterbalancing force and raises the blades in the liquid, inserting resistance, which produces a fall in speed and thus liberates energy from the flywheel. With a reduced current the reverse action takes place, the weight of the blades causing them to enter further into the liquid, reducing the resistance, and thus speeding up the flywheel set again.

It was considered desirable to have means for obtaining slow movement of either of the main reversing motors or the flywheel sets. The provision of barring equipment on each machine would have been somewhat cumbersome, so the difficulty was overcome by the introduction of a heavy-current low-voltage motor-generator set; by this means current can be passed through the armature of either of the mill motors, or of any of the variable-voltage generators, of sufficient magnitude to produce half full-load torque with the fields of the machines normally excited, and a speed

which corresponds to a few revolutions per minute. The barring set is brought into use by plugging it on to the main bars which feed the particular machine to be rotated.

The heavy current, of the order of 12,000 amperes cut-out value, flowing between the generators of the flywheel sets and the mill motors necessitated the use of copper strip connections, and to accommodate them and the large number of field connections which pass between the various machines, the controllers, and the switch-board, an underground tunnel was constructed from one end of the motor house to the other; the two flywheel sets are placed approximately half-way between the two motors, and where the connections from the generators enter the tunnel the bars are arranged with a system of links whereby inter-changeability of any generator with any motor is possible. This will ensure continuity of production of either mill in the event of an accident to any one of the generators, the change-over of the main connections being accompanied by a corresponding change-over of the various field connections, and a switch-board, behind the d.c. switchboard, carries the necessary apparatus for this purpose.



Fig. 7.—General View of the Cooling Bank, showing Live-roller and Skid-gear Motors.

The light-plate mill is of the three-high "Lauth" type, in which the top and bottom rolls are power driven and the intermediate roll is brought into contact alternatively with the top and bottom rolls, and is rotated by friction by the roll with which it is in contact. A continuous-running 3-phase induction motor (fig. 5) of 2,500 h.p., running at 240 r.p.m., provides the necessary power, and interposed between it and the mill is a flywheel 38 tons in weight and 16 ft. in diameter; reduction gear, combined with pinions, reduces the motor speed to the 60 r.p.m. of the mill. The control pillar is of the standard "truck" type, and a liquid starter is employed; in conjunction with the latter there is a permanent metallic slip resistance designed for a drop in speed of 10 per cent. from no-load to full-load, so that the stored energy of the fly-wheel may be utilised for the heavy "passes."

The chequer-plate mill consists of a single two-high stand running continuously in one direction, one "pass" sufficing to "chequer" the plate, driven by a 3-phase motor designed to take peaks up to approximately 1,500 h.p.; it is of the simple induction type, runs at 240 r.p.m., and is geared down to the mill speed of 35 r.p.m. Overhung on each side of the pinion of the reduction gear is a flywheel 8 ft. 6 in. diameter, weighing $11\frac{1}{4}$ tons, and the energy of these two wheels is brought into play by the introduction of a metallic slip resistance in the rotor of the induction motor.

Direct-current motors for such duties as live rolls, screw-down gear, manipulators, mangles, cranes, &c., have been adopted for use throughout the whole plant, as well as for similar duties in the angle and bar mills, which have also been reorganised. The "mill type," Class MM, is specially designed for the very heavy duty entailed, and four of them are used in connection with the slabbing mill. The two which operate the manipulators are each of 100 h.p. at 550 r.p.m.; one, of 60 h.p., controls the tilting device, and one of the two screw-down motors of 60 h.p. is mounted up on the top of the mill housing. The motors are of compact and strong design, and so built that in the event of an accident to the driving-shaft end, the whole machine can be reversed, thus bringing into action the shaft extension at the other end. The insulation used is fireproof, and precaution has been taken to prevent the lodgment of dust where it may cause trouble.

Fig. 6 shows a motor of this class, of 100 h.p., driving one of the plate mangling machines, but it differs from those previously referred to in that, in order to prevent excessive speed when no plate is in the mangles, a shunt winding is fitted as well as a series winding.

A view of the cooling banks appears in fig. 7, and in the foreground are seen the live roller and skid gear motors, the former of 40 h.p. and the latter of 60 h.p.

Some idea of the extent to which power is used for auxiliary machinery is indicated by the fact that over 280 motors have been supplied in conjunction with this equipment.

Independent Power Plant.—In a booklet by Mr. W. C. Mountain entitled "A Word in Favour of the Independent Power Plant," he defends the small power installation against the present movement in favour of the large supply station. He takes up the cudgels for the self-contained plant in the first place on the ground of the saving in distribution costs. The distribution costs of electric supply plants are out of all proportion to generating costs, and the bearing of this on the isolated plant is obvious. The author claims that an up-to-date independent plant with a good load factor can generate energy as cheaply as, or even more cheaply than, the big supply station, and he suggests that insufficient attention is given to the question of efficiency in the case of the small station. In dealing with the competition of the larger undertakings, he says that they will often go to very great lengths rather than allow the installation or continuance of independent power plants in their districts, and asserts that rates are frequently quoted which must be below cost price. Compensation is hoped for in the complicated and indefinite systems of charging, which are all in favour of the power company. The author points to the unfairness of the maximum demand system of charging, as the consumer may be debited for a quarter or a year with a maximum demand which may occur only once for a short period due to exceptional circumstances. In dealing with power factor, the author refers to the clauses inserted in the consumers' agreements whereby the energy charges are increased if the factor falls below a given figure, usually 0.8, which may mean a very heavy additional charge. Reference is also made to the attractive offers by supply authorities to induce consumers to dispose of their private plant and take a public supply. These offers are usually covered by a 3- to 5-years' agreement, at the end of which period, the author points out, the charges can be increased. Transformer losses in the consumer's equipment are not favourable to the consumer. Another disadvantage to the consumer is that he has no stand-by plant to meet a failure in the public supply. In dealing with the reliability of the public and independent plants the author makes reference to the proposal to supply the whole country from a few mammoth stations, and points out that in such a case the whole supply for the country could be more easily shut down in the case of war or industrial dispute. Among the many advantages claimed for the independent plant is that of the facilities afforded for the use of the heat in the exhaust steam.

Artificial Daylight.

With Special Reference to a New Installation.

By W. J. JONES, B.Sc., A.M.I.E.E.

It is well known that the light emitted from the ordinary gasfilled lamp has a greater proportion of red radiation than daylight, say, from a north or even a cloudy sky, and it is essentially in order to facilitate colour matching and the grading of materials that electric lamp manufacturers have devised special incandescent lamps, which, with their selectively tinted daylight bulbs, emit light that is very similar to daylight, since the blue bulb effectively filters out the excess of red light.



Fig. 1.—Lighting from Four Diffusing Units.

Although these lamps have been used with varying degrees of success for colour matching and in purely industrial applications, as, for example, the grading of leather, the grading of flour, also in chemical laboratories for judging the colour of precipitates, &c., they have not yet come into general use. Some attempts have been made to use them in shop windows, but invariably the cold effect produced is repellent. Lack of success in the use of these lamps is generally associated with one of two things: The light source itself is insufficiently concealed, or poor intensity of illumination. When the light is insufficiently diffused intense patches of deep blue are visible, which produce a psychological effect of coldness. The other cause of failure in these installations is due to the fact that the designer has not allowed for the absorption of light by the daylight bulb, and the resultant intensity is insufficient when compared with the light obtained under daylight conditions.

Recently the Lighting Service Bureau of the Electric Lamp Manufacturers' Association had occasion to provide artificial lighting for one of its smaller demonstration rooms. It was decided to try and produce, so far as possible, daylight conditions in this particular room, and, at the same time, afford a ready comparison between the lighting obtained in daylight, the lighting obtained from daylight lamps, and the lighting obtained from the ordinary gasfilled lamp.

Fig. 4 shows a section of the room under consideration, from which it will be noted that the daylight is obtained through a skylight. During the morning of a reasonably bright day in the winter 12-15 foot-candles of illumination are obtained on the table. A blind is arranged immediately under the skylight in order to exclude daylight. A diffusing glass screen is fitted flush with the ceiling, and above this, but below the blind, are installed 16 100-W daylight gasfilled lamps in mirror-lined troughs. There is no reason to suppose that alternative equipment, such as shop-window reflectors, &c., would not prove equally serviceable.

In the room itself four diffusing fittings are installed, each provided with one 100-W clear gasfilled lamp. Table I (overleaf) gives some information concerning the relative intensities of illumination obtained on the table.

Photographs were taken of the room under both systems of artificial lighting and natural daylight, and these are reproduced in figs. 1, 2 and 3. It will be noticed in the case of the "artificial daylight" that there is a complete absence of glare, and a maximum illumination is provided on lower surfaces, while the brightness of the walls diminishes as the ceiling is approached. This is typical of daylight, for invariably the maximum illumination is obtained on the floor, or in any case in lower parts of the room. The second photograph shows how this distribution of illumination in the room is completely reversed, and is particularly noticeable when the light and shade effects are considered. The lighting from ordinary lamps seems quite yellow when compared with that from daylight lamps, while that from the daylight lamps compares very favourably with daylight itself.

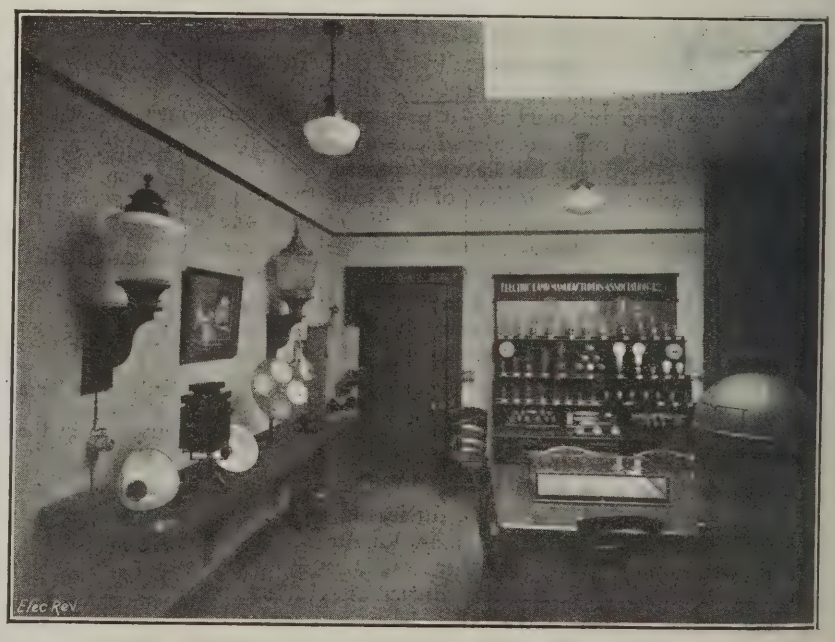


Fig. 2.—Lighting from Daylight Lamps above Skylight.

TABLE I.

TYPE OF LIGHTING.	INTENSITY.	WATTS.
Natural daylight	12-15 f.c.	—
Daylight lamps	15 f.c.	1600
Ordinary lamps in diffusing fittings	10 f.c.	400

So natural are the conditions produced by "artificial daylight" that an eminent assembly of engineers was entirely beguiled into the belief that they were holding their meeting under actual daylight, and were pleasantly surprised when, at the conclusion of their proceedings, they were informed of the true conditions.



Fig. 3.—Natural Daylight from Skylight.

It appears, therefore, that there is a considerable field for the use of illumination of this character, particularly if some satisfactory arrangements could be arrived at with electricity supply authorities regarding the cost of energy. For instance, such an installation in basement offices would be more valuable to the supply company from the point of view of revenue and constancy of load than an electric cooker, and the writer cannot see any reason why in such cases equally favourable terms should not be allowed. If this were possible the cost of lighting this room to the intensity and quality of daylight would only be 1.6d. per hour if the cost of energy were Id. per unit, and the expenditure of these small sums should make it possible to improve the monetary and utility value of parts of buildings which at the present time command a comparatively low rental due to insufficient daylight.

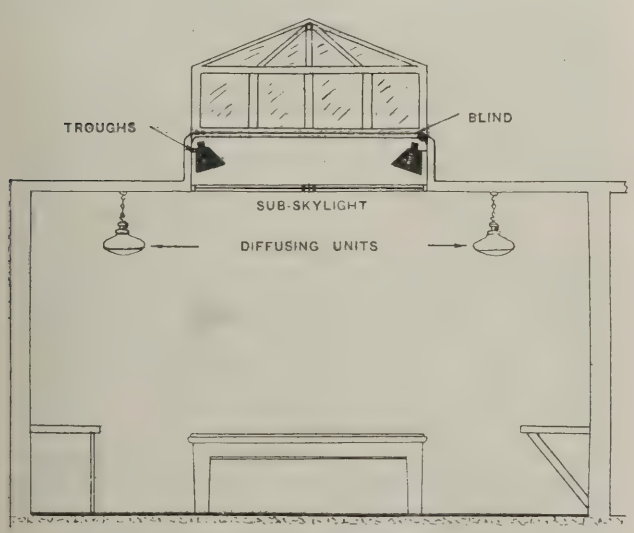


Fig. 4.—Section of Experimental Room.

"Cheapness" and Domestic Electrical Appliances.

By H. E. STRANACK.

THE columns of the technical papers and particularly the correspondence columns have recently contained statements in regard to an alleged public demand for "cheapness" in electrical fittings and appliances. Not only in those quarters, but amongst electrical dealers and contractors, particularly of the smaller or less pretentious type, there appears to be great timidity in approaching their customers with anything to which the adjective "cheap" cannot be applied. On being handed leaflets or literature concerning kettles, irons, toasters, simple electric light fixtures, bowl fittings or the like, at a manufacturer's establishment, the reply of such men is only too frequently: "Yes, this seems all right, but I'm afraid my customers will expect something a lot cheaper than any of these."

Again, where it is a question of the adoption of electric cooking, the question is so frequently put: "Will it be cheaper than gas?" or "How does it compare with gas?"—questions obviously unanswerable without a time limit in which the superiority or inferiority of the newer supplanting agent would have time to manifest itself. Of course, the fact that the retail purchaser asks such questions does not necessarily mean that he is going to refuse the adoption of electrical appliances if they are frankly stated *not* to be cheaper than the gas or other appliances which they are to supplant.

None the less, it may be well for dealers, contractors, and even manufacturers to ask themselves seriously whether or not they have not perhaps in their spoken arguments, used when effecting a sale or in advertisements, circular letters, &c., encouraged the public to ask for cheapness in electrical appliances much more than is justifiable when all the circumstances are taken fully into consideration, and whether they should not in the future leave this consideration out of their arguments altogether and carry conviction by stressing the excellencies or artistic, aesthetic, hygienic, labour saving and other predominant characteristics of things electrical.

It may not be amiss, in this connection, to reflect on what history has to teach us, after which I feel sure that we can safely make the assertion that progress has *not* been along the line of cheapness, but invariably *along the line of superiority*. That is why in our day (we can be optimistic) electricity is making headway in all departments of life; it may, of course, be cheaper in some, even in many directions—but that is not the reason for the advance and for its supplanting all other agents—that advance, and that supplanting are due to the excellent qualities mentioned above.

In support of this opinion, what then can we learn from the more or less recent past? Gas as an illuminant universally replaced candles and oil lamps—it was incomparably dearer, besides which, it had to be expensively installed and lacked the qualities of portability and of being self-contained possessed by its predecessors.

The writer is old enough to remember the introduction of typewriters into city offices; at first they were all one price, *viz.*, £25 each, and no one thought of claiming that they were cheaper than pens, ink and blotting paper. No! but they were a progressive step—therefore, they came and conquered.

Again, a very ordinary motor-car will cost at least twice as much in initial outlay as did, say, 30 years

ago, a pony and trap, and yet instead of there being fewer motors on the roads than there are horse-drawn traps, dog carts, &c., there are probably several hundreds to one.

One of the most successfully sold electrical appliances—the electric suction cleaner, supports this argument most strongly as its extensive sales have been reached not by offering it as being as cheap a contrivance as brooms and brushes, but by the frank admission that, whereas, those old-fashioned and inefficient implements only cost a few shillings, their electrical successor runs from thirteen to twenty-five guineas—in other words, it sells because of its superiority.

Instances could be quoted indefinitely, *e.g.*, the cost of the "push bike," beloved by the clerk or tradesman of the 'nineties, and the "motor bike" costing twelve times as much which his son somehow manages to be able to purchase

Most curious, perhaps, is this demand for cheapness when made by lady customers—I have often been told by a lady when showing her particulars and prices of domestic electric appliances that although they are no doubt good, yet they are so "frightfully" expensive as to be out of all question. To meet this, the electrical salesman must, of course, be able to draw attention to the "excellencies" of his goods, and by dint of persuasiveness and sound reasoning bring the lady to envisage the matter from the true point of view—which, in most cases, he will probably succeed in doing if sufficiently tactful. Artistic merit, utility, hygiene, all these qualities can be evaluated.

When selling an electric fire, it is quite permissible to point out that the family is going to sit round it in a semi-circle, that their eyes are going to rest upon it and, therefore, the less its design is akin to a sort of cross between a superannuated tombstone and an old-fashioned coal scuttle the better!

As a matter of fact, when asking for cheapness at the expense of aesthetic qualities, the modern woman forgets that she herself is a living contradiction of the principle involved. The red fox fur round her neck cost far more than the wrap which was employed to keep her grandmother's neck warm, and the same is equally true of her silken hose (several times the cost of the black stockings which they have replaced), and the dainty footwear as compared with the boots of preceding generations, all costing far more, yet successfully ousting the previous types.

The unnecessary acquiescence in this "cheapness" demand (instead of tactfully and skilfully explaining it away) leads, when we come to contracting work, to strange incongruities. The writer has seen a dining-room table costing, say, ten pounds, illuminated by a gimcrack and tawdry fitting costing, say, fifteen shillings, and he recently visited a clergyman's study which was lighted by a clear glass bulb lamp "shaded" by a very shallow 10-in. opal, the sides of which allowed the bulb to project with all its "glare" effect. What induced the technical electrician to install such a thing in such surroundings—nicely bound books, well upholstered chairs, and suitably framed pictures?

In conclusion, therefore, let us banish this "cheapness" fetish from our calculations, be prepared with the correct arguments to knock its backbone out whenever we meet it, and all of us "do our bit" to elevate electricity in the home to that dignified correspondence with environment that it enjoys in public buildings, large stores, banks, theatres, kinemas, &c., where this unreasonable craze has not been pandered to.

The Need for Accurate Costing—Why Wait?

A Suggestion for Speeding up the Incipient Trade Improvement.

(COMMUNICATED.)

THE recent decision of the Army Council to abolish the greater part of the short-lived system of departmental accounting, advocated by the Lawrence Committee, has brought down upon their heads a torrent of adverse criticism. Their action, showing their apparent distrust of this newly-instituted, but by no means untried, method of departmental financial control, has been incomprehensible to those who have had the opportunity to see and prove for themselves the advantages, and perhaps uncomfortably great possibilities of effecting economies, that may be provided by this system.

Members of the Lawrence Committee, prominent accountants, politicians, and many business men have all given vent to their feelings of disapproval, either at meetings or in letters to the Press, or otherwise. The Army Council have, apparently, but few supporters willing to stand up for them. However this may be, there is one aspect of the situation that appears so far to have escaped notice. Righteous though the critics may be in their attacks on the Army Council, much of its force might, with equal justice, have been directed against many of those who have the control of manufacturing industries in this country under their charge. Whether they be right or wrong, the attitude of the Army Council is far from unique, and not really very different from that of many of these manufacturers themselves, though the latter have not been slow to join in the chorus of criticism against the former.

As is well known, every business worthy of the name has its own set of cash books, purchase ledgers, sales ledgers, journals, and so on, in which are kept with scrupulous care, and by double entry, an exact and careful record of all receipts and payments of cash, cheques and bills of exchange; the utmost care is taken to see that no mistakes can creep unnoticed into these accounts, that no payments of the firm's money, or receipts on behalf of the firm can possibly occur without a corresponding entry in the appropriate account, and that the books always balance exactly. If it should happen that a balance cannot be struck at the first trial, then the mistake has to be found, no matter how small the amount may be.

The following instance, telling what recently took place in a large manufacturing firm, with two millions of capital, will suffice to illustrate the point. At the end of their financial year, when the books were balanced, they were found to be wrong by ten shillings. An immediate search failed to show where the error had occurred, and the accounts staff had to work overtime in order to find it. For four whole days, including three hours' overtime every evening, the search for the ten shillings that were lost continued, to the detriment of much of the ordinary routine work of the office. Every account was added up, and re-added up, checked and re-checked, until at last, on the fifth day, a shriek from a small girl working a comptometer adding machine heralded the announcement that a ten shilling mistake in the addition had been found. There is, of course, on this type of machine no typewritten record of its work, and consequently no means of comparing the figures fed to the machine with those in the ledger; probably because these machines were still an innovation in this particular firm, the glamour of their ingenuity had not yet worn off, and the possibility of an error in work done by them had never even been suspected, until in desperation a check of their results was ordered.

This, it is to be feared, is no exaggerated description of what takes place in many a counting house at the end of their financial year. It is cited here merely as an instance of the enormous importance that is attached to making the financial books balance absolutely, to the nearest halfpenny. The modern system of accountancy has been perfected to such a pitch that errors, even of negligible and insignificant amounts, have no place in the books of even the largest firm. There simply could not happen such a thing as a company presenting its balance sheet to the shareholders with a note of regret to the effect that the accounts were unfortunately found to be wrong by a penny, and that a prolonged search had failed to discover the missing coin! Yet one hesitates to think how many pounds it must have cost this concern in salaries, stationery, heating, lighting, not to speak of tempers, to find the penny that was lost. Regardless of time and expense, the financial accounts of all businesses are made to balance—in the end. Manufacturers, and other business men, all over the country, are in this respect unanimous with the Army Council. They are great believers in the powers of sound bookkeeping. All of them attach the utmost importance to proper and correct accounts, and, of course, no one but a fanatic would have it otherwise. Accounts, if they are to be of any use at all, must be correct, absolutely correct, and not even a penny out!

However this may be, the value of even correct accounts has, after all, its limitations. No matter how excellently or how accurately a firm may keep its accounts, this alone can be no criterion of successful business, or even of economical working inside the business. The fact that accounts can be shown to be a "true and correct view" of the financial position, does not also show that the money of the business has been well and wisely spent. A firm may have a model counting house staff, and the best auditors in the world, and yet be in a financially unsound position, merely because the business has been conducted uneconomically; for books of account, pure and simple, can safeguard only coin and credit.

Obvious though it may appear to all, the full significance of this limitation of accountancy seems to be but rarely understood. Because financial accounts do, in a most thorough manner, control the expenditure of the cash of a business by preventing any payments taking place without the personal knowledge or signature of a responsible director, this is often thought to be all the control of expenditure that can be necessary in a business. Such, apparenly, is the view of the Army Council, which takes ample steps to satisfy itself that its budgeted expenditure is not exceeded in any direction, unless, of course, its special permission has been previously obtained. Such also appears to be the opinion of many directors of manufacturing concerns, who have provided themselves with a sufficient staff to keep the financial accounts of their business, but require no other check over expenditure.

It is proposed to show why it is that in the Army, as in business, financial accounts are themselves insufficient as a means of controlling expenditure in an economical manner, and wherein lies the remedy.

In every business, an enormous amount of time and care is invariably expended on the buying of raw materials, so as to obtain good quality and suitable material at a low competitive price; to obtain the best possible discounts, terms of credit and terms of delivery; and at the same time to guard against secret commissions at the expense of the business, and mistakes being made in the amount of money paid for materials. Thus far, but no farther, does the financial control provided by books of account proceed. Once delivered to the works, the material is handed over to the shops where it is used as required. It may be wasted, or it may not; it may be pilfered or it may not; it may be left lying about inside stores, or in the shops themselves, or even outside in the yard; it may lie there to deteriorate or rust away, and eventually be forgotten, or it may be used to good purpose. Whatever be its ultimate fate, there is seldom any evidence that it is someone's especial charge to find out how it is used. It certainly is not treated as if it were as valuable as money, for once in the shops, the control of the expenditure of material, though it may nominally rest in the hands of the foremen, or a storekeeper, is often either lax, or altogether non-existent. Even when some record of its use is kept, no great importance is attached to its accuracy, and still less to its balancing exactly like an account. If, at stocktaking, a few dozen pieces, or a hundredweight or two are missing, oh, well! it must have gone somewhere! the difference is simply written off, and no further thought or attention is given to the matter. Yet, when one comes to think of it, what difference is there between this material, and the money that is so jealously paid for it, but form and appearance? Why is such scrupulous care taken of payments of money to the suppliers for material, and so little of the material received in exchange? Why should the expenditure of money be so amply safeguarded, when the material, its equivalent in value, is treated with disregard? Why indeed? How, at all events, do these firms, at the end of the year, contrive to compute, to the nearest halfpenny, the value of their stocks on hand, in order to complete their balance sheets?

Much the same may be said about money paid for labour, in the form of wages. It would be interesting and illuminating to have some reliable statistician calculate the cost of wage agreement conferences during the past decade, for the sum must, indeed, be formidable. Wages are the life and soul of industry. If wages are too high, industry cannot stand the strain, and must eventually fail. If, on the other hand, wages are too low, the workmen cannot live and support their families. They do not give of their best work, and industry suffers again.

Many employers to-day will have it that wages are too high, and that improved trade can only come as a result of lower wages. They regard demands for increased wages or salaries as fantastical and out of the question at the present time; they even spend much of their own time in personally examining pay rolls with the intention of cutting them down, either by reducing the staff, or else reducing the rate of wages.

But in men who have been given their appointments, or engaged, personal interest, in so far as their work is concerned, is not always as keen. It is left almost entirely in the hands of foremen and heads of departments to supervise the work of the workmen and staff, and to see that the best use is made of the time for which they are paid. Little or no concern is caused by a queue at the stores window, or by extended perambulations on the part of men understood to be looking for tools, or going to fetch a drawing! Waiting for the crane, waiting for materials, or continual changing over from one job to another, and consequent waste of time in setting up and re-setting up machines, are all regarded as an inevitable part of the process of manufacture. A few exceptions there certainly are who see therein waste of money, a part of which, at all events, there is a chance of turning to better advantage.

How is it that the same praiseworthy care with which pay packets are made up, and handed out on Friday night, that is when the money is being spent, is seldom so much in evidence during the rest of the week, when its equivalent in time is being spent? What happens if a man finds at the end of the day that he has recorded on his time sheet how he has spent 8¼ hours instead of 8½ hours? Does he put in overtime until he has remembered how he spent the odd quarter of an hour, or does he just lump it in on to the job that will stand it best? So far as is officially known in most firms, such dilemmas simply do not arise! In a few others, they are prevented from arising.

Quite recently, the writer happened to come across an interesting example of this sort of thing in a firm where none of the directors was aware of the method by which overtime pay was calculated. It transpired that it had been the custom of the concern to pay overtime, at the rate of time and a third, for each quarter of an hour worked, so that if a man worked ¾ hour overtime, he received the equivalent of one hour's wage. If only part of a quarter was worked, then the nearest number of quarters of an hour was taken as the basis, thus: A man who worked 32 minutes was paid as for ½ hour, but a

man working 38 minutes was paid as for ¾ hour, and so on. If, however, 35 minutes was worked one night, and three minutes the next, ¾ hour overtime was paid at the end of the week, just the same as if the 38 minutes had all been worked on one night. The natural and inevitable outcome of this custom was that all those men who were actually required to work, say, 35 minutes, or 50 minutes, or some period just over the quarters of an hour, invariably took several minutes some other night in the week to find and don their coats, thereby getting paid for an extra quarter of an hour at time and a third!

Though all the directors of this company knew that overtime was paid at the rate of time and a third, no one of them understood how the time itself was worked out, until it was revealed by certain investigations carried out for the company by the writer. Though ample control over money was always kept in their concern, similar careful control over the time was neglected. This money-while-you-wait facility is no longer provided by the company.

Similar occurrences with regard to many of the other numerous expenses of a business such as rent, rates and insurance, can also be cited. Much time, thought and argument is invariably devoted to the amount of money that has to be paid for each, but little or none to the best and most economical use of the space obtained and insured with this money. It is the same with every expense of a business; the coin or cheque or bill given in exchange for labour, material or service, is checked and counted and safeguarded so as to admit of absolutely no leakage, but not so the labour, material, and services themselves.

Despite all that has been said, it does seem that somehow or other, it is reasonable to expect that the control of money spent should also render possible the control of the usages of what is bought for that money. Ample control of the one should somehow lead to the ample control of the other, since they are the equivalent o one another in value. Nevertheless, whatever may b expected in this direction, no one would presumably be willing to accept a low figure for rent as an indication of a well laid-out factory, or a small pay roll as a sur sign of hard-working and well-organised workmen. One is quite compatible with the other, certainly, but not a consequence of the other. The pay roll may be small because the men work well, and are equipped with time-saving devices and tools, so that a large output is obtained from a small staff, or, on the other hand, the number of men may be small because the business an its output are both small.

What is it then, that prevents this dual control? Clearly there is something important missing which must be provided before it is possible to decide the truth or otherwise of such propositions as these. A low rent may under certain circumstances be a perfectly sound indication of the economical use of floor space. It will, for example, indicate a well laid out factory IF the rent per unit of production is also low compared with other similar factories. Similarly, a low pay roll is a true sign of hard working, efficient, and well-equipped workmen IF the wages per unit of output are also low compared with similar businesses, but only IF these second conditions also hold good.

This explanation will, it is hoped, make clear what it is also necessary to do in order that control of money spent may give control over what is obtained for it, namely, to provide the "means of measuring" the pay roll, or the rent of the factory, against some common standard such as the output. Accurate accounts alone can never provide this control, unless accompanied by some such "means of measuring." Then it can be decided without fear of doubt, whether or not the rent is too high, or wages are too high, for their size matters not at all so long as the rent or wage per unit of production is reasonably low. To put it in another way, the control of the expenditure of cash in a business only provides ample and sufficient control over what is received in return for that cash, if some means can be provided of measuring the use made, or benefit obtained from what is received in exchange for that money.

It is just this means of measuring or comparing that is so often absent in a business. It was certainly absent in the company whose directors were unaware of the basis on which the overtime wages were calculated. It is certainly absent again now in the Army, and presumably nothing will now be heard of the officers and privileged civilians who get their private hunters shoed at farriery training schools with Government shoes, Government nails, and in Government time, in return for a moderate tip; or about payments made in return for work done by regimental tailors who use Government material and Government thread, and are paid by the Government for their time; or about the regimental shoemakers. . . The means of measuring has now been removed, and though the allowances laid down in the regulations and in Army Council Instructions will not be exceeded, they will doubtless continue to be paid in full regardless of whether services are obtained for them in full, or not. No one will any longer be able to measure payments made against work done.

(*To be concluded.*)

Water-Power in the Argentine.

Potential Value of the Mendoza District Rivers.

(From our Special Correspondent.)

In no State of South America does there exist a more insistent demand for power generated on a commercial scale than in Argentina; it is needed for industrial plant (especially for the tramways) and the lighting of several rapidly-expanding cities. None of them can claim the usual advantage of occupying a location of natural water-power. All the large foreign-owned utilities companies employ electricity, and make use of imported coal as the source of energy. The utilisation of hydraulic power is therefore a matter of such supreme importance to Argentina that the Government has in its employment investigators and surveyors continually engaged upon search for suitable rivers which might be put to some commercial value.

Among the largest of the enterprises now being undertaken is the Hispano-Argentina super-power station; this will ultimately have a capacity of 500,000 kW, consuming daily 4,000 tons of coal, which it is proposed to use in a pulverised state.

A district hitherto little regarded as of potential value, but which now promises to become of some considerable worth from a hydraulic power point of view, is the mountainous part of Mendoza, which contains some of the highest summits of the Andes. Here, also, are several rivers which, as recent investigation shows, could be effectively harnessed to provide a large volume of power. Unfortunately, the amount of capital that would be required cannot be provided by the State alone, so that any enterprise would have to be undertaken by private or combined interests—private and State.

Towards this end, the Government has expressed its willingness to co-operate; or, alternatively, it is prepared to grant a concession upon certain terms.

A scheme which has recently been made the subject of special study relates to the harnessing of the waters of the Rio Atuel. The river runs strongly from the south to the north-west of the Mendoza province, following an unbroken course over several hundreds of miles of

rocky and at present profitless territory. As the river approaches the town of Nihuil, however, at a distance from the city of Mendoza of about 300 miles, the rocky formation abruptly changes, the waters of the river narrowing between the precipitous walls of a deep cañon. There then comes a sudden drop, forming a waterfall 310 feet in height, and extending over a distance of, roughly, some 550 feet. The flow, which in flood time is estimated at 550 cubic yards a second, has an average all-the-year-round discharge of 450 cubic yards per second.

The location is considered highly favourable for the erection of a large generating plant, estimated to produce between 40,000 and 100,000 h.p. of electrical power. By damming the river, thus providing an even flow throughout the full year, sufficient irrigation waters could be obtained to serve more than 600,000 acres of land—at present little better than desert—in the southern portion of the Province. Electric power for lighting and industrial purposes could be both easily and cheaply sent to the fast-growing city of Mendoza and supply, additionally, the flourishing residential suburbs which are extending around it.

Nearly four years ago, following an investigation made by the State Engineer into the possibilities of the Mendoza waterfall, the Minister of Public Works of the Province of Mendoza offered to grant a concession for the installation and operation of hydraulic plant at Nihual, upon the following, among other, conditions: the concessionaires were to commence and bring to completion a scheme of whatever kind the Mendoza legislature—after taking technical advice—might determine upon. The sole compensation offered to the concessionaires was the right to operate commercially the plant for their own account over a limited number of years, not specified in the first announcement. At the end of the period determined upon, the plant and installation would be delivered in good working order to the perpetual ownership of the provincial government of Mendoza. Before operation of the plant could be commenced, a tariff of charges for the supply of light and power would have to be drawn up and submitted to the Legislature for approval; application for continuance would have to be renewed every five years. A certain percentage of the financial receipts would also have to be paid to the province. A deposit of $100,000 (paper) would be made as a guarantee for faithful compliance with the terms of the contract, upon which work must commence six months after signatures had been attached. Upon its part, the Provincial Government would exempt the concessionaires from taxes and imposts of all descriptions during the life of the concession, and would also undertake to expend a maximum sum of $10,000 for the purpose of making the preliminary studies and topographical surveys.

In view of the extremely one-sided terms of the proffered concession, it is not difficult to understand the small interest aroused.

The Mendoza power scheme, however, is but one among many hydraulic enterprises that are possible in Argentina, inclusive of the Iguazú Falls enterprise, to which reference has already been made in the columns of this journal. Since that article appeared, a United States firm of hydraulic engineers, it has been reported, has expressed itself ready to carry out a scheme with the view of conveying 300,000 h.p. from the falls of Iguazú to Buenos Aires, at a cost not exceeding 60 per cent. of the present cost of electricity.

Electricity Recommendations at Southend.—In a report to the Southend Town Council on its electricity undertaking, Mr. J. H. Rider recommends, *inter alia*, the erection of a new steam power station at South Fambridge to supply Southend as well as a large area to the north of the borough, and that as soon as this station is ready the Diesel engines at the Leigh and Thorpe power stations should be abandoned entirely. He further recommends that a fourth Diesel engine should be installed forthwith at the London Road power station to maintain the supplies until the new station is at work, and that the Diesel plant at London Road should be kept in service for a number of years to work in conjunction with the new power station during peak load periods.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

The Abu Zabal Wireless Station.—On June 10th, Lord WOLMER informed Mr. Ammon that negotiations for the sale of the Abu Zabal wireless station had reached an advanced stage, but the transaction had not yet been completed. He was not, therefore, at liberty to disclose the proposed purchase price or the conditions on which the sale would be effected.

The Finance Bill.—On June 8th, during the Committee stage of the Finance Bill, Mr. FENLY moved that the "safeguarding" duty on imported arc lamp carbons should be 3d. instead of 1s. per lb., as proposed in the Bill. The amendment was defeated by 245 votes to 135.

Mr. PETHICK-LAWRENCE moved to omit from the "safeguarding" duties amorphous carbon electrodes (not including primary battery carbons or arc lamp carbons). This was defeated by 240 votes to 128.

Mr. LIVINGSTONE moved to omit "vulcanising paper" from the scope of the new "safeguarding" duties on paper. He said that vulcanising paper was a raw material which was very essential and important for the electrical industry.

Sir B. CHADWICK, Parliamentary Secretary to the Board of Trade, said that vulcanised paper was produced in this country, and that was why a duty was put on the imported article.

The amendment was negatived by 225 votes to 127.

Slack for Electricity Undertakings.—On June 7th, Mr. LANSBURY asked the Secretary for Mines whether he was aware that certain coalowners and others were offering for sale large quantities of slack and waste deposits lying in and around the pits to electricity undertakings, such undertakings being the only industries which under great difficulties were able to utilise that waste; that those deposits were, in the ordinary course, considered of no value and were written off as a loss; and would he consider the advisability of using his powers under the emergency powers regulations to take over the heaps of slack piled up in mining areas, and so prevent exploitation in this respect.

Colonel LANE-FOX said that one or two complaints about the prices charged for slack had reached him, and he was looking into them. He was quite prepared to consider exercising powers under the Emergency Act to requisition coal or control prices if, in the last resort, this should prove necessary for the protection of the consumer.

Communication with Australia.—On June 8th, Sir A. SINCLAIR asked the Postmaster-General whether, in view of the statements by the managing director of Amalgamated Wireless (Australasia), Ltd., that Australia had stations capable of conducting experiments in radio-telephony with those in this country, that the stations were ready, and that they were willing to co-operate upon receipt of an invitation from Great Britain, he would say whether that invitation would be extended; and, if not, for what reason.

Sir WM. MITCHELL-THOMSON said he had communicated with the Australian authorities and he understood that the Australian company had no stations which could undertake suitable radio-telephonic transmission to this country. Two-way experiments were therefore impracticable; but they had offered to receive the experimental transmissions from Rugby and to report their strength. He had informed them that he welcomed the offer, and he had furnished the necessary particulars of the Rugby transmissions. Unfortunately it had been necessary to suspend the Rugby experiments during the present emergency.

G.P.O. Services.—On June 8th, Col. DAY asked the Postmaster-General what was the estimated surplus or deficit on the postal, telephone, telegraph, and wireless services for six months.

Sir W. MITCHELL-THOMSON said that the estimated figures in respect of the six months ended March 31st, 1926, were as follows:—Postal services, surplus £4,229,000; telephone services, surplus £250,000; telegraph services, deficit, £774,000. The figures in respect of radio services were taken into account in estimating the total deficit of £747,000 for telegraphs. Separate figures for radio services for a recent period were not available.

London Electric and Metropolitan District Bill.—The Bill promoted by the London Electric and Metropolitan District Railway Companies came before the Unopposed Bills Committee of the House of Commons on June 11th. It was explained that the object of the Bill was to provide for the widening of lines, the installation of escalators and other works, at an estimated cost of £2,400,000, and to enable the companies to raise additional capital, not exceeding £1,000,000 in the case of the London Electric Railway and £500,000 in the case of the Metropolitan District Railway. The preamble was passed and the Bill ordered to be reported to the House for third reading.

Swindon Corporation Bill.—This Bill, which contains clauses empowering the Corporation to carry out wiring itself and to sell fittings and appliances, came before the Unopposed Bills Committee of the House of Commons on June 11th and was ordered to be reported to the House for third reading. By agreement a number of provisions to safeguard the position of local electrical contractors were inserted in the Bill.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Trade Names Supplement.—Along with our issue of next week we shall publish the first of a series of four Quarterly Supplements of Electrical Trade Names. These will contain the names and addresses of manufacturers and suppliers of a large number of electrical products and materials which bear special Trade Names. Each Supplement will be distributed free to every one of our 13,000 readers at Home and abroad, and will enable them to get into direct touch with the maker of any article included in the List.

The "Electrical Review" Index.—The Index to Vol. XCVIII (for the half-year ending June 30th, 1926), will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made at once to the Publisher, 4, Ludgate Hill, E.C.

New Argentine Company.—The *Review of the River Plate* records the formation of the Cia. Feba de Electricidad in Buenos Aires, with a capital of $500,000 m/n, "to manufacture, import, and deal in electrical and sanitary machinery and articles in general." The company takes over an existing business.

E.D.A. Activities.—The British Electrical Development Association has published a folder containing reproductions of advertisements which appeared in daily, weekly and monthly papers, with a combined circulation of over 17 million per issue, during the period October, 1925, to March, 1926. The advertisements were specially designed for the various classes of journal in which they appeared and as a result their appeal was greatly strengthened and they must have performed a great deal of useful service for the electrical industry and the public at large.

Unemployment.—There was an increase of 16,521 in the number of registered unemployed during the week ended May 31st, bringing the total up to 1,614,200, as compared with 1,247,306 at June 1st, 1925. The total does not include persons who ceased work in the coal-mining industry on account of the lock-out.

A "Mazda" Display.—The accompanying picture shows a car which took part in a recent Shopping Week procession



A "Mazda" Display at Hendon.

at Hendon. It was arranged by Mr. C. E. Keates, a Hendon electrical contractor, and "featured" "Mazda" lamps in a very prominent manner.

Wages in the Engineering Industry.—The Federation of Engineering and Shipbuilding Trades held its annual conference in Bristol last week. Mr. W. Sherwood, in his presidential address, said a national strike was futile and wasteful, because it could never succeed. It could only be complete if all workers ceased to produce or distribute commodities, and that would result in terrible privation, if not starvation, for the poorer paid workmen with no reserves. If the discipline and enthusiasm shown in the general strike were directed to a closing of the ranks of labour, the abolition of differences between craft and labour organisations, and the establishment of a great and powerful trade union movement, the cost and sacrifice would be worth the effort. The conference decided to apply for an advance of 10s. a week on the existing rates of wages of all workmen engaged in the shipbuilding industry. Determination was expressed to get higher wages in the engineering industry, while it was hoped that satisfactory conclusions to the negotiations proceeding for an advance of 20s. a week would be reached.—*The Times.*

A Hotel Lighting Installation.—The First Avenue Hotel, London, has recently been re-opened after undergoing "spring cleaning" on a very large scale. It has been completely re-furnished and re-decorated and among the improvements carried out is a new lighting installation. Massive real bronze fittings and "Superlux" glassware designed and supplied by the General Electric Co., Ltd., and fitted with "Osram" gasfilled lamps are the leading feature of the instal-



The Lighting of the First Avenue Hotel.

lation in the main entrance and lounge. The entrance is illustrated in the accompanying figure. In other parts of the building similar elaborate fittings are employed. The main staircase is illuminated by ten "Unalux" fittings finished in gilt with decorated glassware. Over 1,000 lamps have been supplied, including 400 "White Osrams" and colour-sprayed lamps.

League's Assistance in Austrian Electrification.—In his latest report the Commissioner-General of the League of Nations for Austria states that in order to provide work for the unemployed on productive investments he has accelerated the rate of grants for this purpose. Included in the work is electrification for which two advances of 3,010,937 schillings and 3,643,950 schillings respectively have been made this year, bringing the total advanced for this purpose up to 12,193,950 schillings.

Portable Generating Set Contracts.—MESSRS. STUART TURNER, LTD., Henley-on-Thames, have received from the Air Ministry an order for a 1½-kW generating set for the triple purpose of general camp lighting, supplying searchlight current and low voltage current for battery charging. One generator supplies the three voltages and a special switchboard is mounted on the set. The engine is the standard type F.S.1 3-h.h.p. petrol engine made by the firm for its 1½-kW generating sets for country house lighting, the only difference being that aluminium is employed for the sake of lightness. The company has also received a further order for 80 small sets from the Post Office. These are for village automatic telephone exchanges. The Post Office has already installed over 200 of these sets.

Trade with Ireland.—We are informed that a movement is afoot among business men who are interested in trade with Ireland to form a special section of the London Chamber of Commerce for the sole purpose of furthering trade with the Free State and Northern Ireland. Further information can be obtained from the Secretary of the London Chamber of Commerce, 97, Cannon Street, E.C.4.

Electricity in the Balkans.—The Jugo-Slavian press agency "Sava" states that the municipality of Krouchevatz in Serbia, intends to construct an electric power-house in the town and that to this end it is open to receive tenders. It is calculated that the setting-up of this station will cost about eight millions of dinars (about £30,000). German, French, Austrian, and Swiss firms are all interested in projects for electrification in Jugo-Slavia.

Social Events.—The staff and employés of Messrs. A. Reyrolle & Co., Ltd., held their fifth annual sports meeting on June 5th at the company's own recreation ground; the attendance was approximately 2,000. Music was provided by the Hebburn Colliery Prize Band and the proceeds from the gate receipts are to be handed over to the Hebburn Infirmary. The prizes were presented by Mrs. H. W. Clothier. The Works Sports Management Committee, of which Mr. H. W. Miller is the chairman, arranged the programme, and attended to the comfort of the employés and their guests.

The Football Section of the General Electric Co.'s Sports Club held a dinner at Pritchard's Restaurant, W., on June 4th. Mr. L. C. Gamage presided, and he and Mr. M. Railing, who was also present, congratulated the teams on their successes during the past season. A number of speeches were made and an excellent musical programme was provided.

Local Exhibitions.—MANCHESTER.—The Electricity Committee has arranged for one of the electric houses on the Burnage Estate to be open for inspection by the public from June 14th to July 10th.

WEST HAM.—*Correction.*—We regret that our last week's note on the forthcoming electrical exhibition at West Ham, stated that it was being held during the current week, when in fact the show is not until September 13th.

ST. HELENS.—Mr. F. N. Rendell-Baker, the St. Helens borough electrical engineer, has sent us photographs of an exhibition which was arranged recently in the Y.M.C.A. Buildings, St. Helens. We reproduce one of these showing a comprehensive display by the General Electric Co., Ltd., in which practically every class of domestic appliance appeared.



The St. Helens Electrical Exhibition.

Our Foreign Trade.—The following were the values of imports and exports of electrical goods and machinery during May :—

	May, 1926.	Inc. or dec.	5 months, 1926.
Imports—	£	£	£
Electrical goods and apparatus	188,658	– 86,539	– 370,114
Machinery	1,049,459	– 15,974	+ 463,160
(Electrical machinery)	80,996	– 18,299	– 15,377
Exports—			
Electrical goods and apparatus	733,053	– 428,580	– 905,678
Machinery	3,184,520	–1,205,646	–1,536,688
(Electrical machinery)	425,183	– 121,555	– 204,032
Re-exports—			
Electrical goods and apparatus	8,938	– 19,710	– 41,491
Machinery	71,051	– 76,255	– 74,430
(Electrical machinery)	2,449	– 3,160	+ 6,411

The Amalgamated Engineering Union.—It is stated in its June *Journal* that the Union proposes to establish an "industrial section" which would cater for all classes of engineering workers over 16 years of age not at present eligible for membership of the Union.

Swedish Trade with Russia.—The *Board of Trade Journal* reports that the very considerable fall in Sweden's exports to Russia during 1925, due to the cessation of exports of locomotives, was partly offset by larger shipments of separators, ball bearings and electric generators. On the other hand, the exports of water turbines, which in 1924 were valued at 3.3 million kronor, were insignificant in 1925.

South African Electrical Imports.—The foreign trade statistics of the Union of South Africa for the year 1925 show that the imports of electrical machinery reached a value of £1,175,990, as compared with £1,078,114 in 1924.

"Your's the Companey"!—An electrical manufacturing company recently received the following application for employment. Comment would spoil so choice a specimen :—

"Dear Sir,

I have a very great pleasure of sending you this letter. For asking your settlement on the Electrical Sub Stations in all part of this Countrey in North Wales the Frawsfynudd Lake supply. Your's the Companey. Will you give me an opportunity of coming to this Electrical Works in this stations the nearest station to me is that station on a hill near Penrhyndeudraeth. I am live within 1½ M to the Station, I am very interesting in the Electrical Instrument, Electric Generator's.

"I am 20 years of age. I like to Apprentice with you i am in a study every night with Electrical Powers and so on. Well i must come to a close now with thanks i waiting for a letter soon from you

Yours trulley,

_____."

Trade Announcements.—The NON-FERROUS DIE CASTING CO., LTD., has removed its showrooms and offices to 36, Grosvenor Gardens, S.W.1.

The JEARY ELECTRICAL CO., LTD., of 26-28, Lambs Passage, Chiswell Street, London, E.C., announce that their business has now been reorganised. A trade price list of electrical accessories has been issued.

MESSRS. BRUCE, DAWSON & CO., 70, Finsbury Pavement, E.C.2, inform us that they are the agents in Great Britain, Ireland, &c., for the electric damping iron described in our issue of June 4th. The iron has been sold for some time past under the name "Elda."

Catalogues and Lists.—THE EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4.—A pamphlet giving particulars and prices of "Ediswan" electric fans.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—June stock list of motors and dynamos.

MESSRS. SPENCER (MELKSHAM), LTD., Melksham, Wilts.—A brochure dealing with the company's goods-handling equipment.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—Bulletin No. 34, containing particulars of "Pul-syn-etic" time-recording systems for works and offices, sirens, bells, &c.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for May, containing profusely illustrated descriptions of "Osram" lighting installations and dealing with the company's valves, fans, &c.

MESSRS. HENRY JENKINS & SONS, LTD., Vittoria Street, Birmingham.—Four catalogue sheets bearing illustrations and prices of canopy fittings for electric lighting.

THE HARLAND ENGINEERING CO., LTD., Alloa, Scotland.—Publication No. 507, describing a.c. motors complying with British Standard Specification No. 168/1923, ranging from 1 to 60 b.h.p., for general industrial purposes.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa., U.S.A.—A series of illustrated leaflets dealing with air-break disconnecting switches, centrifugal oil separators, "Repel-Arc" furnaces, induction motors, baking ovens, and electric solder pots.

MESSRS. H. W. SULLIVAN, LTD., 368 & 369, Winchester House, E.C.2.—A comprehensive list of precision d.c. measuring and testing apparatus for laboratories and test-rooms. Fully illustrated and priced.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Road, S.W.1.—A mailing card showing the situation of the company's instrument repairing depots in Great Britain and Northern Ireland.

MESSRS. J. H. SANKEY & SON, LTD., Essex Wharf, Canning Town, E.16.—A booklet and postcard dealing with "Pyruma" plastic fire cement.

THE REES ROTURBO MANUFACTURING CO., LTD., Wolverhampton.—Pamphlet R.232, illustrating and describing in detail the company's self-contained pumping sets; and Pamphlet R.233, dealing with pumps for acid liquor and chemical trade liquids.

NEW PELAPONE ENGINE CO., LTD., 41, Baker Street, W.1.—Booklet No. 150 and Price List No. 152, containing particulars of the company's small generating sets.

MESSRS. HOUGHTON-BUTCHER (GREAT BRITAIN), LTD., High Holborn, W.C.1.—A price list of radio sets and accessories, including a "special bargain bulletin."

MESSRS. HICK, HARGREAVES & CO., LTD., Soho Iron Works, Bolton.—An illustrated brochure describing surface condensing plant incorporating the "Hick-Breguet" ejectair.

Bankruptcy Proceedings.—GEOFFREY MELLOR, 59, New Oxford Street, W.—This debtor attended at the London Bankruptcy Court on June 11th for public examination, upon accounts showing liabilities of £450 against assets valued at £379. He stated that from October, 1923, till November, 1924, he was employed as a traveller by Neutron, Ltd., a wireless company. In the last named month he commenced business as agent for manufacturers of radio apparatus at Vernon House, Sicilian Avenue, E.C., under the style of "Mellor." He obtained supplies of raw materials and sold them to Neutron, Ltd., who, in return, supplied "Mellor" with manufactured goods for sale on commission terms. Witness closed the business last August and acted as director of Detex, Ltd., which was then formed to deal in a crystal produced by himself. That company went into voluntary liquidation in February last. Since then he had been employed as manager of a limited company engaged in dealing in radio apparatus. He attributed his insolvency to his inability to collect moneys owing to him. The examination was concluded.

C. H. Patrick, 132, Much Park Street, Coventry, electrical contractor and wireless dealer.—The public examination of this debtor was held recently at the County Hall, Coventry. After questions had been put the examination was adjourned. Trustee, Mr. W. Hand, 12, Cherry Street, Birmingham, appointed June 2nd.

H. C. Hall, electrical and fancy goods dealer, "The Pantechnicon," 5, Chapel Street, Penzance.—First meeting held June 16th, at the Official Receiver's office, 12, Princes Street, Truro; public examination, July 19th, at the Town Hall, Truro.

R. Hampson (lately trading with A. Mearns as the Northern Supply Co., of Bolton), electrical engineer, Yew Tree Bungalow, Hall-i'-th'-Wood, Astley Bridge, Bolton.—Receiving order made June 8th, on debtor's own petition.

P. L. Symons, electrician, 4, Nelson Road North, and 4, Victoria Road, Great Yarmouth.—Trustee, Mr. C. B. L. Prior, Official Receiver, 9, Queen Street Chambers, Norwich, released, May 27th.

H. Tidswell (H. Tidswell & Co.), electrical engineer, 54, Trennant Road, Irlams-o'-th'-Height, and 11, Bazaar Street, Pendleton.—Last day for proofs for dividend, June 26th. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

Company Liquidations. — Wainwright Manufacturing Co., Ltd., Walthamstow, E.17, wireless and electrical manufacturers, &c.—A meeting of creditors was held on June 10th, at the Institute of Chartered Accountants, E.C., when the chair was occupied by Mr. Vincent (Messrs. Vincent and Goodrich, C.A.), the liquidator of the company and the receiver for the debenture holders. A statement of affairs was presented which showed liabilities of £3,167, all due to unsecured trade creditors. There was a fully-secured creditor for £35 and debentures and interest amounting to £2,115. The net assets were £788, leaving an estimated deficiency of £2,378. The liquidator said that the company was formed to execute various contracts, and at the time of the incorporation no manufacturing was done. After about three years' trading the company decided to manufacture radio parts, and removed to Walthamstow. The first directors of the company were Mr. E. Wainwright and Mr. S. W. J. Vaisey. On December 6th, 1921, Mrs. Wainwright was appointed a director, and early in 1922 Mr. Vaisey resigned his position on the board, and Mr. H. A. Machin was appointed in his place. The liquidator said that the expenses had been far too heavy. In reply to questions he said that the wireless business had decreased very considerably during the last year; a patent table which the company had taken up was not the property of the company, but belonged to Mr. Wainwright and another gentleman. He (Mr. Vincent) was appointed receiver on May 25th, 1926. It was resolved to appoint a committee of inspection, consisting of the three principal creditors, to act with Mr. Vincent in the voluntary liquidation of the company.

The following are creditors:—

	£		£
Siemens & English Electric Lamp Co., Ltd.	483	Barnes, C. A.	53
Siemens Bros. & Co., Ltd. ...	432	Davis & Timmins, Ltd.	49
Hervé, L., Ltd.	261	Ryman, H. J., Ltd.	47
Wilson, J. R.	174	Streeter, J.	45
Walton Harvey Ltd.	159	Moy, E. F., Ltd.	41
Ever-Ready Co (Gt. Britain), Ltd.	113	Lowenadler, F. W., (Sundries), Ltd.	38
Sifam Electric Instrument Co.	101	Edison Swan Electric Co., Ltd.	36
Ferranti, Ltd.	97	True Thread Screw Co.	35
Igranic Electric Co., Ltd. ...	96	Gillet Bros., Ltd.	29
Robinson & Sons	90	Brands, Ltd.	26
Holmes Bros. (London), Ltd. ...	84	Pettigrew & Merriman, Ltd. ...	24
Norfolk Studios, Ltd.	58	Telegraph Condenser Co., Ltd. ...	23
Birkbys	54	Burnham & Co.	21
Benjamin Electric, Ltd.	53	*Wireless Dealer*	21

B.M.A.S., Ltd., Ashburton Road, Old Trafford, Manchester.—The first meeting of creditors was held on June 7th, at the Official Receiver's Offices, Manchester. According to the statement of affairs the gross liabilities as regarded creditors were put down at £35,840, against total assets of £10,829, leaving a deficiency of £25,011. As regarded contributories the deficiency was estimated at £47,211. The failure of the company was attributed to a falling off in the demand for accessories. The company was incorporated privately in January of last year, to carry on business as manufacturers of electrical ignition apparatus and meter accessories, with head offices and works at the above address, and with depôts for sales and repairs in 11 places in England and Ireland. It was formed to continue the business previously carried on by another company. The total debenture issue was £24,000 and the amount owing to the bank was £24,401. The Official Receiver expressed the opinion that further inquiry into the formation of the company and of the conduct of its business was desirable. The case was left in the hands of the Official Receiver with a committee of inspection.

Bristol & South Wales Electric Welding Co., Ltd.—Winding up voluntarily. Liquidators, Mr. J. W. Williams and Mr. P. Jones, 5, St. Andrew's Crescent, Cardiff. A meeting of creditors is called for June 21st at the offices of the Liquidators. Particulars of claims by July 28th.

Frank Craft (Castleford), Ltd.—Meetings of creditors and contributories June 22nd, at the Official Receiver's office, 21, King Street, Wakefield.

Lydbrook Cables, Ltd.—Winding up voluntarily. Liquidator, Mr. F. V. Hasemore, 123, Queen Victoria Street, E.C.4. Particulars of claims to the Liquidator by June 25th.

Southern Radio Supplies, Ltd.—A meeting of creditors was held on June 9th, at the offices of the liquidator, Mr. P. M. Jones, Terminus Road, Eastbourne.

Private Arrangements.—T. W. Brooks, trading as Brooks and Clayton, electrical and wireless engineer, 72, Belgrave Road, Leicester.—A meeting of creditors was held recently, when a statement of affairs was submitted which disclosed liabilities of £489, all due to the trade. In addition, there were fully secured creditors for £348, who held securities valued at £360, leaving a surplus of £11. The net assets amounted to £615, leaving a surplus of £125. It was stated that the assets were shown on the basis of a going concern and were subject to realisation and costs. Further adjustment might also be necessary. Mr. Brooks commenced business on his own account in June, 1922, with £30 capital. In 1924 Mr. Clayton joined him in partnership, putting £140 into the concern, while Mr. Brooks put in a further £130. In November, 1925, Mr. Clayton left the business. A full set of books had not been kept until this year. It was resolved that a committee of inspection should be appointed consisting of Messrs. Gilbert & Co. (Sheffield), Mr. Tames (E. H. Wood, Leicester), Messrs. Wathes & Co., Ltd., and Mr. C. Latham, of the Wireless & Radio Trades Guardian Association.

J. F. Dare, ironmonger, wireless and electrical engineer, 4, The Parade, Tadworth.—The creditors interested herein were called together on June 8th, at the offices of Messrs. Theodore Bell & Co., London, E.C., when Mr. Bell reported that the liabilities to unsecured creditors amounted to £525, and there were preferential and other claims amounting to £40. The assets consisted of book debts £13 and stock valued at £300. Mr. Bell added that there was a cash creditor for £250, but in the event of the estate being dealt with privately that claim would be withdrawn. The debtor said that he had been in business about 12 months. He had kept no books. He attributed his position to losses on trading chiefly in the radio trade, having installed sets and guaranteed them for six months. It was decided that a committee of creditors should be appointed and endeavours made to sell the business as a going concern.

W. Lanham Mays, 91, Southampton Row, W.C., electrical engineer.—A meeting of creditors was held on June 11th, when Mr. W. A. J. Osborne presented a statement of affairs which disclosed liabilities of £655 and net assets of £118, leaving a deficiency of £537. Mr. Osborne reported that the debtor started business in partnership with a Mr. Short in 1920. He borrowed £250 from his brother and opened offices in the Strand, and also at Tottenham. In 1922 Mr. Short retired from the business. The loan of £250 was repaid, but in March, 1925, was borrowed again in order to enable the debtor to start his present business. The turnover since March, 1925, had been approximately £1,500, and the debtor estimated that he had made roughly 20 per cent. profit. The expenses were £259, and the debtor had been drawing at the rate of £500 per annum. There were no private assets. It was resolved that the debtor should execute a deed of assignment in favour of Mr. W. A. J. Osborne as trustee, provided the cash creditors withdrew their claims.

The following are creditors:—

	£		£
Alliance Wholesale Electric, Ltd.	73	Sloan Electrical Co.	83
Metro-Vick Supplies, Ltd. ...	65		

Dissolutions of Partnership.—Allan & Meggitt, electrical engineers, Canford Hall, St. Peter's Road, Bournemouth.—Mr. J. C. Allan and Mr. S. T. Meggitt have dissolved partnership. Mr. Meggitt will attend to debts and continue the business in his own name.

Reading Radio Installations, dealers in radio supplies, 17, King's Road, Reading.—Mr. A. Williams and Mr. A. Phillips have dissolved partnership. Debts will be attended to by Mr. Phillips, who will continue the business.

Lewis & Mayer, electrical engineers and contractors, Subway Road, Barry Dock, Glamorgan.—Mr. H. E. B. Lewis and Mr. E. T. Mayer have dissolved partnership. Mr. Mayer will attend to debts.

Lead.—In their report dated June 12th, Messrs. James Forster & Co. stated that considerable buying by cable makers caused the firmness in tone early in the week:—"Apart from the lead already in warehouse, the position of supply and demand seems to be pretty evenly balanced. Consumption in this country is of course being curtailed by a shortage of fuel, but, on the other hand, this is being made up for by a better demand from the Continent, there being a shortage of lead in Germany. A satisfactory settlement of the coal dispute and normal fuel supplies for consumers here would probably bring out a good demand for lead, particularly for near delivery, and it is doubtful whether there would be enough lead arriving within the next month to meet this demand. On the other hand, it must not be forgotten that there is plenty of lead in warehouse and this would no doubt make its appearance on any sign of a shortage of arrival lead."

Syrian Customs Duties.—The *Board of Trade Journal* states that by a recent decree the rates of Syrian import duties on most goods were increased. The date of the coming into force of the new tariff has been postponed until July 1st. The duties generally are increased from 15 to 25 per cent. *ad valorem* but a number of specific rates have been instituted. These include a duty of 40 piastres (gold) per hundred on electric batteries for pocket torches.

Irish Free State Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during April last amounted to £30,312, as compared with £25,785 in the same month a year ago. The imports for the first four months of the year are officially returned at £159,499, as against £99,189 in the corresponding period of 1925.

The Licensing of United States Contractors.—All master electricians doing wiring in the city of Kingston, N.Y., now have to file a $500 indemnity bond, pass an examination and pay a $10 licence fee. This is provided for in an amendment to a city ordinance, passed by the Board of Fire Commissioners of the city on April 13th. The Board of Examiners, which will pass on the qualifications of electricians applying for licence, will be composed of the chief of the Fire Department and two members appointed by the president of the Fire Commissioners.—*The Electragist.*

Book Notices.—"Electrical Contracting," by H. Ayres Purdie. Pp. xxxii + 371; figs. 186. London: Ernest Benn, Ltd., 1926. Price, 10s. 6d. net.—The data and information required by the average electrical-contractor is of a varied nature and is usually to be found scattered in a number of publications. The author has made an attempt to put all the necessary information under one cover and the result, in the form of the above book, should prove useful to the electrical contractor, particularly to the man in a small way of business who is employed most of the time on ordinary domestic installation work, but occasionally has to meet conditions where unusual data are required, the small amount of such work not enabling him to draw up the necessary particulars for his own use. The work is divided into six parts, the first of which is devoted to the organisation of an electrical contracting business and should be of value to the contractor when first starting. Many useful suggestions are made concerning capital and credit, business registration, works orders, the requisition of materials, costing, &c. Considerable space is given to the question of advertising and salesmanship, and also to the drawing up of estimates and specifications. The second part, administration, deals with the control of the staff, the issuing of orders and the adherence to the rules and regulations laid down by authoritative bodies such as the Institution of Electrical Engineers. The remaining chapters are concerned with the actual work done by contractors. The various systems of wiring, with recommendations for particular installations, are outlined and many types of apparatus are described and illustrated. A number of diagrams of connections and wiring for installations and apparatus are also included. In an introduction to the book, Mr. J. C. Elvy, A.M.I.E.E., says: "I know of no other single book covering so much ground in electrical contracting work."

The Association of "Old Cromptonians" (Mr. M. Whitgift, hon. sec.), has issued a neat brochure dated May, 1926, containing a list of members, amusing "cataclysms" by J. W. Meares, and "Chelmsford Notes."

"Memoirs of the College of Engineering," Kyoto Imperial University. Vol. IV, No. 2, March, 1926. "The Fatigue of Steel and its Recovery," Part I.

Catalogue of the Collections in the Science Museum, South Kensington. Electrical Communication.—1. "Line Telegraphy and Telephony." Compiled by R. P. G. Denman, M.A., A.M.I.E.E. Pp. 55, illustrated. H.M. Stationery Office. Price 9d. net.—Descriptive and historical notes accompany the items, many of which are illustrated.

Receiver Appointed.—A receiver and manager has been appointed in the Acme Production Co., Ltd., Britannia Works, Engine Street, Smethwick, Birmingham. A meeting of creditors will be held on June 22nd at Queen's Hotel, Birmingham.

Swiss Loan for Bavarian Works.—The *Financial News* reports that the Lech Electrical Works of Augsburg, Bavaria, has placed in Switzerland through a financial group headed by the Bank for Electrical Enterprises, Zurich, a loan of 12,000,000 Swiss francs. The loan bears interest at 7 per cent., and is redeemable within twenty-five years. For the present there will be no public issue.

Lighting and Power Notes.

Adwick-le-Street.—SUPPLY DURING THE STRIKE.—The Urban District Council has rejected the request of over 150 householders at Skelton, near Doncaster, that their supply of electricity should be discontinued during the coal stoppage. The houses occupied by the applicants are supplied with unlimited energy at a weekly charge of not more than 1s. 7½d. per week. The chairman of the Electricity Committee said that applicants were acting within their rights under a clause which said that if a consumer wished to cease taking a supply 24 hours' notice must be given. The Clerk agreed that in law the applications might be in order, but he did not advise that the request be granted. It was pointed out that if permission were given it would be followed by applications during the summer for supply to be discontinued, followed in the winter by requests for renewal.

Australia.—TUMUT.—The *Sydney Morning Herald* reports that the Minister for Works has informed a deputation from the Tumut Municipal Council and the Gadera Shire Council that within a few years the waters of the Tumut Valley would be required as part of the Burrinjuck hydro-electric scheme. Preliminary steps have already been taken for the establishment of a power-house on the Gilmore Creek, near Tumut, to link up with Burrinjuck. The Minister has been informed that a Melbourne company is prepared to spend £1,000,000, and also to supply electricity at a ½d. per kWh.

CASINO.—The new power station at Casino was officially inaugurated in May by the Mayoress, Mrs. Elesmer Jones.

Bangor.—APPLICATION FOR LOAN.—Application is being made by the Corporation to borrow the sums of £3,000 for expenditure on mains and services and £800 for meters.

Barnstaple.—LOAN.—The Town Council has applied for sanction to borrow £3,500 for prospective capital expenditure in connection with the electricity undertaking during the next twelve months.

Bedwellty.—APPLICATION FOR LOAN.—The Urban Council has applied for a loan of £7,945 for electricity purposes.

Billericay.—INSTITUTION LIGHTING.—The Board of Guardians has applied to the Ministry of Health for sanction to a loan of £4,259 for the installation of electric lighting at the new hospital and the institution.

Blackburn.—BULK SUPPLY.—The Mid-Lancashire Electricity Board has made an effort to effect an extension of the existing bulk supply agreement between the Blackburn and Darwen Corporations, but without success.

Bradford.—LOAN.—The Electricity Committee has asked the City Council to approve an application for sanction to borrow £150,000 to meet estimated expenditure on mains and services during the next three years.

STREET LIGHTING.—A special sub-committee appointed some time ago to review the street lighting situation has received a report from Mr. J. F. Colquhoun, street lighting engineer of Sheffield, and vice-president of the Institution of Public Lighting Engineers, who was called in as consultant to examine the street lighting system and give advice on methods of improvement. A feature of the report is a recommendation that gas lighting be replaced by electricity on the main tramway routes. It is recommended that a street lighting engineer be appointed and that the remaining gas lighting be automatic. The sub-committee has accepted the recommendation that a street lighting engineer be appointed, and offers £500 per annum.

Burton-on-Trent.—YEAR'S WORKING.—We have received from Mr. T. Hall, borough electrical engineer, a copy of his report together with the statement of accounts of the electricity undertaking for the year ended March 31st last. The total revenue amounted to £94,937, as compared with £87,559 in the preceding year. Working expenses were £46,498, as against £46,502, leaving a gross profit of £48,440 (£41,058), to which was added a sum of £229 from house rentals, making a total of £48,669 available. After providing for capital charges there was a net surplus of £15,153, of which £2,000 was contributed to the borough fund and the remainder transferred to renewals fund. Reductions in the charges equivalent to a revenue of £5,000 were made during the year. The sales of electrical energy amounted to 15,628,445 kWh, an increase of 2,136,648, and the average price obtained fell from 1.51d. to 1.42d. The maximum supply demanded rose from 4,450 to 5,500 kW. During the year the districts of Swadlincote and Overseal were added to the distribution system.

Cheltenham.—OIL FUEL.—The Electricity Committee has authorised the borough electrical engineer to purchase 50 tons of fuel oil and to make any necessary alterations to the boilers for using the fuel with a view to maintaining as full a supply to consumers as possible during the coal dispute.

Chesterfield.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction for a loan of £5,50 0for the provision of rotary converter plant.

Colombia.—CARTAGENA.—The electricity undertaking recently erected at Cartagena has successfully passed the boiler and turbine tests, and is to be taken over by the municipality of Cartagena.

Continental.—FRANCE.—The Paris correspondent of *The Times* reports that a new hydro-electric power station was inaugurated on June 5th at Eguzon, on the Creuse, in the Department of Indre, some 200 miles from Paris. Here the river has been dammed with a barrage of reinforced concrete, 200 ft. high, and a lake formed containing 72,000,000 cu. yd. of water. The water, passing through pipes 13 ft. 9 in. in diameter, drives five turbines each of 10,000 kW. The 10,000-V energy is transformed up to 90,000 and 150,000 V and is conveyed towards Paris by two lines with numerous sub-stations at intervals, at which the voltage is reduced to 1,500 for traction on the Orleans Railway. It is hoped to save 250,000 tons of coal a year. During slack hours on the railway there will be 20,000 to 30,000 kW surplus available for Paris.

A new 10,000-kW steam turbo-generator has recently been added to the power station at the collieries of the Compagnie des Mines d'Anzin in Northern France.

BULGARIA.—Work has recently commenced on the establishment of a new central power station in Sofia by the Compagnie d'Electricité de Sofia et Bulgarie. Since 1915 the number of consumers has increased from 7,900 to 23,400, and last year the company supplied 14,605,600 kWh, as against 12,637,100 kWh in 1924. A 35,000-V transmission line is being erected between Sofia and Kourilo, a distance of about eight miles.

SWITZERLAND.—Some further particulars of the new Ryburg-Schworstadt super power station which is to be established on

the Rhine as a joint enterprise of the Baden (Germany) Provincial Electric Supply Co., and the North East Swiss Electric Power Co., were given at the recent annual meeting of the Rheinfelden Electric Power Transmission Co. The new plant is to have an eventual capacity of 110,000 h.p., the cost of construction being estimated at £2,400,000.

The Lac de Joux Electric Power Co. has decided on the establishment of a large new power station at an estimated cost of £200,000 with the objects of meeting the increasing demand in the district and also to "export" electricity to France.

CZECHO-SLOVAKIA.—The South Slovakian Electricity Co., of Komarno, which is to supply electricity to a large area in the south of Slovakia, has been formed with a capital of 8,000,000 crowns. Of this the Czecho-Slovakian Government has subscribed 3 million crowns while the remainder has been taken up by the local authorities in the districts to be served by the company. The State is erecting the main power station at its own expense, and will lease to the company for a period of 30 years.

Darlington.—INQUIRY.—An inquiry was held on June 8th by Col. E. T. C. Ekin, Inspector for the Electricity Commissioners, into an application by the Corporation to extend its area of electricity supply so as to include parts of the rural districts of Croft and Darlington. For the Corporation it was stated that it was intended to supply a ring of parishes immediately adjoining the borough boundary which were close to the electricity works. The Corporation was prepared to lay mains in roads and villages where the demand for a supply was satisfactory. The scheme was opposed by the Rural Councils concerned, who demanded that compulsory mains should be laid in certain villages covered by the Corporation's application. The Commissioners' decision will be given in due course.

Darwen.—APPLICATION REFUSED.—An application by the Darwen Corporation for permission to extend its electricity plant by the installation of a 2,000-kW turbo-alternator and one Lancashire boiler has not been granted.

REDUCTION OF CHARGES.—The reduction of the charges for electricity by the Darwen Town Council amount to a total of over £2,800 per annum.

Dover.—YEAR'S WORKING.—The financial statement of the working of the Electricity Department (engineer: Mr. R. C. Harpur) for the year ended March 31st, 1926, records a total income of £55,817, as compared with £52,229 for the previous year. The working expenses amounted to £25,964, as against £28,526, leaving a gross profit of £29,853 (£28,526). The reduction of capital costs, &c., leaves a net balance of £9,253, as compared with £2,023 for 1924-25. The capital expenditure during the year amounted to £14,123, bringing the total up to £296,445. The total kWh sold during the year was 3,070,884, a decrease of 5.04 per cent. on the number for the previous year. The average price per unit amounted to 4.36d.

Gravesend.—ELECTRICITY SUPPLY.—The Electricity Committee has passed estimates of £2,300 for rectifier equipment at Old Road sub-station and £2,000 for h.p. mains to the station from the electricity works.

The Electrical Engineer reports that the cost of providing a supply of electricity to the Tollgate will be approximately £3,000.

Great Yarmouth.—ELECTRICITY IN BULK.—The Electricity Committee is to submit to Lowestoft Corporation terms upon which it would be willing to give a bulk supply of electricity, and a sub-committee has been appointed to confer with the Corporation on the subject.

Hastings.—EXTENSION OF SUPPLY.—The Town Council has decided to extend the mains for the supply of electricity to the housing estate at Broomgrove and for public lighting at an estimated cost of £2,390.

Hazelgrove and Bramhall.—LOAN.—The Urban District Council has applied for sanction to a loan of £1,500 for meters.

Heckmondwike.—SUPPLY RATIONING.—The District Council is rationing its electricity supply to industries, preference being given to food supplies and essential services.

Ilford.—LOAN.—The Urban District Council has applied for sanction to a loan of £5,820 for electricity purposes.

Loughborough.—EXTENSION OF SUPPLY.—A scheme for the extension of its electricity supply to the Nanpantan suburb has been adopted by the Town Council, and application is to be ade for sanction to borrow £3,850. An 11,000-V cable is to be laid partly underground and partly overhead, and a sub-station provided with a 100-kW transformer.

Luton.—LOAN SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £5,000 for meters and overhead mains.

Middleton.—NEW PLANT.—The Town Council has decided to purchase a 1,000-kW converter for £4,360, and has authorised application for sanction to borrow £5,860 for equipment, &c.

Northern Ireland.—BELFAST.—The Corporation has decided to apply to the Electricity Commissioners for Northern Ireland for sanction to a loan of £110,500 for electricity supply extensions

Plymouth.—PLANT EXTENSIONS.—The Electricity Committee of the Corporation has placed an order for a 7,500-kW generating set, the cost, with auxiliaries, being £35,000. The set is to be installed at the Prince Rock station.

Shelf.—BULK SUPPLY.—It is reported that the electricity supply from the Electrical Distribution of Yorkshire, Ltd., is to be available by the end of June.

Shrewsbury.—LOANS.—The Electricity Committee has decided to apply for sanction to the borrowing of £7,000 for mains and £3,000 for services.

Spalding.—UNDERGROUND CABLE.—The Council is to lay underground cables in preference to erecting overhead transmission lines for the supply of electricity in bulk from the Peterborough Corporation, which is expected to be available next March. Tenders for the supply of cable are to be invited.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Electrical Distribution of Yorkshire, Ltd., to supply electricity in the urban districts of Denby, Denby and Cumberworth, Dodworth, Gunthwaite and Ingbirchworth, Hoylandswaine, Shelley, Shepley, Stocksbridge, Thurlstone, Baildon, Denholme, Queensbury, Shelf, and Southowram, and parts of the rural districts of Barnsley, Penistone, and Wharfedale; and Messrs. Crompton & Co., to supply in the urban districts of Seaford and Newhaven, and part of rural district of Newhaven.

Application has been made to the Commissioners by the Urban District Council of Barnoldswick for a Special Order authorising it to supply electricity in the urban district.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical World* the Federal Power Company of Knoxville, Tenn., has applied to the Federal Power Commission for a preliminary permit covering a proposed development on the Nolichucky-Toe Rivers near the North Carolina and Tennessee lines. The primary power to be made available is estimated at 27,800 h.p. The applicant proposes, however, to install 72,000 h.p. The power is intended for public utility service and for use by the electrochemical industry.

The Pacific Gas and Electric Company has in hand a scheme for supplementing the output of its Electra plant. It is proposed to construct a reservoir at Salt Springs, in the Sierra Nevada Mountains, 3,800 ft. above the sea level. The water will be conveyed 23 miles by canal and tunnel to Tiger Creek, where it will fall 1,200 ft. to a new power house of 47,000-h.p. capacity. After passing through the generators of Tiger Creek power house the water will be carried on to the 27,000-h.p. Electra plant, which has lacked sufficient water supply to operate at full capacity in the summer months. The new development will cost about $10,000,000.

Wimbledon.—YEAR'S WORKING.—We have received from the engineer and manager of the Electricity Department (Mr. A. E. McKenzie) a copy of the report of the working of the undertaking for the year ended March 31st last. The total revenue for the year amounted to £130,987, as compared with £116,147 for the previous year. The generating costs for the period in question amounted to £33,696, against £34,460. The net profit of the concern for the year was £33,505 (£23,971). During the year the maximum load on the station increased from 5,280 kW to 6,300 kW. The units sold amounted to 13,586,008, of which 4,520,588 were used for heating and cooking. The average price per kWh was 2.18d., compared with 2.38d. for the year 1924-25. The works costs per unit sold were 21.35 per cent., the total inclusive costs 14.66 per cent., and the coal consumption per kWh was 14.2 per cent. lower than in the previous year. Twenty-eight miles of cable was added to the distribution system during the year.

Tramway and Railway Notes.

Australia.—RAILWAY ELECTRIFICATION.—The South Australian Premier announced recently that the Government has decided on the electrification of the Glenelg railway, which will be the first undertaking of its kind in the State. The Municipal Tramways Trust will supply the electricity and it is expected that the work will be completed in eighteen months. The Premier said that after investigations extending over three years, it had been decided that the most economical method of operating the North and South Terrace lines between Adelaide and Glenelg was by electric traction.—*Reuter's Trade Service* (Melbourne).

Bradford.—THROUGH-RUNNING TICKETS.—The Tramways Committees of the two Corporations are negotiating with a view to issuing through tickets on the Bradford Corporation tramways and the Keighley Corporation motor-'buses, the connection of the two systems being at Cross Flatts.

LOAN SANCTIONED.—The Tramways Committee has received sanction to a loan of £48,000 for track renewals.

Continental.—ITALY.—The tramways between Mantova and Asola and between Mantova and Viadana are to be electrified.

HOLLAND.—A change from a.c. to d.c. has recently been made on the electric railway between Rotterdam and The Hague. The Rotterdam-Scheveningen trains running partly over the same lines are still steam-operated, but it is expected that the line will shortly be completely electrified. Good progress is

also being made with the electrification of the main line between Amsterdam, Haarlem and Rotterdam, and work is expected to be completed next year.

SWITZERLAND.—The report of the working of the Swiss Federal railways during 1925 shows that the output of the Amsteg-Ritom power station last year amounted to 143 million kWh, of which 139 millions were utilised for train haulage purposes. The output shows an increase of about 30 million kWh over 1924, this being due to the completion of the electrification work on the Zurich-Olten, Zurich-Winterthur and Olten-Berne sections. The output of the Barberine power station advanced from 9 million to 23 million kWh, the increase in this case being due to the completion of the electrification work on the Lausanne-Yverdon, Daillens-Le Day and Renens-Geneva sections.

DENMARK.—What is stated to be the first railless electric trolley motor-'bus service in Denmark is shortly to be started in Copenhagen. It is stated that the order for the chassis of the vehicles has been placed in England, while the bodies are to be built in Denmark.

Dewsbury.—COAL CONSERVATION.—With a view to preserving its coal stocks, the Corporation has reduced its tramway services by about 25 per cent.

Leeds.—OIL FUEL.—To help in conserving the decreasing coal supply some of the boilers at the tramway power station at Crown Point are now being partly fired by oil fuel. If and when all the coal reserves are exhausted the boilers can be fed entirely by oil. The plant installed for this purpose during the last mining crisis has been left intact for a repetition of such an emergency.

Liverpool —RESTRICTED AND RESTORED SERVICES.—Following a restricted supply of electricity for power and tramways during the previous few days, the Liverpool Tramway and Electric Power and Lighting Committee on June 4th authorised a full supply of electrical energy for power purposes and a normal tramway service.

London.—MORDEN LINE COMPLETED.—According to *The Times*, the new tube railway from Clapham Common to Morden, which has been constructed at a cost of nearly £3,000,000, has been completed, and it is expected that it will be opened next month. The new railway, which is an extension of the underground system, will serve a population of about 300,000 people. All that is now required is the completion of the electrical equipment and signals. The stations have all been constructed, and the rolling stock has been delivered. Of the five miles of track between Clapham Common and Morden, the first 4½ miles are underground. The remaining half-mile, from Dorset Road to Morden, has been constructed on the "cut and cover" principle, and the railway runs into the open at Morden Station

TRAIN INDICATORS.—Train destination indicators which automatically show passengers the destination of the next train and of the two succeeding trains are to be introduced on the tube lines. These indicators are now being installed on the platforms at Leicester Square, Tottenham Court Road, Charing Cross, Kennington, Euston, Bank, Moorgate, Waterloo and Morden stations, and will be available for use in about a month's time.

Persia.—TEHERAN.—*Commerce Reports* states that the electrification of the horse-tramway system of Teheran has been proposed, and pressure is being brought by the Government upon the Belgian company holding the concession. The company has advised the Government of its willingness to make the change, but suggests that the cost would be prohibitive unless permission to transport materials through Russian territory is secured by the Persian Government.

Sheffield.—TRAMWAY EXTENSION.—The Tramway Committee has prepared a scheme for the extension of the tramway from Millhouses to Beauchief at a cost of £99,000.

Sunderland.—YEAR'S WORKING.—We have received from Mr. A. R. Dayson, manager and engineer of the Tramways Department, a copy of the annual report for the year ended March 31st, 1926. The total income for the year is shown as £124,416 and the working expenses as £99,202, leaving a gross balance of £25,214. After the payment of capital charges, &c., a net balance of £14,068 is left. The car miles run amounted to 1,652,221, the passengers carried to 29,792,834, and the number of units used per car mile was 1.3. During the year £20,346 was spent from the capital account, bringing the total capital expenditure up to £365,750.

TRACK EXTENSION.—The Town Council has decided that the single line of tramway track near the Grangetown terminus shall be doubled, at an estimated cost of £7,000.

Walsall.—YEAR'S WORKING.—The statement of accounts for the tramway undertaking (manager and engineer: Mr. W. Vane Morland) for the year ended March 31st last records a total income of £135,698, of which £80,407 was received from the tramway services and £55,291 from the motor services. The total working expenses amounted to £119,374; tramway, £72,057; and motor, £47,317, leaving a net revenue of £16,324 (£8,350 and £7,974). A total of £6,000 is being given to the relief of rates. The net car mileage on the tramway system amounted to 1,011,544, the passengers carried being 11,800,137. The energy consumption per car mile amounted to 1.471 kWh.

St. Helens.—TRACK RENEWALS.—The borough engineer has submitted to the Tramway Committee a scheme for relaying the tramway track in Corporation Street, Cotham Street, and Shaw Street, and laying track in Station Road and Ormskirk Street, at a total estimated cost of £14,900.

Telegraph and Telephone Notes.

Anglo-Norwegian Cables.—AGREEMENT TERMINATED.—In 1911 the British and Norwegian Governments jointly acquired the Great Northern Telegraph Co.'s cable between Scotland and Norway, but by arrangement with the Post Office the working in Great Britain both of this and of a duplicate cable laid by the two Governments remained in the hands of the Company. The remuneration received for the working of these cables has gradually become insufficient, and the Company has therefore been compelled to terminate the arrangement as from the middle of May last, when the General Post Office itself took over the working of the cables.

The recently-issued report of the Great Northern Telegraph Co., Ltd., for 1925 shows that about 4,968 nautical miles of cable are now being operated in Europe and approximately 3,453 miles in the Far East. By strengthening and renewing all weak sections, the Company's cables have been maintained in excellent condition, the number of breaks repaired during 1925 showing no increase as compared with previous years. In Europe 26 breaks were repaired in 10 cables, and in the Far East 22 breaks in eight cables, apart from which six shore ends were renewed in the Far East.

Brazil.—NEW RADIO STATION.—The new high-power wireless-telegraph station at Rio de Janeiro, which was opened recently by the Brazilian Minister of Communications, has been equipped with a 20,000-metre-ampere valve transmitter by Marconi's Wireless Telegraph Co. The station is being used for telegraph communication by radio between Brazil and Europe, Africa, Australia, North America, and the other countries of South America.

Germany.—WIRELESS ON RHINE STEAMERS.—Permission has now been accorded by the Inter-Allied Rhineland High Commission for the use of wireless transmitters and receivers on Rhine steamers when passing through "occupied territory." Certain conditions are attached to the permission: The maximum wave-length permitted is 600 metres, and the capacity of transmitters may not exceed 250 watts; all apparatus must be registered with the Post Office and an accurate description deposited with the authorities.—*Reuter* (Cologne).

India.—AUTOMATIC TELEPHONY.—Our special correspondent reports that, owing to a number of disadvantages now disclosed in the working of the automatic telephone system, the Government of India has abandoned its intention of extending the system to places where it has still to be introduced. The principal defect found is that the system requires intelligent operation and mishandling is likely to result in wrong numbers being obtained, the subscriber having to pay for his mistake. On this account the system is not considered to be quite suited to India. Wherever automatic instruments have been introduced, they have become unpopular. Even the economy vouched for when the system was being introduced has not materialised, because, though it was expected that by reason of the reduction in the number of operators, money would be saved, it has been found necessary to employ expert and highly-paid supervisors to attend the more complicated adjustments inseparable from the automatic system. The care needed to "dial" a number often proves too exacting for the average user in India.

The Telephone Service.—LAST MAGNETO EXCHANGE.—The "Bank" telephone exchange rang its own death knell on June 5th. It was the first London exchange to be fitted with a multiple switchboard, and the last to be worked on the "magneto" principle, which obsolete method of calling the attention of the operator by turning a handle and ringing a bell has now passed for ever. In point of numbers, "Bank" was the smallest of the London exchanges, having less than 1,000 subscribers, who will now be transferred to the "Central" exchange.

Telegraph Regenerator.—NEW CABLE DEVICE.—Sir John Denison-Pender, in his speech to the shareholders of the Eastern Telegraph Co., mentioned that during the past year an invention of the staff of considerable importance had been installed upon certain of the Company's cables, and would be on practically all its cables so soon as the necessary apparatus could be made. It was termed a "regenerator," and overcame the disabilities inherent in the old system of relaying from one cable into another cable, which did not permit of successful operation of a chain of cables, except at greatly reduced speeds, owing to distortion of signals both in the cables and in the relay apparatus, which distortion became cumulative. The regenerator, which had been installed on the London-Porthcurnow-Carcavellos-Gibraltar cables for over eight months, had increased the speed by over 35 per cent. The additional gain in traffic-carrying capacity due to reduction of stoppages and improved working amounted to 13 per cent., making the total gain on this section over 48 per cent. It had also just been installed on the Gibraltar-Malta-Alexandria station 3 section with improved carrying capacity of 27 per cent. Efforts were continuously being made on other circuits to increase speeds, and, as an instance of the results achieved, the present speed in and out of London on the Company's cables was 23 per cent. in excess of that existing in 1922.

Radio Notes.

Australia.—WIRELESS CONFERENCE.—At inter-State conference was held recently at Sydney, at which animated debates took place on the subject of licence fees and the future control of wireless in Australia. After a prolonged discussion it was recommended that the Federal Ministry should be asked to appoint an advisory board to assist in the administration of broadcasting regulations. Spirited discussion followed a proposal that a Royal Commission be appointed by the Government to consider the advisability of confining the commercial broadcast wave-length in Australia within the standard length of from 200 to 600 metres, but it was eventually decided to take no action with regard to wave-lengths. The conference decided to ask the Federal Postmaster-General to increase generally the margin of wave-length between the stations 4QG (Queensland), 2BL (New South Wales), 3LO (Victoria), 3AR (Victoria), and 5CL (South Australia).—*Reuter's Trade Service* (Melbourne).

Licences.—STILL INCREASING.—Answering a question in the House of Commons, the Postmaster-General (Sir W. Mitchell-Thomson) said the total number of wireless licences at present in force in Great Britain and Northern Ireland was about 2,050,000.

New High-power Station.—DAVENTRY TESTING PLANT.—A new high-power broadcasting station is in course of construction at Daventry for the purpose of experimenting in the direction of making alternative programmes available to a wide circle of listeners provided only with simple receiving sets. The object of the British Broadcasting Co. is to see how far it is possible to provide such programmes without interfering with the existing services of the Government, the Army, the Navy, and the Air Force. The experiments will probably be carried out in the early hours of the morning, and no public programme will be issued from the new station. The strength of the station is to be from 10 to 15 kilowatts, and it is not to be an addition to the present series of stations, but simply for experiments on the ordinary broadcast wave band.

Venezuela.—BROADCASTING SITUATION.—The Empresa Venezolana de Radiotelefonia was formed towards the latter part of 1925 for the purpose of broadcasting entertainments, news, lectures, &c., and to import, construct, sell, rent, and maintain all classes of broadcast radio receivers. The broadcasting station is provided with a 1-kW transmitter, and an aerial supported on two 165-ft. lattice-steel towers, all of American manufacture, the installation and testing having been successfully concluded in May, 1926. H.M. Consul at Caracas reports to the Department of Overseas Trade that the wave-length at present in use is 375 metres; public supply of electricity is relied upon for power, but, in spite of the use of an automatic regulator, trouble is being felt, due to the erratic nature of this power supply. It seems unlikely, however, that local broadcasting will be taken seriously, and consequently purchasers of receiving apparatus will probably still depend essentially on foreign stations for their entertainment.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Asia Minor.—BAGDAD.—June 28th. Direction Générale des Chemins de fer d'Anatolie. One electrically-driven semi-portal crane. (A.X. 3191.)*

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 2528.)*

August 23rd. 10-in. disk suspension insulators. (B.X. 2614.)*

July 14th. Victorian Government Railways. A.c. power interlocking machine. (B.X. 2596.)*

September 1st Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

August 11th. City Council. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

August 10th. Telephone exchange indicators. (B.X. 2597.)*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast.—June 29. Harbour Commissioners. Two electrically-driven main pumps, &c. Specification, &c., from the Harbour Engineer, Harbour Office, Belfast.

Belgium.—June 30. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. 240 kilometres of bronze wire in six lots. Particulars (Cahier des Charges Special No. 3-196) for 95 centimes.

Bentley-with-Arksey (near Doncaster). — June 22nd. Urban District Council. Tubing, wiring and electrical fitting of 32 houses and 16 bungalows on Jossey Lane housing site. Mr. P. C. Woodhall, engineer, Council Offices, Bentley.

Brazil.—PORTO ALEGRO.—July 8th. Municipal Council. Electrical material for street lighting. (B.X. 2571.)*

Burnley.—June 26th. Joint Hospital Board. Electric lighting system at the Sanatorium, Marsden Road. (June 4th.)

Dublin.—June 23rd. Great Southern Railways, Ireland. One steam crane and lifting magnet. Forms of tender from the Stores Superintendent, Inchicore, Dublin.

June 24th. County Borough Commissioners. Arc lamp carbons, electric cookers, and h.p. and l.p. circuit breakers. (June 11th.)

June 28th. One steam turbo boiler feed pump, three air filters, two electric vehicles, and steam and water meters. (June 11th.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537.)*

October 15th. Installation of electric power station equipment at Kench and Luxor. (B.X. 2627.)*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

Glasgow.—June 21st. Education Authority. Installation of electric light at Provanside School. Mr. J. Clark, Director of Education, 129, Bath Street.

Grays.—June 30th. Grays Thurrock Urban District Council. H.p. switchgear, 3,300-V, 3-core cable, and transformers. (See this issue.)

Hamilton.—Lanarkshire County Council. Electric lighting installation at school, Hairmyres Colony. Mr. P. C. Smith, Housing and Town Planning Department, Hamilton.

India.—July 2nd. India Store Department. E.h.p. armour-clad switchgear. (June 11th.)

London.—BERMONDSEY.—July 15th. Borough Council. Electrical installation for lighting, heating, and power at the baths and washhouses, Grange Road. (June 11th.)

Lurgan.—June 21st. Urban District Council. Oil engines and generators, motor-driven pumps, main switchboard, and underground and overhead mains. (June 4th.)

Manchester.—July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plant and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (June 4th.)

July 5th. 33,000-V trunk feeders, pilot cables, and telephone cables. (June 11th.)

New Zealand.—CHRISTCHURCH.—October 19th Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana Electric Power Scheme. (B.X. 2608.)*

July 20th. Phase transformer for Mangahao electric power scheme.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

November 2nd. Electric generators and turbines for Waikaremoana electric power scheme. (B.X. 2622.)*

Normanton.—July 5th. Urban District Council. 1,400 yd. feeder cable. (See this issue.)

Nottingham.—July 6th. Electricity Department. Twelve months' supply of general stores. (See this issue.)

Otley.—June 21st. U.D.C. Electricians' work in connection with the erection of 56 houses, Harefield estate, Farnley Lane. Surveyor to the Urban District Council.

Salford.—June 26th. Electricity Department. Complete workshop equipment for the Agecroft power station. Specifications from the City Electrical Engineer.

South Africa.—July 8th. South African Railways and Harbours. Telegraph material, poles, cross arms, &c. (A.X. 3173.)*

Uruguay.—MONTEVIDEO.—July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres of rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Two turbo-alternators, condensing plant, &c., for Birchills power station. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Australia.—SYDNEY.—City Council.—The Council at its meeting on May 3rd, decided to postpone consideration of the Electricity Committee's recommendation to accept the Australian Commonwealth Shipping Board's tender for mechanical draught plant at £98,833, pending receipt of cable advice from Mr. Forbes Mackay, who is to compare the tenders lodged, &c., and report.—*Tenders.*

The following tenders were accepted :—

Switchgear for Bunnerong power house (£181,356).—Metropolitan-Vickers Electrical Co., Ltd.
Underground cables (section 1).—W. T. Henley's Telegraph Works Co., Ltd. (£4,634); (sections 2, 3, 4, and 5), Enfield Cable Works (Aust.), Ltd. (£19,244).
Fuse boxes and fuses (£10,094).—B. W. Electric Co., Ltd.
H.p. jointing material (£9,762).—Noyes Bros. (Sydney), Ltd.
L.p. d.c. machine panels (£1,300).—Metropolitan-Vickers Electrical Co., Ltd.

NEW SOUTH WALES RAILWAYS. Accepted :—

100 B.T.-H.-type traction motors (£21,996).—Australian General Electric Co., Ltd.

MELBOURNE.—Commonwealth Department of Works and Railways.

Two main passenger electric elevators, Sydney G.P.O. (£9,560).—Standard-Waygood, Ltd.
Electric elevator (kitchen), Sydney G.P.O. (£1,850).—Edmiston & O'Neill Pty., Ltd.

State Electricity Commission of Victoria.

Aluminium cable (£3,943).—British Insulated Cables, Ltd.

—*Tenders.*

Chesterfield.—Electricity Committee. Accepted:—

Cable (£213).—W. T. Glover & Co., Ltd.

Glasgow.—Electricity Committee. Accepted:—

Twelve months' supply of :—

Malleable iron tubes and fittings.—Stewarts & Lloyds, Ltd.
L.p. cables.—Callender's Cable & Construction Co., Ltd.; Enfield Cable Works, Ltd.
H.p. cables.—Callender's Cable & Construction Co., Ltd.; W. T. Glover and Co., Ltd.
I.r. cables and flexibles.—Craigpark Electric Cable Co., Ltd.
Meters.—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Elkay Electrical Mfg. Co., Ltd.; Ferranti, Ltd.; Measurement, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Arc lamp carbons.—General Electric Co., Ltd.
Cast-iron boxes, section pillars, &c.—Carron Co.; Falkirk Iron Co., Ltd.; M'Dowall, Steven & Co., Ltd.; Robert Taylor.
Cotton waste and dusters.—Easson Bros.; Joseph Findlay & Co.; Porter Bros., Ltd.; Tindal, Hamilton & Co.; Wm. Wiseman & Sons.

Health Committee. Accepted :—

Electric lighting installation at York Street reception house (£87).—Northern Electric Co.

Tramways Committee. Accepted :—

D.c.c. wire.—R. Johnson & Nephew; Siemens Bros. & Co., Ltd.

India.—BOMBAY.—Municipal Corporation. Accepted :—

Electrical installation at students' hostel :—

Marsland, Price & Co., Ltd. (Accepted.)	Rs. **6,490**
Eastern Electric Light and Power Co.	6,889
Holland & Co.	8,593
Crompton & Co., Ltd.	8,792
Sterling Electric Works, Ltd.	8,900
Josts Engineering & Co., Ltd.	8,969
Greaves, Cotton & Co., Ltd.	10,000
Allen Electric Co.	11,016

Lamp Contracts.—Contracts for "Cosmos" electric lamps have been placed with Metro-Vick Supplies, Ltd., by the London, Midland & Scottish Railway Stores Department, the Air Ministry, and the London County Council.

London.—ADMIRALTY.

Lampholders and insulators.—Edison Swan Electric Co., Ltd.

ST. PANCRAS.—Special (Emergency) Committee. Accepted :

7,040 yd. l.p. cable (£904).—Standard Telephones & Cables, Ltd.

ST. MARYLEBONE.—Electricity Supply Committee. Recommended :—

Wiring for electricity the tenements in Ashland House (Ashland Place) and Berkeley Buildings.—London & South Wales Electrical Engineers, Ltd.

SHOREDITCH.—Lighting Committee. Recommended :—

Wiring and fittings for electric lighting, heating and cooking, tenements (30), at Archer House Extension and Arrow House (£683).—Electrical Installations, Ltd.
High-pressure boiler feed mains at the Whiston Street power station (£548).—Babcock & Wilcox, Ltd.

Newport (Mon.).—Electricity Committee. Accepted:—

Overhead line to Llanwern (£696).—Johnson & Phillips, Ltd.

Normanton.—District Council. Accepted:—

Transformers (£215).—Bruce Peebles & Co., Ltd.
Cables (£896).—British Insulated Cable Co.
L.p. switchgear (£400).—Metropolitan-Vickers Electrical Co., Ltd.

Oldham.—Electricity Committee. Accepted:—

A.c. meters.—Measurement, Ltd.
Electric motors.—English Electric Co., Ltd.
Portable conveyor.—C. H. Johnson & Sons, Ltd.
Manhole frames and covers.—John Hall & Sons, Ltd.
Meter boards.—Samuel Ashton, Ltd.

Portsmouth.—Electricity Committee. Recommended:—

Cable (£1,351).—Johnson & Phillips, Ltd.
Circulating pump (£740).—G. & J. Weir.
Steam pump (£350), electric pump (£288).—Mather & Platt, Ltd.

Sunderland.—Corporation. Accepted:—

Replacements to mechanical stokers.—Edward Bennis & Co., Ltd.

Sutton Coldfield.—Electricity Committee. Accepted:—

Switchgear (£178).—G. Ellison.

Wakefield.—West Riding County Council. Accepted:—

Goods lift for New Central Stores.—Medway's Safety Lift Co., Ltd.

Forthcoming Events.

Institution of Heating and Ventilating Engineers.—Monday, June 21st, to Wednesday, June 23rd. At Scarborough. Summer meeting.

Radio Society of Great Britain.—Wednesday, June 23rd. At the Institution of Electrical Engineers, Savoy Place, W.C. At 6 p.m. Ordinary meeting.

Institution of Electrical Engineers.—Jubilee of the Telephone. Thursday, June 24th. At the Hotel Cecil. At 1 p.m. Reception and luncheon.
At 3.30 p.m. At the Institution, Savoy Place. Lecture on the "History and Development of the Telephone," by Sir Oliver Lodge, F.R.S.
Thursday, June 24th. At the Science Museum, South Kensington. At 8.30 p.m. Annual conversazione.

Electrical Contractors' Association Allied Associations.—First Annual Conference. June 23rd, 24th, and 25th. At the Royal Pavilion, Brighton.

Tramways and Light Railways Association.—June 24th and 25th. At Torquay. Annual Conference.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

HERCULITE metal filament lamps.

Notes.

Battery Locomotive Competition.—The Secretary for Mines announces that the report of the judges appointed to adjudicate on the electric storage-battery locomotive competition for a prize of £1,000 offered by Mr. Charles Markham has been published. The object of the competition was to encourage the production of a safe and efficient type of battery locomotive for use underground in coal mines, with a view to obviating the use of pit ponies and increasing coal production. Ten entries were received, five of which were selected by the judges as being suitable for submission to working tests. The winning design was entered by Messrs. Joseph Booth & Bros., Ltd. An outline is given of the technical requirements governing the competition, the tests applied, and a general description of the winning locomotive (see ELECTRICAL REVIEW, October 2nd and 9th, 1925). The report (price 1s. 3d., by post 1s. 4d.) may be purchased through any bookseller, or directly from H.M. Stationery Office.

Threatened Tramway Strike Averted.—The Bury Council decided after the general strike to reduce the holidays of its tramway employés from eight days to four, and as a result the men threatened to refuse to run trams outside the Bury and Radcliffe area after June 19th. The Council replied that unless the men worked unconditionally according to the instructions given by the general manager their services would be dispensed with. The men have withdrawn the strike threat and the situation is to be further considered by the General Purposes Committee.

Batti-Wallahs' Trip to Paris.—The Batti-Wallahs' Society will pay a week-end visit to Paris next month, and will be happy to have the company of ladies and gentlemen introduced by members. In order that suitable hotel arrangements may be made, applications should be sent to the honorary secretary, Mr. M. Whitgift, 7, Coulter Road, Hammersmith, W.6, not later than June 22nd. The party will leave Victoria on Friday, July 24th, at 2 p.m., arriving in Paris at 8.15 p.m. It will leave Paris on the return journey on Monday at 4 p.m., arriving at Victoria at 10.15 p.m. (First-class rail, accommodation at Hotel de Louvre (or Louvois), including all meals, motor rides round Paris, to Versailles or Fontainbleau, motor on Sunday to Auteuil Races for the Grand Prix, transport of baggage, &c., £9 10s.)

Late Legal.—MARCONI VALVE PATENT.—In the Chancery Division, on Tuesday, Mr. Justice Tomlin made an order by consent granting an injunction to the Marconi Wireless Telegraph Co., Ltd., restraining Brahams (Houndsditch), Ltd., from infringing their letters patent No. 184,446 for wireless valves. Mr. Trevor Watson, for the plaintiff, said it had been agreed that defendants should pay £50 as damages and 15 guineas as fees to the plaintiff's representatives for the examination of the infringing articles.

RADIO PHONOPORE AND ELECTRICALS, LTD.—Mr. Justice Romer, in the Companies Winding-up Court, on Tuesday, made an order for the compulsory liquidation of this company, on the petition of Mr. C. W. Slingo, of 39, Loveday Road, West Ealing. Counsel for the petitioner said the petition stood over for arrangements to be made. While admitting that negotiations had not entirely broken down, it was obvious that a winding-up order could not be avoided, and he asked for the usual order.

NELSON ELECTRIC CO., LTD.—Mr. Justice Romer, in the Companies' Winding-up Court, on Tuesday, adjourned for a week the petition of Mr. Eugene Durand for an order for the compulsory liquidation of this company. Counsel for the company said the petitioner's debt had been paid, and that arrangements had been made to pay other creditors for sums amounting to £2,369 within a few days.

W. E. Highfield Shield Competition.—The deferred meeting of the London members of the National Association of Supervising Electricians was held on June 10th to decide on the winning papers in the fourth annual competition for the above shield and additional prizes. For the members' section the shield and the first prize, value £3 3s., presented by Messrs. W. T. Henley's Telegraph Works Co., Ltd., were awarded to Mr. R. K. Haslett, Belfast, for "27 Years Experience of Electrical Installation Work." The second prize, value £2 2s., presented by Messrs. Burdette & Co., Ltd., was awarded to Mr. W. J. Revell, London, for "Practical Hints on Estimating." The third prize, value £1 1s., by Millns Electrical Co., to Mr. J. Southern, London, for "Ups and Downs of Electrical Contracting." The first prize of the associates' section, value £2 2s., presented by Power Contracts, Ltd., was awarded to Mr. T. V. Harding, London, for "Marine Practice To-day," and the second prize, value £1 1s., by the Editor of *Electricity*, to Mr. H. J. Kimber, London, for "Organisation and its Relation to Progress."

Breakdown at Manchester.—It is reported that a fault on one of the 33,000-V cables connecting the Barton generating station with the city resulted in an almost complete failure of the supply to the city on June 13th.

Indian Railway Electrification.—An important contract received by the Metropolitan-Vickers Electrical Co., Ltd., from India comprises 41 electric freight locomotives for the electrification of the Great Indian Peninsula Railway main line from Bombay to Igatpuri and to Poona, both branches passing over the Ghats, where gradients of 1 in 40 and 1 in 38 are regularly encountered; the gauge of the line is 5 ft. 6 in. The locomotives will be of the side-rod type, with motors mounted above the deck, and consist of two trucks, each with three axles, coupled together with an articulating joint, a single body being mounted on the pair of trucks. Each truck will have a twin motor of 1,300 h.p. rigidly mounted on it and driving a jack shaft through single reduction gearing, with gears on each side of the motor. Pinions of the flexible spring type will be used in order to transmit the power resiliently to the jack shaft, which will transmit its power to the rear axle of the truck through long connecting rods, and to the other two axles from the rear axle by means of coupling rods. Each truck will have the same electrical equipment, the total horse-power of the locomotive being 2,600 h.p. on the one-hour rating. The motors will be provided with forced draught so as to enable a high continuous rating to be obtained. The centre of gravity of the locomotive will be comparatively high, with the main running axle boxes inside the wheels, which will give a very good combination for smooth running. The locomotive speed will generally be about 20 miles per hour on the gradient, with a maximum speed of 45 miles per hour. Regenerative braking is to be provided to enable heavy trains to be safely handled on the hilly section of the line.

Proposed Electrical Congress in Moscow.—The Trade Commissariat has authorised the State Planning Commission and the Supreme Economic Council to call a Pan-Union Electrotechnical Congress in Moscow towards the end of the year.—*Reuter's Trade Service* (Moscow).

Drying-Out Plant for Transformers.—In Bulletin No. 56/57, just issued by Messrs. Oerlikon, Ltd., London, there appears a description of a new drying-out installation recently put into service at the Oerlikon Works in Switzerland, which presents several interesting features. It consists of a tank capable of accommodating the largest transformers, in which the air is exhausted during the drying-out process by means of a vacuum pump. Heating is effected either by steam pipes arranged in the tank, or by an external heater through which the oil of the transformers is forced by a circulating pump. The tank has a diameter of about 16 ft. and a total height of about 22 ft. The tank has a circular section, both bottom and cover being dished; the cover is fitted with a vacuum gauge and a thermometer. Provision has been made for glass inspection windows and electric lighting in the tank, so that the upper surface of oil in the transformer tank can be easily examined during the drying-out process. The cover of the tank is hinged and can be raised by means of a motor-driven winch; the tank is nearly completely sunk in the floor.

The use of steam heating by means of the pipe system is mainly confined to cases where a number of small transformers are being dried out at the same time. When, however, large transformers with a great heat capacity have to be dealt with, this mode of heating is too slow, owing to the low thermal conductivity in the tank, due to the rarefaction of the air. The transformers are then dried out by causing the oil to circulate through the oil heater, which is of standard Oerlikon design and has a capacity of 100 kW. Owing to the fact that the oil is heated indirectly in this plant and does not come into contact with the electric heating coils, there is no danger of the oil being overheated at any point. The oil heater is fitted with safety devices which cut off the heating current when the temperature of the oil rises too high, or interrupts the oil circulation. Arrangements have been made to permit of heating the oil directly by means of electrical resistances, should it be desired, air-tight bushings being provided for leading in the conductors.

As the drying-out process is carried out with a high vacuum in the tank, the circulating pump for the oil heater cannot operate as a suction pump, but has to be used as a compression pump; consequently, it has been necessary to mount it at the bottom of the tank. The oil heater, however, is installed above on the floor level, at the side of the tank. The circulating pump consists of a centrifugal pump built as an integral part of the driving motor; the pump has no glands and no external moving parts; it requires no attention, works practically noiselessly, and is very reliable in operation. The vacuum pump for exhausting the air in the tank is also of the Oerlikon Co.'s manufacture.

Fatalities.—At an inquest at Boosbeck, Redcar, recently on Henry Nellist, 16, it was stated that while in some outbuildings he took hold of about three inches of non-insulated wire attached to an electric lighting ceiling fitting and received a fatal shock. A verdict of "Accidental death" was returned.

An inquiry was held recently into the death of J. E. Redwood (36), who was killed by falling a distance of 70 ft. whilst working at the Grove Road generating station, St. Marylebone. Deceased was engaged in shifting tackle. A verdict of "Accidental death" was recorded.

As the result of burns received from a fire at the Osborne Street, Manchester, generating station on June 10th, John Ryan (36) died in the Jewish Hospital on the same day.

Fulham Strike Episode.—It is reported that the Fulham Electricity Committee has recommended that the six men who were concerned in the recent strike episode at the Fulham electricity works be taken back as vacancies arise, at the discretion of the engineer, on the strict understanding that a repetition of such action will be visited with instant dismissal without any hope of reinstatement.

Awards to Inventors' Report.—The fourth report of the Royal Commission on Awards to Inventors has been published as a Parliamentary Paper (Cmd. 2,656, H.M. Stationery Office, price 2d. net). It relates to the proceedings of the Commission from August 1st, 1924, to December 31st, 1925. The Commission sat on 46 days and dealt with 39 cases; the Investigating Committee dealt with 60 claims and heard 14 of the claimants in person. Particulars of the claims actually heard are given in appendices of the report. Awards varying from £200 to £2,500 were granted in respect of several wireless apparatus inventions.

Cooper's Hill War Memorial Prize.—The triennial award of the above prize which fell to the Council of the Institution of Electrical Engineers last year is still at their disposal, no papers having been submitted. The Council have selected the following seven subjects, and members are invited to submit for consideration not later than October 31st a paper on any one of them:—

"The Use of Electricity in Public Works."
"Hydro-Electric Power in Rural Districts."
"Electrification of Railways."
"Electricity in Agriculture."
"Electric Railways in the Empire Overseas."
"Hydro-Electric Resources in the Empire Overseas."
"The Line and Wireless Communication of India."

Only corporate members of the Institution who were under 30 years of age on January 1st, 1926, are eligible for the prize, which consists of: (1) A bronze medal; (2) a parchment certificate of award; (3) a money prize of the value of about £25.

Appointments Vacant.—Shift engineer for the Eccles Corporation electricity works. Shift engineer for the Hong-Kong Electric Co., Ltd. District engineer for the Electricity Distribution of North Wales and District, Ltd. General manager and engineer for the Rhondda Tramways Co., Ltd. Electrical engineers for the Public Works Department, Government of Burma. Meter room assistant for the Stepney Borough Council Electricity Department. (See our advertisement pages to-day.)

Hospital Equipment.—In the new buildings of University College Hospital, London, having a total content of about 4,000,000 cubic feet, new boiler plant has been installed for the heating of the whole of the hospital buildings. From a central control room the heating, hot-water and steam services throughout the buildings are regulated, with the aid of electrical distant thermometers in all the wards, &c. The four kitchens are all equipped with apparatus for cooking by steam, gas, and electricity, automatic electric lifts, and electric ventilating fans, and washing-up is done with electrically-driven steam-heated washers, which enables one maid in half-an-hour to do work which formerly occupied several women for the whole afternoon. Refrigerating plant is also installed. All the sterilisers can be operated by either steam or electricity. The whole of the engineering work was designed by Mr. A. H. Barker, M.Inst.C.E., consulting engineer to the hospital.

Large Italian Transformers.—The Società Industriale San Giorgi, of Turin, is at present constructing three oil transformers with external water cooling, for the Terni steelworks, which are notable from the point of view of their size. Each of the transformers, which will weigh about 134 tons, will have a continuous capacity of 43,000 kVA, and is intended to deal with 10,100/143,300-V 45-period energy.

Association of Consulting Engineers.—The 12th annual general meeting of the Association of Consulting Engineers (Inc.) was held on May 27th, when the report of the committee for the 12 months ended April 30th, 1926, was presented. The membership of the Association at the end of the period under review was 110. The income for the year was £467, being £51 in excess of the expenditure.

Institution Notes.

Institution of Electrical Engineers.—JUBILEE OF THE TELEPHONE.—The fiftieth anniversary of the telephone will be celebrated by the Institution on June 24th, 1926, and in that connection the President and Council are giving a luncheon at the Hotel Cecil on that day. A meeting is also to be held at 3.15 on the same afternoon in the lecture theatre, when the Faraday Medal of the Institution will be presented to Colonel R. E. B. Crompton, C.B., honorary member and past-president. The presentation will be followed by a lecture by Sir Oliver Lodge, D.Sc., F.R.S., on "The History and Development of the Telephone." The Institution conversazione will take place in the evening.

Institution of Public Lighting Engineers.—CONFERENCE.—The annual conference of the Institution is to be held at Newcastle from September 14th to 16th next, and municipalities throughout the country are being invited to be represented. Mr. H. Dickinson, City Electrical Engineer of Liverpool, will read a paper at the conference on "Some Aspects of Electric Street Lighting in Liverpool." We are informed that Mr. Alexander C. Cramb, M.I.E.E., engineer and manager of the Electricity Department, Croydon, has accepted the invitation of the Council of the Institution to take the office of vice-president so as to become president of the Institution in 1927, when the annual conference will take place at Brighton.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

The *Birmingham Post* states that the Wolverhampton Electricity Committee has accepted the resignation of the borough electrical engineer, Mr. S. T. ALLEN, following his appointment as engineer and manager of the West Midlands Joint Electricity Authority. The Committee recommended the appointment of the present assistant engineer, Mr. E. MORGAN, as his successor, but when the matter was discussed by the General Purposes Committee there was a sharp division of opinion, and the General Purposes Committee passed a resolution that the post should be advertised. The salary proposed was £1,000 per annum, with two annual increments of £125 per annum, and it was not proposed to appoint a successor to Mr. Morgan. The Electricity Committee pointed out that the generating station would be transferred to the West Midlands Joint Authority probably at the end of the current financial year, and it was considered advisable to have an engineer familiar with the undertaking. The matter came before the Town Council on June 14th, when it was decided to appoint Mr. Morgan to the position at a salary of £1,000, without the proposed annual increments.

Mr. EDGAR SHUTT, who has retired after 19 years' continuous service in the meter department of the Blackpool Corporation Electricity Department, was recently presented with an easy chair by the staff. Mr. C. Furness, chief engineer, made the presentation.

At the annual meeting of the Ayrshire Electricity Board, ex-Provost MATTHEW SMITH, O.B.E., Kilmarnock, was unanimously reappointed chairman of the Board. Police-Judge SMITH, Ayr, and ex-Bailie DAVID JONES, Kilmarnock, were unanimously re-elected conveners of the Finance and Engineering Committees respectively.

Mr. A. J. HOWARD, borough electrical engineer, Taunton, left Southampton on Saturday last on the *Berengaria* for a health and pleasure trip, at his own expense, to U.S.A. and Canada, where he will have an opportunity of studying electrical developments.

Mr. P. G. RUDD has resigned his position as sales manager with the Solidite Manufacturing Co., Ltd. His private address is 13, Courtley Avenue, Clapham Common, S.W.

Mr. H. G. WRIGHT, A.M.I.E.E., engineer and manager, The Cleveland Trust, Ltd., Electricity Works, Saltburn-by-the-Sea, has been appointed electrical engineer to the Aldershot Gas, Water and District Lighting Co., and will take up his duties on June 24th.

Mr. W. D. DAWES, London manager and secretary of the Anglo-Argentine Tramways Co., Ltd., has been appointed managing director of the company, and the assistant secretary, Mr. J. S. ANDERSON, has been appointed secretary.

Mr. J. T. GREEN, who has been with the Liverpool Electric Cable Co., Ltd., since its formation in 1901, as chief clerk, assistant secretary and branch manager, has relinquished his connection with the company. His address is 51, Devonfield Road, Orrell Park, Liverpool.

Mr. C. W. PEARCE, late works manager of the Dynamo and Motor Repairs, Ltd., has been appointed works manager of Manda Motors, Ltd.

Obituary.—LORD STEVENSON.—We regret to record the death of Lord Stevenson at the early age of 53 years. As Mr. James Stevenson he rendered important organising service to the Ministry of Munitions during the war; in 1921 he was appointed to the Committee which subsequently became responsible for the Stevenson rubber restriction scheme; and when the British Empire Exhibition was in process of organisation he was appointed chairman of the Standing Committee.

MR. H. HOLLIDAY.—We regret to learn of the death, which took place on June 12th, of Mr. Harry Holliday, manager of the Rhondda Tramway Co. He was 40 years of age, and was the eldest son of the late Mr. T. B. Holliday, a former manager of the tramways at Hastings.

New Companies Registered.

Record Corporation, Ltd. (213,766).—Private company. Registered May 13th. Capital, £35,000 in 25,000 preference shares of £1 each and 20,000 ordinary shares of 10s. each. To acquire the business of engineers and manufacturers of "Record Silent" engines for industrial, electric lighting, marine and other purposes, and all or any of the assets of that business, including the British and foreign patents and patent rights now belonging to W. O. Larmuth in connection therewith. The subscribers (each with one preference share) are:—H. F. Heal, 57, South Oak Street, Burton-on-Trent, secretary; C. F. Rossiter, The Elms Cottage, Sutbury, Burton-on-Trent, works manager. The first directors are to be appointed by the subscribers. Qualification, £100 shares or stock. Remuneration as fixed by the company. Secretary: H. F. Heal. Solicitors: Addleshaw, Sons & Latham, 15, Norfolk Street, Manchester.

Traders Magneto and Dynamo Co., Ltd. (7,485).—Private company. Registered in Dublin on May 4th. Capital, £1,000 in £1 shares. Objects: To carry on the business indicated by the title and that of manufacturers and hirers of and dealers in motor-cars, motor cycles, cycle cars, cycles, &c. The directors are:—A. J. Doyle, 74, Hannaville Park, Terenure, Dublin, motor factor and engineer; Mrs. C. C. Callaghan, Ferndene, Stradbrook, Blackrock, Co. Dublin; M. B. Doyle, 74, Hannaville Park, Dublin.

American Radio Corporation, Ltd. (214,190).—Private company. Registered June 7th. Capital, £500 in 495 6 per cent. cumulative preference shares of £1 each and 100 ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in wireless accessories of all kinds, &c. The permanent directors are:—F. N. Coni, 71, Amesbury Avenue, Streatham Hill, S.W.16; L. C. Curd, 11, Springfield Gardens, Upper Clapton, E.5; F. Parlett, 26, Queen's Gardens, W.2. Remuneration as fixed by the company. Secretary: L. C. Curd. Solicitors: Pollock, Booth and Addis, Milton House, 35, Surrey Street, W.C. Registered office: 18, Conduit Street, W.1.

Grosvenor Battery Co., Ltd. (214,180).—Private company. Registered June 5th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers, importers and repairers of, agents for and dealers in electrical goods, equipment and accessories of all kinds, fittings, switchboards, recorders, indicators, bells, clocks, time switches and batteries; manufacturers of, agents for and dealers in instruments and accessories used in connection with radio-telegraphy, &c. The subscribers (each with one share) are:—W. G. Adie, Fels Farm, Eastbrook End, near Romford, Essex, merchant; M. G. Chant, 70a, Basinghall Street, E.C.2, C.A. Directors: F. Goodchild and W. G. Adie. Remuneration, £50 each per annum.

Berk and Dundas Fox, Ltd. (214,258).—Private company. Registered June 10th. Capital, £2,000 in £1 shares (1,800 5 per cent. preference and 200 ordinary). Objects: To carry on the business of electricians, mechanical and wireless engineers, manufacturers of and dealers in all apparatus for use in connection with the generation, distribution, supply and employment of electricity and radio power, small hardware merchants, fancy goods merchants, gold and silver smiths, watch and clock makers, manufacturers and repairers of and dealers in motor cars, &c. The first directors are:—A. Berk, 28, Hanover Square, Bradford; W. Dundas Fox, 25, Blenheim Road, Bradford (both permanent, subject to each holding 10 ordinary shares). Qualification of ordinary directors, 10 preference or ordinary shares. Remuneration as fixed by the company. Solicitor: D. G. Ineson, 1, Northgate, Cleckheaton. Registered office: 86a, Manningham Lane, Bradford.

Electric Brush Co., Ltd. (214,195).—Private company. Registered June 7th. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in electrical brushes, appliances and implements, mechanical and electrical apparatus and articles required for use in connection with the toilet or massage, or for the stable or for recreation or amusement, &c. The subscribers (each with one share) are:—S. Cronin, 31-4, Basinghall Street, E.C.2, solicitor's clerk; F. Cockayne, 31-4, Basinghall Street, E.C.2, solicitor's clerk. The first directors are to be appointed by the subscribers. No share qualification required. Solicitors: McKenna & Co., 31-4, Basinghall Street, E.C.

Official Returns of Electrical Companies.

Thames Electric Wireless Co., Ltd.—H. C. Mundy, of 93 and 94, Chancery Lane, W.C.2, was appointed receiver and manager on May 3rd, 1926, under powers contained in first mortgage debentures dated July 4th, 1923.

Gil-Ray Trading Corporation, Ltd.—Debenture dated May 20th, 1926, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: G. A. Anderson, 11, River Street, Rhyl, North Wales.

Erith Electrical Co., Ltd.—R. B. Tyler, C.A., of 1, Queen Victoria Street, E.C.4, ceased to act as receiver or manager on May 18th, 1926.

West London and Provincial Electric Supply Co., Ltd. (62,097).—Capital, £150,000 in 70,000 ordinary and 80,000 preference shares of £1 each. Return dated April 7th, 1926. 23,354 ordinary and 49,077 preference shares taken up. £57,431 paid on 15,854 ordinary and 41,577 preference shares. £15,000 considered as paid on 7,500 ordinary and 7,500 preference. Mortgages and charges, nil.

Wycombe Borough Electric Light and Power Co., Ltd. (53,133).—Capital, £125,000 in 20,000 ordinary and 5,000 preference shares of £5 each. Return dated April 27th, 1926. 15,000 ordinary and 3,000 preference shares taken up. £90,000 paid. Mortgages and charges, £40,000.

Brompton and Kensington Electricity Supply Co., Ltd. (25,913C).—Capital, £300,000 in £1 shares. Return dated April 1st, 1926. All shares taken up. £199,845 paid. £100,155 considered as paid. Mortgages and charges, nil.

Erskine, Heap & Co., Ltd. (126,262).—Capital, £50,000 in £1 shares. Return dated April 1st, 1926. 45,489 shares taken up. £7,826 paid. £37,663 considered as paid. Mortgages and charges, nil.

Cambridge Electric Supply Co., Ltd. (36,457).—Capital, £100,000 in £10 shares. Return dated March 31st, 1926. All shares taken up. £100,000 paid. Mortgages and charges, £75,000.

Charing Cross Electricity Supply Co., Ltd. (29,122).—Capital, £2,250,000 in 400,000 preference, 900,000 ordinary, 400,000 City Undertaking preference, and 550,000 City Undertaking ordinary shares of £1 each. Return dated March 18th, 1926. 400,000 preference, 576,000 ordinary, 400,000 City Undertaking preference, and 550,000 City Undertaking ordinary shares taken up. £1,280,000 paid. £646,000 considered as paid. Mortgages and charges, £1,336,178.

Cecil Hodges & Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated May 20th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Allen, West & Co., Ltd. (108,870).—Capital, £150,000 in £1 shares. Return dated December 31st, 1925. 141,724 shares taken up. £141,724 paid. Mortgages and charges, £60,000.

Douglas Southern Electric Tramways, Ltd. (45,701).—Capital, £50,000 in 30,000 preference and 20,000 ordinary shares of £1 each. Return dated December 24th, 1925. 25,973 preference and 15,472 ordinary shares taken up. £18,370 paid on 12,566 preference and 5,804 ordinary. £23,075 considered as paid on 13,407 preference and 9,668 ordinary. Mortgages and charges, £1,376.

Smithfield Markets Electric Supply Co., Ltd. (53,354).—Capital, £100,000 in 60,000 shares of £1 each and 8,000 shares of £5. Return dated March 11th, 1926. 60,000 £1 shares taken up. £60,000 paid. Mortgages and charges, £16,170.

Northallerton Electric Light and Power Co., Ltd. (59,301).—Capital, £6,500 in 2,900 preference shares of £1 each and 12,000 ordinary shares of 6s. each. Return dated March 10th, 1926. 1,161 preference and 7,829 ordinary shares taken up. £3,509 paid. Mortgages and charges, £3,900.

British Columbia Electric Railway Co., Ltd. (51,953).—Capital, £5,000,000 in £1,440,000 5 per cent. cumulative perpetual preference stock, £1,440,000 preferred ordinary stock, £1,440,000 deferred ordinary stock, and £680,000 shares of £1 each (unissued). Return dated January 6th, 1926. £4,320,000 stock taken up. £4,120,000 paid on £1,440,000 5 per cent. cumulative preferred preference, £1,440,000 on preferred ordinary stock, and £1,240,000 on the deferred ordinary stock. £1 15s. paid up on 7 forfeited shares. £200,000 considered as paid on £200,000 deferred ordinary stock. Mortgages and charges, £3,851,870.

W. E. Dove & Co., Ltd.—Capital, £3,500 in £10 shares. Return dated March 8th, 1926. 320 shares taken up. £2,000 paid. £1,200 considered as paid. Mortgages and charges, £800.

Gosport and Alverstoke Electric Lighting Co., Ltd. (82,693).—Capital, £35,000 in £10 shares. Return dated July 8th, 1925 (filed April 7th, 1926). 2,500 shares taken up. £25,000 paid. Mortgages and charges, nil.

Lymington Electric Light and Power Co., Ltd. (57,985).—Capital, £30,000 in 4,600 ordinary and 1,400 preference shares of £5 each. Return dated April 21st, 1926. 4,600 ordinary and 1,285 preference shares taken up. £29,425 paid. Mortgages and charges, £9,600.

Camborne Electricity Supply Co., Ltd. (57,950).—Capital, £10,000 in £1 shares. Return dated May 13th, 1926. 605 shares taken up. £605 paid. Mortgages and charges, nil.

Win-Sum Electric Diffusers, Ltd.—G. A. Siday, of Plant House, Ealing, W.5, was appointed receiver and manager on June 1st, under powers contained in debentures dated February 2nd, 1926.

H. L. Wood & Son, Ltd.—T. Delaney, of 88, Fleet Street, E.C., was appointed receiver on May 31st, 1926, under powers contained in debentures dated November 17th, 1925.

Rhayader Electric Light and Power Co., Ltd.—Mortgage by demise dated May 29th, 1926, to secure £300 charged on certain property at Rhayader, rights and easements, &c. Holder: A. G. Richardson, Bryncoed, Rhayader.

F. Geere Howard, Ltd.—Satisfaction in full on May 31st, 1926, of debentures dated August 10th, 1922, securing £6,250.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—Capital, £535,000 in £1 shares. Return dated March 31st, 1926. All shares taken up. £535,000 paid. Mortgages and charges, £250,000.

British Insulated Cables, Ltd. (52,285). — Capital, £2,000,000 in 1,333,333 ordinary, 500,000 preference, and 166,667 unissued shares of £1 each. Return dated April 5th, 1926. 1,333,333 ordinary and 500,000 preference shares taken up. £1,406,008 paid on 1,033,658 ordinary and 372,350 preference shares. £427,325 considered as paid on 299,675 ordinary and 127,650 preference shares. Mortgages and charges, £700,000.

British Insulated Cables (S.A.), Ltd. (formerly Telegraph Manufacturing Co. (Colonial). Ltd.). (71,854).—Capital, £2,000 in £1 shares. Return dated March 24th, 1926. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Electro-Metals, Ltd. (110,432).—Capital, £30,000 in 4,000 preference shares of £5 each and 10,000 ordinary shares of £1 each. Return dated December 28th, 1925. 102 preference and 10,000 ordinary shares taken up. £510 paid on the preference shares. £10,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

Whitchurch and Pangbourne Electric Supply Co., Ltd. (75,400).—Capital, £10,000 in 1,700 ordinary and 300 preference shares of £5 each. Return dated May 19th, 1926. 1,700 ordinary shares taken up. £8,500 paid. Mortgages and charges, nil.

Wellingborough Electric Supply Co., Ltd. (65,747).—Capital, £50,000 in £10 shares. Return dated March 11th, 1926. 4,500 shares taken up. £45,000 paid. Mortgages and charges, £17,500.

Ericsson Telephones, Ltd. (formerly the British L.M. Ericsson Manufacturing Co., Ltd.) (79,061).—Return dated April 13th, 1926. Capital at date of return, £200,000 in 99,990 preference and 100,010 ordinary shares of £1 each (increased April 14th, 1926, to £500,000 in 199,970 preference and 300,030 ordinary shares of £1 each). 99,990 preference and 100,010 ordinary shares taken up. £170,000 paid (being £1 per share on 50,010 ordinary and 99,990 preference and 8s. per share on 50,000 ordinary shares). £30 000 considered as paid (being 12s. per share on 50,000 ordinary shares). Mortgages and charges, £100,000.

Gent & Co., Ltd. (78,797).—Capital, £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. Return dated March 9th, 1926. 4,427 preference and 20,876 ordinary shares taken up. £6,887 paid on 957 preference and 5,930 ordinary shares. £18,416 considered as paid on the remainder. Mortgages and charges, £16,500.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

British Electric Traction Co., Ltd.

The annual meeting was held on June 11th, Mr. J. S. Austen (chairman) presiding. The chairman briefly reviewed the working of the past year. It would be seen, he pointed out, that the Company had earned £14,000 more than in the previous year, and was able to recommend the payment of 8 per cent. on the ordinary stock, against 7 per cent. That was the fourth consecutive year in which they had been able to raise the dividend by one per cent. Early last year they became anxious because they were not going to receive a dividend upon their holding in the Scottish General Transport Co., whereas they had received over £11,000 in the previous year. That loss had been made good. After the payment of the ordinary dividend they were able to add about £22,500 to their undivided profits account, making that account practically £300,000. There were many stockholders who would like to see those undivided profits represented by a certificate, in other words, they would like to have a stock bonus. Theoretically, there was no benefit to the stockholders in the stock bonus, because the dividend paid on it would otherwise have been distributed as an extra dividend on the ordinary stock, and in practice there were many difficulties attached to a stock bonus. They had to be careful that they did not infringe the rights of the holders of the preferred stocks. The rights of the latter were that, in the first place they were entitled to a dividend of 6 per cent., following which the ordinary stock received 8 per cent., and then they shared equally until the preferred had received 8 per cent., after which they had no further participation. So that if they were to make a distribution of ordinary stock, they would, in fact, be paying a certain amount in front of the preferred stock. He thought, however, that he could put before them a scheme that would obviate that difficulty. Stating the terms in round figures, supposing they found themselves in the position to distribute an extra £20,000. Of that sum, £7,000 would belong to the preferred stockholders, and £13,000 to the deferred stockholders. It was obvious that it would make no difference to the preferred holders, so long as they got their £7,000, what happened to the £13,000. So that if they were to create a deferred stock it would not matter to the preferred whether that £13,000 went to the ordinary stock or to the new deferred ordinary stock. In other words, the scheme would be to turn the ordinary stock into an 8 per cent. ordinary stock, or to limit the dividend on the ordinary stock to 8 per cent., and then to give to the ordinary stock some deferred stock which would receive all over the 8 per cent. the ordinary was now entitled to receive. That was the scheme the directors had in their minds, and that being the case, it was only right the shareholders should know it. If they wished to know when the scheme was likely to materialise, the answer was as soon as they found themselves in the position to make extra distribution upon the preferred stock. Owing to the uncertainty of the effects of the general strike and the coal stoppage he could not say more. He expressed the hope that if they were not able to do it this time next year, they would at least then be in the position to indicate a fairly close date when it would take place. Mr. Baldwin asked what there was to prevent a cash distribution instead of a distribution of stock. The company was interested in the Underground Group in investment in the London & Suburban & Associated Construction Companies, which had in the past year shown but poor results, and he thought some scheme might be put forward whereby in the event of any amalgamation scheme and a reconstruction of the capital of the Underground Railway Companies, they could come in as shareholders in a common fund stock. The chairman, in reply, said as far as he could say, there would be no legal objection to the distribution mentioned by the last speaker, except that it had not been considered advisable in the past to divide the profits right up to the hilt, which policy still continued. If they did such a thing they would have to reduce their dividend on the ordinary stock and he could not see that any benefit would arise from such action. As regarded the possible Underground amalgamation, that was far too big a question to be dealt with that day. There was already in existence a scheme by which receipts were pooled, but the procession of evolution must be, necessarily, slow and could not be hurried. He looked forward to the day when the whole of the means of traction in London would be in the one hand. The report and accounts were adopted.

Electric Construction Co., Ltd.

The annual general meeting was held on June 10th, Mr. P. E. Beachcroft (chairman) presiding. In presenting the report and accounts (ELECTRICAL REVIEW, June 11th, p. 882) the chairman expressed the board's regret at the death of Sir Henry Mance, who had been connected with the company for over 33 years. Mr. W. M. Furniss, the manager of the works at Wolverhampton, had been appointed to fill the vacancy on the board. Although the crisis through which the country had recently passed did not actually occur within the year under review, the preceding unrest seriously affected operations in almost every industry, with the result that the general conditions of trading were rendered extremely difficult, and although inquiries for new machinery and equipment were numerous, the placing of orders was greatly retarded. They were therefore justified in congratulating themselves on being able to present a satisfactory report. The general strike did not directly affect the company to any extent, as the workpeople were not called out until two days before the strike ended, and a very small percentage only suspended operations then. There was undoubtedly a solid foundation for belief that, if further labour troubles did not intervene, a long period of prosperity lay before the electrical industry. In whatever form the Electricity Bill now before Parliament became law, it could not fail to create a very large demand for electrical plant and apparatus for the stations to be erected and for new consumers. Moreover, the interconnection of those large stations, involving the standardisation of the frequency of supply, would render obsolete a great deal of existing electrical machinery.

Thus the outlook for manufacturers was exceedingly good, but it might be a year or two before any benefit was derived from the new legislation. The chairman then reviewed the accounts, and said that during the past financial year they had purchased and cancelled £3,700 of debenture stock, the discount, amounting to £921, having been added to the general reserve fund, which now amounted to £165,921. That fund, together with the dividend equalisation fund and the undivided profits, amounting to the sum of £217,458, being invested entirely in gilt-edged securities, the financial position of the company left nothing to be desired. With regard to the immediate outlook he was pleased to say that since the beginning of the new financial year the orders had exceeded those of the corresponding period of last year. As, however, extensions to central stations were, to a large extent, suspended until the Electricity Bill had been passed, and as there were still no indications of the mining dispute or the general depression in trade coming to an end, it was impossible to speak with any assurance as to the future, but he had no doubt that they would continue to secure their fair share of what business was going. They had just completed negotiations for the acquisition of the goodwill of Sandycroft, Ltd., relating to the manufacture of electrical machinery and switchgear, with the exception of certain specialities. The acquisition included the sole manufacturing rights of the well-known cascade machines and one-half share of the patents taken out by Sandycrofts jointly with the inventor—Mr. L. J. Hunt—who was to act in an advisory capacity for the company solely, for a period of three years. They were confident that those arrangements would add considerably to their turnover as soon as the machinery and tools, &c., purchased from Sandycroft, Ltd., had been transferred to their own works at Wolverhampton.

Eastern Telegraph Co., Ltd.

Sir John Denison-Pender, G.B.E., presiding at the annual meeting on June 8th, said that the agreements with the Eastern and South African, the Europe and Azores, and the West African Telegraph Companies came into force on January 1st, 1925, and as a result there had been a considerable augmentation in both the revenue and the expenditure which made comparison with 1924 impossible. The financial result was satisfactory having regard to the depressed state of trade; the increased available balance was chiefly due to a reduction of £81,000 in respect of taxation and the interest on the loan from the Eastern and South African Co. The dividend had been maintained at 10 per cent. free of tax, while the contribution to reserve and the balance carried forward had been increased. The reserves were being rearranged; the sum of £860,000 appearing as " Provision on account of investment fluctuations " was in excess of the amount required, but it was proposed to leave it undisturbed to meet any possible future contingencies. Referring to the pensions provisions, the chairman said that it was the practice of the board to supplement retiring allowances in consonance with the increased cost of living. The International Telegraph Conference in Paris last year discussed many matters, the principal one being the question of increasing the charges for code language. The Eastern Companies' representatives declared themselves against any disturbance of existing conditions; a committee was appointed to go into the matter and report to the next International Conference. The companies' delegates also opposed any increase in charges. The chairman said that although Government administrations had sanctioned increases the company's tariffs remained at the pre-war level. The position in Greece and Turkey remain practically unaltered. The change of Government in Turkey had delayed negotiations, while the revenue from the Greek traffic still gave the company a very small return. If the company could not secure an adequate margin of profit it would be obliged to close down in Greece and dismiss its Greek staff, numbering nearly 500. After lengthy negotiations with the French Administration, it was hoped that a special wire between London and Paris would shortly be leased to the company, with permission to deal direct with the public in Paris. New offices had accordingly been secured in that city. Two recent improvements were mentioned by the chairman, *viz.*, the use of " loaded " cables and the invention of a " regenerator " by the company's staff. That apparatus overcame the disabilities inherent in the old system of relaying from one cable to another which only permitted reduced speeds owing to distortion. The regenerator increased the speed of transmission by over 35 per cent. and a further gain was secured by a reduction of stoppages, making an overall improvement of 48 per cent. A considerable speeding-up had been effected during the past year or two. In conclusion, the chairman mentioned the retirement from the board of Sir Robert Kindersley and the appointment of Mr. H. C. Hambro in his place.

United River Plate Telephone Co., Ltd.

The annual meeting was held on June 8th under the chairmanship of Mr. Percy Cross. In moving the adoption of the report and accounts (*vide* our last issue, p. 882), Mr. Cross said that the results of the past year's working were very good. During the year issues of new capital amounting in the aggregate to £1,320,000, had been made; the position and prestige of the company had enabled it to raise the money without difficulty. The capital expenditure had very nearly reached the million-pound mark forecast last year. The connecting of new subscribers had been retarded by delays in the delivery of equipment, but the number had been increased by 10,805 to 141,251. That was a net increase, taking into account changes of address and withdrawals of subscribers; actually 30,000 new lines were installed. There were still 5,000 people awaiting service in Buenos Aires and district. Orders had been placed for equipment which should be sufficient to meet all demands up to January, 1929. The rapidity of development had prevented the company from having that reserve of spare plant which a city of the magnitude of Buenos Aires should possess, but they were doing their best to hasten the manufacture of the apparatus. The company was now in its fortieth year and it had continually kept abreast of developments. Its immediate aim was the provision of automatic exchanges as rapidly as possible. Thirteen of those exchanges were already working in Buenos Aires, Rosario, Cordoba and Santa Fé and six more were in course of erection in the capital, all of which, it was hoped, would be in service early next year. This would give the company an automatic equipment embracing 76,000 lines. They were doing their best to educate subscribers in the use of the automatic system. The work of connecting up Bahia Blanca, 500 miles from Buenos Aires, was completed during the year and the President of the Republic performed the opening ceremony. The company was installing repeating equipment in Buenos Aires which would enable calls to be made between Cordoba and Bahia Blanca, a distance of nearly 1,000 miles. The traffic between those important cities was encouraging and additions would soon be rendered necessary. The trunk service was increasing to such an extent that it would probably be necessary to substitute cable for the existing overhead lines between Buenos Aires and Rosario and Mar del Plata. That would involve heavy expenditure which, however, would be justified within a short period. If necessary the Government would be asked to sanction increased rates for the seasonal traffic between Buenos Aires and Mar del Plata. The matter was still being studied, but it could not be completed for some time. Further capital would be required and the shareholders were asked to approve an increase in the nominal share capital from £5,000,000 to £6,000,000 by the creation of 200,000 £5 shares which would be issued at the appropriate time. After giving some statistics of the company's system the chairman referred to the visit of the Prince of Wales to Argentina, when the local chairman was honoured, and to the recent death of Dr. O'Farrell, a former local chairman. The report and accounts were adopted and the proposed increase in the capital was approved.

Cawnpore Electric Supply Corporation, Ltd.

Mr. J. G. B. Stone occupied the chair at the annual meeting on June 8th and in the course of his speech said that the earnings, the surplus available and the amount of energy sold had all increased. The load factor had improved on account of an increase in the amount of electricity supplied for industrial purposes. The working expenses of both the electricity supply and traction undertakings had increased with the increased business. The traction expenses had been increased by a new item—two motor omnibuses which the company was running as an experiment with a view to meeting competition. The capital expenditure in India during the year was £126,433. That represented expenditure upon the extension of the Riverside station, the payment for which had been completed within a few thousand pounds, and new mains. Mr. Stone said that in the course of a recent visit to India he gathered that Cawnpore was growing in importance as a manufacturing city and the company's prospects were good. Great benefit should accrue from the railway reconstruction which was in hand. At present the company was only dealing with half the load which it could carry but in spite of that its rates compared favourably with those in other Indian cities, where facilities for cheap coal were better. The report and accounts were adopted.

India Rubber, Gutta Percha and Telegraph Works Co., Ltd.

In a circular issued to the shareholders under date June 14th, the directors report that the company's trading for the half-year to the end of February was satisfactory. Compared with the corresponding period of last year practically all departments showed improvement. There had been a falling off in the wireless section of the business, but this was much more than covered by the general increase in other directions. The debentures of £400,000 which became due for payment in March were paid off and replaced by a similar issue; the issue was considerably over-subscribed. The interruption of the general strike and the coal trouble will adversely affect the second half of the financial year and it is not yet possible to estimate, even approximately, the effect of these difficulties on the year's results. In these circumstances the directors are unable to recommend the payment of an interim dividend on the ordinary shares, but the half-yearly dividend on the preference shares will be paid as usual on July 1st.

Eastern Extension, Australasia and China Telegraph Co., Ltd.

The annual meeting was held on June 10th. Sir John Denison-Pender, C.B.E., who presided, said that the gross revenue had fallen owing to the reduction of the rates for Australasian traffic. The reduction had, however, been offset by an increase in the volume of traffic in the Straits Settlements and by a slight increase in the Australasian traffic. The former increases in response to tariff reductions could no longer be counted on owing to the existence of lower special rates. During the year two cable ships were sold and their capital cost, less receipts from their sale, was written off. The ships' reserve had again been strengthened after that operation. A

loss on the sale of investments had occurred owing to the fall of the franc but steps had been taken to guard against a repetition of the loss. The duplication of the Cocos-Fremantle section, by means of cable of the "loaded" type, was successfully completed in March. The cable was not yet in full use as experiments to obtain reliable signals at maximum speed were being carried out. An agreement had been made with the Commonwealth Government for the lease of a fast-working land line between Fremantle and Adelaide (1,676 miles) to connect with the new cable. A new office was being constructed at Fremantle and should be completed at an early date. The Darwin office was being enlarged to accommodate the installation of automatic working. The negotiations with the Chinese Telegraph Administration had made no progress and weekly settlements were being enforced. So far payments had been made regularly. The report and accounts were adopted.

Telephone Manufacturing Co., Ltd.

The directors report that there was a loss on trading of £21,212 for the year ended December 31st last, after charging interest, &c., amounting to £32,165 and placing £7,000 to the contingency reserve. For the nineteen months ended December 31st, 1924, there was a net loss of £46,258. The report states that the trading has been handicapped by stringent financial conditions, but nevertheless, an improvement occurred during the year under review. Since the close of the year a scheme for the reorganisation of the company's finances has been adopted and sanctioned by the Court. This will enable the company to discharge the whole of its indebtedness to the bank and to redeem the whole of the income bonds, thereby freeing itself from all interest and other charges. Further working capital will also be provided. The effect of the scheme is already manifest as the amount of work in hand at the close of last month was nearly five times as much as at the corresponding period of 1924. The meeting was to be held yesterday (Thursday).

Sir W. G. Armstrong, Whitworth and Co., Ltd.

The annual meeting of the Company was held on June 8th, when Lord Southborough explained that he had recently been appointed chairman, while Sir Glyn West had resigned, with certain of the directors. Mr. Frater Taylor and Sir A. Kaye Butterworth had joined the board. The chairman then outlined the history of the company since its inception and said that its present difficulties were mainly due to the necessity for finding other work to employ the large works which had been erected or acquired during the war. Other circumstances which had contributed to the position were the investing of large sums in works which had not proved profitable—or immediately profitable, and the acceptance of large orders showing a small margin of profit or on deferred payment terms. The company's affairs were being thoroughly investigated by Mr. Frater Taylor, who had had wide experience, and it was hoped to present a full report and recommendations in due course.

Delhi Electric Tramways and Lighting Co., Ltd.

The company's lighting and tramway undertakings had a net revenue of £45,019 for 1925. After deducting expenses and debenture interest, and adding £1,974 brought forward, there remains £46,882, which it is proposed to deal with as follows:—Depreciation of plant and equipment, £17,500; reserve for British and Indian taxation, £5,000; renewals reserve account, £5,000; employés' provident fund, £2,000; a dividend of 12 per cent. upon the preferred and participating shares, £12,000; and a dividend of 11.1724 per cent. on the ordinary shares, £3,240, leaving £2,142 to be carried forward. Additions costing £20,641 were made to the plant during the year, consisting chiefly of mains, sub-stations and converting plant. The agreement for a bulk supply from the Government generating station to assist the supply has not yet been completed. The meeting was to be held on Wednesday last.

German Companies.

The *Lloyd Dynamo Works Company*, Bremen, reports gross profits of 583,000 marks for 1925 as against 627,000 marks in the previous year. After providing for depreciation and taxes, the accounts show a loss of 158,000 marks, which is extinguished by the balance brought in and by an appropriation from the reserve fund.

The *Voigt and Haeffner Company*, Frankfort-on-Main, states that the exceptionally large volume of orders received in the early part of 1925, was followed by a sudden decline in the autumn, the result being a great increase in the stocks, which, however, have since been considerably reduced. Sale prices were much depressed and it was only about the end of the year that they were brought into some relation to the costs of production. The export trade continued to be exceptionally difficult. The accounts indicate net profits of 664,000 marks, as compared with 655,000 marks in 1924, the dividend remaining at 8 per cent., as in the preceding year.

The *Continental Company for Electrical Undertakings*, Nuremberg, which is a holding concern associated with the Schuckert Company, states that as a result of the growth of the number of consumers the general economic crisis did not fully affect the undertakings in which the company is interested. The financial requirements for extensions were very considerable. The net profit for 1925 amounted to 505,000 marks, as compared with 319,000 marks in the previous year, permitting of the payment of 6 per cent. on the preference shares of 1922, 6 per cent. on those of 1907, and 5 per cent. on the 1925-26 shares, as well as 4 per cent. on the few ordinary shares.

The *Accumulator Works Company*, Berlin and Hagen, reporting on the year 1925, states that extensive new orders for accumulators were received in the first half of the year although prices in various branches were inadequate. The export markets were almost entirely closed as the costs of production owing to the burden of taxation were too high. During the year the orders diminished, owing largely to the sudden depression in the automobile industry, and large dismissals of workmen had to be made. New orders for starter batteries for the mass production of which the workshops had been reconstructed, almost entirely ceased. A beginning was made during the year with the systematic establishment all over Germany of charging stations and repair workshops. After writing off 683,000 marks for depreciation, the accounts show net profit and balance forward amounting to 1,929,000 marks as against 1,200,000 marks in the previous year; the dividend is raised from 5 to 8 per cent.

Austrian Companies.

The shareholders of the *Upper Austrian Water Power and Electric Co.* have approved the directors' scheme of capital reorganisation on a schilling basis. The share capital has been fixed at 12,000,000 schillings, divided into 1,200,000 shares of a nominal value of 10 schillings each. The shareholders will obtain one new share for each 50 old shares they surrender. The company will have a reserve of 3,200,000 schillings. The net profit for 1925 amounted to 666,257 schillings. A dividend of 5 per cent. will be distributed.—*Financial News.*

The accounts of the *Felten and Guilleaume Company*, Vienna, show net profits of 890,000 schillings for 1925, as against 870,000 schillings in the previous year, the dividend being at the rate of 2 schillings per share as in 1924.

Calcutta Tramways Co., Ltd.—The revenue for the year 1925 was £219,044 and the addition of £14,266 brought forward makes £233,310. After providing for debenture interest and preference and interim ordinary dividends there remains £15,956, which it is proposed to allocate as follows:—To depreciation reserve, £60,000; to general reserve, £28,000; written off suspense account, £7,289; to staff provident fund, £2,068; a final dividend of 3½ per cent. on the ordinary shares (making 7½ per cent. for the year) free of tax, £24,500; leaving £37,703 to be carried forward. The reduction of the dividend (from 10 per cent.) and the strengthening of the reserves is considered advisable by the directors on account of motor-omnibus competition, which, however, is said to be declining. The board is continuing its policy of extension of lines and services and increasing the number of omnibuses which act as feeders to the tramway system. Meeting: June 29th.

W. T. Henley's Telegraph Works Co., Ltd.—The accounts for the year ended March 31st last show a net profit of £311,029. From this is deducted £52,398, representing directors' fees, debenture interest, depreciation, &c., and a net balance brought forward of £477,396 is added, making £736,027. Income tax, reconstruction of Holborn Viaduct premises, transfer to reserve (£50,000) and preference and interim ordinary dividends absorbed £134,748, leaving a balance of £601,279. After paying a final dividend of 3s. per share on the ordinary shares (making 4s. for the year) the sum of £503,779 remains to be carried forward. The report records the death of Mr. M. Roberts, a director, and states that the company's business made satisfactory progress during the year under review. The meeting is being held to-day (Friday).

Barcelona Traction, Light and Power Co.—The revenue for the year ended December 31st, 1925, was $3,678,234, and the balance available $3,482,081. The service of bonds absorbed $2,233,985, and a total dividend of 5 per cent. has been paid for the year. The 7 per cent. prior lien "A" bonds were called for redemption on June 1st. The redemption of these bonds put the 6½ per cent. prior lien bonds in the position of a first specific charge upon the whole of the mortgaged assets of the company and a first floating charge upon its general undertaking and assets. The railway revenue decreased during 1925, but the earnings of the combined enterprises showed an increase.

Whitehall Electric Investments, Ltd.—The gross income during the year ended March 31st last was £708,522, as against £612,043 in 1924-25. The net income was £456,102, against £324,491. After providing for the preference dividend it is proposed to make a distribution of 2½ per cent. on the ordinary shares (as compared with *nil* last year), leaving £143,602 to be applied in reduction of discount on debenture stock. It is stated that during 1925 the Cia. Electrica de Tampico resumed payment of its preference dividend and that satisfactory results have been obtained by the other operating companies.

Oxford Electric Co., Ltd.—Messrs. Close Brothers announce that shareholders representing over 70 per cent. of the ordinary share capital of the company have accepted their recent offer for the purchase of the ordinary shares of the company at 28s. per £1 share (equivalent to £7 for the old £5 shares). As the offer was made subject to acceptance by the holders of at least 50 per cent. of the ordinary share capital it now becomes effective.—*Financial Times.*

Chloride Electrical Storage Co., Ltd.—A final dividend of 5 per cent. (actual), free of tax, has been declared, making 10 per cent., free of tax, for the year, plus a tax-free bonus of 2s. per share.

Globe Telegraph & Trust Co., Ltd.—A final dividend of 5s. per share (net) has been declared on the ordinary shares, making 10 per cent. (net) for the year, as in 1924

Kidderminster and District Electric Lighting and Traction Co., Ltd.—The net receipts for the past year amounted to £7,196, which was increased to £7,566 by the balance brought forward. After meeting expenses and allocating £1,000 to renewals and £800 to reserve, it is proposed to pay a dividend of 2½ per cent. on the ordinary shares, leaving £454 to be carried forward. The Kidderminster and Stourport Electric Tramway Co. made a profit of £19, which is added to a balance of £625 brought in and carried forward.

Manila Electric Corporation.—A dividend of 50 cents per share has been declared on the common stock in respect of the quarter ending June 30th.

The directors propose to issue 120,000 additional shares of common stock of no par value at the price of $33 per share and present stockholders are to be given preference. The issue is intended to provide for the redemption of the $3,419,300 outstanding first refunding mortgage gold bonds (due 1942) of the Manila Electric Company.

English Electric Co. of Australia, Ltd.—The net profit for the year ended March 31st last was £10,982, as against £5,601. A dividend of 2½ per cent. has been paid and £23,325 is carried forward. The previous year's dividend was 5 per cent., and 10 per cent. was paid in 1923-24.

Guest, Keen & Nettlefolds, Ltd.—The balance at credit of profit and loss for the year ended March 31st last is £948,297 and the addition of £223,808 brought forward makes available £1,172,105. As previously reported, the final ordinary dividend is 1s. per share, free of tax, again making 10 per cent., tax-free, for the year. £235,639 is carried forward.

Victoria Falls and Transvaal Power Co., Ltd.—The preference shares are to receive a final dividend of 1 per cent., making 10 per cent. for the past year, and a dividend of 3 per cent. in respect of the current half-year. The final dividend on the ordinary shares is 11 per cent., making 14 per cent. for the year, as compared with 12½ per cent. for 1924.

Anglo-Swedish Electric Welding Co., Ltd.—The accounts for the year ended March 31st show a net profit of £6,003, to which is added £5,349 brought forward, making £11,352. It is proposed to pay a dividend of 10 per cent. (against 8 per cent.), to put £3,000 to reserve, and to carry forward £4,602.

Oriental Telephone and Electric Co., Ltd.—The directors recommend a final dividend of 6 per cent. on the ordinary shares, free of tax, making 10 per cent. for the year, free of tax, and a bonus of 2 per cent. tax-free.

Anglo-Argentine Tramways Co., Ltd.—The directors have declared a dividend of 2¾ per cent. on the 5½ first preference shares and one of 3 per cent. on the 6 per cent. preference shares in respect of the half year ending June 30th.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be officially quoted :—

Shropshire, Worcestershire and Staffordshire Electric Power.—50,000 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,160,001 to 1,210,000.

Dealings in the following have been specially allowed by the Committee under Rule 159 :—

Lancashire United Transport and Power Co.—£250,000 6 per cent. first debenture stock, issued at 93 per cent., partly and fully paid.

Howard & Bullough, Ltd.—A final dividend of 2½ per cent. has been declared on the ordinary shares, making 10 per cent. for the year, as in 1924-25.

Shawinigan Water and Power Co.—A dividend of $2 per share on the common stock has been declared in respect of the quarter ending June 30th.

Pinchin, Johnson & Co., Ltd.—The usual half-yearly dividend at the rate of 6½ per cent. has been declared on the preference shares.

Edgar Allen & Co., Ltd.—A dividend of 5 per cent., free of tax, is recommended on the ordinary shares. The 1924 dividend was 2½ per cent.

Brush Electrical Engineering Co., Ltd.—The annual meeting was held on June 14th; a report of the proceedings will appear in our next issue.

Cape Electric Tramways, Ltd.—The ordinary shares are to receive an interim dividend of 3 per cent., free of tax, as in 1925.

Stocks and Shares.

MONDAY EVENING.

CAPITAL continues to flow steadily into Stock Exchange markets. Notwithstanding the uncertainties which hang round the coal position, the investor is helping himself liberally to the new issues that are spread in profusion before him. There is a pronounced willingness to buy investment stocks, and, despite the competition of the newcomers, the older securities are in constant demand. New capital can be placed without any difficulty provided that the issuers have reasonably good stock to offer. The feature of the week so far as electrical descriptions are concerned, is the strength of Underground Electric Railway shares.

A House of Commons Committee has passed the preamble of the London Electric and the Metropolitan District Railway Companies' Bill for power to execute works and to raise additional capital. The estimated cost of the works is about £2,400,000 and the London Electric Company asks for power to raise additional money not exceeding on the whole a million pounds. Underground Electric ordinary shares have had a dramatic jump to 4. The price rose 10s. in a day, and rumour was exceedingly busy in weaving various causes to account for the persistent pressure to buy the shares. The chief reason was the expectation of a reorganisation plan to be published almost at once. It is declared, with a show of some authority, that the Underground Company's £10 shares are to receive 7 1/5 new shares of £1 each in a reorganisation, and that the 1s. "A" shares will be exchanged at the rate of 10 of these for 11 new shares. The income bonds have risen to 101. Districts, after a drop to 51½, recovered to 53. Metropolitans are a point lower on the week.

In the market for electricity supply shares, Kensingtons are better at 13⅜ and Bournemouth & Poole recovered to 57s. 6d. The Brompton & Kensington Electricity Supply Company has announced to its customers that, as its electrical energy supply is generated exclusively by oil fuel, the restriction in consumption required by the Government order does not apply to the company's consumers. "You are therefore not called upon to practice," says the circular, "the economy demanded by the shortage of coal." Several of the preference shares are better. Midland Counties Electric hardened to a guinea. Whitehall Electric preference strengthened to 20s. 3d., upon the declaration of a dividend on the ordinary shares. This market as a whole shows a good deal of steadiness.

Cable stocks are good. Eastern ordinary gained 3½, Eastern Extensions, Globes and Westerns have all advanced. This is due not only to the satisfactory reports published by the companies, but to the persistence of an investment demand to which reference has been made so constantly. Dividends deducted from the prices of such sound stocks and shares as are found in the Eastern group, are recovered promptly, and the difficulty is to find stock to satisfy the would-be purchasers.

British Electric Tractions have gained another point at 134½, on the strong hint provided at the meeting in regard to the possibility of a bonus. It seems likely that the ordinary stock will be converted into an 8 per cent. issue; after which, deferred stock will be given, to rank for profits over and above the 8 per cent. to which the existing ordinary and preference stocks will become entitled. Apparently it is the coal strike which has delayed the suggestion from being put into practical effect, but stockholders will doubtless be ready to possess their souls, and the stocks, in patience.

Mexican issues are again harder, the Tramway Company's bonds being substantially better, while Mexican Light & Power preferred put on a point. Brazilian Tractions have advanced to a trifle over par. Anglo-Argentine Second preferences are ⅛ up at 2⅞. The Barcelona Traction, Light & Power Company reports a remarkable increase in earnings, the balance available for dividends being 1¼ million dollars against a bagatelle of $75,000 in the previous twelve months. The company's preference shares are now receiving their full 5 per cent. dividend, and the common shares have risen to 30. Tokyo Electric Sixes at 93 are 1 up.

Metropolitan-Vickers ordinary have strengthened to 24s. 6d. The company has obtained an important contract from the Great Indian Peninsula Railway for work to be done on the main line electrification from Bombay to Poona. Forty-one electric locomotives, of a total value of over £650,000, have been ordered. Edison-Swans are a good market at 10s. 3d., showing a rise of a florin, and British Aluminiums gained half-a-crown at 2¼. British Insulated are 1/16 higher at 3 5/16. The wireless group is quiet, Marconis being 1/16 off at 1 3/16 and Canadians a little heavy at 4s. 3d.

The Telephone Manufacturing Company reports a loss for 1925 of £21,200, as against a loss of £46,200 for 1924. The Board has re-valued the company's assets, and thus obtained a surplus of £148,400 for the balance-sheet. By the aid of this, the debit balance on profit and loss account, and various other items, have been written off, leaving £23,274, now placed to special reserve. The company's business has improved, and the price of the ordinary shares advanced to 8s. Henley's fine report shows a profit of £311,000 for the year, compared with £361,400 for the previous 15 months. At 4, the price of the shares remains unchanged. Oriental Telephones keep at 43s. 9d.; the company's report announces that the sale of the China and Japan Telephone Company, a subsidiary of the Oriental Telephone, was satisfied partly in cash and partly in shares of the new concern, the Hongkong Telephone Company.

Calcutta Tramways at 18s. 9d. are unaffected by a reduction from 10 per cent. to 7 per cent., both tax-free, in the dividend. The revenue balance of £226,800 is about £11,000 less than that for 1924, and the directors have decided to conserve the company's resources owing to private omnibus competition and the commercial unrest that has lately occurred.

Engineering shares hold their values, but the iron and steel market is naturally dull, owing to the coal position. Rubber shares are a shade better, which is more than can be said for the amount of business doing in them.

We have frequently criticised the Electric Light & Power Contracts Finance Corporation and the Warwickshire and South Midland Electricity Supply Corporation. Both these companies were fined £20 and five guineas costs last week for having failed to file their annual summaries of account at Somerset House. Sir Charles B. H. Soame, Bart., and various directors were fined £20 each for permitting the default. Walter Thompson, solicitor, of West Hampstead, is a director of both concerns; he was required to pay only one fine. Lord Ilkeston, the stipendiary before whom the cases came, said it was very necessary that the provisions of the Act should be observed by those responsible for carrying on the business of public companies. The returns have been filed this month.

Share List of Electrical Companies.

	Nom. £	Dividend. 1924	1925.	Price June 14 1926.	Rise or fall.	Yield. p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	14	14	57/6	+1/6	4 17 5
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	47/-	—	6 7 8
do. do. 6% Pref.	1	6	6	22/-	—	5 9 1
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15		£8/3	—	5 12 8
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	23/6	—	5 19 2
do. 7% Pref.	1		7	22/6	—	6 4 8
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13¾	+¼	5 9 1
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5 7/16	—	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4¾% Pref.	1	4¾	4¾	17/-	—	5 5 11
Midland Counties	1	5½	6	21/-	+6d.	5 13 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	16⅛	—	5 8 6
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	26/3	+9d.	5 6 8
Urban Ordinary	1	4	7	1 1/16	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44/6	—	6 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	2(/3	+9d.	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	64½	−1	7 15 0
do. District	,,	3½	3½	£3	+½	6 12 1
Underground Electric Ordinary	10	Nil	Nil	4	+½	Nil
do. do. "A"	1/-	Nil	Nil	12/-	+1/6	Nil
do. do. Income	Bonds	6	6	101	+1	*5 18 10
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 6
do. Def.	,,	1½	1½	24	—	6 5 0
Automatic Telephone	1	8	6	2½	—	4 0 0
Chili Telephone	5	6	5	6⅞	—	*3 12 9
Cuba Sub. Ord.	10	5	5	£¾xd	—	7 8 2
Eastern Extension	10	10	10	18⅛	+½	*5 9 7
Eastern Tel. Ord.	Stock	10	10	181	+3½	*5 10 6
Globe Tel. and T. Ord.	10	10	10	18½	+⅜	*5 9 7
do. do. Pref.	10	6	6	11	+⅛	5 9 1
Great Northern Tel.	10	22	20	28	—	7 2 10
Indo-European	25	8½	10	45½	—	*5 10 0
Marconi	1	10	10	1 3/16	—1/16	8 8 10
Marconi Marine	1	10	7½	21/3	—	7 1 2
Oriental Telephone Ord.	1	12	12	43/9	—	*5 9 7
United R. Plate Tel.	5	8	8	8xd	+3/9	*5 0 0
Western Telegraph	10	10	10	17½xd	+½	*5 14 3
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3⅛	—	8 16 0
do. do. 2nd Pref.	5	6	6	2⅞	+⅛	10 8 8
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord.	,,	7	8	134½	+1	5 18 11
do. do. 6% Pref.	,,	6	6	111	—	5 8 1
Brazil Traction	100	4	5	101½	+½	4 19 6
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	86½	—	5 17 0
do. do. Preferred	,,	96/-	126/9	105½xd	+⅝	*6 0 2
do. do. Deferred	,,	129/5	8	127xd	+⅝	*6 6 0
do. do. Deb.	,,	4¼	4¼	76	—	5 11 10
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	49	—	8 3 4
Mexico Trams 5% Bonds	—	5	5	69½	+4	7 4 0
Mexican Light Common	100	Nil	Nil	33½	—	Nil
do. Pref.	100	Nil	Nil	74½	+1	Nil
do. 1st Bonds	—	5	5	71½	—	6 19 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	12	13	52/-	—	*5 0 0
British Aluminium Ord.	1	5	10	2¼	+⅛	4 8 11
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3 1/16	+1/16	4 10 9
Brush Ord.	1	10	10	27/-	—	7 5 6
Callenders	1	15	15	4½xd	+1/6	3 12 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	10/3	+2/-	3 18 1
do. 5% Deb.	Stock	5	5	83½	+½	6 0 6
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	22/6xd	—	5 15 7
,, Ord.	1	5	7½	30/3	+6d.	4 19 2
Henley	1	16	20	4	—	5 0 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	3½	—	5 15 8
Met.-Vickers Ord.	1	8	8	25/6	+6d.	6 5 6
do. Pref.	2	8	8	2½	+⅛	6 8 6
Siemens Ord.	1	7½	7½	28/9xd	—	5 4 4
Telegraph Construction	12	20	10	28	+½	*4 5 8

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only genera and they may vary according to quantities and other circumstance

	CHEMICALS, &c.		Price June 15th.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£25 10s.	...
a	Potash, Chlorate	per lb.	4d. to 4½d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£15 15s.	...
a	Sulphur, Commercial	,,	£9 10s.	...
a	,, Roll	,,	£9 10s.	...
a	Soda, Chlorate	per lb.	3¼d. to 3½d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks	per lb.	4d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£120 to £125	...
b	,, Wire	per lb.	1/9 to 2/6*	...
b	,, Sheet	,,	1/6 to 2/-	...
p	Babbitt's Metal and Anti-friction Metal—			...
	Grade I	per ton net.	£242	£2 inc.
	Grade II	,, ,,	£169	£1 inc.
	Grade III	,, ,,	£93	£1 inc.
c	Brass (rolled metal 2" to 12" basis)	per lb.	9⅝d.	...
c	,, Tubes (solid drawn)	,,	11¾d. to 1/-	...
c	,, Wire, basis	,,	9⅝d.	...
c	Copper Tubes (solid drawn)	,,	1/0¾	...
c	,, Bars (best selected)	per ton.	£90	...
c	,, Sheet	,,	£90	...
c	,, Rod	,,	£90	...
d	,, (Electrolytic) Bars	,,	£65 10s.	20/- inc.
d	,, ,, Sheets	,,	£143 10s.	...
d	,, ,, Wire Rods	,,	£75 10s.	10/- inc.
d	,, ,, H.C. Wire	per lb.	9½d.	⅛d. inc.
f	Ebonite Rod	,,	2/3 to 2/6	...
f	,, Sheet	,,	2/3 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	8/-	...
h	India-rubber, Para fine	,,	1/6½	2d. dec.
l	Iron Pig (Cleveland No. 3.)	per ton.	72/6	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£32	30/- inc.
g	Mercury	per bot.	£15 10s.	...
e	Mica (in original cases) small	per lb.	3d. to 3/-	...
e	,, ,, medium	,,	4/- to 8/-	...
e	,, ,, large	,,	10/ to 20/- & up.	...
p	Phosphor Bronze, plain castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3	...
p	,, ,, rolled strip & sheet	,,	1/2¾	...
p	,, ,, wire	,,	1/3½	...
o	Platinum	per oz.	£23 10s.	...
d	Silicium Bronze Wire	per lb.	11½d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£266 15s. to £267 5s.	20/- to 50/- inc.
n	,, Wire, Nos. 1 to 16	per lb.	4/1	4d. dec.

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd,
r W. F. Dennis & Co.

A Long Transmission-Line Span.—What is claimed to be the longest span in an overhead transmission line is in course of erection across the Narrows of Puget Sound (United States). The channel is 4,800 ft. wide, flanked by cliffs about 300 ft. high. The sites for the towers are some distance from the water, making the total distance between them 6,240 ft. To comply with Government directions that the lines must have a minimum clearance of 200 ft. over the water the towers have been made 316 ft. high, and their elevated situation will permit of a maximum sag of 397 ft. The span will be in duplicate, necessitating a pair of towers on each bank of the Sound. The maximum computed reaction at the base of each tower is 310,000 lb. The line will be operated at 110,000 V.

Commodity or Privilege?—In some respects the business of electricity supply in the United States resembles our own practice very closely. In a recent address, reported in the *Electrical World*, Mr. J. C. Parker, vice-president of the Brooklyn Edison Co., said:—"A lay customer . . . who oughtn't to have to know anything about our miserable technique . . . just naturally can't come up to the counter and ask for 50 kWh to be wrapped up in a neat bundle and delivered to his house charged to his monthly account, but rather has to go through making an application in which he subscribes to a fine-print waiver of all his property, his rights as an American citizen and his hopes of everlasting salvation. He then runs the gamut of the credit department and the claim bureau and negotiates with his contractor and then gets a violation slapped on by the company or any one of a half a dozen official bodies, and, in the course of time just before he is gathered to his fathers he has opportunity to make a limited and restricted use of the commodity in which we claim to be rendering public service."

The Incorporated Municipal Electrical Association.

Annual Convention at Glasgow.

The I.M.E.A., with admirable courage—doubtless inspired by the Scottish resolution of its President, Mr. R. B. Mitchell—determined to hold its annual Convention, coal or no coal, and therefore assembled at Glasgow last Monday evening, to carry out at least the essential items of its programme, and as many of the social events as possible. Some curtailment of the programme was inevitable, but not so much as to detract seriously from the success of the meeting, though it could not be expected that so large a gathering would be recorded as in normal times. It will be remembered that in 1915, when Major H. Richardson, of Dundee, was president, no convention was held, and again in 1921, with Major Richardson a second time as president, the convention was cancelled on account of the coal stoppage; it is therefore a long time since the Association has met in Scotland, the last occasion being the Glasgow Convention of 1910, when Mr. W. W. Lackie was president. Those who were present on that occasion and partook of the lavish hospitality of the "Second City" would cordially endorse the decision of the Executive Council, and by the time these notes are read the many members who have now enjoyed the same experience for the first time will have realised that the Scot hides a warm heart under a sometimes rugged exterior.

Of Mr. R. B. Mitchell's career in electrical engineering we gave an account in our issue of July 3rd, 1925; a Glasgow man by birth and inclination, he has served the Corporation continuously for 28 years, becoming the head of his department six years ago—a record of which he may well be proud; carrying on the high traditions of his predecessors, he has maintained the efficiency of the Glasgow Electricity Department at the utmost pitch, and stands high in the esteem of the Corporation, as well as of his brother engineers. That he has left nothing undone to ensure the success of the Convention in spite of the difficulties of the time is certain, and in that aim he has had the hearty support of the staff of the Department.

Glasgow, as a great industrial centre, situated in a district rich in mineral wealth, and bestriding a river which for over a hundred years has been made navigable at great cost, has long possessed world-wide fame for its engineering works and achievements, and has been the home of many distinguished scientists, engineers, and administrators, the greatest of whom was Lord Kelvin. The population of the City is well over a million, and it covers 30,000 acres.

The government of Glasgow has been held up as an example of wise and prudent municipal administration for generations; the public services are admirably planned and efficiently conducted, and in every sense the city is up to date. Elsewhere in this issue we give an account of the Dalmarnock power station, designed by Mr. W. W. Lackie and extended by Mr. R. B. Mitchell; this plant is one of the most economical in the country, and has been visited by many engineers from overseas. The undertaking has over 61,000 consumers connected, to whom last year it sold 175 million kWh; it supplies power to 17,297 motors aggregating 140,000 h.p., and feeds over 4,000 street lamps. The total capital expended approaches nine millions sterling, but the net debt is only 5½ millions; the total revenue for the year 1924-25 was £1,242,118, and the average price received was 1.639d. per kWh sold. The Electricity Committee, of which Councillor Dr. D. McK. Dewar is Convener, has adopted a progressive policy, and is developing the domestic side of the business with assiduity; it has over 10,000 cookers, radiators and other apparatus out on hire, and supplies a total of 54,000 appliances of this class, having a total capacity of 72,150 kW. The Committee, under the advice of Mr. R. B. Mitchell, has instituted an assisted-wiring scheme, under which 2,000 houses have already been equipped.

Some 700 members and visitors attended the Convention on the first day, when fair weather prevailed. The organising work of the secretary, Miss Lanfear, and her staff was carried on under a heavy handicap, and they are entitled to the sympathy which the members have extended to them. Writing before the event, we believe the charming cruise in the Firth of Clyde which was planned for Wednesday afternoon, at the invitation of Messrs. Babcock & Wilcox, to follow the visit to that company's Renfrew works, will not take place—a sore disappointment to those who have enjoyed the trip on previous occasions, but unavoidable in view of the shortage of coal, and other obstacles.

The programme was opened on Monday with a reception by the President and Mrs. Mitchell, Dr. Dewar and Mrs. Dewar, followed by dancing and a display of kinema films on subjects of electrical interest arranged by E.D.A. On Tuesday the Convention was opened with a civic welcome by the Lord Provost, Sir Matthew W. Montgomery, after which Mr. Mitchell read his presidential address; the ladies then placed themselves in the care of Mrs. R. B. Mitchell, and visited the Electrical Exhibition, whilst Mr. S. E. Britton, M.I.E.E., read a paper on "Supplies to Outlying Districts." After the Corporation had entertained the visitors at luncheon, they were photographed in Linn Park, and proceeded to Dalmarnock power station. In the evening the Lord Provost and magistrates held a reception in the City Chambers, which was followed by dancing and a concert.

On Wednesday the works of Messrs. Babcock & Wilcox were visited, the party afterwards travelling to Gleneagles, where dinner was served, the return to Glasgow being by special train.

(To be continued.)

Presidential Address.

By R. B. Mitchell (Engineer and Manager, Glasgow Corporation Electricity Department).—*Abstract.*

As one of the Council's representatives on the British delegation of the International Electrotechnical Commission, I attended the Conference in New York and subsequently joined in a tour to all the principal cities of the United States and Canada. It was good to see the enthusiasm and amity which prevailed at the Conference and satisfactory to learn that greater progress had been made towards unanimity at this year's meetings than ever before. Apart from the technical side of its work, this Commission is really and truly a League of Nations in the best sense; its work will do a very great deal to promote good feeling and to induce international friendship.

Density of Load in United States Towns.

The first impression made upon my mind by the skyscrapers of New York was one of envy. What a place in which to supply electricity! Beyond doubt, there is to be had there a greater consumption of electricity per square foot of area than in any other city in the world. In one part of the area one-quarter mile square, the density is estimated to be at the rate of 280,000 kW of actual load per square mile. Any electrical undertaking operating in such a city has every prospect of success.

Rural Supplies.

There is the other side of the picture when we survey the vast extent of rural areas where the population is very scanty, and possible consumers cannot average more than five to the mile. Nevertheless, supply is being given, although the load to be obtained cannot possibly be remunerative for a long time to come.

In general, the rates of charge for rural supply are the same as for the metropolitan areas. It is recognised that the bad must be taken along with the good, and this is a problem which we, in this country, are to be faced with very soon if the ideals formulated in the Weir Report are ever to come to fruition.

It must not be forgotten, however, that the main justification for interconnection is the mutual benefit to be derived by developed areas by this interconnection. The supplies given to the rural areas on the route of the transmission lines are merely incidental, but are certainly of great benefit to those areas when once established.

New York Edison Company—Distribution.

The New York Edison Company is maintaining perhaps the most expensive system of distribution existing at the present time, and one which we, in this country, are trying to break away from. The supply is direct current at the low pressure of 120 volts. All cables are laid in ducts, and batteries, installed in sub-stations, are floating continuously on the network, to come into action in the event of a breakdown of the generating plant. Justification is claimed for this large expenditure because of the special conditions which exist, and particularly the installation of storage batteries is justified because of the serious consequences which might result from a failure of supply in that very congested area.

Power Stations.

In inspecting power stations in America, one is impressed by the size of the generating sets. I visited ten stations belonging to public utility undertakings, and I did not see any sets in use of less than 15,000 kW, and these formed a very small proportion. For the most part, capacities were of 35,000 kW and upwards, and it is the intention in one plant to install, at an early date, a unit of 100,000 kW. We are not in a position at the present time to follow that example. When interconnection becomes more general and extends over wide areas, the position may be very different.

Apart from the size of the turbo-alternators, which is the main feature of the power plants in America, one very important development is taking place there—the introduction of the high-pressure turbo-alternator, taking steam from a separate boiler at about 1,200 lb. pressure, and exhausting into the main steam range at the pressure of the main boilers. One plant of this description was seen at Weymouth station, in Boston, in operation, and another in course of construction at Milwaukee. This development may prove a means of making our moderately-efficient stations still more efficient without heavy capital expenditure, and without much scrapping of what may be still good and useful plant. It is estimated that, under good conditions, a saving of 7 per cent. can be obtained by the superposing of this high-pressure set on the ordinary sets in a power station.

Particular note was taken of the plants which were operating with pulverised fuel. Considerable experience has now been had in America with this form of firing, and comparisons have been made with equivalent stoker firing. In all cases under our review, complete satisfaction was expressed with pulverised-fuel firing, and I think there can be no doubt that, as larger and larger boilers are demanded, we on this side shall be driven to adopt this equipment. Large-capacity boilers need large stokers. The larger the stoker, the weaker it is in proportion and the more complicated. It is at this point that pulverised fuel becomes worthy of serious consideration. In the building of stokers a high degree of perfection has been attained. One travelling-grate stoker, 40 ft. wide, was seen in operation in one of the stations visited.

Attention should be called to the extent to which automatic boiler control has been developed in the States. In all large boiler rooms we find these equipments working with satisfaction to the users. I have no doubt that, at an early date, this matter will receive the attention here which it undoubtedly deserves.

A stigma which has been attached to the generation of electricity from coal during the whole period of public supply, in that the burning of crude coal was wasteful and wrong, has now good prospects of being removed. In Milwaukee, at Lakeside power station, I saw, completed, an installation for the treatment of coal in the pulverised form which, if expectations are realised, will enable valuable by-products to be extracted, before the residual, in the form of pulverised coke, is sent to the boilers. A saving in fuel costs calculated at 50 per cent. is expected to be the outcome, and if this be the happy result, a reproach long levelled at us by our gas friends will no longer be justified.

As regards the cost of power stations in the United States, the figure of £25 per kilowatt installed is considered nowadays to be quite moderate. In this country it would be deemed to be very much too high.

Cost of Electricity.

With regard to the rates at which electricity is sold in New York and other large U.S. cities generally, our own rates of charge compare very favourably with these, and in many of our undertakings they are much lower. The impression undoubtedly exists in this country that we are much behind in this respect, and it is time that an emphatic contradiction was tabled.

Supply engineers over there venture the opinion that the rates in this country are unnecessarily low, and point to their own extraordinary development as proof of the correctness of that statement. I do not agree with this opinion. Rates of charge, in municipal as well as company undertakings, should be as low as possible consistent with sound finance, if our consumers are to be able to make full use of what electricity can do for them. In America the ordinary consumer, although quite well-to-do, uses electricity for lighting, and there may be an iron and a vacuum sweeper in his household; but the rates do not permit the use of electricity for much else, and a 3-unit fire would be quite out of the question.

Development.

In spite of these charges, the rapid rate of the development of electricity supply is really astonishing. This fact has often been referred to in the past, and comparisons have been drawn with a view to emphasising our own backwardness.

The latest figure available makes the comparison even worse, namely, that of the record of the Commonwealth Edison Company of Chicago, as published in its last report. The units used per head of the population for the year in question amounted to 1,030, a figure, I believe, excelled only in one other undertaking, also in America.

This rapid development is, of course, due to America being a comparatively new country with any quantity of land ready for occupation, and also to the fact that it is passing through a time of great prosperity.

In Chicago last year lighting and small power was 26 per cent., railway light and power, 30.1 per cent., while power used in industry was 38.6 per cent. of the total, with 5.3 per cent. sold to other undertakings. In 1907 more than half (55 per cent.) of the total output of this company was for railway use, and lighting and small power amounted to 43 per cent. of the total.

These figures are interesting and show the extent to which the electrification of railways has proceeded in America. Approximately one-third of the output of this very large undertaking is used for railways. We have nothing to compare with this in our country. We all look forward to the day when the percentage of output for railway use, not from one of our undertakings only, but for the whole country, will approach the figure I have given above. These figures bring out another interesting point, *viz.*, that if the output for railway use is deducted, the units-used-*per-capita* figure becomes about 700. As the overall figure for this country is about 200, we still show up very badly in comparison.

Showrooms.

The showrooms of the electricity supply undertakings of the United States are an object-lesson to us in this country. Everything is done on what would be considered here a very lavish scale. An amount of space which we would consider excessive is allocated to showrooms, although it would seem that only the domestic side is catered for. No simple hiring of appliances is undertaken, but almost every sale is made on a deferred payment system. In one undertaking, the showroom sales amount to £1,000,000 per annum, and about 90 per cent. of this sum is received in instalments. In Chicago 48,000 irons were sold in one year, and in the same period five and a quarter million lamps were given out on the free-replacement system. Anything can be obtained on deferred-payment terms, from a house to a motor-car, and there is no doubt that business is stimulated thereby. We would do well to copy, to some extent at least, this example set by our American friends.

Domestic Load.

As with us, the importance of the domestic load has been recognised by supply authorities, and despite the high rates in force, great efforts are being made in many undertakings to induce domestic consumers to use electricity for purposes other than lighting. The re-laying of distribution mains in residential areas is faced quite cheerfully, the increased returns being confidently expected to make the expenditure well worth while. This may be a lesson to some of our own members who have hesitated to encourage, or have even discouraged, the use of appliances for purposes other than lighting by their domestic consumers.

Refrigerators.

In every showroom visited, the domestic refrigerator was found very much in evidence, and its sale being pushed energetically. This appliance is receiving at the present time, from sales managers in the States, more attention than any other. It has arrived now at a state of perfection which makes it a very reliable and very desirable part of every kitchen equipment. I am not prepared to say that in our climate it is so essential in the household as it is under American conditions, but there is a large field for it in hotels, restaurants, &c., and that field ought to be explored by everyone interested without delay.

Service.

The motto "Service to the Consumer and Prospective Consumer" has been adopted in all earnestness by the public supply undertakings in the United States. A telephone system dealing with "service" only is worked at the highest efficiency. Prompt attention is given to all complaints, broken-down appliances are repaired in the shortest possible time, and every care is taken to ensure that there is not one dissatisfied consumer. Research departments are maintained, and these are regularly called into assist in solving some problem which may have arisen on the selling side, involving the use of the company's supply. We would do well to follow this very good example.

Electric Vehicles.

The electric vehicle is making headway. I found that in New York city there are now some 4,000 vehicles working regularly, and their number is steadily increasing. One large biscuit factory has one hundred 5-ton wagons in use on its transport services. The agreement with the supply company

restricts the supply of energy for battery-charging purposes to the night hours.

The development of this business means not only increased consumption, but load-factor improvement.

To sum up, one can only conclude from these observations that in the United States they, in many respects but not all, are well ahead of us in things electrical. They are thoroughly converted to the super-power idea; they believe in big plants and in interconnection over wide areas; they are going for maximum reliability and efficiency, the former always being placed first. The men at the head of affairs are very proud of what has been achieved and of the people who have helped to bring about the present state of development.

Electricity Supply to Outlying Districts.

By S. E. Britton.—*Abstract.*

The paper deals with the supply of electricity by authorised undertakers to districts which are adjacent to, or within the economic limits of, secondary transmission and low-voltage distribution from their own stations, but are at present not served with electricity.

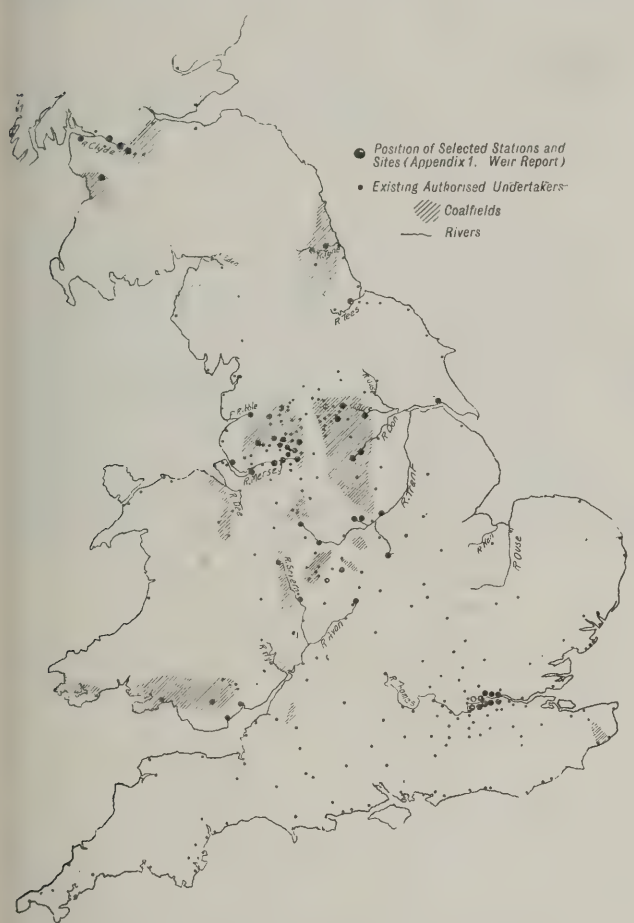


Fig. 1.—Generating Station Sites and Coalfields.

One of the reasons for the present unsatisfactory progress is that there are now available sufficient cases of inconsistency in the administration of the Electricity (Supply) Acts to justify the mistrust and uncertainty prevalent throughout the industry.

The methods of constituting Joint Electricity Authorities and of dealing with applications for Special Orders under the 1919 Act have been most effective in encouraging super-parochialism. The effect of collecting together hundreds of people from a district thousands of square miles in area, the majority of whom have no knowledge of how electricity is generated and supplied, representative of all the various forms of local government, and asking such an ill-assorted band to consider schemes for affording a supply over a large area, cannot be expected to lead to a satisfactory result. One of the fundamental provisions of the 1919 Act, therefore, instead of checking parochialism, is responsible for the continuance of a condition which it is vitally important to remove.



Figs. 2 and 3.—Existing Areas Authorised Undertakings could supply with Secondary Transmission (left) at 6,600 V and (right) at 11,000 V.

The registrar-general's Statistical Review of England and Wales for the year 1924 contains a record of deaths from various causes, including the following:—

Cause.	1919.	1920.	1921.	1922.	1923.	1924.	Total.
Accidental burns ...	2,095	1,785	1,588	1,722	1,608	1,565	10,363
Machinery	326	329	180	192	213	229	1,488
Vehicles, Railways, &c.	3,730	3,826	3,496	3,485	3,751	4,436	22,724
Injury by animals ...	111	69	84	63	63	66	456
Lightning	5	11	3	4	8	12	43
Electricity	32	26	19	21	25	37	160

which figures emphasise the fact that electricity is not necessarily as dangerous as the severity of the regulations issued by the Electricity Commissioners and the Postmaster-General would lead the public to imagine. The inconsistencies in the relationships of the electricity supply with telephone and telegraph services, together with the rules for obtaining wayleaves, are amazing. It is incredible that matters have not been improved before attempting to formulate the Electricity (Supply) Bill, 1926. It is abundantly clear that the industry cannot be efficiently carried on when such details as lopping trees and wayleaves have to be referred to the Electricity Commissioners and the Minister of Transport in London. Given suitable legislation, these matters at once become matters of routine and local interest only; they can, therefore, be settled in a more satisfactory manner and by less costly public officials than those now entrusted with them. It is suggested that the land agent of county council estate departments might be appointed to settle such matters on the spot on payment of a standard fee, plus out-of-pocket expenses; the procedure might be somewhat similar to that adopted in appointing an electrical inspector under the Electric Lighting Clauses Act, 1899.

While parochialism is not a charge usually levied against private enterprise, or power companies, with a few exceptions their attitude towards the development of their areas has been narrow-minded; they have confined their attention to the most thickly populated and industrialised parts in much the same way as local authorities have done. The country cannot afford to allow the development of a scheme to be sport for politicians, or men of intriguing propensities, neither are the decisions of the Electricity Commissioners and the Minister of Transport in respect of applications for Special Orders for distribution powers always free from the reproach of parochialism.

The decisions regarding the district of which Chester forms the centre justify the opinion that London is not a suitable place from which to arrive at a correct and final judgment on the technical, administrative, and economical merits of proposals for the development of the supply of electricity in rural areas. An instance of how *not* to proceed has recently been provided by the Wirral Rural District Council, which attempted to develop a distribution scheme in its area. The Electricity Commissioners approved of Wirral's application for a Special Order, and eventually a scheme was formulated and application was made to the Commissioners for sanction to borrow £180,000 to enable it to be carried out. At the public inquiry into the application it was stated that agreements for bulk supplies of electricity had been prepared between the Rural District Council and the Mersey Power Co. and the Wallasey Corporation respectively, based on a kilowatt charge and a price per unit, with a minimum payment per annum irrespective of the quantity of electricity taken, thus safeguarding both the Company and the Corporation against loss in giving a bulk supply. The estimates of income and expenditure for operating the undertaking during the initial stage showed a loss of about £9,000, if the maximum price allowed by the Special Order was charged, whereas figs. 2 and 3 indicate that the area of the Wirral Rural District Council could be more economically supplied by ignoring the District Council's boundaries and attaching it to the area of one, or more, of the adjoining authorised undertakers.

If it is admitted that large quantities of cheap electricity can be generated in this country only where there is abundant natural water for condensing purposes in close proximity to

the coalfields, then such localities are limited to a few districts. A national scheme therefore resolves itself into: (*a*) Generation in comparatively few localities; (*b*) a comprehensive system of transmission; and (*c*) extensive areas of distribution.

Fig. 1 shows lengths of rivers which have at least 800 square miles of catchment area and estuaries that have water available for generating stations with a plant capacity of 100,000 kW and upwards, the coalfields, the selected stations referred to on pages 26, 27, 28, 29, and 30 of the Weir Report, and other authorised undertakings. This map indicates the proximity of the "selected" stations to natural water and the coalfields and the extent to which the undertakings are distributed over the country; also how illogical it is to constitute Joint Electricity Authorities to generate electricity in the districts which have so far been delimited, and emphasises the necessity of generating stations being erected with a view to meeting the requirements of the country as a whole.

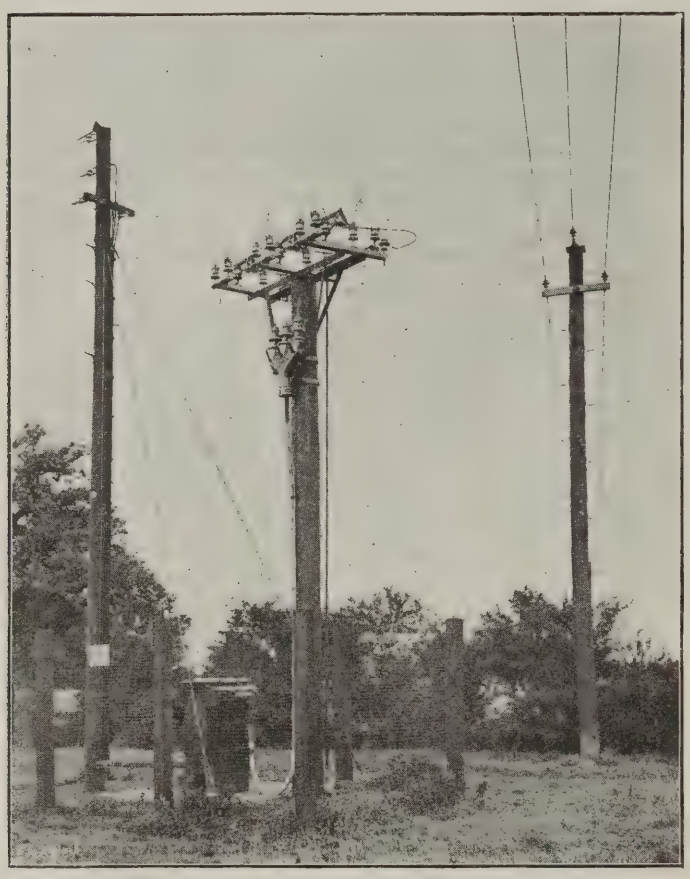


Fig. 4.—A 6,600/400-V Transformer Sub-station, Controlled by 6,600-V Outdoor Switchgear.

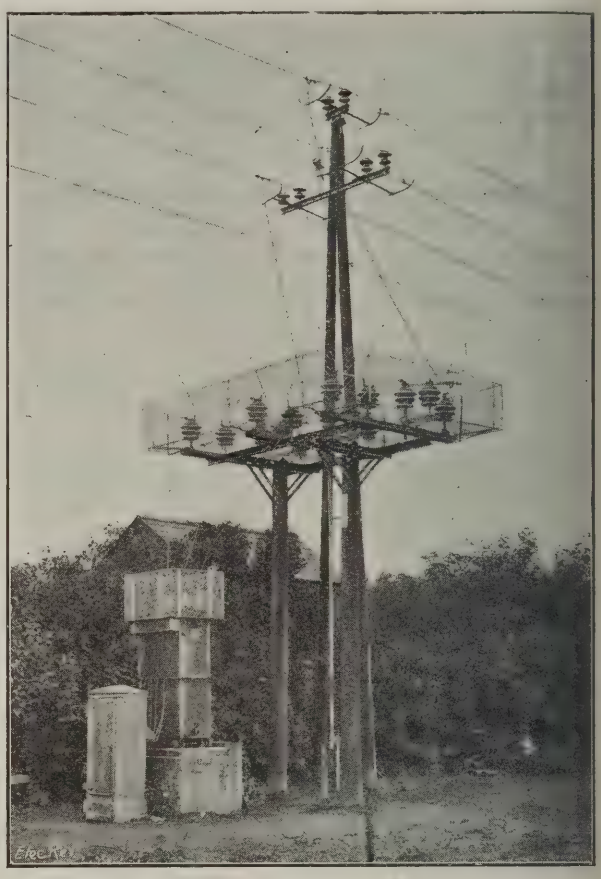


Fig. 6.—A 33,000/460-V Transformer Sub-station, Controlled by 33,000-V Outdoor Switchgear.

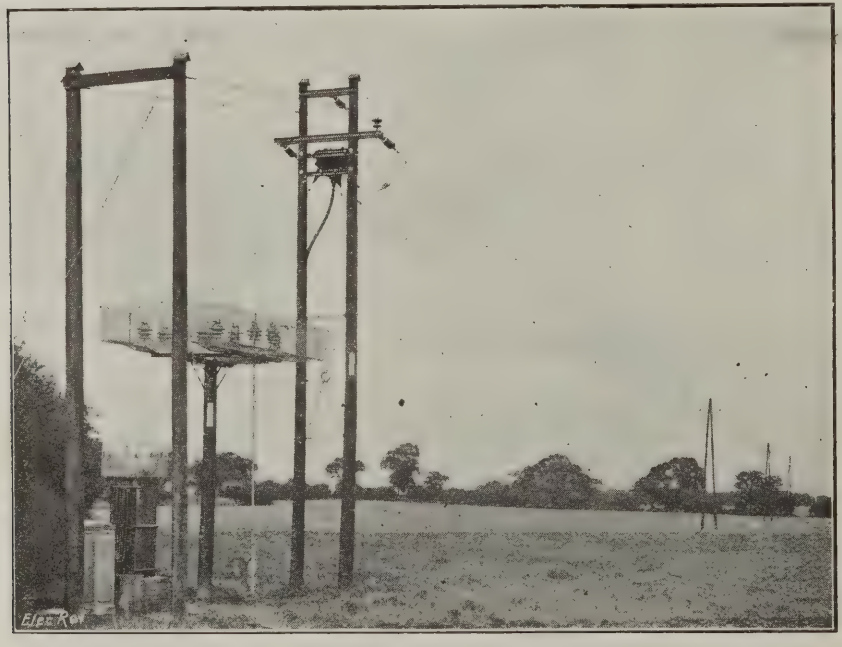


Fig. 5.—Outdoor 33,000/460-V Sub-station.

Figs. 2 and 3 show the positions of all authorised undertakers, except the smallest, and the areas they would cover if their systems of distribution were extended to the limits of transmission at 6,600 and 11,000 volts respectively, as well as the effect of covering the whole of the country with distributors of electricity. They indicate the necessity for withholding, for a specified time, the grant of Special Orders to those who are not already authorised undertakers so as to enable existing undertakers to investigate the potentialities of the areas which lie within the economic limits of 6,600 and 11,000 volts respectively from their stations. This would be better than adopting the proposals contained in paragraphs 70 to 78 of the Weir Report. (*To be concluded.*)

The I.M.E.A. Exhibition.

In connection with the Convention an exhibition of electrical apparatus is being held at the McLellan Galleries, Sauchiehall Street, where floor space of about 10,000 square feet is being utilised by some twenty-four manufacturers, the Electricity Department of the Corporation of Glasgow, the E.L.M.A. Lighting Service Bureau, the British Electrical Development Association, and the Electrical Association for Women. The displays cover the whole range of modern lighting, heating, cooking and labour-saving appliances, electro-medical applications, water heating and refrigeration. In addition, a number of special exhibits of interest

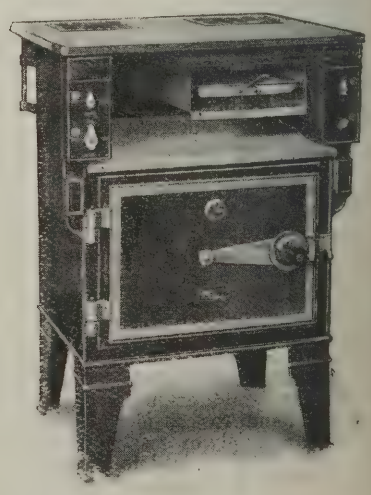


Fig. 1.—A Modern Electric Cooker.

to engineers include thermostats, meters of special types, heat-storage apparatus, industrial heating appliances, and new wiring methods. The exhibition is open to members of the Convention and to the general public at specified times.

The General Electric Co., Ltd., is exhibiting a wide range of its products, including "Magnet" electric cooking apparatus, and electric suction cleaners, the latter being manufactured throughout in Great Britain and sold exclusively through the electrical trade. The running cost of the cleaner is approximately one half-penny per hour. Fig. 1 shows the maker's H.7500 model electric cooker. A full range of "Gecoray" shop-window lighting reflectors, various lighting units, "Freezor" electric fans, and numerous types of "Osram" lamps are among the other exhibits. Owing to the limited amount of space available on the stand at the Convention, a special display is also being made of the Company's products at its Glasgow showrooms, where demonstrations, "Doing it Electrically," are being featured throughout the period of the Convention.

A representative selection of the various models of "Creda" electric cookers is to be seen on the stand of Credenda Conduits Co., Ltd. This includes five models from a size convenient for two up to a large cooker suitable for 18 persons. The special feature of these cookers is the embodiment of "plug-in" elements. Considerable interest is being shown in the new "Globar"-pattern elements for boiling plates and grills. In these a new resistance material, "Globar" (Electrical Review, May 7th, p. 761), is employed, which marks a departure from the usual nichrome alloy. The advantages claimed for the "Globar" rods are that they are unaffected by any liquids being spilt on them, and even a piece of wire laid across two of the rods, causing a dead short, will do no harm beyond blowing the fuses. A very long life is claimed for the material, and it has the further advantage that a very high loading can be obtained, as much as 3,000 watts being possible on a standard 7 in. by 7 in. hot plate. "Globar" elements can be fitted as an alternative to the firm's standard element at a slight extra cost. The other exhibits of this company include a new series of electric kettles, having automatic protective devices, and a very neat wash boiler. A few electric fires embodying the "Crater" fire bars are also on view.

The Siemens & English Electric Lamp Co., Ltd., is exhibiting a selection of "Siemens-Xcel" electric domestic appliances, including electric irons, kettles, fires and electric cookers. The fires comprise various types of well fires and those of the imitation-coal type. The cookers, which have been designed with a view to efficiency in use combined with simplicity in operation, have boiling plates of special patented design, circular, 7 in. diameter, so arranged that the utensils are in close proximity to the spirals. These are supported in grooves and arranged so that on medium heat the centre spiral only is in circuit, giving practically the equivalent of full heat for a small pan with only half loading, and avoiding the wastage of heat from uncovered spirals. A feature is the ease with which the elements may be replaced. Plug-in terminals are adopted for both the boiling plates and the grills. The grill, which is fitted with 3-heat control, is provided with a damper plate, which, when removed, exposes a circular portion of the grill element, and renders the unit suitable for boiling purposes. The hobplate is hinged. The oven elements are arranged on busbars, and are easily removed by slackening two screws. The "Xcel" No. 1 iron is made in various weights and is fitted with a patented side-entrance connector which keeps the flex away from the user's arm and obviates one of the common troubles with irons, *viz.*, the failure of the lead caused by the continual pulling out of the connector by means of the wire. A thumb grip is provided, which must be used to remove the connector, and a special steel bell-mouthed entry prevents wear on the flex.

A very attractive stand is that of the British Thomson-Houston Co., Ltd. An important feature of the exhibit is the "No-Lag" induction motor, which is being shown for the first time. This machine (Electrical Review, February 12th, 1926, p. 271), in addition to possessing all the advantages of an ordinary induction motor, operates at practically unity power

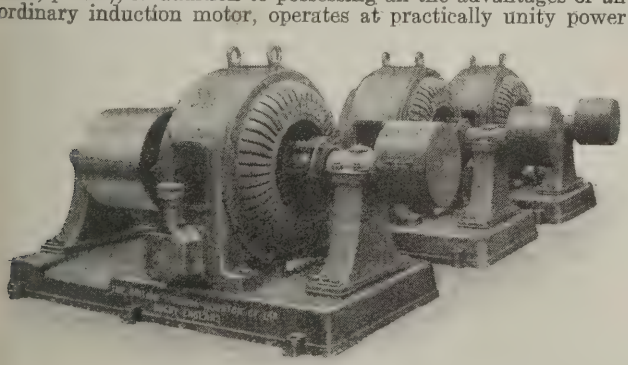


Fig. 2.—B.T.-H. "No-Lag" Induction Motors.

factor over the entire load range. The "No-Lag" motor can be supplied to give a leading power factor of 90 per cent. at full load, thereby improving the power factor of the system when working with other motors of the ordinary induction type. At the same time, it is claimed, the "No-Lag" motor will take its full rated load. Fig. 2 shows a group of "No-Lag" induction motors, each rated at 250 h.p., 600 r.p.m., 433 V, 3-phase, 50 cycles.

An exhibit of motor-control gear representing recent advances in this direction is of particular interest. For d.c. work a very compact unit, comprising a face-plate type starter, fuses, line switch and protective devices, all completely enclosed in an iron case, designed to meet the requirements of motors up to about 18 h.p., is among this equipment, which may be obtained for wall or pillar mounting. An a.c. motor-control pillar has a starting switch of the drum type, built on the lines of the B.T.-H. controllers for crane duties; it has a slow motion, or step by step, starting mechanism with the dead-man's-handle feature. Interlocks are provided to guard against any contingency, and full protective equipment is fitted. Provision is made for routine inspection and testing in a quick, clean and effective manner, all parts being easily accessible for this purpose. Examples of the B.T.-H. fractional horse-power motors are being shown, and also "Tungar" battery chargers for both high- and low-pressure charging. One of the most attractive features of the stand is a wonderful display of "Mazda" lamps, lighting fittings and reflectors. The lighting equipment is ingeniously arranged, and provides effects which are at once striking and artistic. One fascinating item in the lighting section shows some of the possibilities of coloured lighting for shop-window displays. A novel method of presenting a record in an attractive manner of some of this company's products is the use on the stand of illuminated stereoscopic views in colour of a number of important installations of various kinds.

Some models of electric cookers built on the lines of the one described in his paper on "An All-Electric House," read before the Institution of Electrical Engineers by Dr. S. Parker Smith (Electrical Review, December 11th, 1925, p. 951), are among some of the most interesting exhibits. These were built



Fig. 3.—Cooker with Plug-in Utensils.

for Dr. P. Smith by Messrs. Archibald Low & Sons, Ltd. A table model boiling plate is of special interest. For use with this apparatus are three pots—of a substantial type—of 3-, 6- and 9-pint capacity, each fitted with heating elements and arranged for three-heat control. At the back of the bench sockets are fitted to accommodate the three-pin plugs of the utensils; no flexibles are used, the sockets being given a certain freedom of movement in their mountings. It is claimed that the consumption and cost of cooking have been reduced to less than one-half by replacing the two original open boiling plates with utensils having their own heating elements. Most of this saving is due to the high overall efficiency of electrical appliances with self-contained elements, and the rapidity with which the maximum efficiency is attained after switching on, thus rendering such vessels eminently suitable for the short operations which are characteristic of household practice. The model also contains a 3-heat control grill and an enclosed-type boiling plate. The latter is intended for use with utensils for occasional duty. Fig. 3 shows one of the models which is attracting considerable interest. It is of the usual design of domestic cooker, incorporating the self-contained-element utensils and the plug-in principle for the boiling arrangements. The cost of this cooker exceeds that of the ordinary apparatus by the value of the utensils, but it is claimed that the extra charge will be quickly covered by the saving in consumption.

An interesting display of electric water-heating equipment is to be seen on the stand of Messrs. Benham & Sons, Ltd. Several types of electro-vapour radiators and towel rails are being shown, including, of the former, a specially-designed apparatus for use on board ship. A 4-gallon aluminium-lined urn is shown complete with a neat switchboard and the necessary connecting leads. An electro-vapour coil is included

in the exhibits. It is designed for the heating of inaccessible places such as linen cupboards, drying rooms, and garages. This apparatus is made in capacities of 200 W upwards. Other interesting items are electric geysers, fig. 4; these are of the electro-vapour type, and each consists of a

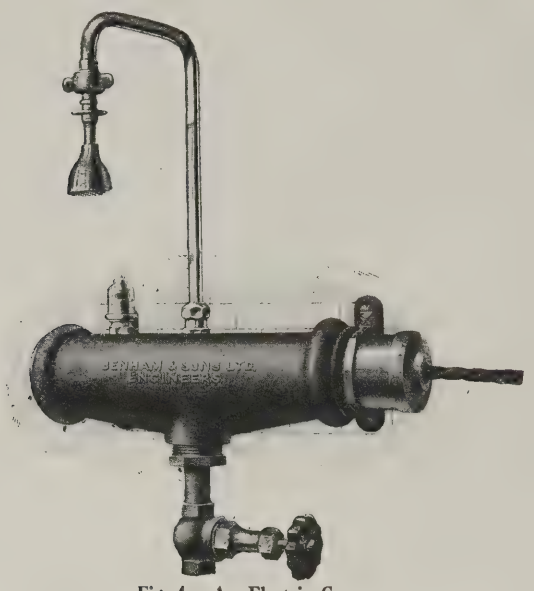


Fig. 4.—An Electric Geyser.

chamber into which one or more "Benham" immersion elements are screwed. Two models shown are of 900- and 2,000-W capacities and are fitted with 1- and 3-heat elements respectively. Other exhibits include a 20-gallon galvanised electric water-heating cylinder and an electric toaster, 12 in. by 12 in.

One of the items included in the display of Messrs. CARRON COMPANY is the firm's No. 616 electrically-heated wash boiler, fig. 5. This has a cast-iron pan with a well as the lowest part, over which is fitted a perforated guard of galvanised sheet steel. The cast-iron legs are connected with a triangular jointing piece. A large-bore draw-off tap is fitted to the pan, and an auxiliary tap is fitted to the base. The boiler is heated by means of two 2-kW immersion heaters fitted in the well. Two "Carron" electric cookers are also being shown, models 310 and 311. Fig. 6 is one of a variety of electric fires which are on view at this stand. This model, 223a, is fitted with a fireclay element which is interchangeable with the firm's patent cast-iron enamelled element. It is 12 in. wide by 19 in. high, and weighs 27 lb. The loading is 1 kW. Other articles shown here include a selection of electric irons, kettles, grills, and boiling plates.



Fig. 5.—Electric Wash-boiler.

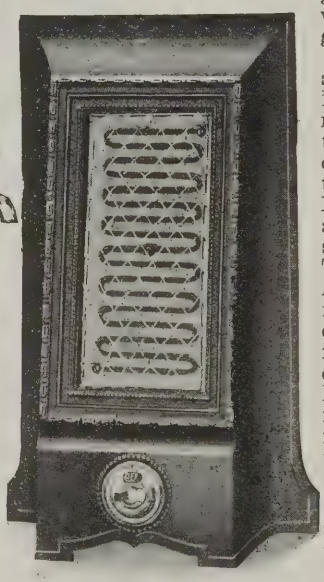


Fig. 6.—An Electric Fire.

Messrs. BELLING & Co. are making a special display of their No. 6 cookers. These have been designed specially for hiring-out purposes, and whilst the general design and constructional details are uniform throughout, three different types of heating elements are used in various combinations. The most interesting of these elements is one of entirely new design; this is of the closed type with a cast-iron top, and it is claimed to be impossible for spilt liquids to come into contact with the spiral. The design of the protecting plate enables a pint of water to be boiled from cold in 8 min. with a loading of 1,200 W. Another of the elements is of the open type, while a third incorporates the solid fireclay principle.

Two stands at the exhibition are occupied by the BRITISH ELECTRIC TRANSFORMER CO., LTD. One of these is devoted to selections of the latest "Tricity" sun-ray radiators, which are shown in something approaching a home setting, though the space available does not permit of anything like full-size rooms. On the other stand various types of cooking apparatus are shown and cooking demonstrations given. A section is set apart for general domestic electrical apparatus, including fires, toasters, irons, and kettles. The fires include models fitted with a new alternative element, in addition to the well-known "Flame" element fires. The new element is fitted with a steatite base and has spiral coils.

Messrs. D. B. SELKIRK & Co. are displaying some interesting ultra-violet apparatus, including their artificial "mountain sun" mercury-vapour lamp, some vacuum and atmospheric types of burners, and various models of arc lamps with special tungsten-cored carbons. Radiant-heat apparatus for covering the whole of the body or for local application is also being shown, and also diathermy apparatus for cauterising malignant tumours and treating certain diseases, and high-frequency equipment for the treatment of nervous disorders.

Messrs. J. H. TUCKER & Co., LTD., are devoting the space allocated to them to the demonstration of the efficiency of their new B.4,000-type 5- and 15-A switches (ELECTRICAL REVIEW, March 26th, 1926, p. 517). One switch of each capacity is controlling a load consisting of electric fires on 250 V d.c. The 15-A switch is acting as a main switch and controls two 3.3/4-kW fires, one of which is governed by the 5-A switch. The demonstration shows conclusively the exceptional high efficiency of the switches, which renders them most suitable for heating and gasfilled lamp loads.

An interesting selection of heating equipment may be seen on the stand of Messrs. YOUNG, OSMOND & YOUNG, LTD. This includes a standard skirting heater for use with the makers' electric tubular heating system. The heaters are placed horizontally on the skirting boards so as to obtain the maximum number of heat units per sq. ft. for a given surface temperature. The device is constructed with a coiled heating element passed in a hairpin bend through two porcelain tubes. The complete element is inserted in a steel tube provided with a cap at one end and a terminal cover at the other. Wall- and floor-type towel rails are also shown. With the latter no flexible wiring attachment or wall plug is necessary, a terminal being contained in the base with a length of conduit leading to it. A feature of the stand is a water-tight and gas-tight tubular heater designed for use where liquids or inflammable gases are present. Window heaters, for the prevention of water condensation on shop windows, and car-bonnet and garage heaters are also included in the exhibit.

Some interesting models of "Burco" electric wash boilers are displayed by Messrs. BURNLEY COMPONENTS, LTD. The No. 60A model has a loose lid which fits into a recess in a top rim of galvanised iron. The addition of three lugs soldered to the inside of the pan and supporting a cage or perforated container, enables this apparatus to be used for steaming vegetables or boiling puddings, &c. This boiler has a capacity of 10 gallons and a loading of 3-3½ kW. An all-copper model is also on view; the casing is of polished copper treated with a special transparent lacquer to withstand the action of water. This type of boiler is made with loadings of from 3- to 5-kW. A combination electric boiler shown is designed for boiling milk, porridge and other liquid foods, as well as for use as an ordinary wash boiler. The apparatus consists of one pan fitted inside another, the inner pan being made from hard rolled copper, tinned inside and out, and fitted with handles for lifting-out purposes. Milk is placed in the inner pan and water is poured into the outer pan by means of a funnel which is fixed on the side of the body. When the inner pan is removed, the boiler is ready for use as an ordinary wash boiler.

A range of modern domestic cookers is also being shown and operated on the stand of the CABLE ACCESSORIES CO., LTD. An all-enamelled oven is attracting a good deal of interest. It is constructed of welded-steel sections, vitreous enamelled on both sides. The lower corners at the sides and back are rounded and a lip on the front edge of the floor projects and forms a weathered joint with the casting, effectively preventing the ingress of liquids during cooking or cleaning. The oven elements are built up of refractory bars of steatite and are hung on the oven walls. A large hot cupboard is fitted with a drop door forming a shelf when open. Standard "Revotherm" semi-enclosed boiling plates are fitted on all the cookers. A new plate incorporating the "Globar" element is also being prominently shown and demonstrated. The hinged top plate is a feature of the cookers. A novel and extremely useful pot-rack is also proving of interest. It is instantly adjustable to any of six heights or at once removable. The rack and pillars as a whole are hinged and may be dropped down on to the top casting for packing or when raising the top for inspection. All the wiring is carried out in solid copper strip and all the connections to the elements are made by a standard-size nut. A selection of fires is being shown, each incorporating the "Emitter" fire bar. This is built on the parabolical-refractory-reflector system. Plug-in contacts are provided, facilitating rapid interchangeability of bars. A display of electric irons in all sizes from a 20-lb. laundry model to a small traveller's iron is also being shown.

(To be concluded.)

The Binary Converter.

A New Type of A.C.-D.C. Converter.

THE chief characteristic of the usual types of converting apparatus is that the direct-current voltage regulation depends either on the use of transformers or of two distinct machines, such as the motor-generator set. It seems, therefore that converting apparatus consisting of one machine only, capable of being arranged to be fed with alternating current of any voltage (including a high-pressure supply) without the use of transformers and, at the same time, of delivering direct current of any voltage independently of that of the alternating current, should find a wide field of application; and its value is still further enhanced by the possibility of arranging the d.c. side so as to have any desired characteristic, series, shunt, or compound, or even such special characteristics as are required for welding purposes. The type of machine described below (fig. 1) has been designed to satisfy these requirements, and is believed to possess marked advantages over every other.

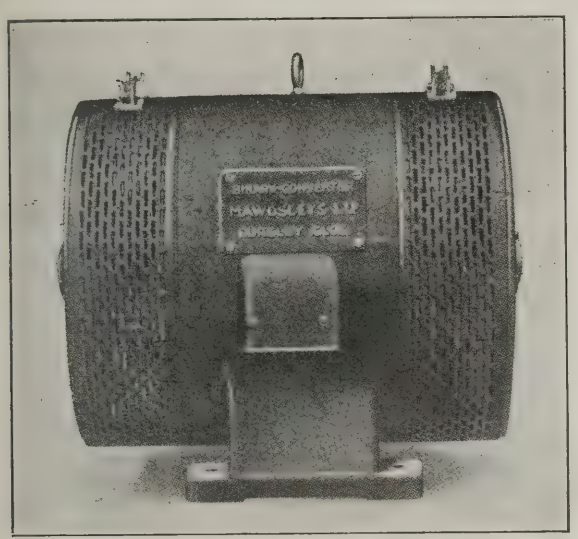


Fig. 1.—The Binary Converter.

The sectional elevation of the binary converter (fig. 3) shows that it consists of a laminated stator similar to that of an induction motor and mounted in the same way inside a cast-iron frame. The stator contains a standard induction-motor winding in the space next to the air gap, and a field winding in the same slots, but completely insulated from the alternating-current winding, there being no electrical connection whatever between them. Inside the stator a rotor carries a direct-current winding attached to a commutator; this winding is exactly the same in nearly all respects as that of a standard d.c. machine, but contains special circuits adapted to carry the secondary current of the induction-motor end; it is fitted with standard brush gear.

The binary converter may be either of the synchronous or induction type; considering the former pattern first, suppose a machine carries four windings, two on the stator and two on the rotor (*a*, *b*, *c*, d, fig. 2) and that of the rotor windings *c* is arranged for six poles and *d* is a two-pole winding; also that of the two stator windings *b* is arranged for two poles and *a* is a six-pole field winding. Suppose d.c. to circulate in the two-pole field winding *d* on the rotor and the machine to be running at the synchronous speed of this two-pole winding (namely, 3,000 r.p.m. at 50 cycles), then clearly the two-pole winding can induce no voltage in the rotor winding *c*, since it revolves with it and hence does not cut it; similarly, if d.c. circulates in the field winding *a* on the stator, it can induce no e.m.f. in the other winding *b* on the same core, since both windings are fixed. Winding *a* induces e.m.f.'s only in *c*, and *d* induces e.m.f.'s only in *b*; the flux due to winding *d* (stationary with respect to the rotor) will revolve in respect of the stator, while that due to winding *a* will revolve with respect to the rotor and is stationary with respect to the stator.

If winding *b* is supplied with 50-cycle single-phase or polyphase current, the machine will run as a synchronous motor and, if winding *c* is joined to a commutator, a direct-current e.m.f. will be produced across that commutator. Winding *d* cannot induce any e.m.f.'s in *a*, since the two are wound for dissimilar numbers of poles; for the same reason winding *c* cannot induce any e.m.f.'s in *d*.

In practice the use of two windings on the rotor of such a machine is inconvenient, and is rendered unnecessary if the single rotor winding attached to the commutator is given a pitch which is equally adapted to operate with six or two poles, such, for instance, as the full two-pole pitch which is also equally well suited to six poles. If this winding is tapped at points differing by two pole pitches of the six-pole field (that is, at three points 120 deg. apart) and the points brought out, say, to slip rings, no e.m.f.'s will be induced

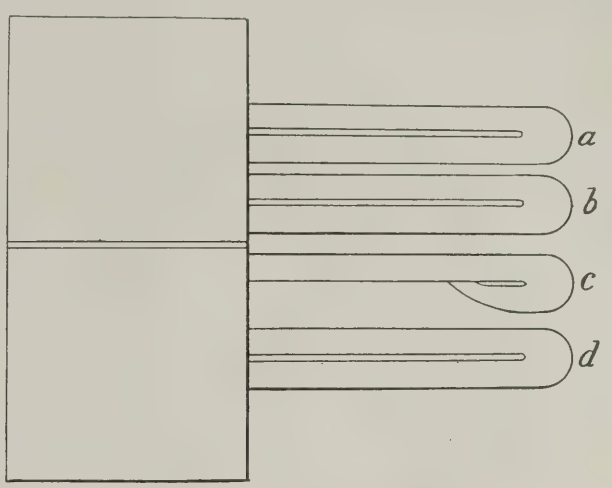


Fig. 2.—Arrangement of Windings.

by the six-pole flux between any two slip rings. If, therefore, a pair of them are short-circuited and direct current inserted between the short-circuited pair and the remaining ring, two-pole excitation of the rotor may be brought about without requiring the use of a separate winding. In this way the six-pole and two-pole windings may be combined also, but for brevity let it be assumed for the present that separate d.c. and a.c. windings are employed on the stator, as is actually most convenient in the smaller sizes.

The alternating side of the machine may also be caused to operate as an induction machine if the points which before were connected to slip rings are short-circuited. Under such circumstances currents of slip frequency will flow through the short-circuited connections and the slip rings may be eliminated. In this case, of course, the short-circuited points need not be limited to three so long as care is taken that only points two pole pitches apart of the six-pole flux are connected. This type of machine, owing to the absence of slip rings and of the necessity of d.c. excitation of the rotor, is most suitable in small sizes.

In the case of the induction machine it is no longer true

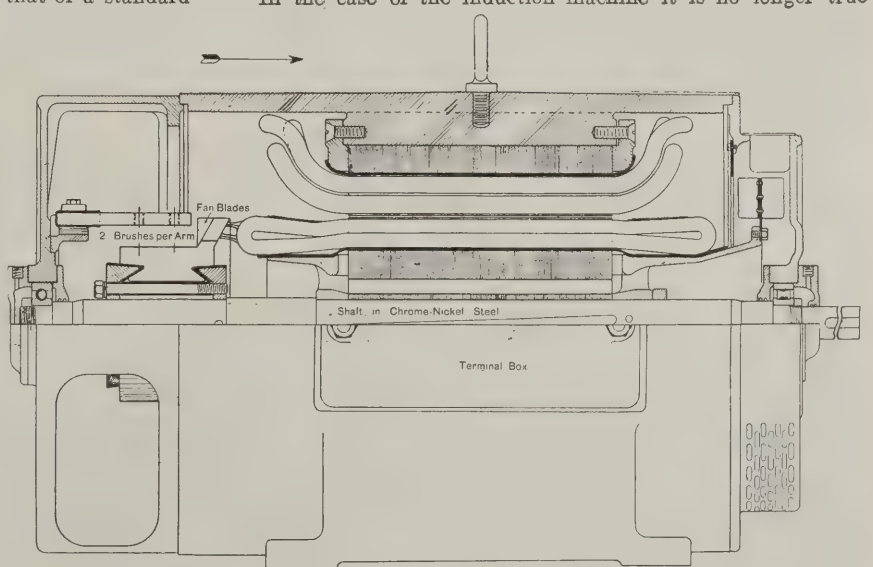


Fig. 3.—Sectional Elevation of Machine.

to say that one flux is stationary with respect to the rotor and the other with respect to the stator. The flux which is now generated by the alternating-current winding on the stator is in slow rotation with respect to the rotor also, the effect of which is to superimpose a tiny ripple (of an amplitude of perhaps one half per cent. of that of the direct-current voltage) on this voltage; the ripple is of absolutely no significance. Of course, the machine is not limited to two and six poles, but can be built for many other ratios of poles.

The practical construction of a machine of small size arranged

for two and six poles needs 24 slots in the stator, six of the slots being devoted to a shunt winding. In order to prevent the two-pole flux inducing very high e.m.f.'s in the shunt winding, which may have a very large number of turns, it is necessary to ensure that the alternating e.m.f.'s in the shunt winding shall cancel out turn by turn; for this purpose the winding is made as a single long coil, each turn passing from the first slot through the whole of the six slots before returning to the first again as is shown in fig. 4. Intermediate between any two adjacent slots of the shunt winding are three other slots. In parts of those slots next to the air gap is placed a two-pole three-phase winding of the ordinary concentric type, while in the rear of the same slot is placed the interpole winding.

in standardised sizes up to 50 kW. Fig. 5 is a curve of the full-load efficiencies of all the sizes mentioned plotted against kW rating, and other advantages claimed for this type of machine include the following: No slip-rings are needed, synchronising is unnecessary, high power factor, transformers never required, effective on single-phase circuits, can be made to run at any speed independently of the number of poles on the d.c. side, and its efficiency is about equal to that of a rotary converter of moderate size. It will thus be appreciated that the characteristics of the binary machine closely resemble those of a motor-generator, excelling chiefly over the latter by virtue of greater compactness, lighter weight, and higher efficiency, together with moderate cost.

Applications of the binary converter are many and diverse,

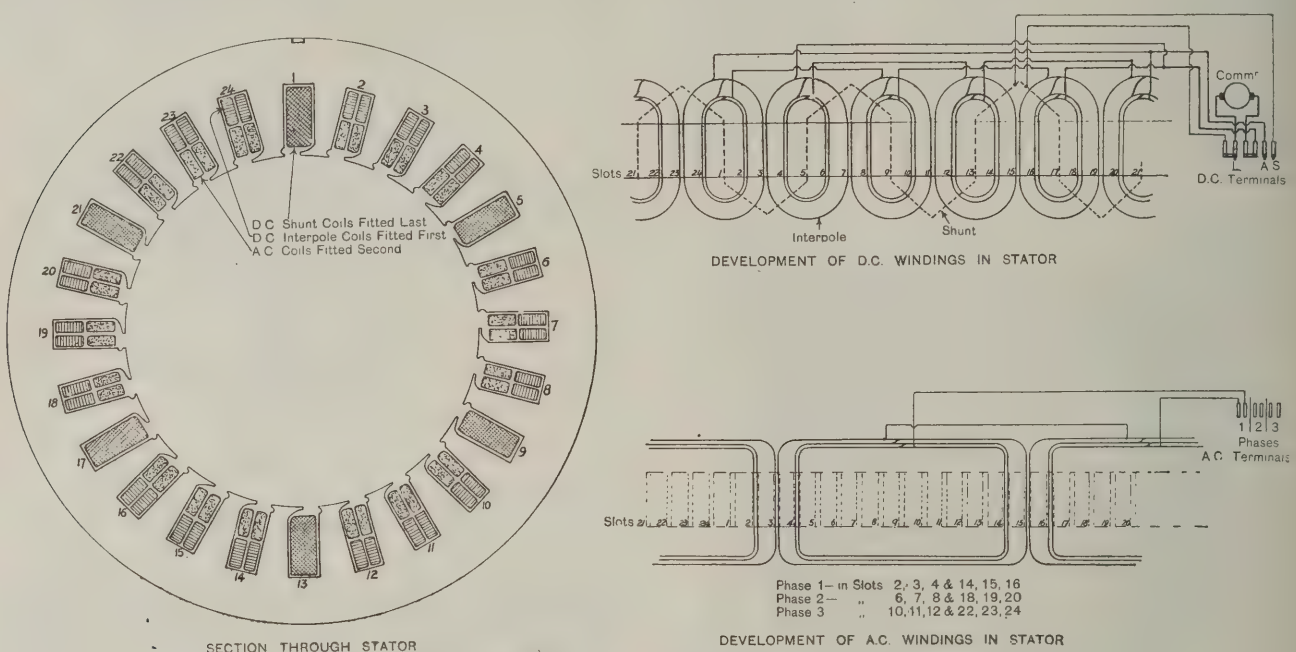


Fig. 4.—Binary Converter Stator Winding Diagram.

The rotor consists of a d.c. armature of a perfectly normal type, corresponding to that of a two-pole machine, and short-circuited along a number of points (each two pole pitches apart) of the d.c. winding. Such a machine, in essence, consists of an induction motor driving a direct-current generator, both having common magnetic circuits and common windings. On the d.c. side it has all the characteristics of the d.c. interpole generator, *i.e.*, it can be compounded by moving the brushes off neutral, the d.c. voltage can be regulated by a field rheostat in the usual manner, and it can be started in the same way as a squirrel-cage induction motor, not requiring synchronisation.

The starting gear of the binary converter is that appropriate to a squirrel-cage induction motor. The smallest size of converter may be switched directly on to the line; for sizes of from 1 to 5 kW star-delta starters are employed, while

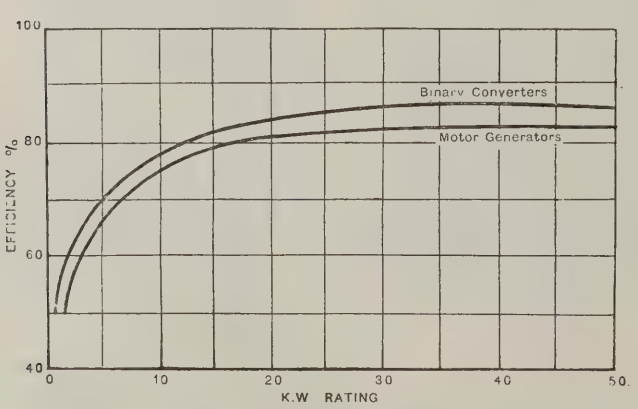


Fig. 5.—Efficiency Curves.

for larger sizes either an auto-transformer starter may be employed or a type which has been specially designed for the purpose; the latter, in the starting position, inserts a choke in series with the line in order to cut down the voltage supplied to the motor, and in the running position connects the terminals of the motor directly to line. It should be pointed out that the binary converter always starts on absolutely no load, and only has to accelerate its own rotor against the friction of the brushes. It is therefore possible to reduce the starting current of a squirrel-cage motor to a very low figure, not exceeding twice full-load current; or, when an auto-transformer starter is used, one and a half times full-load current.

Binary converters are being built under Mr. F. Creedy's patents and placed on the market by Messrs. Maudsley's, Ltd., of course, and special applications include the possibility of obtaining Ward-Leonard control with a "single-unit" set. The converter could be mounted with a suitable small exciter and d.c. motor on a common bedplate, or the motor might be separately located, and the complete combination requires no more space than does a d.c. motor with worm gear and pony motor, so often used for driving a printing press at inching speeds for example. At the same time, the binary arrangement eliminates the elaborate control frequently required, since a Ward-Leonard unit is controlled entirely by means of field rheostats, as shown in fig. 6, in which the

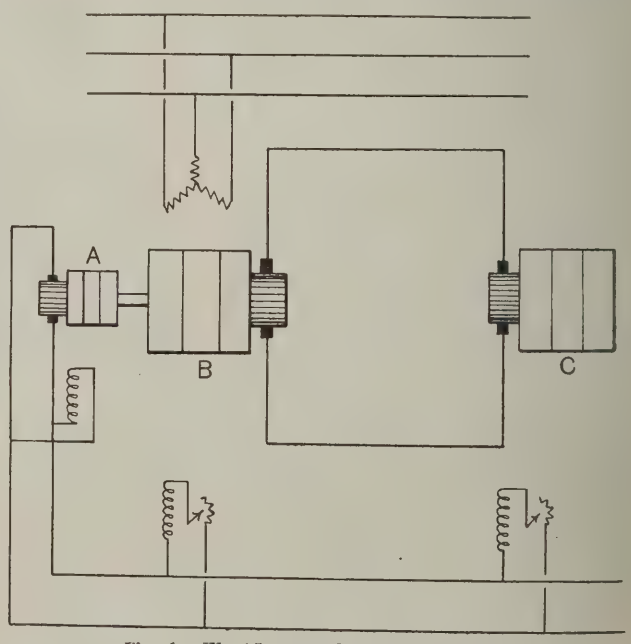


Fig. 6.—Ward-Leonard Control Arrangement.

exciter A (which is required for such applications so that voltage regulation at the binary commutator may not vary the voltage across the motor field) is shown mounted on a common shaft with the binary B; it excites the two fields of the binary and motor C in parallel, the commutators of the two machines being permanently coupled together. For printing press work the two field rheostats are operated by a small auxiliary motor which first cuts out the resistances in the converter circuit, thereby raising its voltage to the

maximum, and next weakens the field of the motor to obtain still higher speeds. The auxiliary motor which operates these field rheostats is controlled by push buttons mounted on various parts of the press in the usual manner.

For certain purposes the motor has to run at not more than 3 per cent. of its maximum speed, the total speed range, therefore, being 33 to 1; by means of the arrangement just described this very wide speed range can, it is stated, be easily accomplished. Where such extreme speed ranges are not required regulation of the strength of the motor field may often be omitted, the whole of the control being effected by means of the converter. Moreover, since the binary converter can be accurately compounded, very close speed regulation with increasing loads can be obtained. Automatic control as applied to the binary is claimed to represent considerable simplification, and steps are being taken in conjunction with control-gear specialists to adapt standard methods of automatic control for sub-station purposes.

For arc-welding the advantages of the binary converter are chiefly that a short circuit on the d.c. side does not mean a short circuit on the a.c. side, as there is no electrical connection between the two, and the independence of the voltages renders it possible to design the d.c. side with the required drooping-voltage characteristic.

A New Type of Boiling Plate.

An I.M.E.A. Exhibit.

One of the exhibits which is attracting a great deal of attention at the I.M.E.A. Exhibition at Glasgow this week is a new type of boiling plate shown by Metro-Vick Supplies, Ltd. This new "Cosmos" product is of the totally-enclosed type and has some unusual design features, being based on the invention of Mr. Christian Bergh Backer of an entirely new method of manufacturing electric heating elements, a new insulating material being produced in the process. The insulating substance consists of crystalline magnesium oxide (or hydroxide), made by treating pure magnesium metal in steam under high pressure, or alternatively in water under high pressure and at raised temperature. The crystalline magnesium hydroxide and oxide so obtained have been found to be fairly good heat conductors, whereas in any other form the material is a very bad conductor of heat. It is also known to be of the best of electrical insulators at high temperatures, and the combined properties have proved of great value in the new boiling plate elements.

Experiments on the production of heating elements for such as boiling plates for kitchen ranges, were started by the inventor of the process at the beginning of the year 1921, and the results soon proved that the new magnesium oxide was far superior to anything previously tried out as an insulating medium in electric boiling plates. The plate itself is of a special heat-resisting cast-iron, on the underside of which is a cast groove running in a spiral from the centre of the plate to the edge, fig. 1. Into this groove is placed a flexible magnesium-metal "tube" which has the coiled-up resistance wire inside it. The outside diameter of a magnesium "tube" is such that the tube fits tightly into the groove in the cast-iron plate, fig. 2. The plate is now placed in an autoclave and treated with steam, whereby the magnesium metal "tube" is converted into a similar "tube" of crystalline magnesium hydroxide. During the conversion the material grows or expands, so that the insulation becomes about twice as thick as the metal was before conversion, fig. 3. This expansion of the oxide is a very important attribute, as the coil of resistance wire thereby becomes completely embedded in the oxide, and is not only held firmly in place, but intimate thermal contact is assured. After the oxidising process is completed, the spaces in the grooves are filled with alumdum cement; a thin mixture is used, so that it runs easily down into all the openings and fills out the groove in the cast-iron plate completely. Whilst the cement is wet, an asbestos disk is placed over the coil and the element is finished off with a cast-iron press plate held in place by a screw in the centre, fig. 4. The insulation as yet is magnesium hydroxide (not oxide), as the temperature must be raised to over 300 deg. C. in order to drive off the "hydroxide water." Once the plate has once been dried out, any moisture which may enter it subsequently, either by soaking or by leaving it for several weeks in extremely damp air, is easily driven off by switching on the current for a few minutes. The actual wire used has been chosen as the result of exhaustive tests which have been carried out by the Metro-Vick Research Department on the behaviour of resistance wires at widely different temperatures. One very important characteristic of crystalline magnesium oxide is its elasticity. It has been found that after several thousand hours' use the formation of the oxide crystals is exactly the same as it was immediately after conversion from the magnesium metal, which supports the claim that this form of oxide positively does not break up into powder. The result is that the wire always remains compactly embedded, and the "breathing" of the wire during heating and cooling is amply taken care of by the elasticity of the magnesium oxide.

The "Cosmos" 8 5/16-in. diameter boiling plate of 2,000 W loading will reach the maximum temperature of about 600 deg. C., that is, red hot, if left uncovered by a utensil. This plate, it is claimed, will stand running red hot for years without burning out the resistance wire, because the wire itself, even with this extremely high loading, never comes up to a higher temperature than about 750 deg. C., at which heat the best grades of nickel-chromium wire will stand indefinitely in any elements where air for all practical purposes cannot get in contact with the wire.

The high loading permissible on these plates is only made possible owing to the comparatively high thermal conductivity of the crystalline magnesium oxide, and also on account of the fact that the element is embedded in the cast-iron itself so that the heat generated in the coil has a free and uninterrupted path through the oxide to the surface of the plate.

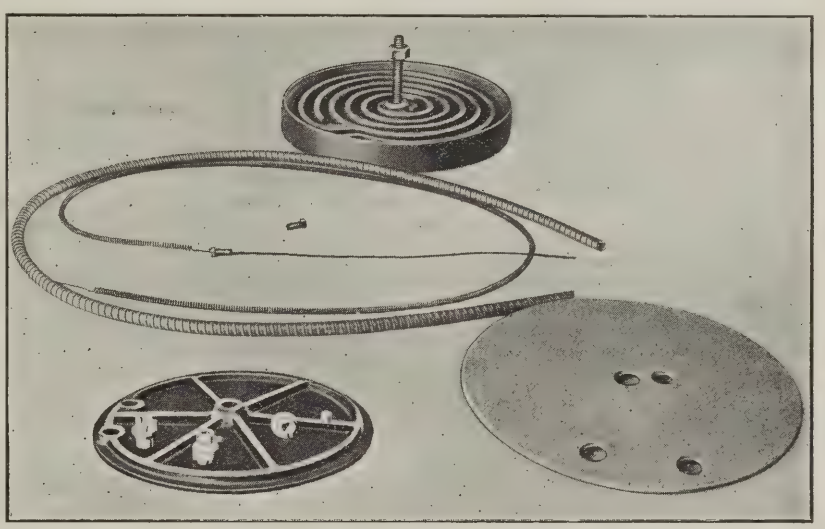


Fig. 1.—Boiling-plate Parts, Unassembled.

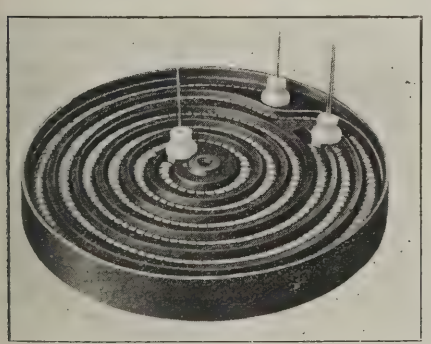


Fig. 2.—Magnesium Tube Before Oxidisation.



Fig. 3.—Tube After Conversion.

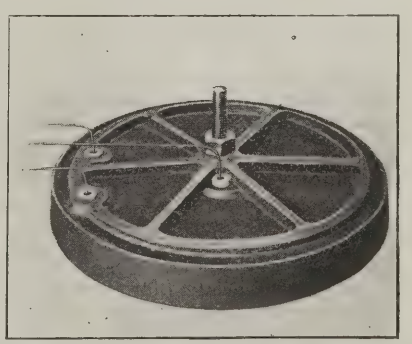


Fig. 4.—Complete Boiling Plate.

The following figures which have been obtained during tests by the National Physical Laboratory regarding the operation and serviceability of this boiling plate, add to the interest of these particulars. Two pints of water were brought to the boil from 60 deg. F. in 8.5 min. on a consumption of 285 Wh; three pints in 10.75 min. on 360 Wh; four pints in 13 min. on 435 Wh; and five pints in 15 min. on 505 Wh.

The smaller quantities of water were boiled in a cast-aluminium kettle with a machined bottom measuring 8 in. in diameter, and weighing 1 lb. 12½ ozs. The larger quantities were boiled in a cast-aluminium saucepan with a machined bottom measuring 7⅞ in. in diameter, 4¾ in. high, weighing 3 lb. 8½ oz. It is claimed that after the plate has been on circuit for from five to ten minutes, its efficiency approaches 90 per cent.

The boiling plates are at present made in two sizes, 8½ in. and 6½ in., with loadings of 2,000 and 1,200 watts respectively for 100-250 volts.

The process above described is in no way restricted to the manufacture of boiling plates; it is claimed that it can be utilised for all types of heating elements in use at the present time and we look forward to developments in this direction with interest.

An Electricity-Supply Emergency Organisation.

Measures Adopted by the North-East Coast Supply Companies During the General Strike.

The following particulars have reached us concerning the position of the North-East Coast Power Companies during the general strike. On May 6th official notice was received by the Newcastle-upon-Tyne Electric Supply Co., Ltd., and its Associated Companies, that certain grades of their employés would be called out on strike at the end of the evening shift. This notice affected 889 men, of whom a certain number were engaged in such duties as construction work, which automatically came to an end in the time of emergency. It was only necessary to replace those strikers who were engaged at the three main coal-fired generating stations and the sub-stations. In an extremely short time arrangements were made to draft a large number of emergency workers into these parts of the system, 281 of whom were members of the staffs of the companies or their consulting engineers, Messrs. Merz & McLellan, and were mainly drawn from the technical and clerical personnel.

The number was made up by the addition of many outside volunteers, including a number from local engineering or electrical works, or contractors. Others were supplied by the Armstrong college union or the local voluntary-service organisation. Many offers of help were received from firms or individuals in the district, which the companies had regretfully to decline.

The task was by no means completed with the replacement of the industrial staff; it was found necessary that the emergency workers in the various stations should be housed on the premises, and a welfare organisation was formed to provide sleeping accommodation for all who were confined to the power stations, and to cater for about 700 workers. At the Carville station a temporary hut was available, and in this and the offices 147 men were housed. At the Dunston and North Tees stations there were no buildings which could be used for sleeping purposes, but the London and North-Eastern Railway Company provided a train of seven coaches at each power house, which made very comfortable sleeping quarters. In addition to the main power stations, there were 18 rotary sub-stations which had to be permanently manned. One man per shift was drawn from the technical staff and two non-technical men on each shift were obtained from the volunteers to be available for any emergency which might arise.

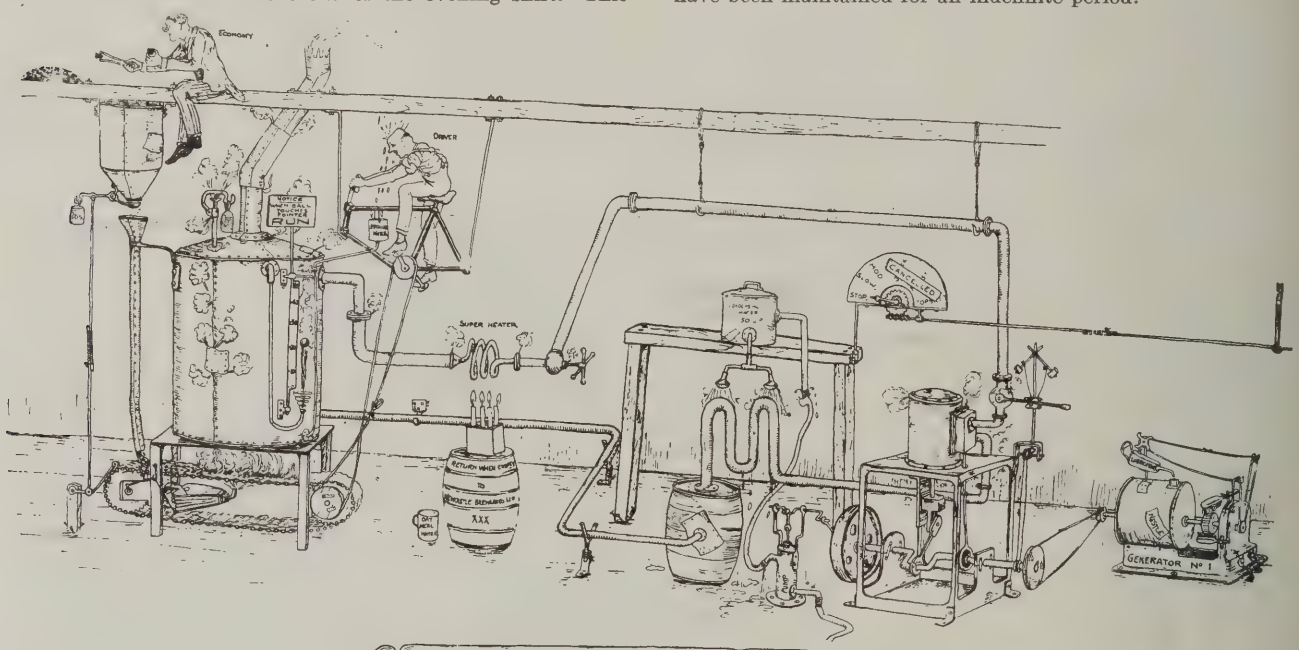
Under a chief welfare officer at the head office, an officer was allocated to each station, who was responsible for all the arrangements for accommodation and catering. At the North Tees power station and the garage cooking was done entirely by electricity, while at the other two generating stations army field kitchens were used. To keep the staff at the various stations in touch with the activities of the company, a news bulletin, "Nesco News," was issued daily.

The transport work was done wholly by volunteers, who were drawn mainly from the existing staff of the company, with the addition of a few helpers from outside.

Transport officers were appointed, who were on duty night and day, and a certain number of the emergency transport workers slept on the premises. Some idea of the amount of work done by the transport organisation during the emergency period may be gathered by the fact that the 80 cars and 12 lorries employed covered over 30,000 miles. The work included the transport of members of the clerical staff to and from their work; many of them living ten to fifteen miles from their offices.

In addition to road transport, a considerable amount of work was done on the River Tyne. A prominent shipbuilding company placed a launch and crew at the companies' disposal, which was available night and day for transporting men and material between the Dunston and Carville stations and Newcastle. By this means laundry work, letters, parcels and the amenities of life were dealt with.

The result of the work done by the emergency organisation was that no single consumer in the companies' territory of 1,400 square miles was subject to any interruption of supply as the result of the general strike. The organisation which was, of course, at the first rough and ready, daily became more perfect, and there is little doubt that supplies could have been maintained for an indefinite period.



THE VOLUNTEER'S DREAM.

The accompanying illustration, an effort by Mr. Collingwood, of the Newcastle-upon-Tyne Electric Supply Co., Ltd., represents his idea of the impressions of the inner working of the generating station on the mind of the "volunteer."

Investment and Production in the United States.—In the course of an address delivered at the recent annual convention of the National Electric Light Association, Mr. Samuel Insull, president of the Commonwealth Edison Co., said that sales of electrical energy in the United States lagged behind the increasing investment in plant and equipment and were not keeping pace with the increase in generating capacity. It was satisfactory to see that the reduction of the cost per kW of plant by improved methods of generating electricity had resulted in the average investment being reduced from $425 per kW in 1912 to $294 per kW in 1923. It would naturally be concluded from this that the number of kWh generated per dollar invested had automatically increased. From 1912 to 1923 that was true, the number was nearly doubled. In 1924, however, the figure fell from 10,000 kWh per dollar invested to 9,450 kWh, and in 1925 there was a further decline of 9,300, a fall of 7 per cent. in two years. When the relation of generated energy to plant capacity was considered the unsatisfactory position was accentuated. In 1912 the average number of kWh generated per kW of capacity was 2,240. By 1917 it had risen to 2,820 and it remained at about this level until 1923, when it fell to 2,450, receding further to 2,410 in 1924. There was a slight improvement in 1925, when a figure of 2,440 kWh per kW was reached. Mr. Insull deduced from those figures that the supply industry of the United States, on the whole, was not expanding and increasing its business as fast as it should.

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 888.)

STANDING Committee C of the House of Commons resumed consideration of the Electricity (Supply) Bill on June 7th, the Committee having decided to sit on two or more afternoons in each week in order to facilitate the progress of the Bill.

Sub-section (2) of Clause 2 enables the Central Electricity Board to delegate powers to "any authorised undertakers or other bodies." Mr. ATTLEE (Limehouse, Lab.) proposed to leave out the words "or other bodies" and to insert instead the words "being a local authority or group of local authorities." He explained that the Board might at any time, without the consent of the Electricity Commissioners, delegate its powers to any authorised undertakers or other bodies, to be exercised by such bodies on behalf of the Board. The Labour party was desirous of maintaining public control. There was nothing in the clause, as it stood, to prevent the Board, if it so wished, from delegating, for instance, the whole of its powers in the Yorkshire area to the Yorkshire Electric Power Co., although probably some of the local authorities would have something to say in that case. The Labour party said that if there was to be delegation, it should only be to public authorities.

Sir DOUGLAS HOGG, the Attorney-General, in resisting the amendment, said that if the Committee was going to set up a Board and give it powers of delegation, it should trust the Board to exercise those powers reasonably. He was always in favour of delegation, in proper instances, being entrusted to local authorities; but equally, in proper instances, when the authorised undertakers were in fact private companies, he saw no reason why the same power of delegation should not be exercised. The effect of the amendment would be that, when an undertaker was a private company, there would be no power to delegate to it any powers, though exactly similar powers in an adjoining area, where the local authority was the authorised undertaker, would be delegated to that local authority. That was not a reasonable proposal.

Sir JOSEPH NALL (Manchester, Hulme, U.) suggested that the Committee should delete the words "or other bodies," but should not insert the words "being a local authority or groups of local authorities." He said that, wherever the Board proposed to delegate its powers, it ought to do so to the authorised undertaker in that district.

Mr. G. BALFOUR (Hampstead, U.) supported this view, which was eventually adopted by the Committee. The words "other bodies" were deleted from the clause, but the substitution for them of the words "being a local authority or group of local authorities" was negatived by 40 votes to 11.

Mr. ATTLEE then moved the insertion of the following new sub-section:—"(3) The Board shall, with twelve months from the date of this Act, or such later date as may be approved by the Electricity Commissioners, submit to the Electricity Commissioners a scheme providing that in the district of any joint electricity authority or other body formed under the provisions of Section 6 of the Electricity Supply Act, 1919, and any Act amending the said Act, all the powers and duties imposed upon and entrusted to the Board under this Act shall be exercised on behalf of the Board by such joint electricity authority or other body, and any such scheme shall contain provisions enabling the Board to resume the exercise of its powers and duties in such district or districts in default of such joint electricity authority or other body." He said that the amendment was a mandatory one, directing the Board to make a scheme for delegation in certain definite areas.

Lt.-Col. MOORE-BRABAZON, Parliamentary Secretary to the Ministry of Transport, opposed the amendment, which, he said, would be almost a breach of faith with regard to past legislation. The amendment was negatived by 28 votes to 10, and Clause 2 was then added to the Bill.

Clause 3 provides: "(1) that the Board shall appoint one or more consultative technical committees consisting of engineers employed in connection with generating stations which are by virtue of this Act for the time being selected stations; and that (2) a consultative technical committee shall give advice and assistance on such matters as may be referred to the committee by the Board, and for that purpose the Committee shall meet from time to time as the Board may determine." An amendment to substitute the Electricity Commissioners for the Board was negatived, but a further amendment, moved by Mr. CLAYTON (Widnes, U.) to make it optional instead of mandatory on the Board to appoint committees of technical engineers was accepted by the Government and agreed to.

The Committee then adjourned.

On the resumption of the proceedings on June 8th, Sir D. HOGG moved an amendment to insert after the word "with" in sub-section 1 the words "undertakings owning." He said that the clause provided for the appointment of consultative technical committees, consisting of engineers employed in connection with generating stations, but sometimes a chief engineer of a large undertaking might not be actually employed in connection with the particular generating station which had become a selected station, and it would not be desirable to make him ineligible for the Committee; hence the amendment, which was agreed to.

On the motion that the clause stand part of the Bill, Mr. G. BALFOUR opposed the clause, as Clause 1 was quite wide enough to provide the Board with all the technical consultative assistance that was required.

After further discussion the clause was added to the Bill.

Clause 4 makes it the duty of the Board to submit a scheme to the Electricity Commissioners. Mr. R. HUDSON (Whitehaven, U.) moved an amendment to provide that the Commissioners should prepare and submit a scheme to the Board, explaining that this and other amendments which he proposed to move carried out a suggestion which he made earlier in the Committee's discussions. The Board would hear all objections and afterwards publish the scheme, which would be, in essence, a considered judgment by an impartial tribunal, as it were a court of appeal. After that, an impartial appeal tribunal would be set up to consider the case of anyone who felt that his interests were unreasonably affected, the only proviso being that no alterations in the fundamental principles of the scheme might be made by any decision of that appeal tribunal.

Sir D. HOGG, without pledging himself to the exact wording of the amendment, said that the view of the Government was that Mr. Hudson's scheme was a reasonable and fair one. It met the difficulty which the Government had felt of increasing cost and delay so much as to render the scheme financially impracticable. Therefore, the Government proposed substantially the scheme that Mr. Hudson had put forward.

Mr. ATTLEE opposed the amendment, saying it would involve the complete remodelling of the Bill and the practical abolition of the Commissioners.

Sir J. NALL said that the new proposal would result in prolonged delay. For how long was development to be held up owing to uncertainty about the present Bill?

Mr. HARDIE (Glasgow, Springburn, Lab.), who opposed the amendment, declared that the Bill was being forged to protect private interests.

Sir C. WILSON thought the best thing was to take the Bill back and recast it, for it was quite unworkable.

Sir D. HOGG said that if the Bill was passed by the end of next month the Commissioners hoped that schemes for certain areas would be submitted to the Board before the end of the year, and, if all went well, he saw no reason to doubt that those schemes might actually become operative in the early part of next year. He hoped the Bill would receive the Royal Assent by the end of July.

Mr. Hudson's amendment was carried by 29 votes to 13.

Mr. GRANT (Derby, U.) moved to insert after the words "that the Electricity Commissioners shall prepare and submit to the Board a scheme," the following:—"or schemes relating to the respective areas specified therein."

Sir D. HOGG agreed that there must be schemes for different areas, but there must ultimately be one scheme for the whole country, of which each separate area would form a coherent part.

The amendment was carried by 38 votes to 18.

Mr. CLAYTON (Widnes, U.) moved an amendment to make it feasible for the Board to leave the construction of the transmission lines to independent parties, because the scheme would work very much better if it were split up into areas. He was no believer in the "national grid"; he wanted the different areas to be linked one with the other, but would like the areas to be worked independently, because, although 50-cycle alternating current was the best method of generating and transmitting at the moment, it did not necessarily follow that it would always remain so. It was a false step to stereotype for the whole country, and it would be very much better if each large area (the country might be divided into six or 80 divisions) were left to work out its own method of generation and supply; they could be linked, and the amount of electricity that was likely to pass from one area to another would be only a small proportion of the energy generated. There was no particular reason why Newcastle with 40 cycles should be altered to 50; Birmingham believed that 25 cycles suited its requirements; it was possible that the generation and transmission at high voltage by direct current might also prove a success.

Lt.-Col. MOORE-BRABAZON said that one of the fundamental principles of the Bill was that the Board should retain power to acquire and maintain such lines as it wished.

The amendment was withdrawn, and the Committee adjourned.

The proceedings were resumed on June 10th, when discussion was continued on Clause 4.

Sir D. NEWTON (Cambridge, U.) moved that the standard frequency should "ultimately be the same throughout the country." Personally, he was doubtful whether the standardisation of frequency could ever be obtained.

Lt.-Col. MOORE-BRABAZON, while sympathising with the object of the amendment, pointed out that the frequency was only to be changed when it could be clearly shown that from the point of view of pounds, shillings, and pence there was an advantage to change it to 50 cycles, *i.e.*, when there was a "spilling over" of current from one to another area. With

regard to the railways, they used direct current which was from 25-cycle a.c. If they were to be compelled to change in every case from 25 cycles to 50, their plant and plans would be dislocated.

Mr. G. BALFOUR declared that the railway services were entirely independent of the standardisation of frequency.

After some discussion, in the course of which it was pointed out that the general debate on the question of standardisation of frequency would come on Clause 9, the amendment was withdrawn.

Sir J. NALL moved that the period of the temporary arrangements to be made between the Board and the owners of generating stations with respect to the giving and taking of to and by the Board of supplies of electricity, &c., should be limited to the period of carrying out of the works specified in the scheme, was accepted by the Government and agreed to.

A further amendment, moved by Mr. R. HUDSON, to leave out the proviso that the temporary arrangements should be based "upon such terms as in default of agreement may be determined by the Electricity Commissioners" was also accepted by Sir D. Hogg, and agreed to.

Sir D. Hogg accepted an amendment, moved by Mr. FIELDEN (Manchester, Exchange, U.) to provide that generating stations operated by railway companies at the date of the passing of the Act should not be chosen as "selected stations." Sir D. HOGG pointed out that the railways at present were not coming into the scheme. They used direct current, and their generating stations were, therefore, not required under the scheme. The railway companies' request to be specially excluded was not unreasonable, and the Government had acceded to it.

Another amendment was agreed to exempting generating stations owned by dock authorities from being "selected stations."

Lt.-Col. MOORE-BRABAZON resisted an amendment, moved by Sir J. Nall, asking for an inquiry to be held by the Board if representations were made to it after the publishing of the scheme. After some debate, the Attorney-General undertook to move an amendment to give power to the Central Board to hear parties if it thought fit, and on this understanding Sir J. Nall withdrew his amendment. Later, the Attorney-General's amendment was agreed to.

Mr. CLARRY (Newport, U.) said that the gas industry was desirous of co-operating with the electrical industry through the Bill, primarily with regard to the selection of sites and the formation of schemes with regard to fuel, and at a later stage with regard to distribution.

Sir D. HOGG welcomed this statement, seeing in it an opportunity properly to co-ordinate the country's fuel resources.

The Committee adjourned.

(To be continued.)

Italy's Electrical Trade.

THE following statement, showing the imports into and exports from Italy of electrical goods during 1925 has been compiled from the recently-issued official trade statistics. The figures for 1924 are added for purposes of comparison and notes of any increases or decreases are made:—

IMPORTS.

	1924. Quintals.	1925. Quintals.	Inc. or dec. Quintals.
Electric generators and motors—			
Total	17,000	24,000	+ 7,000
From Austria	700	1,400	+ 700
,, Germany	6,200	12,000	+ 5,800
,, Great Britain	270	800	+ 530
,, Hungary	2,700	4,500	+ 1,800
,, United States	2,000	650	− 1,350
Static transformers—			
Total	6,700	11,000	+ 4,300
From Austria	200	500	+ 300
,, Germany	4,100	7,000	+ 2,900
,, Germany (Reparation account)	640	—	− 640
,, United States	1,200	600	− 600
Electricity meters—			
Total	7,000	5,700	− 1,300
From Germany	6,000	4,500	− 1,500
,, Switzerland	500	900	+ 400
Telegraph and telephone apparatus—			
Total	1,800	2,600	+ 800
From Germany	600	1,200	+ 600
,, Germany (Reparation account)	270	40	− 230
,, United States	50	130	+ 80
,, Belgium	150	120	− 30
Carbons, electric—			
Total	50,000	51,000	+ 1,000
From Germany	13,700	19,000	+ 5,300
,, Jugo-Slavia	10,600	3,000	− 7,600
,, United States	19,000	24,000	+ 5,000
Insulators, porcelain, &c.—			
Total	23,000	21,000	− 2,000
From Germany	13,800	12,700	− 1,100
,, United States	3,600	4,400	+ 800
Steam boilers—			
Total	39,000	18,000	−21,000
From Germany	19,500	4,000	−15,500
,, Great Britain	7,900	13,000	+ 5,100
,, Czecho-Slovakia	10,000	1,000	− 9,000
,, Switzerland	100	100	—
Electric lamps—			
Total (thousands)	13,100	16,700	+ 3,600
From Austria	2,400	1,700	− 700
,, Germany	5,800	5,700	− 100
,, Holland	7,800	7,800	—
,, Switzerland	135	137	+ 2
,, Hungary	330	1,040	+ 710
Insulated electric wire or cable, covered with rubber or textiles	1,700	1,500	− 200
Ditto, armoured, including submarine cables	3,000	2,500	− 500

EXPORTS.

**Insulated electric wire or Cable, covered with rubber or textiles*	4,200	5,100	+ 900
**Ditto, armoured, including submarine cables*	20,000	22,000	+ 2,000
Electric generators and motors—			
Total	17,800	16,170	− 1,630
To Belgium	2,000	500	− 1,500
,, France	1,500	1,100	− 400
,, Spain	2,000	900	− 1,100
,, India	2,300	3,100	+ 800
,, Argentina	3,600	2,300	− 1,300
,, Brazil	3,400	5,000	+ 1,600
Static transformers	1,700	1,700	—
Accumulators	2,000	2,000	—
Magnetos	440	500	+ 60
Electricity meters	90	70	− 20
Telegraph and telephone apparatus	77	106	+ 29
Radio apparatus	250	370	+ 120
Insulators, porcelain, &c.	280	480	+ 200

* Principal destinations: United States and Argentina in 1924, and Argentina, Peru, Poland, Cuba and United States in 1925.

Legal.

British Thomson-Houston Co., Ltd., v. Siderman.

MR. JUSTICE TOMLIN, in the Chancery Division on June 8th, gave judgment for the British Thomson-Houston Co., Ltd., against L. Siderman, in an action for an injunction restraining infringement of the plaintiffs' patents for gasfilled electric incandescent lamps and leading-in wires, in default of defence.

This was the case in which the importance was urged of granting injunctions *ex parte* owing to the difficulty of stopping the importation and sale of lamps infringing the plaintiffs' patents. Counsel now said that that action was started against three defendants, Wood, Siderman and a company owning the wharf to which the lamps were traced, but the action was discontinued against the company upon hearing their evidence. Both patents had been held to be valid.

Fellows Magneto Co., Ltd., v. E. H. Druce & Co.

MR. JUSTICE MACKINNON, in the King's Bench Division on June 11th, had before him an action brought by the plaintiffs to recover the sum of £425, balance of account for a quantity of machinery and plant sold to E. H. Druce and Company, Coventry. Mr. H. D. Samuels was for the plaintiffs and Mr. J. F. Eales for the defendants.

Opening the case for the plaintiffs, Counsel stated that in July, 1925, his clients made a contract orally that defendants should purchase machinery from them, which consisted of a number of lathes, screw slotters, and milling machines, at a price of £1,235. That contract was confirmed by invoices and it was part of the contract that the payments were to be made at once and that the goods were not to be removed from the plaintiffs' works before payment. In July defendants paid £850 and removed part of the goods. Defendants' case was that the contract was not completed inasmuch as the machines were not complete and were lacking equipment; that prevented the defendants from again selling at a profit and as a result they counterclaimed for £314.

His LORDSHIP held that the defendants' view of the contract was the right one, and entered judgment for the defendants on the claim and the counterclaim with costs.

Electrical Companies and Directors Fined.

THE *Birmingham Post* reports that at the Birmingham Police Court, on June 9th, the Stipendiary (Lord Ilkeston) inflicted fines of £20 and five guineas costs in each case on the Warwickshire and South Midland Electricity Supply Corporation, Ltd., and the Electric Light and Power Contracts Finance Corporation, Ltd., for failing to file their annual summaries

of account at Somerset House. The following directors were fined £20 for permitting the default, except in the case of Bridgen, who only joined the board of the Electric Light and Power Company at the end of last year, the fine in his case being £10. Of the Warwickshire Corporation: Wilfred Burton, London; Emerton Claude Buik, Dulwich; Walter Thompson, West Hampstead; and Edward Bennett Calvert, London. Of the Electric Light and Power Company: Sir Charles B. Hearne Soame, Bart., Coalbrookdale, Salop; James Bridgen, London; Christian Ernest Paul Groth, Soho, London; Eliot Foley Hill, London.

Mr. E. W. TUNBRIDGE, on behalf of the Board of Trade, said the Warwickshire Company filed a return up to March, 1924, but nothing further in the way of an annual return was forthcoming from it until a few days ago, after the summons was issued. With regard to the Electric Light Corporation, no annual summary was filed until June 4th this year, though the company was incorporated on April 16th, 1924. The summary then submitted had been accepted and filed.

For the defence Mr. HAROLD ELWELL stated that all the directors of the two companies were present with the exception of Mr. Hill, who had communicated with the Court, and Sir Charles Soame, who had sent a medical certificate. The directors accepted responsibility and had instructed him to say that the omissions arose through a dispute with a firm of accountants employed to keep the books. Further, Mr. Alan Eaden, who was secretary of both companies, died in September last year. ROBERT PAUL HARLEY, the new secretary to both companies, said that when he took over in September last the accounts were in a chaotic state, and he had had considerable difficulty in making up the accounts.

Alleged Mercurial Poisoning.

THE judgment of his Honour Judge Ruegg, was read by Judge Dobb at the Birmingham County Court on June 9th, in a case under the Workmen's Compensation Act. The point at issue was whether the workman died from mercurial poisoning or natural causes. The claim of the widow was heard in April by Judge Ruegg, who sat with a medical assessor (*vide* ELEC. REV., May 7th, p. 762). The deceased man, named Richard Goffe, was a meter inspector in the employ of the Birmingham Electric Supply Department, and the plaintiff was his widow, Lucy Goffe. The amount of the claim, £520, was not disputed by the Corporation, but it was held that the death was due not to mercurial poisoning, as the plaintiff submitted, but to an obscure germ.

Judge RUEGG held that, although he accepted the evidence that death was due to myelitis, he thought that deceased would not have died but for mercurial poisoning. The germ was one which attacked people of low vitality. Judgment was accordingly given for plaintiff.

Stepney Ratepayers and Electricity Stoppage.

THE *Daily Telegraph* reports that a case arising out of the general strike was heard at the Town Hall, St. Georges-in-the East, on June 10th, when Messrs. Buck & Hickman were summoned in respect of the non-payment of a portion of the general district rate. The Town Clerk (Mr. V. B. Bateson) represented the Stepney Borough Council, and Mr. T. J. O'Connor appeared for the defendants.

Mr. O'CONNOR said that the defendants had never previously refused to meet their due obligations in the matter of rates, and they desired to have the reasons stated why they now refused to pay. By criminal conspiracy to control the supply of electricity for a political purpose the Borough Council deprived them unlawfully of electricity supply from May 3rd to May 12th. The supply was only restored on May 13th, the day before the general strike ended.

Mr. BATESON said that that was an allegation of a serious character, and was absolutely groundless.

Mr. O'CONNOR quoted a section of the Electric Lighting Confirmation Order to show that the Council was liable to penalties, except where failure to supply was due to accident or *force majeure*, and said that as a result of the failure to supply sixty-five men were thrown out of work, the firm being deprived of power. There was no *force majeure* because the Electricity Commissioners had broadcast a notice that they were prepared to supply volunteer labour to carry on such undertakings wherever required. The Council took no steps to avail itself of this offer, but used its position wrongfully to prevent his clients "obtaining money with which to pay the rates, which I say is action of a criminal character against a law-abiding firm."

Mr. BATESON protested. Every statement made, he said, was a misrepresentation.

The CHAIRMAN, after consultation, said there would be an order for the payment of the rates, which could be paid under protest, and the defendants could take any action they pleased after that.

Gilbert Gilkes & Co., Ltd., v. Marshall.

BEFORE Mr. Justice Talbot, on June 8th, at the Lancaster Assizes, Messrs. Gilbert Gilkes & Co., electrical engineers, Kendal, sued Mrs. E. E. Marshall, Keswick, to recover £126 7s. It was stated that there was a contract for renewing and recharging the cells of the battery in defendants' power house, and the plaintiffs' electrician did the work in March, 1925. After the electrician had left the premises a fire broke out and destroyed the power house. Defendant received £250 from an insurance company, but denied liability to pay Messrs. Gilkes because they had not handed over the job and their workman had been negligent in leaving the door of the power house locked when he knew that dangerous gases came from the charging of new accumulators.

Expert evidence was given for the defence on June 9th by Mr. JULIUS FRITH, M.Sc., M.I.E.E., who expressed the opinion that the fire originated in the battery room, where there was a collection of hydrogen, through the place being closed immediately after the charging current was switched off. A spark might have come from a short circuit between the wires from the cells and the switchboard. Cross-examined, he said that a skilled workman would have left the windows open. At the end of a long charge the dangerous condition was more pronounced through leakage or bad connections at the terminals, especially when old wires were used. Witness thought the fire occurred either through a spark or from the ignition of the inflammable covering of the cables.

Mr. H. BAWN, an electrician, said he had frequently charged the old batteries, and always left the window open to let out gases from the wooden building. There was always danger from leakage in battery rooms.

Mr. W. M. HARRISS, A.M.I.C.E., director of Gilbert Gilkes and Co., said that it was quite safe to use old wires. Any deterioration in insulation would have been evident during the charging period.

Mr. P. H. BAILEY, electrical engineer, said he had never heard of an explosion in a battery house due to hydrogen collecting after the charging ceased.

Mr. DERBYSHIRE, for defendant, said that they had been asked to pay for work before it was done, because it was destroyed. The plant had run 11 years and the presumption was that the plaintiffs' electrician had been negligent in leaving the place.

His LORDSHIP said that while he believed the goods were ordered, he did not think the plaintiffs were entitled to be paid for labour.

He found for the plaintiffs for £109 4s. 2d., and dismissed a counter-claim by the defendant.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Earth Tubes for Radio Sets.

Regarding the discussion on radio earths in your columns, the following may be of some little interest.

For experiment, two other earths were tested against the water-pipe earth which is regularly used with my broadcast receiver. One was a buried earth consisting of a piece of galvanised iron sheet put down about two feet six inches, the other a well-known make of copper earth tube.

A crystal set was used, which had a micro-ammeter in series with the crystal. The following readings were obtained on Daventry (100 m.) and 2ZY (45 miles), at the same setting of the crystal:—

	Water Pipe.	*Buried Plate.*	*Tube.*
Daventry	70	70	65
2ZY	51	40	22

The figures relate to scale divisions, 23 of which equal one micro-ampere. In all other tests the figures have been of the same order, although their proportions have varied somewhat. My conclusions are that with the 1,600-metre wave a fairly good buried earth will almost equal the water pipe, but on 378 metres there is a very marked difference in favour of the water pipe, the tube showing up poorly.

The micro-ammeter mentioned was home-built at the cost of a few shillings and a lot of patience, but its infinite usefulness in attacking problems like the above has justified all the trouble. No mirror is fitted, but a pointer.

A. O. Griffiths.

Caergwrle, *June 7th*, 1926.

A Tip for the E.D.A.

In these days of coal rationing we are all asked to economise in the national interests, and by economising it is presumably meant that we should all use less gas and electricity, thereby cutting down the *quantity* of coal which is consumed at the gas and electricity works.

There is a big difference between quantity and *quality*, and a few recent incidents have led the writer to wonder whether our gas friends are quite as patriotic as their electrical competitors.

On arriving home the other evening, the writer heard a lot of grumbling in the kitchen, the complaint being that the rotten gas simply would not boil the kettle. Earlier in the day a similar complaint had come from the charwoman, who was mourning the loss of several more pennies which she had had to put in her slot-meter in order to get her usual *quantity* of gas.

Oh, yes, those of us who still use gas are being rationed all right, but apparently the rationing applies to both quantity and quality, and with the above-mentioned slot-meter

comments in mind, I am wondering whether my gas bill at the end of the quarter will be any less, or shall I lose on the swings what I am trying to save on the roundabouts. In other words, as a result of the poor quality of the gas, will my efforts at economising be knocked on the head by the increased hours I have to burn the gas and consequently a corresponding increase in quantity, which, no doubt, my gas meter will faithfully or unfaithfully register?

It would appear from the above remarks that a very nice little leaflet could be prepared by the experts of the E.D.A., as no matter how old or inefficient the plant is, or whether the "juice" is generated in Timbuctoo or—shall we say?—Hackney, it is all the same *perfect quality* and *cannot be deteriorated.*

Switching back again to the aforesaid gas grumbles, a further complaint was that the smell was decidedly more obnoxious than usual, so this, combined with the rationed quantity and poorer quality, has not acted as an advertisement for gas.

A few electrical slogans suggest themselves as follows:—

You can ration the quantity of electricity, but not the quality. There is and can be only one quality of electricity, and this is always perfect. There are no fumes with electricity, and consequently no smell. You can easily and safely control all your electrical circuits, and as for cleanliness, well—there is nothing else to touch it.

June 9th, 1926. **F. T.**

The Electrical Equipment of Collieries.

Your recent article on "Electricity in Mines" suggests a fairly reasonable and effective solution to the present coal problem.

Your contributor states that in American mines, where electrical coal-cutting machinery is installed, the output per man is three or four times what it is in this country. I don't know what it would cost to equip our mines with similar apparatus, but surely it would only be a fraction of the £23,000,000 said to have been spent by the Government on the subsidy—an expenditure, too, yielding no return.

If, now, the Government were to issue a loan, on similar lines to the War Loan, for the purpose of equipping the mines with efficient electrical machinery, the greatly increased output would not only enable interest to be paid on the loan, and in time pay off the loan, too, but would also enable wages to be maintained at their present level, and so solve one of the most pressing difficulties of the present situation. It would also place the mining industry on a sound foundation, and enable it to compete successfully in the markets of the world.

There would no doubt be difficulties of detail regarding the independence of the industry while partly financed by a Government loan, but these should not be insuperable—in fact, should be no greater than when the miners' wages were aided by a State subsidy.

Perhaps this suggestion will be worthy of discussion in your columns.

Liverpool, *June 10th*, 1926. **Stanley G. Joscelyne.**

Electrical Engineers' Salaries.

In the current issue a certain Council is applying for a mains assistant at a salary of £150 per annum. Does not this make an engineer feel that his scientific job is sadly on the down grade? The writer is not at present looking for a job, but feels very sorry for his brother engineers who have such insults as this flung at them. The advertisement is unfortunately typical of many that appear weekly in the REVIEW, and if this sort of thing continues it simply means that when a smart boy is anxious to become an electrical engineer, his parents will dissuade him from adopting that career. The result will be that in a few years' time no *real* engineers will be available. For the benefit of the Council which offers such miserly pay I would inform them that assistant cleansing superintendents receive a much more handsome salary.

June 5th, 1926. **Contractor.**

"Rings."

It is regrettable that so many valuable contracts are being placed abroad when our own country is at present in such a stagnant condition. In your issue of June 11th it is stated that the Leicester City Council has placed an order with a Zurich concern for a turbo-alternator. In the circumstances could it be blamed for choosing to deal with foreigners? The chairman of the Electricity Committee said that an examination of the British tenders revealed the remarkable absence of free competition, while subsequent events proved that the prices were fixed by a combination of British manufacturers. In other words "rings" are simply driving good business out of Britain and I, as an individual, would be happy to see all these unfair "combinations" made illegal. It is obvious to most of us that the prime function of "rings" is to keep prices inflated, and, of course, to prevent competition. Why should a few big manufacturers be permitted to dictate what the selling price of an article shall be when many of the articles could be sold at a much lower price and still allow a good margin of profit? From the writer's point of view "rings" are stumbling blocks to progress, as anything that stands for keeping up prices to an uneconomic level is useless to any country. I am all out for my own country, but in the particular instance mentioned above, had I been a member of the committee I should have felt compelled to agree with the majority in handing over the work to the foreign concern.

June 12th, 1926. **Non-Ring.**

[We think it only right to refer our correspondent, and others who are interested in this subject, to an article entitled "Prices of Electrical Plant," by D. N. Dunlop, published in the ELECTRICAL REVIEW, for February 29th, 1924, p. 330.—EDS. ELEC. REV.]

Trade-Mark Applications.

Trade-mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from June 2nd:—

Wylex. No. 467,926. All goods in Class 8.—G. H. Scholes & Co., Ltd., 27, Blantyre Street, Chester Road, Manchester.

Phonos (lettering and design). No. 466,768. Class 8. Apparatus for use in connection with radio-telegraphy and telephony.—Pettigrew & Merriman (1925), Ltd.

Cosmos Radio Valve (lettering and design). No. 467,878. Class 8. Thermionic valves.—Metropolitan-Vickers Electrical Co., Ltd.

Orolite. No. 468,322. All goods in Class 8.—O. Ruhl (1922), Ltd., 85, City Road, E.C.2.

Noirlac. No. 468,530. Class 8. Electric cables.—Falk, Stadelmann and Co., Ltd.

Lecite. No. 468,777. Class 8. Cables for electrical purposes.—Liverpool Electric Cable Co., Ltd.

Etho-Cone. No. 468,893. Class 8. Loud speakers and sound reproducers; and Etholog. No. 468,894. Class 8. Instruments and apparatus for use in connection with radio-telegraphy and telephony.—Burndept Wireless, Ltd.

Vispark. No. 468,587. Class 13. Sparking plug heaters.—Miltiades A. Mitaranga, Marseilles. (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

31,321. "Vacuum electric tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. December 31st, 1924. (251,673.)

1925.

551. "Means utilised for securing electric conductors to or in relation to contact members or apparatus to which it is desired to supply electric current." J. A. Crabtree. January 8th, 1925. (Cognate application 6,264/25.) (251,676.)

2,484. "Connectors or gripping devices for wires, rods, cables, and the like." Twiss Electric Transmission, Ltd., and G. H. Dean. January 28th, 1925. (251,679.)

2,972. "Carrier wave systems." F. W. Le Tall (Westinghouse Electric and Manufacturing Co.). February 2nd, 1925. (251,683.)

3,393. "Wireless receiving or transmitting apparatus." G. A. Morris and B. C. Stevenson. February 6th, 1925. (251,693.)

3,394. "Variable resistance devices." Igranic Electric Co., Ltd., and S. R. Wright. February 6th, 1925. (251,694.)

3,396. "Electromagnetically-operated selector with longitudinal and rotary adjustment for telephone exchanges." F. Merk. February 25th, 1924. (230,034.)

3,506. "Three-electrode valves." Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. February 7th, 1925. (251,701.)

3,761. "Electric motor generators." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. February 10th, 1925. (251,704.)

3,799. "Method of mounting crystals for wireless rectification." P. V. Castell-Evans. February 11th, 1925. (251,706.)

3,848. "Telephonic receivers and the like." W. J. Palmer. February 11th, 1925. (251,707.)

6,322. "Automatic telegraph transmitters." C. J. Aston. March 9th, 1925. (251,727.)

8,245. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and J. Berry. March 27th, 1925. (251,744.)

9,419. "Dry-cell terminal." National Carbon Co., Inc. August 16th, 1924. (238,506.)

10,137. "Electrical switches." D. Grant. April 18th, 1925. (251,757.)

10,150. "High-frequency electric induction furnaces." C. R. Burch, N. R. Davis, and Metropolitan-Vickers Electrical Co., Ltd. April 18th, 1925. (251,758.)

13,135. "Magnetic separators." H. H. Thompson, A. E. Davies, and W. E. Box. May 20th, 1925. (251,780.)

15,605. "Electric ignition apparatus for internal-combustion engines." J. Lucas, Ltd., E. O. Turner, and F. W. Handley. June 16th, 1925. (251,794.)

16,416. "Electric-light fittings." British Thomson-Houston Co., Ltd., W. Millner, and S. J. Tucker. June 25th, 1925. (251,801.)

16,663. "Telephone apparatus." Neufeldt & Kuhnke. August 25th, 1924. (238,855.)

16,860. "Method and apparatus for making electrical condensers." Dubilier Condenser Co. (1925), Ltd. July 1st, 1924. (236,559.)

20,671. "Apparatus for the electromagnetic separation of ores." A. Davies. August 18th, 1925. (Cognate application 25,860/25.) (251,821.)

21,746. "Electric cord protectors." S. D. Black and A. G. Decker. August 31st, 1925. (251,827.)

23,805. "Device for indicating sparking and other disturbances and for automatically cutting out transformers, choke coils, and other electrical apparatus operating in an insulating medium." M. Buchholz. March 24th, 1925. (Divided application on 250,004. Addition to 198,936.) (251,843.)

25,136. "Manufacture of caps for incandescnt electric lamps or the like." Edison Swan Electric Co., Ltd. June 29th, 1925. (251,854.)

26,126. "Device for the protection of electricity meters against the influence of external magnetic fields." Landis & Gyr Soc. Anon. February 4th, 1925. (247,150.)

27,295. "Electric knife switches." Akt. Ges. Brown, Boveri et Cie. December 8th, 1924. (244,058.)

29,817. "Process and apparatus for protecting electric or other cables." J. O. Gogry. November 27th, 1924. (243,741.)

30,669. "Construction of electric switch for use with steering appliances of motor road vehicles." G. C. C. Marriott and D. M. S., Ltd. December 4th, 1925. (251,892.)

31,192. "Methods of and apparatus for electric arc-welding." British Thomson-Houston Co., Ltd. December 26th, 1924. (245,090.)

1926.

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1,960. "Incandescent electric lamps." A. A. Samuel. January 22nd, 1925. (246,504.)

The

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The I.M.E.A. Convention.

THE Convention which was held last week at Glasgow by the Incorporated Municipal Electrical Association, in despite of adverse conditions, must be set down as one of the most successful in the history of the Association; the attendance fell but little short of the high record attained at Brighton last year, in far more favourable circumstances, showing unmistakably that the members fully endorsed the decision of their Executive Council to carry out the programme as far as possible, and the weather, which is so important a factor on such occasions, with the exception of one bad break, was mostly fair and sometimes excellent, being especially gracious during the delightful excursions to the Trossachs and the Falls of Clyde which brought the Convention to a close. The only notable departure from the original programme was the unavoidable abandonment of the river trip, and this proved to be a fortunate chance, for it fell on the one rainy day; instead, a visit was made to the Gleneagles Hotel, where fair weather prevailed, and as the President remarked after dinner, in expressing the thanks of the Association to the Babcock & Wilcox Company, a trip on the river in the rain was a thing to be avoided. Mr. R. B. Mitchell is to be congratulated on his admirable conduct of a most enjoyable Convention, and on the efficiency with which he and his staff collaborated with the honorary secretary, Mr. A. C. Cramb, and the secretary, Miss Lanfear, and her assistants in the work of organisation under unusually difficult conditions.

Mr. R. W. L. Phillips, of Bedford, was elected president for the ensuing year, and will be faced with the problem of housing so large a body of members; doubtless, as Bedford cannot possibly provide adequate accommodation, the Convention will be held elsewhere, and various more or less helpful suggestions have been put forward to solve the problem. It is interesting to note that, following the chief of one of the largest undertakings in the country, the new President represents one of the smaller ones, whilst Mr. F. W. Purse, the new vice-president, who was formerly a champion of the small undertakings and took a prominent part in securing their direct representation on the Council, is now in charge of an undertaking which falls within the "large" category.

Seeing that the membership of the I.M.E.A. now stands at 225 (out of 264 undertakings eligible for membership), the fact that the attendance numbers about 700 indicates that the engineers are in the minority; that so many councillors take part in the Convention is a highly advantageous circumstance, as it enables them to exchange views on electricity supply and to absorb new ideas with regard to progress and enterprise, which must bear fruit in the enlightened management of their own undertakings. The greatest drawback to municipal electricity supply is undoubtedly the necessity of entrusting so highly technical a business to the hands of lay committee-men who, through no fault of their own, come to the work with absolutely no training for it and generally with no prior knowledge of its complexities; the Conventions offer to those who have so far triumphed over their difficulties as to attain the rank of chairman priceless opportunities for improving their knowledge and broadening their outlook. The popularity of these meetings is further exemplified by the large number of ladies who take part in them, and this factor is being turned to good account from the business point of view, by enlisting their services in the work of development with the aid of the Electrical Association for Women, which is rapidly gaining strength and, under the able management of the chairman, Alderman Mrs. Hammer, the secretary, Miss Haslett, and an energetic committee, is destined to play a notable part in hastening the adoption of electricity for every domestic purpose.

The professional work of the Association on this occasion, without being too burdensome, was both varied and interesting; the papers were practical, and the visits instructive. The latter included an up-to-date and highly efficient steam power station, a hydro-electric installation of some importance, and (on Saturday) an example of co-operative enterprise in the shape of the rapidly developing joint undertaking of the Ayrshire Electricity Board, which embodies the principles of interconnection, centralisation of generating plant, extension into rural areas, and the supply of power to a variety of industries from one station—all highly commendable and tending to promote the public welfare. The electrical exhibition which was held in connection with the Convention was also larger, more varied, and better organised than on any previous occasion, reflecting great credit on all who took part in its preparation—amongst whom the first place must, of course, be given to the British Electrical Development Association. Several new devices of considerable promise were shown at this exhibition, and attracted a great deal of attention; we anticipate that the exhibitors will have no ground for complaint with regard to the business side of their participation, whilst the educative effect of the show, which was open to the public during certain hours, must have been very valuable.

It should be borne in mind that the "slogan" of the Lord Provost and the Electricity Committee of Glasgow Corporation is "cheap electricity," and that their practice is in accordance with their precept; electrical energy is supplied for domestic purposes at $\frac{3}{4}$d. a kWh, plus a small fixed charge, and during the night, for heating water, it is available at $\frac{3}{8}$d. per kWh. As Dr. S. Parker Smith has shown, at these rates there is every inducement to use electricity for all domestic purposes, without the aid of coal or gas, the saving in labour not only lightening the burden of housework but actually resulting in economy of wages, in addition to the reduction in cost of maintenance. Wherever such conditions obtain—and we understand that they are already available to four million people in this country—the *all*-electric house is a practical economic proposition.

Finally, turning to the report of the Council, of which we will print an abstract next week, we find that the committees have done very good work in connection with the improvement of electric cookers, with especial attention to the question of standardisation, and with the reform of the regulations for overhead line construction, which we hope will be materially influenced by the recommendations which the Council has submitted to the Electricity Commissioners.

Our Trade Names Supplement.

ACCOMPANYING the present issue of the ELECTRICAL REVIEW, we are circulating, free of charge, to the whole of our readers at Home and overseas—approximating to 13,000—the first of a series of four Quarterly Supplements of Electrical Trade Names. We have had abundant evidence of the need for such a publication in the thousands of inquiries that have reached us during the last few years asking the names of the makers or suppliers of a specified piece of apparatus, article, or material.

Every day we receive communications from correspondents at home and abroad telling of something electrical that they wish to purchase but cannot, because they only know its trade name. Generally, we are able to answer these questions through the post, and business passes on to the manufacturer or trader. We do not begrudge this service—indeed, we like to render it—for in serving non-electrical buyers we are bringing them into direct touch with the electrical trade. But we are convinced that the publication of the information in the form of a special periodical supplement will simplify the operations of our readers and save some of the time that is necessarily lost in sending in inquiries, hunting up our records, and dispatching replies. It is safe to calculate that for every inquiry that reaches us there are many others which are never made, but can easily be satisfied by reference to a printed list. We believe that if this Supplement is in the hands of the whole body of ELECTRICAL REVIEW readers everywhere many questions can be settled at once as they arise. The value of the Supplement will be increased as the entries are added to in successive issues, but it is not intended to supply this directory of trade names apart from the ELECTRICAL REVIEW. Our Service Department will continue its activities in this and other directions, and correspondence is invited from those in need of information not at present obtainable from our list.

Municipal Selling Powers: Agreement at Swindon.

WHEN these lines appear in print the Convention of the Electrical Contractors' and Allied Associations will be in progress at Brighton, and prominently before the minds of all present will be the question of municipal selling powers. Already the subject has received prominence at the gathering of the I.M.E.A. both in the address of the president and in the report of the Council, while other important deliberations have been taking place for some time past. What has happened in connection with several Bills before Parliamentary Committees is familiar to our readers, and we may now direct attention to the Swindon Corporation Bill case, which is reported on another page of this issue. The Corporation sought under one of the clauses of its Bill relief from its existing obligation to carry out the wiring of premises only through a contractor. As a result of negotiations between the I.M.E.A. and the E.C.A. the opposition to its application for this relief was dropped subject to a number of conditions which are set out in our report. These conditions entail a regulation of the prices at which installations and apparatus shall be sold; retail prices to the public and trade prices to contractors. The prices are to be fixed at such figures as shall cover all expenditure, including financial charges, and the accounts for such trading operations are to appear separately in the published returns of the department. The aforesaid retail and trade prices will be determined by a committee representative of the interests concerned, which committee is to be appointed by the Electricity Commissioners.

The Efficiency of Gas Works.

IT is well known that gas engineers claim to obtain an efficiency of 75 or 80 per cent. in the manufacture of gas from coal, and that for this purpose they include the gross heat content of the coke and tar on the credit side of the account, regardless of the fact that the heat thus "recovered" cannot be utilised without a further process of conversion involving heavy loss; in point of fact, the heat in the tar is not usually

employed as heat at all. But there is another way of looking at the matter which does not seem to have received due attention.

In the course of an able paper on "Competition with Electricity," read by Mr. H. E. Copp, of Hull, at a recent meeting of gas managers in Newcastle-on-Tyne, the author states that the gas produced from coal represents 23 per cent. of the original energy, the coke 46 per cent., and the tar 6 per cent.—total, 75 per cent., the loss being therefore 25 per cent. The object being primarily *to produce gas*, and the by-products (coke and tar) being entirely superfluous to that end, the actual result should be stated thus:—

Heat originally in coal, B.th.u.	...	100
Heat remaining in residue ...	...	52
Heat operated on in gas manufacture		48

Of the last-named quantity, 23 B.th.u. is contained in the gas, and 25 B.th.u. is lost. The efficiency of conversion is therefore at the most 48 per cent. ($100 \times 23 \div 48$), not 75 per cent. Moreover, the heat not usefully operated on—namely, that remaining in the coke and tar—is rendered less readily available than in its original lodging, and is therefore depreciated in value.

The Strike and Electrical Exports.

It might reasonably have been expected that our electrical export trade during the month of May would be very seriously affected by the general strike, but the recently-published Board of Trade return does not present a picture fulfilling expectations, which, for once in a way, is all to the good. The decline from the April total was only £40,878, but then April was itself a bad month. A better comparison is with the corresponding month of last year, but this shows an apparently appalling drop of over half a million. An examination of the details, however, provides an item of information which, while not entirely discounting the decline, goes a long way towards explaining it. We refer to the huge fall in the value of exported submarine cable—from £373,597 to £246. This particular section for obvious reasons cannot be excluded from the table which we prepare from the Board of Trade return each month, but its almost fantastic movements make fair comparison practically impossible. In the case under examination its exclusion would have reduced the decline from the May, 1925 total to £176,784; this, of course, is a fairly large decrease, but matters are given a considerably more favourable appearance.

The decrease as compared with the corresponding month of the previous year was £364,209 in January and £406,367 in April, of which submarine cables accounted for £259,193 and £278,195 respectively. This appears to show that, in spite of the general strike, the position was not much worse in May than it was in January and April. A similar explanation serves to show the reason for the decline of £1,109,770 in the total for the first five months of the year as compared with January-May, 1925. The net decrease in the value of exported submarine cable during this period amounted to £919,041.

It is thus clear that the electrical industry generally is not losing its export trade, and we have no doubt that the remaining seven months of the year will witness greater activity if the coal dispute is soon settled and further industrial troubles are avoided.

Servants and Electricity.

We wonder whether those who are already doing such excellent work in organising what we may term the woman's side of electricity supply are devoting attention to the household domestic. Electricity is sometimes credited with providing a solution to the servant problem. It may well happen that when full use is made of electrical appliances the number of domestics required will be lessened, and beyond all possible question the change can lighten the labour of the one solitary maid or the daily help, and what is even better still for very large numbers of people, it can lessen the strain upon the busy wife and mother. But the servant and her likes and dislikes—shall we say predilections and prejudices?—particularly the latter, require a good deal of careful attention. Electrical women of tact have here an excellent opportunity for the exercise of their peculiar gifts in dispelling ignorance and removing prejudice. We heard recently of a public personage in a particular locality who, impressed at a local showroom with the merits of the electric vacuum cleaner, electric fires, and so forth, ordered delivery thereof to be made at his abode, but unfortunately he had not previously consulted those in authority, and to his bewilderment he found that either those appliances or the established domestics would have to go. Of two evils he chose the lesser one, and so chooses still, preferring to forgo the delights of electrical advance for a season rather than to dispense with the pleasures of domestic felicity. Who has not heard, too, of menservants who make use of certain electrical contrivances for a time, but when the novelty wears off or when something, however slight, gets out of order, leave them unused?

In most cases we believe that initial prejudices of servants can be overcome as the result of experience of the benefits attending practical use of apparatus, but perhaps we have been too solicitous for lightening the load of the mistress by solving her servant problem and have paid too little attention to the thoughts, limbs, and wishes of the maids themselves. Electrical women will know how best to reach them, to educate, and to convince them.

Supplies to Outlying Districts.

The paper read by Mr. S. E. Britton on the first day of the I.M.E.A. Convention was intended to draw attention to the advantages of extending the operations of existing electricity supply undertakings into the surrounding districts, and the difficulties which impede that process; no one is better qualified for the purpose than the author, who has had plenty of experience under both these heads. As he eloquently demonstrates, the electricity supply industry in this country has been, to say the least, unfortunate in the legislation with which it has been favoured, and even the working of the Act of 1919 fails to gain his approval. Mr. Britton, in fact, is a wholehearted advocate of freedom for individual undertakers to develop their areas with the minimum of administrative interference. It was very clearly evident at the Convention that there was a strong current of opinion in municipal circles adverse to the Electricity Bill in its original form, and that the interference with local management which appears to be threatened is strongly resented, particularly by the larger undertakings. There is a widespread feeling that development should proceed on normal lines, without the adoption of artificial methods which are likely to increase the cost of electricity where it is already cheap, in order to reduce the price where it is unduly high. The views to which we have on many occasions given expression were, in fact, generally endorsed both in public and in private.

With Mr. Britton's comments on the undue stringency of the regulations for overhead lines, the difficulties in obtaining wayleaves, and the many other obstacles to the erection of aerial conductors, we are of course in the fullest agreement. Not only is the industry overburdened with harassing regulations and cumbrous procedure—it is also hampered by exaggerated reverence for private rights, which are allowed to restrict development to an extent unheard of on the Continent and in America. It must be realised that the supply of electricity is a public service, which must not be subordinated to the whims of private persons or the wayleave cupidity of the owners and occupiers of land. We do not suggest that electrical undertakers should be granted autocratic powers to ride roughshod over private rights; but they should not be at the mercy of every profiteer that they encounter, nor should they be required to wait for months before wayleaves can be obtained. As Mr. Britton urges, the procedure should be immensely simplified, and should be in the hands of local officials. Why this important matter has been omitted from the Bill is incomprehensible.

The Clyde Valley Electric Power Co.

Hydro-Electric Power Developments.

THE present consolidated position of the Clyde Valley Power Co., which came into being in 1901, abundantly justifies the foresight of its founders, and Mr. E. T. Goslin, M.I.E.E., chief engineer and manager, maintains the enterprising and far-sighted principles set up by his distinguished predecessors in the general management. There is an unmistakable spirit of enthusiasm and zeal for electrical development permeating the whole staff, which is sensed throughout the entire one thousand and thirty-three square miles of the company's allotted area.



Fig. 1.—The Clyde Valley Electric Power Co.'s Area of Supply.

The two original stations, at Yoker and Motherwell, planted strategically on the river banks, one below and the other above the Glasgow boundaries, bore the vicissitudes of the early years. The varying fortunes of the steel works and collieries around Motherwell and of the shipyards and repair shops at Yoker kept the economic load fluctuating rather more than was desirable to enable the best results to be obtained; so in 1910 the almost prophetic step was taken of linking-up these two important distant stations by a through line, skirting Glasgow on the south. Remunerative progress was then assured, and within three years from the time of inter-connection the maximum load on the system had more than doubled, and had passed 10,000 kW. The next important step in the company's growth was marked by the establishment of the station at Clydes Mill, which grew with great rapidity during the war to super strength, and is most favourably adapted for further extension. These three generating stations now distribute to the area through 253 sub-stations. The accompanying Table I indicates the recent output, and illustrates the important group of key industries served by the company.

TABLE I.—ANALYSIS OF RETURNS.
Year ended December 31st, 1925.
SUMMARY OF OUTPUT AND REVENUE.

		Gross energy sold		Amount received	Av. price per kWh. sold
		kWh.	%	£.	d.
1.	General power users	29,889,373	17.55	135,249	1.086
2.	Collieries	31,072,709	18.24	120,351	.929
3.	Textiles	4,200,871	2.47	20,454	1.168
4.	Bulk	30,411,102	17.85	69,534	.548
5.	Traction	1,831,811	1.08	11,535	1.511
6.	Engineering & repair shops	21,483,976	12.61	103,629	1.157
7.	Shipyards	14,168,207	8.32	62,654	1.061
8.	Iron & steel works ...	37,268,463	21.88	107,573	.693
		170,326,511	100	630,979	.889

The installed plant capacity of the Yoker station is 35,750 kW, that of Motherwell 18,000 kW, and that of Clydes Mill 50,000 kW, giving a total for steam generation of 103,750 kW; this will be increased by 15,520 kW when the new hydro-electric plant is ready—probably by the end of the present year.

The Hydro-Electric Scheme.

This is a most important development of the activities of the company, representing as it does the linking-up of hydro and steam generating stations for varied industrial supply over a wide area.

British rivers have not the abundant natural reserves to be found in some larger countries, and adequate storage methods involve great expense. Isolated hydro-electric stations can only give a constant efficient output if designed for dry-season conditions. It would therefore seem that the peculiar problems of the utilisation of this country's coal and water-power resources are being happily solved in the Clyde Valley, where the large steam stations are located at the centre of the coal-producing districts and linked with hydro stations of a capacity sufficient to employ the available water power. The water, much or little as the seasons decree, goes to conserve the coal. The torrents and snows of the distant hills in winter give work and warmth and light in the towns, and in future springs and autumns the coal stations will pay back their debt to the country places and to agriculture.

The Falls of Clyde have long been places of pilgrimage by lovers of beauty. The Bonnington Falls are a mile or so upstream from the town of Lanark, and the Stonebyres Falls are downstream from that town. The latter, being the more easy of access, are the better known to visitors; but the Bonnington group has more grandeur, as there, after an impressive cascade, the river sweeps onward through a half-mile chasm, with perpendicular rock walls, and then at Corra Linn falls sheer into a reverberating and deep cavernous basin. The

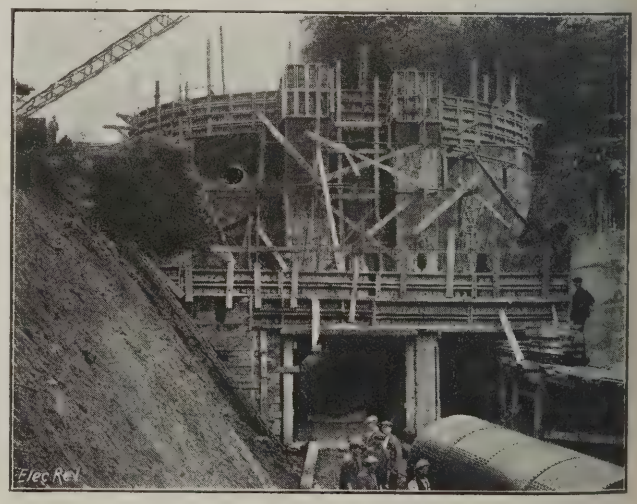


Fig. 2.—Bonnington Surge Tank, showing Pipe-line Exit.

Falls, and the works of the company associated with them, were visited by the members of the I.M.E.A. during the annual Convention which was held at Glasgow last week.

The Bonnington Scheme.

This "Astounding Flood!" in Wordsworth's phrase, is now being trapped to form the upper of the new hydro-electric stations.

The two schemes have much in common. In each a sloping intake at the weir leads to a subterranean tunnel, and each of the tunnels feeds a pair of steel pipe lines which run from a surge tank to a pair of turbines in the corresponding station. The Bonnington station utilises two falls, *i.e.*, Bonnington and Corra Linn, and has a longer tunnel and pipe line with a higher available head, while the lower scheme at Stonebyres has a greater volume of water to deal with.

A weir is in course of building above the Bonnington Falls, and the power house for this scheme is placed about one hundred yards below the Corra Linn Falls, the total head of water being 189 ft. from weir to tail-race.

The Weir.

The weir is of novel construction, having three automatic tilting gates of steel, fixed to a concrete sill on knife-edged pivots. Each gate has counterweights in the form of floating iron boxes. When the river rises the tilting gates are depressed and so guard against undue flooding; during highest flood level the tilting weirs are levelled right down to the river bottom, and the fact that the counterweights are of the floating type ensures that the gates do not rise till the waters have abated.

Fig. 4 shows the present stage of construction of this weir, with the river diverted to half its normal width by a temporary dam. The picture also shows that the reinforced-concrete pillars which flank the gates carry a bridge roadway. A hand-operated sluice gate is fitted on the right of the weir.

The intake is also at the right of the weir, in the foreground of the picture. It is 50 ft. wide, and is fitted with screens which are inclined to the horizontal at 60 deg. The parallel-rod screens are arranged in portable rectangular grid sections lying in guides. The sections can be readily raised for special cleaning if required.

Between the rough and the intermediate screens the bottom of the intake is formed into an efficient sludge trap channel, which can be flushed out by means of two sluice gates.

The Tunnel.

The bottom of the intake slopes to the tunnel mouth, which is fitted with a sluice gate and inspection shaft. The tunnel is 10 ft. in diameter and 773 yards long, with a slight inclination.

While a great part of the tunnel track is through rock, some difficulties had to be overcome where shifting sand and water were encountered. These places have been cleverly and skilfully dealt with by a cementation process; this has the effect of making the liquid sludge encountered into a powdery rock which can be readily tunnelled. The sludge is pierced at numerous points by long tubes, and a mixture of cement and silica is then forced at great pressure through the tubes, the pressure being maintained while the tubes are being gradually withdrawn. In a short time the cement sets and cakes its surroundings.

Cast-iron bolted segments are being used to line the parts which are not cut through solid rock. The entire inner surface is finished off with smooth cement. The tunnel ends in a circular reinforced-concrete surge tank, which measures 61 ft. across. The surge tank is provided with a fine screen and arrangements for discharging silt and *débris*. Bell-mouthed exits are provided for the pipe lines. Two steel pipe lines, each having sluice gates, run from the surge tank down to the turbines in the power house. The sluice gates are separately controlled by oil pressure from the pump which supplies the oil-operated turbine governor relay valve.

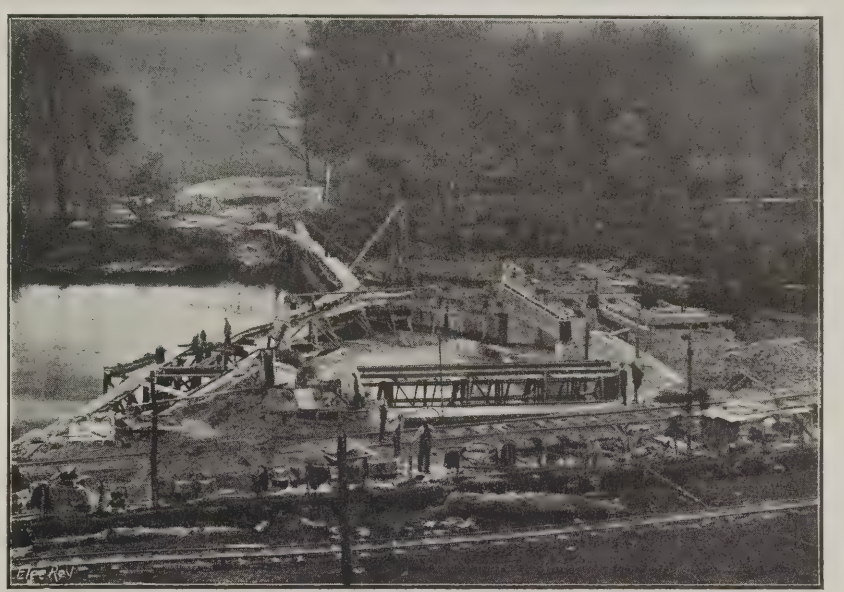


Fig. 4.—Bonnington Weir under Construction.



Fig. 3.—Bonnington Pipe-line, showing Anchor Blocks.



Fig. 5.—Stonebyres Falls.

Pipe Lines.

The steel pipe lines are each of 6 ft. 6 in. internal diameter. The riveted plates have a minimum thickness of $\frac{3}{8}$ in. for the upper portions, increasing to 9/16 in. at the lower end. The pipes are provided with massive concrete anchor blocks and supports, and lie on plate cradles grooved for the entry of rust-preventing grease. Expansion joints and inspection doors are provided, and the pipes terminate in two hydraulic balanced valves inside the power house.



Fig. 6.—Stonebyres Weir, showing Intake Screen and Tilting-gate Counter-weight.

The Bonnington Station.

The station buildings are pleasing in design, and strike no harsh note with their surroundings. It may be said here that nowhere in these schemes do the buildings, weirs, or works obtrude or clash with the natural beauty of the district. For this no doubt great credit is due to the special Amenity Committee which considered this important aspect of the matter.

The station is of the one-floor type, and the turbine house measures 97 ft. by 37 ft. 6 in. The main space is, of course, to be occupied by the two turbo-generators. A gallery 8 ft. above the floor and running across the station carries the e.h.p. control board. The low-pressure a.c. and the d.c. switchboards are placed beneath this gallery.

An annex on the downstream side of the turbine house will hold the 11,000-volt switchgear, booster transformers with regulating gear, and a battery for the control mechanism.

A portion of the annex is allotted to the e.h.p. switchgear, and has room for 12 lines of main switchgear. Another portion houses the station auxiliary transformers and the booster transformers for the main transmission lines, the regulating switchgear being immediately above. A house for the senior attendant, with workshop, &c., is placed at the upstream end of the building.

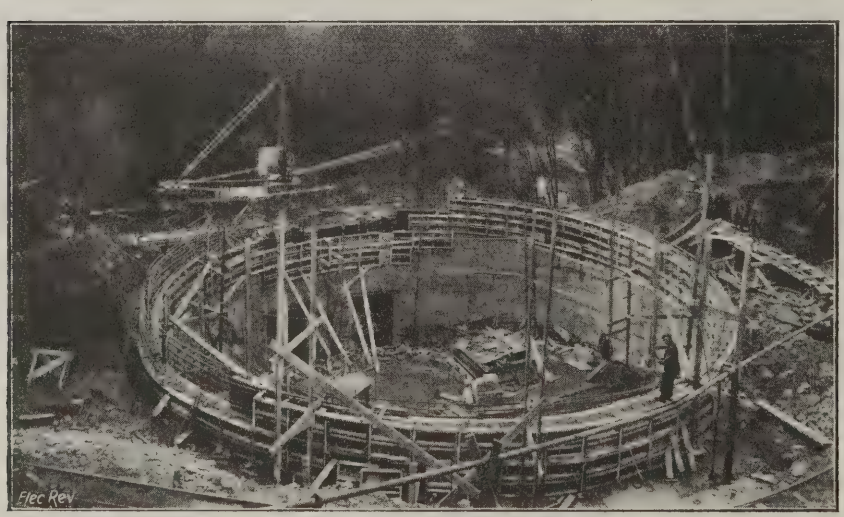


Fig. 7.—Surge Tank at Stonebyres.

Turbines, Alternators, and Auxiliaries.

The circular foundations are now set for the two turbo-alternators. The machines will run at 375 r.p.m., and will be of the vertical reaction type, each of 6,750 h.p., coupled to a 25-cycle, 11,500-volt alternator of 6,150-kVA output.

Each turbine will be provided with an automatic governor with servo-motor and connecting gear to control the swivel gates for the water. A time-lag relief valve is to be provided to divert the water to the tail race, which will act upon a sudden cessation of the load.

The governors will be provided with a return motion gear coupled through a relay to a float at the intake works. Thus the degree of opening of the turbine gates will be regulated according to the water available in the river. The vertical-shaft generators will be directly coupled to the turbine shafts, and the exciters will be carried on shaft extensions.

The auxiliaries will include a motor-generator charging set for the batteries, one motor-driven oil pump for the governor and head-bay sluice gates, one water-wheel coupled to an oil pump as stand-by to permit of the station starting up independently of an outside electricity supply, and two 50-kVA transformers for auxiliaries and local lighting.



Fig. 8.—Tilting-gate Fully Open with Sluice Gate on Left.

The total output of Bonnington station, with a water flow rate of 825 cu. ft. per second, will be $4{,}920 \times 2 = 9{,}840$ kW at 0.8 power factor.

The Stonebyres Station.

Stonebyres is about three miles further down the Clyde from Bonnington, and will utilise the water which will be returned to the river from the upper station. The stream is augmented by the tributary stream, Mouse, which reaches the Clyde above Stonebyres, and the catchment area is 54 square miles additional to that serving Bonnington; it embraces 385 square miles net and has an average annual rainfall of 43 inches.

Tilting weirs are also employed at Stonebyres, and these have been modified to suit the altered configuration of the river. The intake and screen arrangements are similar for both stations.

At Stonebyres the tunnel, surge tank, pipe lines, turbines, &c., are all of similar type to those at Bonnington, but with the slight modifications in design required to deal with the increased water flow rate which will be 911 cu. ft. per second. The tunnel here is shorter, being 492 yards long, and its diameter is

11 ft. The total working head from weir to tail-race is 97 ft. 6 in.

The twin pipe lines are, at Stonebyres, comparatively short, and no relief valves or hydraulically-operated valves are being provided on the turbines, the water entry to the pipes being controlled by oil-pressure servo-motors.

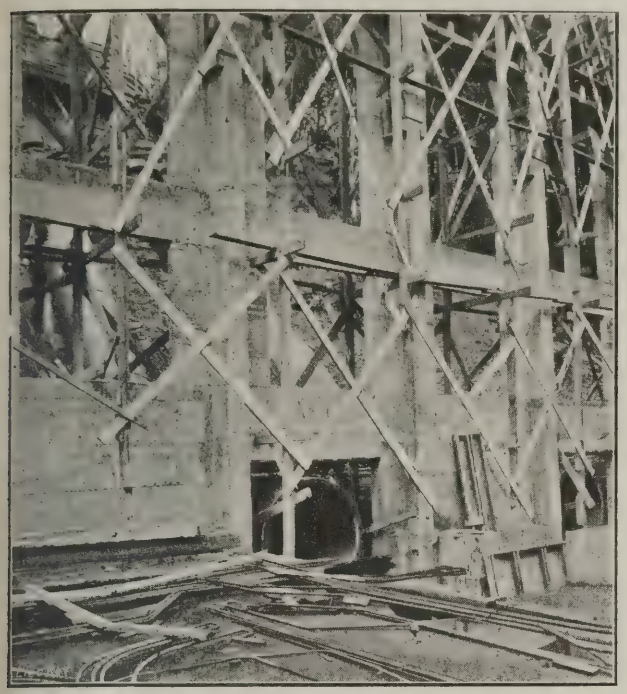


Fig. 9.—Stonebyres Station, showing Pipe-line Entrance.

The turbines and general design and equipment and the buildings are all like those at Bonnington. The normal speed of the turbines will be 375 r.p.m., and each is to be coupled to a 2,840-kilowatt, 11,000-volt alternator. The total output of Stonebyres station will be, therefore, 5,680 kW, as compared with 9,840 kW at Bonnington.

To correct voltage fall between stations, the plant at Bonnington has been designed for normal working at 11,300 volts, and that at Stonebyres for 11,000 volts.

Transmission Scheme.

Bonnington and Stonebyres will be linked by two interconnectors consisting of two 3-wire lines on separate pole routes.

A north interconnector to the steam generating system, consisting of a six-wire overhead line on one line of poles, will go direct from Bonnington to the Overton switch-house on the existing Clyde Valley Co.'s 11,000-volt network, traversing the burgh of Lanark, the town of Carluke, and the villages of Law and Braidwood.

A south interconnector of similar construction will join Stonebyres with the Motherwell station. This line will serve Larkhall, Stonehouse, and Strathaven.

A third direct transmission line will connect the Stonebyres and Motherwell power stations.

The necessary correction of line voltage will be dealt with by boosters at the different stations, and, where required, these will have their current and pressure windings split to form part of the split-conductor protective scheme.

At the towns and villages through which the lines will pass, the necessary transforming arrangements are being made for local supply.

The placid flow in the upper reach of the river gives place to the spectacular double falls at Bonnington, where the channel traverses a rocky gorge and half-mile chasm between perpendicular cliffs from 70 to 100 ft. high, the site being one of the few in this country where hydro-electric power development of any magnitude is possible without the aid of costly storage reservoirs. The undertaking of the scheme, by the Clyde Valley Electric Power Co. and its associate, the Lanarkshire Hydro-Electric Power Co., reflects great credit on all concerned in it.

The civil engineering and building constructional work is being carried out by Messrs. Sir Wm. Arrol and Co., Ltd., to the designs and specifications of Messrs. Buchan & Partners. The electrical and hydraulic plant equipment is by the English Electric Co., Ltd. The work is being superintended by the Clyde Valley Co.'s engineers under the direction of Mr. D. Macfarlane Mcleod, to whom, and to the chief engineer, Mr. E. T. Goslin, we are indebted for facilities to prepare this article.

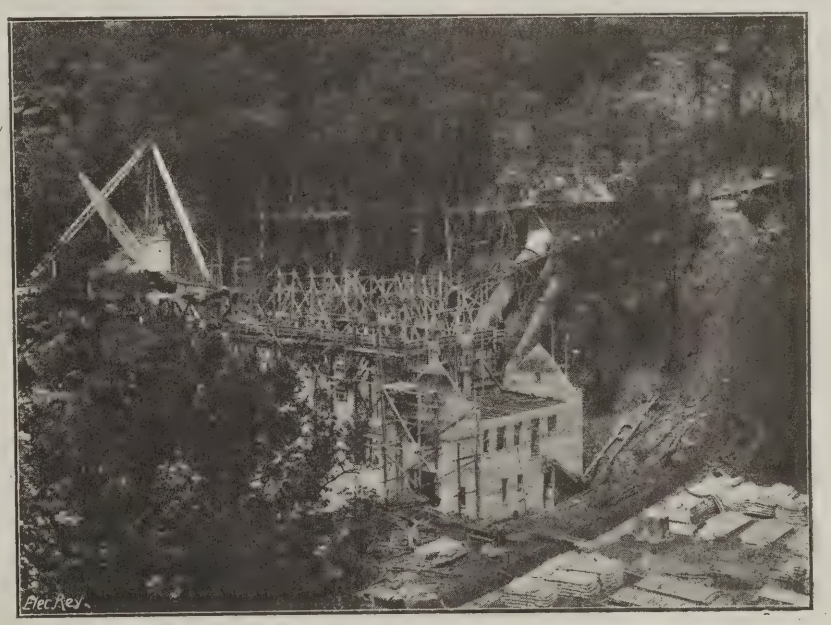


Fig. 10.—Stonebyres Power House in Course of Erection.

Demonstrating Radio Apparatus.

A New Idea—Take it to the Customer's House.

By PAUL D. TYERS.

Now that the wireless public is becoming more critical and is beginning to realise the possibilities of true reproduction, the subject of demonstration is one to which greater attention must be paid than has hitherto been necessary.

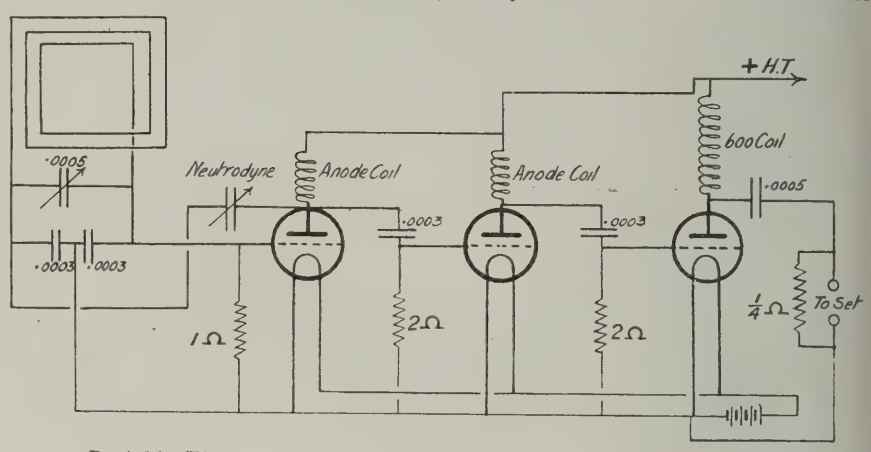
It is frequently of little use trying to convince the possible customer of the capabilities of some particular receiver merely by the usual form of sales promotion literature. The prospective purchaser is usually instinctively sceptical, and a demonstration is the only possible way to stimulate any real interest. Here, again, the trader may find another obstacle in his path, due merely to apathy. Once he can persuade his client to come into his showroom and listen to a demonstration of the set, he certainly has a very good chance of making a sale, provided, of course, that the instrument gives a sufficiently good performance. In nine cases out of ten, however, it is only with the greatest difficulty that this type of client can be persuaded to summon sufficient energy, or take sufficient trouble, to be interested to this extent. If, then, a sale is to be made, and the proverbial mountain will not come to Mahomet, Mahomet must go

to the mountain. In other words, the trader has to take the set to his client's house.

Usually the trader is debarred from demonstrating in the client's house owing to the absence of a suitable aerial and earth, and such a procedure has usually only been possible when the set is of the portable or frame aerial type.

However, it is really very easy to build a portable amplifier which can be substituted for the aerial and earth system, and used in conjunction with any ordinary type of broadcast receiver, thereby enabling a demonstration to be carried out almost anywhere, and under any conditions. In order to avoid a multiplicity of tuned circuits and not to introduce complication it is preferable to build an amplifier of the impedance-coupled type, so that there is only one tuning control, that is, the frame condenser. Several types of semi-aperiodic anode impedances are on the market, and these can conveniently be used. The accompanying diagram illustrates a three-valve, high-frequency amplifier used in conjunction with a frame aerial on the lines suggested. A neutrodyned input circuit is employed, and if a centre tap frame is not available the arrangement of two condensers shown in the diagram should be utilised. The anode circuits of the first valves contain tapped anode impedances of any well-known make, while the anode circuit of the last valve contains an inductance such as an Igranic 600 coil. The output of the amplifier is taken from a small condenser of about .0005 mfd., and a $\frac{1}{4}$-megohm grid leak, the two output terminals then being connected to the aerial and earth terminals of the set. Common batteries may be used for the frame amplifier and the set if desired, but it will probably be found essential to use condensers across the high-tension tappings in order to prevent parasitic oscillation.

When demonstrating with a frame amplifier of this type care should be taken, if working very near to a broadcast station, not to blast the set by obtaining too great a potential on the grid of the detector valve. This trouble can very easily be eliminated, preferably by rotating the frame so that it is slightly out of the maximum position. A frame amplifier of the type referred to can very easily be built into a case which also contains the batteries for both sets and the frame aerial itself. The cost of building the frame amplifier is comparatively negligible, and it should prove of great assistance in demonstrating anywhere. If desired, the frame amplifier may be provided with outside aerial and earth terminals, so that it can be used to boost up signal strength when only a very poor aerial is available. Here, again, the frame amplifier should be found valuable for demonstrating in public buildings, when, usually, far from efficient temporary aerials are to be obtained.



Portable Three-Valve High-frequency Amplifier and Frame Aerial.

The Electricity Supply Bill and the Consumer.

By R. W. WEEKES, A.M.Inst.C.E.

THE President of the Institution of Electrical Engineers, in his constructive criticism of the above Bill, published in your issue of April 30th, states his opinion that—

> "Our backwardness in the use of electricity is due rather to the inefficient and hampering legislation of the past than to the shortcomings of the electricity undertakings."

This is not borne out by Section 12 of the Report of Lord Weir's Committee, which reads:—

> "In using these figures it must be remembered that they include only the consumption from authorised undertakings. In this country, due to the existing high price of electrical energy, in many parts of the country, and the dependence on small generating stations, many industrial users and private persons prefer to generate their own electricity. The amount of privately generated current is not accurately known, though a census was made in two given areas to form some opinion. It is estimated that if energy from every source, both public and private, were included, the consumption per head in this country would be raised from 110 units to about 200."

If this estimate is correct, 45 per cent. of the electricity used in this country is still produced by private plants, and this is a serious reflection on the authorised undertakers. In my experience several plants have been installed due to the high prices asked for a supply by the authorised undertakers of the districts in which they were situated. To give two cases: Some years ago I acted for a large concern in the Midlands which worked continuously from midnight Sunday to mid-day Saturday. The load factor was unusually high in consequence, but the engineer of the supply undertaking concerned would not quote lower than 2d. per unit. He stated that the price for power had to be high because there was no demand for power in his district. In point of fact his argument should have been reversed. There was no considerable demand for power from the public because the price asked was too high. His successor, some five years later, fixed up a contract with me for some other clients for a smaller factory, working ordinary hours, at a price just over 1d. per unit. Under new management this supply undertaking has grown rapidly, and the present rate of increase is above the average. The other case, within the London area, is quite recent. At a factory with normal hours and a maximum load of about 350 kW, large extensions were to be made, and the question of a new private plant *versus* a supply from a company's main had to be decided. The price demanded averaged 2.55d. per unit, and the larger private plant was installed.

Supply for lighting is, in many places, equally calculated to prevent consumers from coming on or mains being laid to supply them. Last year I built a house about 12 miles from London, on a new estate. The Metropolitan Water Board, the Gas Company, and the Post Office Telephone Department laid their mains down the newly-made roads to serve the first houses built. The electricity undertakers had a high-pressure main in the road bounding one side of the estate, but it took 11 months to get them to lay a low-pressure cable up my road, and a scheme to put down a private plant to

supply the estate was practically completed before the company would move. The charge is 10d. per unit for light and 3d. for heating, which naturally prevents many inhabitants from taking supply. It limits the use of electric heating and makes electric cooking prohibitive. My conclusion is that past legislation is not responsible for the above cases, but that the undertakers failed to exercise their powers properly.

The influence of cost of supply on demand is not recognised by some undertakers, as the curve published in Section 13 of the Report of Lord Weir's Committee shows; or else they deliberately prefer to supply a few consumers at a high price rather than deal with a larger output and many consumers. The following comparative figures for two residential areas near London of about the same population bear this out:—

Year ended		Pop. about	Units sold	Total revenue	Av. Price obtained per unit	Units sold p. hd.
Dec. 1924	Bromley & Chislehurst	44,000	1,552,963	£48,555	6.9d.	35.3
Mar. 1925	Tunbridge Wells ...	46,700	3,022,302	£42,623	3.20d.	64.5

Perhaps in the above comparison, past legislation had some influence. The Tunbridge Wells Corporation has the security of tenure that the 1888 Act gives to municipal bodies. The Bromley Electric Light Company may lose its powers in 14 years, and hence the directors may not find it easy to raise further capital for the larger mains so urgently needed. In the meantime the inhabitants suffer from the restricted supply which is the result of high prices. At Tunbridge Wells the units sold have increased 140 per cent. in the last four years, while at Bromley the increase has been only 54 per cent. To carry the comparison further, neither of the two undertakings is well situated as regards coal and water. In spite of this, Tunbridge Wells accounts show a works cost of 1.67d. per unit sold. At Bromley a large part of the energy is purchased in bulk, and yet the works cost per unit sold was 2.98d. for the corresponding year. It is on this figure that the Electricity Supply Bill will have effect if Parliament passes the measure. It is certain that the proposed Central Electricity Board could give bulk supply to both these undertakings at a price below the figures quoted above, and the Board can also insist on the benefit being passed on to the consumers. This would be done under Clause 14 of the Bill, which reads—

"Where in any year the Board notify to any authorised undertaker owning a generating station, not being a selected station, that the Board are in a position to supply directly or indirectly to those undertakers the whole quantity of electricity required for their undertaking on specified terms, and are satisfied that the cost of the supply on those terms is below the then prevailing cost to those undertakers, and those undertakers refuse or within three months after such notification fail to agree to take such supply directly or indirectly from the Board, then, if the Electricity Commissioners are satisfied as respects the next subsequent year that the cost of production of electricity generated by those undertakers substantially exceeded the cost they would have incurred had they purchased the like quantity of electricity directly or indirectly from the Board on the specified terms, the Electricity Commissioners shall by order require the authorised undertakers to make such abatement from the rates and charges for electricity for the ensuing year that the estimated aggregate amount of the abatements will be as near as may be equal to the amount of such excess as aforesaid."

The duty of the Board will be to supply electricity to authorised undertakers, and the Bill is drafted to give it full powers to insist on the supply being taken. This will enable the generation of electricity throughout the country to be organised on lines which cannot be followed with the existing legislation. The latter was too parochial in character, but it has enabled the large corporations to deal effectively with the supply of electricity within the municipal boundaries. Mr. Chattock's undertaking is a case in point, but the Corporation of Birmingham cannot be expected to finance the supply in bulk to an indefinite surrounding district, the various parts of which can individually accept or refuse supply. The strength of the present Bill is the fact that the Board will deal with the country as a whole, and can prepare schemes on engineering lines with the assurance that the whole of the demands for electricity will eventually be handled. Under such a scheme the money now frequently spent on introducing inefficient plants will be saved. In my opinion the financial proposals of the Bill are a most important feature, and in no other way could this national scheme be quickly started. I gather that Mr. Chattock would prefer a partial scheme, to do in districts what the Bill proposes to do for the whole country. This would avoid, for the time, the expenditure for standardisation, but in the future this matter would have to be handled, and the cost then would be greater, as larger plant would then have to be altered.

The recent general strike gives a further reason for the adoption of this Bill, and for the generation of electricity being put in firmer hands. The majority of the undertakers continued to give a general supply and called in volunteers to replace the men on strike. There were other Corporations with Labour majorities who cut off supply during the day, and so shut down factories, the employés in which were all willing to work.

The Need for Accurate Costing—Why Wait?

A Suggestion for Speeding-up the Incipient Trade Improvement.

(COMMUNICATED.)

(*Concluded from page 910.*)

To write so much about the need for seeing that a day's work is obtained for a day's pay may seem to be making a long story of an obvious platitude, but it is nevertheless a truism that is more often neglected than acted upon. Were a little more attention paid to this measurement of services obtained for money spent, of work done for overtime wages paid—and there is room for more of it in some nine firms out of every ten—there would be heard much less of the outcry against high costs of production, and far greater attention would be devoted to reducing them. It is by means of such measurements that those who believe their costs are too high, can find out in what particular direction unnecessary expenses are being incurred.

If the necessity for providing some such means of measurement is clear, surely the power and possibilities of control that will be the natural outcome of the constant and careful application of such an instrument must be even clearer. The comparison of work done for wages paid (on day work as compared with piece work, for instance) not for the factory as a whole, which would be a mere average, but for each or any distinct department, or process or operation, or if need be for each man, must very quickly show where delays are taking place, or where time is being lost. Once the source of the trouble has been traced, the reason for its existence can quickly be discovered. It may be found that there is too much work in the shop for one crane to cope with, or there may be insufficient tools, so that men have to wait about till their fellows have finished with them, or lack of supervision may be shown to be the trouble. Loss of time and material may be due to a thousand and

one things, in many of which it is impossible to *see* a fault; only from defects of which they are the *cause* can their insufficiency be detected and made known.

The present age is always glad to hear about instances of slow production, not so as to provide an opportunity of "getting at" the men concerned, but rather to find out the reason for the delay, so that steps may be taken towards its removal. It is this means of measuring that provides the central agency for such news. Much has been heard recently of the need for a new spirit of co-operation in industry. Very often it is just these delays in production, once the management gets to know of them, that provide the opportunity for this new spirit to show itself, by having things put right to the mutual advantage of the workmen and the company.

A monumental example of what has already been done by applying this measuring stick, on an international scale, is to be found in the "Inquiry into Production," published (only in French) by the International Labour Bureau, at Geneva. Two extracts will be quoted:—"Owing to the improvements in methods of production in the steel-making industry of the U.S.A., whereas the number of workers in the industry in 1850 was 20,298, it has only increased in 1919 to 38,243, yet the tonnage production has gone up from 504,245 to 31,015,364. The number of workers is barely doubled, yet the production is 60 times greater."

"In 1921 the output per worker in the British cotton trade is given as only 50 per cent. of what it was in 1913."

These comparisons are, as has been said, measurements on an international scale, and though highly informative, are far less valuable for the purpose of showing where there is a possibility of cost reduction, and greater economy, than would have been similar comparisons for individual factories, or even sub-divisions of individual factories, but they do typify facts that matter in a business.

If, then, there be admitted the need for, and the advantages of, some such measuring instrument to compare services obtained for money spent, it remains but to show, in a more definite manner, how such means can be provided. This, fortunately, is not difficult if those who read have but the little foresight and enterprise necessary to make the experiment for themselves, and are prepared to shun rule-of-thumb methods as they would the plague.

As is truly, but very necessarily pointed out in this "Inquiry into Production," you cannot explain the facts, until you know the facts! Yet, how many directors of companies engaged in the manufacturing industries of this country are there who really do know the facts about all that is going on in the factories they control? There may be many good reasons and excuses why directors are not in the closest touch with every-day occurrences in their business, but there is absolutely no reason why they cannot have the fullest information about facts, both pleasant and unpleasant, which ought to be placed before them. If there is any waste or leakage not only of money, but of time, space, services, and material, then they can, if it be their desire, ensure that news of it reaches their ears. It is regrettable that the number of directors who arrange to be supplied with such information is not far greater than it is.

An instance may be cited to show what befell one board of directors who failed so to equip themselves. This refers to a large firm engaged in the manufacture of cast iron pipes. In 1920, when the price of pig iron reached a maximum of about £15 per ton, the cost of these pipes became so great that a price high enough to cover the calculated cost could no longer be obtained, and the firm began to search for some alternative and cheaper pipe to offer in its stead. After some deliberation, they decided to commence manufacturing welded pipes made from sheet steel. Though much cheaper than cast iron, great difficulty was experienced in persuading customers that the new pipes were equally suitable for the purpose required. Cast iron pipes had always been used for the purpose, and a change to some cheaper, but possibly inferior, alternative was not at first relished at all. Customers still wanted cast-iron pipes, but they wanted them at a lower price than that for which they could be made.

Very gradually, however, this conservatism was overcome, and the sale of welded sheet steel pipes began to increase. People began to find that not only were they equally as serviceable though cheaper, but they were also much lighter than cast iron, and more easily held in position. Bit by bit the fashion changed, until to-day the welded steel pipe is in universal demand, and it is the cast iron pipe that is hard to sell for this particular purpose. Now, however, the price of cast iron and sheet steel have both fallen far below the maximum figures reached in 1920, and to-day a good grade of foundry pig iron can be bought for about £3 10s. per ton instead of £15—the 1920 price. The result is that a complete reversal has been brought about, and now the cast-iron pipe is the cheaper from the manufacturing point of view.

In this firm, so much energy had been expended by the directors upon inducing customers to overcome their objections to the sheet steel pipe, and so concentrated was their attention on this one object, that the measuring stick had been lost or forgotten, and though they, of course, were aware of the fall in prices that had taken place, they were entirely oblivious to the re-adjustment in cost that had accompanied it. It was not until some entirely different reasons led them to have installed an up-to-date system of costing, that these directors became aware of the true state of affairs.

An accurate method of costing, specially designed to suit the trade, organisation and particular conditions of the firm concerned, is the means by which this "measuring" that has been referred to, can be maintained in continuous operation. If properly and intelligently made use of, there can be no doubt that all that has been claimed will be realised by this means.

Many people seem to regard costing as a job that can be entrusted to a few clerks, and that it is, at best, only useful as a rough guide to what it has cost to manufacture the products of the firm during the year. A firm of rope and twine manufacturers of some repute in the trade, make a practice of adding together the cost of their purchases of hemp, &c., their wages bills, and their works and office establishment charges, dividing by the total weight of rope made, and believing that they know their costs. This pernicious habit of self-deception is then flattered by them with the name, costing.

Comparatively few people believe that costing can ever give really accurate results, or supply figures that are more than partially reliable. Even fewer are apparently aware that costing can claim to provide other information than what it has cost to manufacture.

If a company gets into low water, that is, if its auditors are unable to bring out the balance of the profit and loss account on the right side, then the first to feel the effects of the wild and desperate rush to reduce staff that follows are the few hapless cost clerks. "We cannot possibly afford the luxury of costing in bad times like these." In arguing how and where to economise further, the last place to which they turn for help or guidance is their cost system, though, did they but know it, it is the one and only part of their office organisation that is capable of pointing out where and how economies and savings can be made; where, in other words, the least service in return for money paid out, is being obtained. The financial accounts can only provide the cold fact, long after the mischief has been done, that the year's trading has resulted in a loss; they are powerless to show how and where.

As Sir Edward Grey repeats in his "Memoirs," "It is precisely the man at the centre who is often unable to see the wood for the trees," and the truth of this is always much in evidence immediately after the presentation of an adverse report by the auditors. In the haste to prevent a repetition at the end of the current year, already partly spent, the axe is wielded in a manner so ruthless, and the disturbance caused is so great, that often it is the really useful and necessary people that are hastily discharged, and the last state is worse than the first. The only way in which this affliction of the vision, which so often attacks responsible men at such times, can be guarded against, is to don the spectacles

provided by the cost system. By this means a clear insight into the workings of the business can be quickly and easily obtained.

Cost systems are often condemned and disregarded because they have this fault (though it can hardly be said to be the fault of costing), and that is that they are left in the hands of a few clerks. The cashier or perhaps the secretary of the firm may be nominally in charge of them, but these officials have their own allotted duties to perform, and little time to devote to costing, which is not their proper work, so it often receives neither their interest nor their best attention, even if they have the necessary knowledge of the subject to make a success of it, and this is but rarely the case. Inevitably, the cost results presented under such conditions are nothing but the work of a few clerks. The results may be correct, but they are not brought out or expressed in such a way that important and useful features will inevitably catch the eye of the directors concerned, even if they do happen to look at them at all.

Costing, like everything else, must be properly supervised if it is to be of any value. Clerks working on their own cannot be expected to produce this finish, which makes all the difference between a page of figures and really helpful and valuable statistical information. For one thing they are seldom in sufficiently close contact with the directors to know their policies, and what will help and interest them in endeavouring to carry them out. For another, if they could produce "finished" work, they would no longer remain clerks.

Costing is now rapidly becoming a separate and distinct science of its own. It is not accountancy, and it is not economics, but something between the two, and yet different from either. What really matters in the training of a specialist in costing is practical knowledge of the manufacturing process which he has to cost. Costing is primarily a shop problem. The greatest benefit is derived from its ability to help the shops to produce more economically and more cheaply, to help them to choose, not the machine that will produce the quickest, but the machine that will produce the cheapest; two things which are by no means always synonymous.

Though a little costing is now included in the syllabus of training of a chartered accountant, the majority of accountants realise and admit their inability to tackle costing problems, because they have had no opportunity of studying "shop practice." The wisest of them consequently leave costing to those who have made a special study of the subject, and have had the essential advantage of practical experience in the shops.

To such people, manufacturers who believe that their foundry costs, or their by-product costs, for example, or their selling costs ought to be less, will be well advised to turn for guidance in these matters.

The Royal Society's Soirée.

Annual Exhibition and Demonstrations.

THE Royal Society's annual conversazione was held at Burlington House, London, on June 16th. Sir Ernest Rutherford, O.M., president, welcomed Fellows and guests, and the usual scientific exhibits and demonstrations had been arranged; though they were not so numerous as in past years, they totalled 33, several of an electrical nature being amongst them.

Mr. W. M. MORDEY conducted some experiments of considerable interest, which demonstrated a strong rotation in multiphase fields of magnetic materials which are either non-conducting in themselves, or are made so by being reduced to powder and mixed with glue, or shellac, which electrically separates the particles from one another. Disks or cylinders of such materials were used, including magnetite, pyrrhotite, nickel, hard cast iron and hard steel grit. In such substances no appreciable eddy currents are produced, but they form induction rotors with no windings and no induced currents. The rotation, which is attributed to hysteresis only, is in the same direction as that of metal disks or cylinders placed in the same magnetic fields; loose powders of the same magnetic materials rotate in the opposite direction. No movement takes place either with moulded disks or with loose powders of non-magnetic metals, such as copper or aluminium, showing that no appreciable eddy currents are produced in powders even of good conducting substances.

Mr. A. C. DOWNING'S electrical instruments for physiological research included a simplified moving-magnet galvanometer of great sensitivity and short period, with a very light magnet system and a "mumetal" shield (Gutta Percha Co., strip wound alternately with copper and annealed at 900 deg. C. in nitrogen), which is claimed to cut out 99.9 per cent. of the external magnetic fields. He also showed thermopiles for measuring the heat production of muscle and nerve and, with Dr. Anrep, apparatus employing a hot wire for measuring the velocity of the flow of blood from a vessel during a single cardiac cycle. The hot wire wound on a thermopile used for measuring the strength of stimulus, or for "calibration," will measure 20 microamperes a.c. to less than 1 per cent.

Studies of radio-telegraphic atmospherics were the subject of the Radio Research Station's exhibit, in collaboration with Prof. E. V. APPLETON. A method of examining the wave-form of transient electrical impulses, involving the use of linear and unambiguous time-base with the cathode-ray oscillograph, was shown in actual application to the visual observation of atmospherics received on a local antenna; the nature of the time-base e.m.f. was separately demonstrated. Records of typical wave-forms of atmospherics observed in the tropics were on view, together with records of their direction of arrival and of the meteorological environment of their sources.

Dr. W. H. ECCLES, F.R.S., and Dr. WINIFRED LEYSHON showed a neon tube and tuning fork combination for producing electrical oscillations of harmonic frequencies suitable for calibrating wave-meters. When a neon tube is connected in parallel with a condenser and in series with a resistance and a battery, an intermittent luminous discharge passes through the tube as was shown by Pearson and Anson. In the exhibit such currents were passed through the coils of an electromagnet so as to keep a steel tuning fork in continuous vibration. For this purpose the electrical constants must be chosen so that the intermittent discharges have the same frequency as the natural frequency of the fork, and then the fork will react on the circuit and compel accurate isochronism. The current in such a circuit has many high harmonics, and, therefore, induces an oscillatory current of any chosen harmonic frequency in a neighbouring circuit tuned to that frequency.

Sir ROBERT HADFIELD, F.R.S., exhibited sample alloy steels for various special purposes, including specimens specially suitable where great resistance is required to withstand the effect of temperatures of from 800 to 1,000 deg. C.

A rotor with wheel, blades, and shaft machined from one piece of "ERA/ATV" steel was shown as used in the construction of exhaust-gas turbines. These rotors are driven by the exhaust gases from internal-combustion engines; they work continuously at a temperature of from about 800 to 950 deg. C., and run up to the very high testing speed of 53,000 revolutions and working speeds of about 30,000 revolutions per minute. These special steels possess not only a high resistance to

the corrosive and erosive effects of very hot gases, but also great mechanical strength even at a bright red heat, enabling parts made from this material to withstand exceedingly high centrifugal and other stresses.

A tuning fork of high nickel chromium alloy steel, with constant frequency at varying temperature was on view, the necessary characteristic of the material for such a purpose being a very low temperature coefficient of the modulus of elasticity.

The Clarendon Laboratory, Oxford, exhibited a photoelectric photometer (Prof. F. A. LINDEMANN, F.R.S., and Dr. G. M. B. DOBSON) built on the principle that two beams of light from an electric filament lamp traverse two different, but similar, paths and finally both fall on one photoelectric cell. A shutter allows one or other of the beams to be cut off; at one point the beams are brought to a focus, and the photographic plate to be measured is placed on a mechanical stage so that the focus falls exactly on the film. The second beam passes through an adjustable optical wedge, which is moved until the electrometer connected to the photoelectric cell shows the same deflection whichever path the light is traversing. The reading of the wedge gives a measure of the density, and in this way the density of very small areas, such as spectral lines, can be measured and high accuracy can be obtained, an accuracy of 1/10 of 1 per cent. being easily attainable.

The physical laboratories, Victoria University, Manchester, showed some ingenious models of crystal structure (Prof. W. L. BRAGG, F.R.S., Mr. G. B. BROWN, Mr. J. WEST). Crystals of BeO, of Al_2O_3, and of $BeAl_2O_4$ are very different in form, but a comparison of their structures has shown that the relative positions of the oxygen atoms are almost identical in all three. The shape of the structure appears to be determined by the large oxygen atoms, the metal atoms being inserted into the spaces between. The structure of the typical orthosilicates, olivine (Mg_2SiO_4) and monticellite ($MgCaSiO_4$), are exactly like that of $BeAl_2$, O_4, while beryl ($Be_3Al_2Si_6O_{18}$) is another interesting example of a silicate with a simple structure. Photographs showed B-ray tracks associated with absorbed and scattered X-rays (Mr. J. M. NUTTALL and Mr. E. J. WILLIAMS) produced in a gas by a beam of homogeneous X-rays in a Wilson cloud chamber. The long tracks are due to electrons ejected from atoms which have absorbed a quantum of the incident X-rays; the short tracks are supposed by Wilson and Crompton to be due to this scattering of a quantum. A large number of photographs has made it possible to find accurately the relative numbers of these two types of track for different gases and wave-lengths. Mr. A. J. BRADLEY indicated the structure of "β" manganese and "γ" brass.

In Mr. W. A. DOUGLAS RUDGE'S mechanical models, which illustrate the structure of the atom, the electron is represented either by a small rapidly-rotating electric lamp, or by the negative glow of a vacuum tube. In the first form the lamp is rotated simultaneously about two axes at right angles to each other; a continuous line of light, by persistence of vision, is thus traced, cutting off a more or less spherical space, representing the envelope of the atom; the nucleus is represented by another lamp at the centre of the system. In the vacuum tube model, a system of tubes is so rotated that the anode glows are concentrated at the centre, forming the nucleus, whilst the cathode glows are distributed in the space outside.

The apparatus of Prof. O. W. RICHARDSON, F.R.S., for the investigation of soft X-rays consists of a tube in which very soft X-rays, varying in wave-length from about 20 to 400 Angstrom units, are produced by the electronic bombardment of solids; the tube is of transparent silica and is highly exhausted to a pressure of about one ten-millionth of a millimetre of mercury. The presence of the X-radiation was demonstrated by the photoelectric emission which it produces from a copper plate enclosed in the tube, the photoelectric current being detected by an electroscope. Diagrams showed the results of the excitation of characteristic X-rays and other effects at certain critical voltages, contrasting some of the properties of ordinary and soft X-rays.

The ROYAL ARSENAL, Woolwich, research department's display consisted of radiographs of general interest, showing, amongst other things, penetration of 4.5 in. of steel.

Dr. J. S. OWEN'S bore-hole alignment indicator was designed to guard against the fact that deep boreholes, driven by rotary drills, may deviate greatly from the vertical without the drillers being aware of the fact. To find the true direction a clinometer and magnetic compass, together with a clock, a contact-making drum, a battery and lamps, are enclosed in a brass tube about 4 ft. long, which is capable of withstanding considerable water pressure. The instrument operates in vertical, horizontal, or inclined holes, and the records are made at pre-determined intervals of time on strips of sensitised paper.

The METEOROLOGICAL OFFICE'S exhibit was concerned with the methods of measuring solar radiation, one of them being the use of a Gorczynsky pyrheliometer, which records direct solar radiation as it is made to fall on a Moll thermopile connected with a recording millivoltmeter; to avoid friction the pen is free, but is automatically pressed against the paper at short intervals.

Low-Pressure Distribution.

Some Particulars of a New Design of Network Box.

By L. R. LEE.

THE distribution of electrical energy at its final consumers' pressure, particularly over dense cable networks and in large towns, has never been the easiest problem with which mains engineers have had to deal. Electrically, the distribution of d.c. is more difficult than that of a.c. owing to well-known natural phenomena acting adversely with the former, but granting that the electrical troubles have been and can be largely overcome by good design and careful installation, there still remain other troubles—largely mechanical—to be surmounted, some of which are incidental to the type of distribution-point unit adopted. Generally, it may be said that most networks are fitted with distribution points or units either in the form of above-ground pillars or underground boxes. In any case, the distribution unit is perhaps first of all called upon to provide efficient and quick action during fault times; that is to say, a fault having occurred, it is very desirable that discrimination between faulty and good cables should be automatically obtainable at the distribution point, and that the unit should lend itself easily to getting supplies going again with the minimum of delay. Agreeing that this is the correct suggestion, and that any fault should be so confined as to affect the smallest number of consumers, it follows that it is not correct practice to make what are known as solid tee joints on the distributors. On the contrary, each distributor should, as far as possible, be brought back to some well-defined distribution point, and there attached to other distributors and possibly to a feeder. If at this point each

distributor can be supplied through a thoroughly efficient cut-off, so much the better.

It will probably be agreed that until very recently, no really reliable cut-off capable of being used in the confined spaces left for a mains engineer's use in the crowded streets of our towns was obtainable, and therefore the existing best arrangement appears to be that, as far as possible, feeders are kept separate at their network ends and fitted with automatic circuit breakers at their station ends, the distributors forming open-ended branches from the feeder, being coupled to it through some solid form of connection, and thus, in case of fault, the whole tree—non-faulty as well as faulty distributors—is shut down. It now appears, however, that the above conception of the best method is seriously altered by the fuse lately perfected by Mr. Vernon Hope,

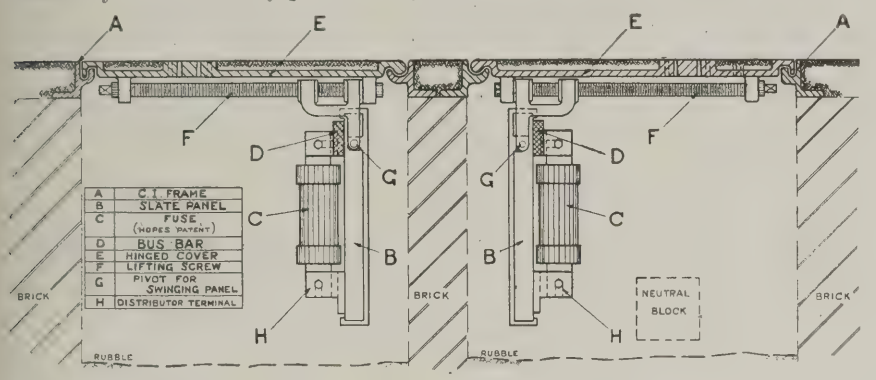


Fig. 1.—A 3-pole D.C. Distribution Box.

and by its use the writer suggests that it may be easily possible, not only to link together feeder and feeder to a reasonable extent at their network ends, but also to provide each distributor with a really reliable discriminating cut-off. Whatever be the method adopted, however, for ensuring continuity of supply to the greatest number of feeders, we have finally to decide on the type of distribution unit to be employed in the streets.

At the moment, the above-ground pillar has certainly appeared to find most favour, because operation at the distributor ends is so easily accomplished, but its great drawbacks are: (1) As it must be placed at the curb-edge of the footpath, it is frequently being knocked down by skidding motor lorries, thus resulting in heavy short circuits and the cutting-off of supplies to large numbers of consumers; (2) that the cable work in the bottom of the pillar is very congested and most difficult to get at; and (3) that some supply companies are unable to obtain permission to erect overground pillars from the road authorities in whose towns they operate.

With regard to underground network boxes, they are divided into at least two classes: (*a*) Those in which the electrical unit is erected in a more or less spacious underground chamber; and (*b*) those installed as cast-iron boxes, containing the electrical terminals, fuses, links and bus-bars mounted on an insulating base plate—forming a horizontal switchboard of small dimensions and horrible possibilities. One need only look at a drawing of one of these boxes to see what the possibilities are; for instance, when it is required to connect up all three (or four) poles of a feeder, and, say, four sets of multi-core distributor cables.

Summing up the troubles and disadvantages of underground boxes, we may say they are: In the case of (*a*), the necessity of a very costly drain connection to the sewer, the undesirability of jointers' work being done so far below the ground, the difficulty of adequate ventilation, and the very great overall cost owing to size; in the case of (*b*), we have the probability of short circuits occurring when connecting up and whilst in use, the troubles caused by condensation inside the box—the water finding its way below the compound level to the insulating base, the great difficulty of connecting new cables, and the trouble of lifting the lids when they have been in use for some time, owing to the oxidation of the jointing material between the lid and the box. And again, during working, if it is desired to withdraw the links or fuses, the operation has to be done below the street level and the operator's feet. When installing this type of box, the practice usually adopted is to put in short lengths of cables to fill up all the ways and to make straight joints on the cables outside the box, thus actually putting an extra joint on each cable. From the above it would appear to be distinctly advantageous if the best points of both the overground pillars and the underground boxes could be combined in one and the same unit, and the disadvantages of both eliminated.

The result of the writer's attempt to put an overground unit below the ground and to bring an underground unit above the ground so that the electrical gear may be in either place as and when required is shown by the accompanying illustrations. The designs have been made so that the "Hope" fuse, which should preferably be used in a vertical position, can be employed; but, of course, they permit the use of any other form of fuse or link.

Fig. 1 shows the design for a 3-pole d.c. unit distributing 2,000 amps. in four circuits, and the total space required for its installation is about 20 cubic feet, the depth of the containing pit being only 2 ft. Each pole—positive and negative—is, as shown, on a separate panel, whilst the neutral terminal block is separately affixed to one of the walls of the containing pit. For operation purposes—renewal of fuses or disconnection of a cable—the hinged street-leved lid E, from which the fuse panel is hung at point G, is raised to a vertical position on its hinge, and in doing so, the fuse panel is brought slightly above street level, and by virtue of the pivot at G maintains a vertical position. Further raising of the panel to a position wholly above street level is accomplished by revolving the screw F. Although the two charged panels are shown in the drawing back to back and close to one another, one pole may be much more removed from the other if desired. In fact, one pole could be in one street and the other round the corner in another street, the neutral block being in either containing pit; or, if desired, the panels could be arranged face to face in the same containing pit without the brick division wall shown.

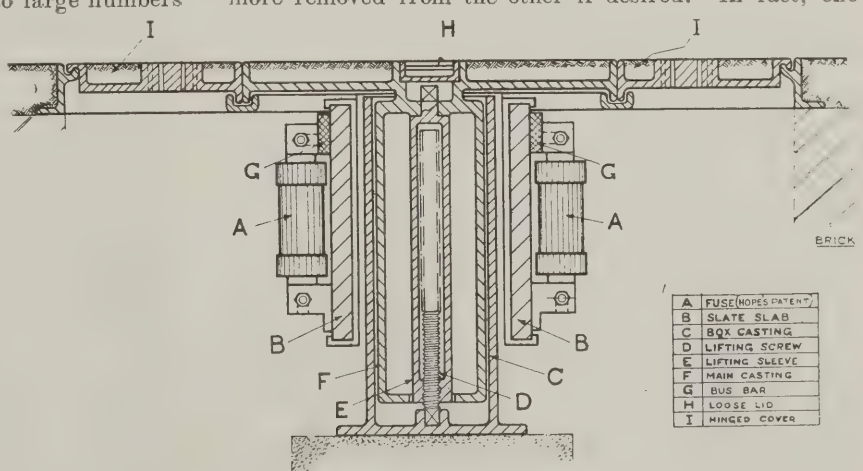


Fig. 2.—A 2,000-Ampere Distribution Box.

Fig. 2 shows a unit for distributing the same amount of energy as in the case of fig. 1, but here both charged panels and the neutral terminal block are mounted on a central support, so that if the lifting sleeve E is revolved at H, the whole mounting is raised above street level, bringing the fuse and terminal panels into a position above ground. The cubic space required for this design for

a d.c. unit is about equal to that required for the other design.

In both cases, the upward movement of the panels is permitted by the use of standard flexible cables connected between the tail-end box of the underground cable and the distributor terminal at the lower end of each fuse (or link). If the unit is also to be used as a feeder point, the feeder flexibles would be attached directly to the bus-bar shown in each case, and such feeder copper should perhaps be divided into two half section cables so that one half could be attached to each end of the bus-bar.

Supposing that the distribution is for a.c. circuits, then in the case of fig. 2, the third charged panel would be placed on the square central mounting opposite the neutral block, whilst in the swinging-panel design, a third containing pit would be required. It may be mentioned that the small street covers I in fig. 2 are suggested simply for the easy examination of the pits by the "box inspectors." The central cover rises with the electrical gear when the screw sleeve E is revolved.

The claims made for the new designs are: Simplicity; all the advantages of an overground pillar; no abnormal obstruction of the footpaths; entire freedom from short circuits; owing to the small depth of ground pit required, there is no necessity for drain to the sewer, as the gear would be well above the normal ground water level, the street-level frame being drained to the curb-edge; water troubles through condensation are non-existent because of the ease of ventilation and freedom from gas accumulation; their suitability generally for power distribution and for street lighting terminal boxes, for tramway and railway section dividers and feeder points, and for use in docks and all places where it is desirable to have unobstructed floors and gangways —designed on smaller lines, the gear can be adapted for wall or floor boxes in mills and like places; and the small space required for the distribution of comparatively large loads, thus cutting down the costs of installation.

It may interest readers to learn that application for the necessary letters patent for the new designs has been made.

Practical Experimental Work.

The Scientific Organisation of Procedure in Research.

By W. R. NEEDHAM.

IT is not every works which has an elaborately fitted research laboratory. Indeed, it is very few which have any laboratory at all, whether fitted elaborately or otherwise. At the same time, however, it would astonish many to know really how much experimental work is undertaken by small as well as large concerns. Such efforts may not be on any imposing scale, and yet may quite logically be classed as research work.

Most men with any experience worthy the name can recall times when something has gone wrong, and it has been up to them to worry out expedients or preferably discover remedies. In many instances this has involved days and days spent on the machinery itself, trying now one device, now another, until at last things have been so adjusted that normal functioning has been secured. This is no uncommon occurrence. Many men hate such a break as this occasions in the ordinary run of their work. Unless, however, it has all arisen by reason of some carelessness for which they are themselves responsible, they do far better to welcome these incidents as providing opportunity for finding out something very well worth while. In any case, very much depends upon the spirit or temper, and the mentality, of those who take matters in hand. The man who is all nerves and funks the whole job cannot in general be expected to succeed brilliantly. Of course, he may be a sticker, and fighting down his apprehensions really make good. Usually he isn't, and often his stage fright is not altogether unassociated with paucity in mental equipment for the task. Such chances may provide opportunity not available otherwise; they do offer scope in many instances for initiative and the garnering of valuable data. Where the results are other than expected, they are not necessarily on that account unimportant. As a matter of fact, what is dubbed a negative or dud result, may be far more instructive and useful than one in strict accordance with the experimenter's wish or preconception. In a very real sense there are no negative results. Once a man becomes at home in such work, he will be quite happy to observe what happens. He will then record what *does* happen. He will have overcome the novice's temptation (none the less real, because half involuntary) to jot down what he deems to be favourable and omit what he thinks otherwise. He will take care to make his notes impersonal, impartial. The true experimenter does not take sides. He is a reporter, not an advocate. Then afterwards he marshals his facts and deduces his laws, and is the better equipped to understand the real trend of things, to interpret the true meaning of the experiments he has undertaken. Thus, and thus only, can he hope to carry on and probe deeper. It may seem the longer way round. It is the truly scientific way. Often, even in apparently simple experiments, there is no short cut through. They who make a big splash sometimes do not get far. They may console themselves thinking they have won at a stroke, where others have failed at great length. Too frequently their remedies are hopeless quacks, and later the real doctor has to be called in.

It is obviously impossible to lay down hard and fast rules. Procedure varies to a large extent, according to circumstances. At the same time, however, there are certain broad and general considerations which are not unimportant. They assist one to get to grips. The more particular details are then all the more readily and logically attended to.

The present contribution closes with a brief discussion of these desiderata.

1. The person directly interested should either himself undertake and father the experiments, or else he should keep in close touch with the work.

It is always well to remember that however conscientious and painstaking a deputy may be, he cannot be expected, in the ordinary course of events, to understand fully the inwardness of things. Generally speaking, he will do what he is told to do, will work more or less closely to programme. But he will not carry out the whole in an altogether satisfactory manner. For him to do this, he needs instruction not merely in procedure, but more than anything else he needs to know what it is all about, and what it is for.

Thus if such work must be put in the hands of assistants, they should be given freedom of the facts; and the assistants chosen should be proven men, who can enter into the spirit of the enterprise. Good results cannot be expected unless the experimenter's interest is whetted and his zest awakened.

2. When determining the range and scope of tests, it is extremely advisable that careful thought be given to the subject. It should be studied from several angles. The kind of questions one asks one's self include:—

(*a*) What is it the experiments are to reveal?

(*b*) Is the problem one involving a few or many factors?

(*c*) How can one be reasonably sure the ground is really covered?

(*d*) What are the actual data sought?

(e) What readings and records are necessary? How many subsidiary details must be noted?

It is most annoying to find later that interpretation is obscured by reason of gaps in the records. A series of tests may have been taken, and the test sheets issued, and then it be found that certain highly important items have been overlooked during the tests. It is better to think beforehand than regret afterwards. In any case, the preliminary records should be in the hands of the responsible party before the apparatus has been dismantled. In this way, though the best may not have been secured, the worst may yet be avoided.

3. Having thought out the scheme, it should be translated into the black and white of definite instructions. A chart of procedure, carefully arranged, and fully informing, should be drawn up. It should embody the salient features and also the subsidiary particulars required.

Only the man really in the know is qualified to undertake this most necessary drafting of the plan of operations. He does well to supplement the written instruction with verbal explanation, preferably on the job itself. He cannot exonerate himself from blame unless he makes sure that those carrying out his orders really know what those orders are.

The more important the research is, the more necessary it is for him to nurse it well. His interest will stimulate that of those who assist him. Keen men become keen when they realise the importance of the work they do, and specially so when they truly grasp the hang of things. His frequent presence and keenness count for more than he probably realises.

4. As the experimental work proceeds, it is eminently desirable that one should keep constantly on the lookout for developments in the work itself.

Often enough it happens that results are being recorded which surprise the observer. They run counter to his predilections. It may thus be very advisable to modify one's original scheme in order to ensure that the real nature of the development be recorded. This in turn may suggest hopeful investigation along what would at first sight have appeared a side track.

This kind of experience has been fairly common to the workers in pure as distinct from applied science. Much of the success which has been won by these less trammelled pioneers has met them when they have turned aside to follow whither the trail has led.

It is essential that the experimenter be keen to observe just what happens, and as keen to trek where the scent draws him. The obstinate man, the prejudiced man, is useless in the pursuit of either pure or applied science; and experiments really have no meaning for him. His eyes are open for the phenomena which appear to support his theory; and he is blind to all else. In science and in its application to engineering, he is a drag, often a menace.

The writer is convinced he does well to urge these matters. He has several times been unable to reach a definite conclusion because tests which were supposed to be fully informing, omitted just the data which would have supplied the defect.

The plain fact is that often too little thought is given to the real object of the experiments; and thus only partial information is forthcoming. These things ought not to be. They need not be.

To mention one point only. Were adequate readings made, and records digested and analysed, how much more definite information we might have on the still somewhat obscure and very involved subject of lubrication. Tests are taken of all classes of commercial machines, many with oil ring bearings, many with flow lubrication. Exactly where is the zone of demarcation? It is not a wide zone. When is water cooling or oil cooling necessary? Usually we rely upon deductions from laboratory experiments carried out by eminent physicists on small bearings. Here, however, at the different works the very material is at hand. It ought to be readily possible to get a closer answer than needs must at present satisfy many engineers. Here surely is an excellent opportunity for putting theory to a fairly thorough test.

The Foundry Trades Exhibition.

Some Electrical Exhibits.

DUE no doubt to the present restricted train services, the number of exhibitors at the International Foundry and Allied Trades Exhibition, which was held at the Royal Agricultural Hall, London, N., from June 10th to 19th, was considerably short of what is usual. In spite of that, the exhibition was fairly well patronised, and the exhibits proved attractive, and a few of these were of interest to electrical people. The FOSTER INSTRUMENT CO. and the BOWEN INSTRUMENT CO. each had an interesting display of electrical pyrometers. The former company showed its new "Fixed Focus" radiator pyrometer, a "total radiation" type of instrument which is purely automatic in action. It is fitted with a patented removable window at the centre of the receiving tube to protect the sensitive part of the apparatus from damage by fumes and dust. The tube is also provided with ventilation openings, a diaphragm to prevent the entrance of stray radiation, and a special sighting device to facilitate accurate pointing. Among the other exhibits by this firm were the "Dial" recorder, which operates by producing a chain of dots by means of a carbon-paper sheet underneath a translucent circular chart; and a power-plant pyrometer, which has a concentric form of thermo-couple, in which the actual hot-junction is directly exposed to the temperature to be measured. Included in the range of pyrometric instruments by the Bowden Co. was a series of radiation instruments of which the "Pyro" was particularly interesting. In this instrument the radiation from the source of heat is received on a lens, which concentrates the radiant energy on a small thermocouple. A portable type of this instrument contains the optical system, the thermocouple, and the indicator complete in one unit weighing only 25 ounces and measuring 7 in. long by 4⅜ in. in diameter The instrument is provided with a wooden carrying case and shoulder strap. For permanent installations the "Pyro Tube" is offered for connection by an external cable to either an indicator or a recorder, and a number of these tubes may be attached to the same instrument for multiple-station equipments.

Messrs. S. WOLF & CO., LTD., made a special display of electric tools, including drilling and grinding machines. A portable stone-grinding and polishing machine which was exhibited is the latest addition to this firm's products. The driving motor is mounted on a base (on wheels), which also carries an upright which supports the driving end of a flexible shaft; this is belt-driven from the motor. The flexible shaft enables a wide range of work to be done, including moulding, sawing, bevelling, and polishing. A water tank is mounted at the head of the upright, a suitable tube from this enabling wet grinding to be done.

Among a selection of air compressors shown by Messrs. BROOM & WADE, LTD., was a 2-cylinder "Broomwade" directly coupled to and mounted on a common bedplate with a 25-h.p. driving motor. This machine will give an output of 130 cu. ft. of free air per min. at 100 lb. per sq. in.

Some interesting magnetic separating machines were seen on the stand of the RAPID MAGNETTING MACHINE CO., LTD. A patent combined sand sifter and magnetic separator was employed on the regeneration of used moulders' sand. The working part of the machine is a slightly-tilted horizontal revolving drum through which the mixture travels. The upper and major portion of the drum is a sieve, which discharges the pure sand; the splashings, &c., are attracted to the magnetising end at the bottom of the drum.

A portable electric sand riddle was exhibited by Messrs. JOHN MACDONALD & CO. This machine carries the sieve on a projecting arm and operates it in an elliptical motion with the necessary "kick" required in such a machine. The ¼-h.p. driving motor and the crank gearing are entirely enclosed and thoroughly protected from the sand. The whole is mounted on three legs, one supplied with a roller, enabling the machine to be moved about as with a wheelbarrow.

Messrs. JAMES KEITH & BLACKMAN CO., LTD., showed a newly-designed dust and grit separator for the removal of grit from flue gases. In this device the separator and fan are arranged as a single unit.

The TURBINE FURNACE CO., LTD., exhibited the "Vulcan" boiler tube and flue cleaner. It is steam operated and is equipped with up to 5 or 6 parts for the steam outlets to the required parts of the boiler. The ports are governed so that only one is open at a time, the last port being automatically closed as the next one is opened.

A special non-commercial and technical portion of the exhibition was organised to show something of the research carried on in the industry (foundry), its history, apparatus available for the scientific control of processes, and a survey of some of the raw materials used. A number of special furnaces were seen on the stand of the NATIONAL PHYSICAL LABORATORY, including a high-frequency induction furnace suitable for 20-lb. melts of iron or copper alloys. The Research Department, Woolwich, showed some of the applications of X-rays for the examination of metal castings and forgings. By means of one set of equipment it is possible to take a radiograph through over 4 in. of steel and to reveal an internal hole of ⅛ in. diameter in the centre of the specimen. The Universities of Sheffield and Birmingham, the British Non-Ferrous Metals Research Association, and the British Cast-Iron Research Association also exhibited.

D

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

The "Electrical Review" Index.—The Index to Vol. XCVIII (for the half-year ending June 30th, 1926) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made at once to the Publisher, 4, Ludgate Hill, E.C.

Company Law Amendment.—A lecture traversing the report of the Company Law Amendment Committee was given on June 16th by Mr. Herbert W. Jordan, under the auspices of the Incorporated Secretaries' Association, to members of that body and representatives of the banking and accountancy professions.

Trade with Newfoundland.—In a report to the Department of Overseas Trade (Stationery Office, 2s. 3d. net) Mr. F. W. Field, Senior Trade Commissioner in Canada and Newfoundland, states that the colony's trade is in a position which indicates that an improvement might be made so far as the United Kingdom is concerned. In 1923-24 the total imports of Newfoundland were valued at $27,677,182; of this Canada supplied $11,569,434, the United States $8,589,290, and the United Kingdom $6,250,360. In the succeeding year, however, of a total of $36,404,674, Canada's share was $13,759,788, that of Great Britain $11,357,585, and that of the United States $9,976,292. The merchant firms of St. John's are an important factor in import trade. The people of Newfoundland do not approve of the appointment by British firms of agents in Canada to attend to business in Newfoundland.

Newfoundland Tariff Changes.—The *Board of Trade Journal* publishes a list of alterations in the Newfoundland customs tariff which took effect on May 19th last. Among the goods affected are steam engines, i.c. engines, electric generators and motors, air compressors and steam boilers for use in connection with mining machinery, which are to be admitted free of duty; radio "machines" and apparatus which are subject to an *ad valorem* impost of 50 per cent.; and welding outfits which will pay 35 per cent. *ad valorem*.

The Registration of Contractors.—At the last meeting of the Executive Committee of the National Register of Installation Contractors the following were accepted, while 11 applications were refused and one was withdrawn :—

Carwin Electrical Co., Preston
Mulligan Bros., Dublin
Webb & Co., Birmingham
Spouge, C. R., Lincoln
Rayton, S., & Co., Leeds
Patterson, R. H., Jesmond, Newcastle-on-Tyne
Brightside Foundry & Engineering Co., Ltd., Birmingham
McCall, W. A., Blackburn
Milner, E. H., High Wycombe
Teesdale & Jones, Swindon
Carr, Harold, Leeds
Davidson, Taylor & Co., Sunderland
Smerdon, T. H., N.W.5
Parker, Winder & Achurch, Ltd., Birmingham
Birch & Evans, Walsall
Cross, G. & A. J., Tunbridge Wells
Brady, G., & Co., Manchester
Sigsworth, A. B., & Co., South Shields
Saunders, H., & Son, Horsham
Fletcher & Thurley, Manchester
Warburton, W., & Co., Ltd., Halifax
Smith, W., & Son, Weymouth
Dudley, C., & Co., Blyth
Kent, F., Clonmel, Tipperary
Phillips, H. S., Weston-super-Mare
Riddels, Ltd., Belfast
Stoves, L., South Shields
Thomas, A. J., Newton Abbot
York Corporation Electricity Department
Beckenham Urban District Council Electricity Department

Telephone Apparatus Contracts.—The Sterling Telephone and Electric Co., Ltd., informs us that it has recently received a number of important overseas contracts, including one valued at about £80,000 from the Commonwealth of Australia for telephone switchboards, one for switchboards from the Union of South Africa, and another for wall and pedestal telephones and switchboards from Argentina.

Swedish Electrical Exports.—The *Swedish Economic Review* (the official organ of the Swedish Board of Trade) states that during the first four months of the current year electrical machines to the value of 8,277,000 kr. and telegraph and telephone apparatus valued at 1,650,000 kr. were exported from Sweden. In the corresponding period of 1925 the figures were 4,700,000 kr. and 1,962,000 kr. respectively.

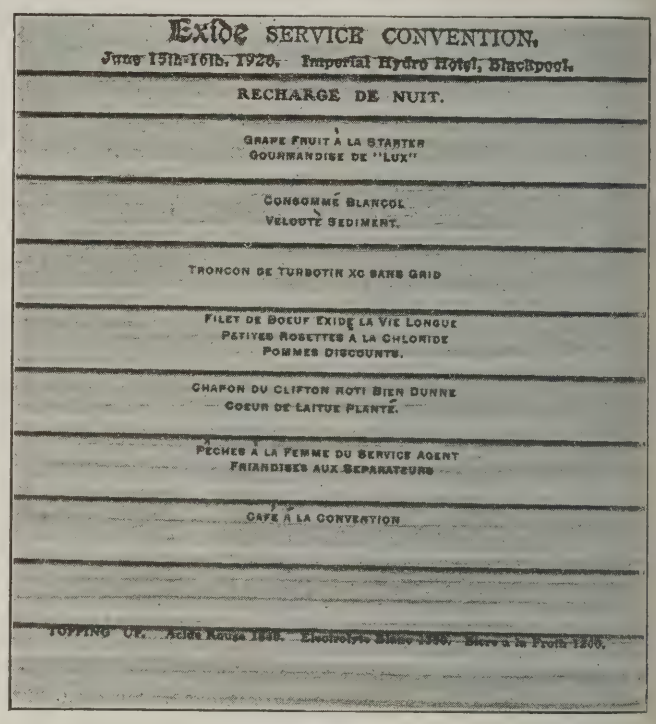
Difficulties of the Swedish Market.—In the course of a report on this subject a representative of the Federation of British Industries says that British manufacturers endeavouring to obtain a footing in the Swedish market should class Sweden as a manufacturing country. In all engineering matters Sweden plays a leading part and has an established position in this industry. It is true that certain lines of British products will always find a sale, but, generally speaking, Sweden is determined to manufacture as much and import as little as she can, and in this policy she has the assistance of a protective tariff on goods which can be manufactured locally. A country where the currency has remained steady for several years has obvious attractions for the foreign exporter, and it is probably a fact that Sweden, in comparison with the extent of her purchasing power, has had more offers of foreign agencies than any country in Europe.

Household Appliances.—A Household Appliances Section of the London Chamber of Commerce is being formed. At a luncheon to be held at the Holborn Restaurant on Monday, July 12th, Mr. F. W. Goodenough will deliver an address on "The Advantages of Co-operation in the Household Appliances Industry."

Adhesive Tape.—Messrs. A. H. Hunt, Ltd., have sent us three samples of their adhesive insulating tape. Two of the samples are in tins of different sizes; the third is wrapped in tinfoil. The tape is supplied in attractive cartons in four colours for counter displays.

Foreign Orders for Germany.—The *Deutsche Bergwerks Zeitung* learns from Helsingfors that as a result of the public adjudication for the supply of electrical cables and insulators to be used in the construction of the largest water power works in Eastern Europe, on the Imatra waterfall, the Finnish State Water Power Commission has placed large orders with the German electro-technical industry. The German telephone works have received fairly large orders for telephones, and contracts for the supply of insulators and cables have been signed with the Brown, Boveri Company, the Gutehoffnungshütte A.G. and the Hermsdorf-Schomburg Isolatoren G.m.b.H.—*Reuter's Trade Service* (Essen).

An "Exide" Convention.—Last week the annual convention of "Exide" battery service agents was held at Blackpool, when there was an attendance of about 200. The meetings were held in the large ballroom of the Imperial Hydro and the subjects discussed included developments of new designs, regulations affecting battery workshops, new and improved methods of charging batteries, &c. It is claimed by the Chloride Electrical Storage Co., Ltd., that these conventions prove of real value to a great proportion of the general public. The annual dinner was held on June 15th. A novel and apposite menu was provided, printed on wood separators. One of these is depicted herewith.


Exide SERVICE CONVENTION.
June 15th-16th, 1926. Imperial Hydro Hotel, Blackpool.
RECHARGE DE NUIT.
Grape Fruit à la Starter
Gourmandise de "Lux"
Consommé Blancol
Velouté Sediment.
Tronçon de Turbotin XC sans Grid
Filet de Boeuf Exide la Vie Longue
Pétives Rosettes à la Chloride
Pommes Discounts.
Chapon du Clifton Roti Bien Dunne
Coeur de Laitue Plenté.
Pêches à la Femme du Service Agent
Friandises aux Separateurs
Café à la Convention
TOPPING UP. Acide Range 1240. Electrolyte Blend 1300. Brew a la Profit 1200.

A Novel "Exide" Menu Card.

Employment during May.—Employment in the engineering industry during May was very bad, being seriously affected by the general strike and the coal stoppage. The general average of unemployment throughout the industry rose from 10.4 per cent. in April to 15.8 per cent. The electrical engineering branch was badly hit, the figure in this case rising from 6.6 to 10.6 per cent. The electrical wiring and contracting industry showed an unemployment figure of 10.3 per cent., as compared with 9.1 per cent. in April, although the figure was better than in May, 1924, when it was 13.3 per cent. The percentage of unemployed in the electrical cable, wire, and electric lamp manufacturing group rose from 6.5 to 9.6.

Lead.—Reporting on June 19th, Messrs. James Forster and Co. stated: "Consumers in this country, owing to the importation of large quantities of foreign coal, are now obtaining their full supplies of fuel, and are therefore consuming lead at the normal rate, the Home trade being particularly busy. Arrivals, on the other hand, so far this month are on the short side, the deficiency being made up by deliveries of warehouse lead. The present position of lead seems to us to be fundamentally sound, and we do not expect to see the present reaction carried very far, but look for higher prices again in the near future." The Board of Trade returns for May show:—Imports, 18,752 tons; exports, 1,005 tons, leaving for Home consumption 17,747 tons.

Irish Free State Electrical Imports.—The Irish Free State Ministry of Industry and Commerce has issued detailed figures of imports for last year as compared with 1924. From these we have compiled the appended table, showing the value of the total imports of electrical machinery and apparatus into the Free State and the amount attributed to the United Kingdom as country of shipment but not necessarily of manufacture:—

	Total.		U.K. Share.	
	1925.	1924.	1925.	1924.
	£	£	£	£
Electric wires & cables	123,620	78,416	92,367	62,619
Telegraph and telephone instruments and apparatus	28,961	28,531	27,909	28,406
Electric lamps and parts	58,917	61,913	56,878	59,221
Batteries and accumulators	36,418	32,839	34,048	29,860
Radio sets and parts ...	84,966	93,753	83,225	91,414
Other electrical goods and apparatus ...	70,703	98,535	67,355	94,412
Electric generators ...	18,042	13,313	13,822	12,265
Electric motors	23,465	17,330	22,811	16,585
Other electrical machinery	73,873	65,917	63,261	51,777
Totals ...	£518,965	£490,547	£461,676	£446,559

It will be seen that while wide variations are shown in the different classes of goods, the 1925 imports show an increase of £28,418 as compared with those of the preceding year. All but £57,289 of the goods came from the United Kingdom and of the balance £38,901 is attributed to Germany, £8,334 to Belgium. £5 to Switzerland—the last being a drop from £12,762 in 1924—and £9,049 to "other countries."

Japanese Developments.—*Commerce Reports* states that the over-development of electric power enterprises has caused a surplus of power. In consequence, business in electrical power-plant equipment is expected to slow up for about a year. In the meantime the power companies are promoting sales and encouraging the use of consuming devices for domestic and other purposes.

Trade Announcements.—MESSRS. MAXTED & KNOTT, LTD., have closed their offices at Dunstable and Queen Anne's Gate. Their new address is 82, Victoria Street, S.W.1. Telephone: Victoria 0529; telegraphic address: "Rightfully, Sowest, London."

The address of TRACTOR TRADERS, LTD., is now: Thornycroft House, Smith Square, S.W.1. Telephone: Victoria 7609; telegrams: "Tracenergy-Parl, London."

The S. H. COLLETT MANUFACTURING Co. has moved to 60, Pentonville Road, N.1. Telephone No.: North 0791.

As an impression is abroad that recent financial difficulties would necessitate the closing down of FULLER'S UNITED ELECTRIC WORKS, at Chadwell Heath, we are asked to state that the business is being carried on as usual under the control of Sir John Mann, as receiver and manager.

Owing to the expansion of their London business, MESSRS. HIGGS MOTORS have taken larger offices. Their London address is now 170, Strand, W.C.2.

Catalogues and Lists.—THE BLACKADDA RADIO Co., LTD., 48, Sadler Gate, Derby.—A booklet (price 1s.) containing details of the company's system of building various types of radio receiving sets from standard parts.

SIEMENS & ENGLISH ELECTRIC LAMP Co., LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 150, containing illustrations and prices of wall brackets, lanterns, electroliers, pendants, and other electric lighting fittings.

BRITISH CENTRAL ELECTRICAL Co., LTD., 6-8, Rosebery Avenue, E.C.1.—A catalogue (124 pp.) of industrial lighting fittings, conduit and fittings, cables, switchgear, instruments, &c. Fully illustrated and priced.

THE MARCONIPHONE Co., LTD., 210-212, Tottenham Court Road, W.1.—A well-illustrated price list of "Marconiphone" and "Sterling" radio receivers, accessories, and components.

MESSRS. PRIESTLEY & FORD, 3, Carr's Lane, Birmingham.—A comprehensive catalogue of radio apparatus and a pamphlet dealing with "Pye" receiving sets and components. Illustrated and priced.

BRITTAIN'S ELECTRIC MOTOR Co., 110, Cannon Street, E.C.4.—Illustrated pamphlets advertising the firm's single- and polyphase motors.

MARCONI'S WIRELESS TELEGRAPH Co., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1,056, containing an illustrated description of the Marconi recording receiver.

THE FALKIRK IRON Co., LTD., Falkirk, Scotland.—Publication No. 487, dealing with the method of cooking employing the "Falco" "inducer."

THE J. K. W. MANUFACTURING Co., 1 and 2, Bridge Street, Middlesbrough.—An illustrated pamphlet giving details and prices of "J. K. W." solid-contact lampholders.

THE IRON & NICKEL BATTERY Co., LTD., 17-19, Cockspur Street, S.W.1.—A descriptive pamphlet dealing with the company's "Ionic" nickel-iron accumulators.

MESSRS. J. H. TUCKER & Co., LTD., King's Road, Tyseley, Birmingham.—Leaflet No. 200, advertising the company's "Telac" 15-A plugs and sockets. Priced.

THE GLOBE ENGINEERING Co., LTD., Brighouse.—List No. 14, containing particulars of the company's battery-charging motor-generators and auxiliary equipment.

MR. J. R. MORRIS, Imperial House, 15-19, Kingsway, W.C.2.—A booklet containing hints on the choice of radio batteries and advertising "Columbia" products; with useful technical data.

THE VACUUM OIL Co., LTD., Caxton House, Westminster, S.W.1.—No. 24 of the "Gargoyle" Technical Series dealing with the lubrication of horizontal steam turbines for stationary plant.

MESSRS. E. P. ALLAM & Co., LTD., 107-109, Gray's Inn Road, W.C.1.—A stock list of d.c. motors, &c.

THE ENGLISH ELECTRIC Co., LTD., Queen's House, Kingsway, W.C.2.—Publication No. 768, containing an illustrated description of plate mill equipment installed at the Consett Iron Co.'s works.

MR. PAUL DIENY, 21, Laurence Pountney Lane, E.C.4.—A pamphlet advertising a crushing, mixing and separating mill for foundries.

Bankruptcy Proceedings.—J. M. LONGE, 1, Queen's Gardens, Lancaster Gate, W.—The public examination of this debtor, who formerly traded as an electric lamp manufacturer, was held on June 18th, before Mr. Registrar Francke, at the London Bankruptcy Court. He failed in April last with liabilities of £8,866 and assets "cash in hands of solicitor," £185. The debtor said that in July, 1920, he commenced and afterwards carried on business in partnership with two persons named Edgehill and Shear, as manufacturers of electric lamps under the style of "The Eclat Electric Lamp Company." He took no part in running the business, but only provided money; he paid £1,800 for a one-third share of the business and in addition advanced over £2,000 for its purposes. During 1921 he commenced proceedings for a dissolution of the partnership and in December of that year a Receiver was appointed to wind up its affairs. Witness experienced some difficulty in getting matters settled and, in fact, they were not all wound up yet. He personally discharged the liabilities of the partnership, although his partners were equally liable and he was of opinion that they owed him about £5,000. He had not returned them as book debtors, because he did not know their present whereabouts, and he was unable to recover anything. His total loss over the partnership was about £7,000. In January, 1923, witness purchased for £8,000 the Spencer Lamp Works and the Standard Lamp Works at Wimbledon, and during the next six months carried on those businesses under management. He gave bills for £2,000 on account of the purchase price, which were duly met, and the remaining £6,000 was left on mortgage. Miss Stewart, a creditor for £4,350, guaranteed advances by the bankers for the purpose of that business and also of buying a farm. In July, 1923, witness registered "The Eclat Electric Manufacturing Co., Ltd.," with a nominal capital of £500, which acquired the Wimbledon businesses and as consideration he was allotted £13,500 second mortgage debentures. First mortgage debentures were given in respect of the mortgage, and debtor was appointed one of the directors. In June, 1924, the company obtained a loan of £11,000, from the Westminster Bank, and he guaranteed the repayment of the loan. The petitioning creditor signed a guarantee to the amount of £3,500, and witness gave a guarantee for the same amount. He (debtor) also deposited with the bank, as security for the loan, shares in various trading concerns to the value of £9,000. A debenture holders' receiver was appointed on February 14th, 1925, because although the company was doing fairly well, the debenture interest had not been paid. Towards the end of 1925 the petitioning creditor called upon witness to discharge his guarantee; he could only do so to the extent of £300 and bankruptcy proceedings were instituted. The Bank sold off the securities which he had deposited, and all his other assets, including some valuable furniture, had been disposed of. In September, 1923, witness registered another company called "The Eclat Electrical Accessories (Paddington) Company, Ltd.," with a nominal capital of £1,000, to carry on business as dealers in electrical accessories. He acted as a director, but the company was not a success and he did not know anything regarding its present condition. The debtor attributed his insolvency to the failure of the two before-mentioned companies and to his liability under the guarantee for £3,500, for which he received no consideration. Apart from that guarantee he estimated his loss over the companies at £5,500. The examination was concluded.

C. J. NICHOLS, trading as C. J. Nichols & Co., 7, Park Street, Bridgend, Glam., electrical engineer.—The adjourned public examination of this debtor was held recently at the County Court, Bridgend. The deficiency was estimated at £1,308. Debtor stated that he had lost money on contracts through unforeseen events. It was stated that one of the trustees had died, and it was necessary to appoint a new one. The examination was adjourned.

E. H. TANSEY, wireless dealer, 65, Factory Road, Hinckley.—Receiving order made June 12th, on debtor's own petition. First meeting, June 25th, at the Official Receiver's offices, 1, Berridge Street, Leicester. Public examination, July 2nd, at the Castle, Leicester.

C. W. WILSON, electrical engineer, Wepre, Higher West Cross Lane, Swansea.—Receiving order made June 16th, on creditor's petition.

S. C. RAPSON, C. L. BURRILL and A. J. HEFFER (Suburban Electrical and Maintenance Co.), electricians, 2, Plough Yard, Shoreditch.—Last day for proofs for dividend, July 2nd. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

J. H. PAINTER (Venables & Co.), electrician, 99, The Broadway, Cricklewood, N.W.—First and final dividend of 1s. 1d. in the £, payable at the offices of Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C.

R. C. J. WARNER and S. R. PEARCEY (Warner & Co.), electrical and radio engineers, 28, Hill Street, Poole.—Receiving order made June 10th, on debtors' own petition.

A. E. S. CHALLENER, radio engineer, 277, St. Sepulchre Gate, Doncaster.—First meeting, June 23rd, at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination, July 1st, at the County Court Hall, Sheffield.

J. R. BARKER, wireless dealer, Tanshelf House, Front Street, and Gillygate, Pontefract.—Last day for proofs for dividend, June 30th. Trustee, Mr. B. S. Briggs, 21, King Street, Wakefield.

Company Liquidations.—REFLEX RADIO CO., LTD., 198, Lower Clapton Road, Clapton.—The first meetings of creditors and shareholders were held on June 14th at Carey Street, W.C. Mr. J. Barwick Thompson, Official Receiver, reported that the winding up order was made on May 11th, 1926, upon the petition of Watson & Jones, Ltd., creditors for £191. The company was formed in September, 1925, with a nominal capital of £1,000, to acquire as a going concern the business of wholesale factors of radio components, carried on under the style of Reflex Radio Company. The business had been carried on by A. T Izzard and R. E. Izzard (who were the first directors), since October, 1923. The company agreed to pay for the business £1,150, to be satisfied by the issue of a debenture for £1,000 and £150 in shares. The directors had stated that the business was carried on successfully until January, 1926, when the demand for the "Reflex" coil, of which the company had obtained the sole selling rights, considerably decreased owing to the competition of a similar coil and this resulted in the company trading at a loss On March 18th, 1925, owing to the debenture interest being in arrear, and also to the fact that creditors were pressing for payment, the debenture holders appointed Mr. F. Davies, as receiver and manager. That gentleman carried on the business until May 27th, 1926, and had realised most of the stock and book debts. He had paid off the debentures and handed to the Official Receiver a balance, with the result that, assuming the other book debts realised anything like the value placed upon them, there would be assets to the amount of £385, to meet the unsecured claims of £1,710. The failure of the company was attributed to excessive competition, heavy cost of advertising, and delay in the delivery of coil plugs at a time when there was a considerable demand. In the opinion of the Official Receiver, however, the failure was due to mismanagement and excessive expenditure. Considerable discussion ensued respecting offers sent out by the debenture holders' receiver to purchase the unsecured claims at 1s. and 3s. in the £ respectively, and eventually the chairman, in whose hands the liquidation was left, said it might be his duty to report the facts to the Court.

RADIO EQUIPMENT CO., LTD., 5, Dyer's Buildings, Holborn, E.C.—Under a compulsory winding up order made against this company last March on the petition of a creditor, Mr. G. D. Pepys, Official Receiver, reports that accounts have been lodged showing unsecured debts of £5,575; preferential claims, £37; loans on debts, £980; assets valued at £314; and a deficiency of £6,273 to the shareholders, the issued capital being two ordinary shares of £1 each. The company was formed as a private company in July, 1922, with a nominal capital of £100, to carry on business as manufacturers of and dealers in radio equipment. The promoter of the company was P. J. White, who states that he formed the company primarily for the purpose of acting as the selling agents for the manufactures of John Hall & Co., Birmingham. The directors at the date of the winding up order were the promoter and G. F. Ostins, the proprietor of John Hall & Co., who each held one of the only two shares issued by the company. In November, 1922, the company entered into an agreement with Ostins, under which it was given for a term of five years the exclusive selling agency of the "wireless accessories" output of John Hall and Company, and a considerable part of its trading has consisted in conducting this agency. The company also opened small "assembling" depôts at Stratford and Birmingham, at which receiving sets were manufactured and placed on the market as its own products. These depots, however, had to be discontinued owing to lack of capital, and in October, 1923, the directors formed Radio Works, Ltd., and to this company was transferred the goodwill, plant, stock-in-trade, &c., of the Birmingham depôt. No independent valuation of the depôt appears to have been made, and the Official Receiver states that he will require to be satisfied that the amounts apportioned were the true values and estimates or approximately so. Radio Works, Ltd., went into voluntary liquidation in February, 1926, and by its liquidator (who is also the liquidator of Radio Equipment Co., Ltd.), is claiming to be a creditor for goods supplied to the company. A debenture securing £980 was given by the company to Lighting, Heating and Glass, Ltd., but having been made within three months of the commencement of the winding-up it could not be a valid charge for more than £558, representing the value of goods supplied. The failure and insolvency of the company is attributed by White to foreign competition and insufficient capital. In the opinion of the Official Receiver, the rate of remuneration drawn by White and L. C. Russell (who acted as a director for a time) has substantially increased the financial strain and contributed to the failure of the company. On April 22nd, 1926, the debenture holder appointed Mr. C. Latham as receiver and the Official Receiver has handed to that gentleman the small amount which he has so far collected from the book debts and certain of the books. Mr. R. L. Taylor, I.A., Coventry House, South Place, E.C., has been appointed liquidator, with a committee of inspection.

SOUTHERN RADIO SUPPLIES, LTD., Junction Road, Eastbourne.—A meeting of creditors was held recently at the offices of Messrs. Edmonds, Clover & Jones, Eastbourne, when the chair was taken by Mr. P. M. Jones, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. A statement of affairs was presented, which disclosed liabilities of £470 and assets amounting to £312, leaving a deficiency of £158. The issued share capital of the company amounted to £300, so that there was a total deficiency of £458. The position of the company was attributed to insufficient capital and losses on trading. It was decided that the voluntary liquidation of the company should be continued with the present liquidator.

ANDERSON, ANDERSON & ANDERSON.—At a special meeting on June 11th, it was decided to amalgamate the business of the company with Anderson's Bristol Rubber Co., Ltd., W. McKee and Co., Ltd., and Geo. Cording, Ltd., and with that view to wind up the company voluntarily and appoint Mr. G. Wilkins, of 52, Coleman Street, E.C., liquidator, with powers to consent to the registration of a new company under the name of Anderson's Rubber Co., Ltd.

NELSON ELECTRIC CO., LTD.—The petition of Eugene Durand and Co., of India Street, Crutched Friars, E.C., for an order for the compulsory liquidation of this company, was dismissed by Mr. Justice Romer in the Companies' Winding-Up Court on June 22nd. Counsel for petitioners said that they had been paid in full, and he asked for the petition to be dismissed.

BRITISH BARIMAR-THERMIT WELDING CO., LTD.—Winding up voluntarily. Liquidator, Mr. F. Rowland, 3, Thames House, Queen Street Place, E.C.

CAR LIGHTING & IGNITION CO., LTD.—Winding up voluntarily. Liquidator, Mr. E. R. Bradley, 584, Christchurch Road, Boscombe.

TRENT BRIDGE RADIO CO., LTD.—A meeting of creditors was held on June 22nd at 44, Parliament Street, Nottingham.

Private Arrangements.—COMTON WIRELESS MANUFACTURING CO., 26-28, Bartholomew Square, Old Street, E.C.1.—The creditors interested herein were called together on June 14th, at the above address, when the chair was taken by Mr. P. Houston, of Messrs. Corfield & Cripwell. No statement of affairs was presented but Mr. J. Mortimer, accountant, stated that the debtors had executed a deed of assignment to him for the protection of the assets that day. He had been consulted some two months earlier with a view to obtaining capital owing to creditors pressing. He read a balance sheet for the nine months ended December 31st, 1925, which showed trade creditors at £2,496, and a bank overdraft of £161. A Mr. Freeman was a cash creditor for £250 and there were sundry creditors for £232. The assets were valued at £3,907. A further balance sheet as at May 31st last showed that the trade creditors amounted to £2,508; the bank's claim was £136; Mr. Freeman was a cash creditor for £81 and there were sundry creditors amounting to £479. The assets were smaller. Several creditors held stock as security for their debts. There were three partners in the business. Two creditors had levied execution and a sale had been advertised by the sheriff for the following day. It was decided that the meeting should be adjourned for a week. The following are creditors:—

	£		£
Ebonestos Insulators, Ltd.	102	Robinson & Sons, Ltd.	52
Davis & Timmins, Ltd.	167	Barrel Polishing & Plating Works	22
Spears & Co.	88	Weber & Fluck (Switzerland)	107
Fahr & Co. (Switzerland)	340	Franklin, T. H., & Co.	171
Creasey, Geo., & Sons	23	Smith & Sons	120
Lowenadler, F. W.	540	Trader Publishing Co., Ltd.	53
Barnard & Crannis, Ltd.	40	Bankers	136
Crystalate Mfg. Co.	122	Scadding & Bodkin	53
Franklin & Freeman	405	Samuels, A. E., & Co.	249
B.D. & Co. (E. A. Boynton), Ltd.	68	Freeman, A.	81

A. & M. HAMILTON, LTD., 148, Fenchurch Street, and London Street, E.C., radio and cycle dealers.—A meeting of creditors was held on June 14th at the offices of Messrs. De Meza and Menasse, solicitors, Bishopsgate, E.C., when Mr. De Meza reported that the liabilities to trade creditors amounted to £650 and there was an amount of £725 due in respect of the rent of the two premises. The assets were valued at £700. An overdraft at the bank for £80 had been guaranteed. There were no cash creditors. The company was formed about twelve months ago with a nominal capital of £1,000, of which 400 shares had been taken up, 200 shares being given in part payment for stock. He was unable to get figures relating to the trading, but said that the present position had been brought about chiefly by the very high rents which were paid and insufficient profit. An offer was made of a composition of 5s. in the £, payable by monthly instalments and guaranteed. That offer was subsequently increased to 6s. 8d. in the £. Several creditors intimated that they would be willing to accept the offer, and it was decided that a committee of inspection should be appointed.

Dissolutions of Partnership.—HOOPEL & FARMBOROUGH, automobile and electrical engineers, 7, Loveridge Road, Brondesbury, N.W.—Messrs. F. C. Hoopel, A. E. Farmborough and W. T. Sharpe has dissolved partnership. Mr. Farmborough will attend to debts.

DASH WIRELESS SERVICE, dealers in wireless apparatus, 241, Park Road, Aston, Birmingham.—Mr. H. A. Burton and Mr. A. H. Onions have dissolved partnership.

DENNIS & JAMES, electrical engineers, Triumph House, 189, Regent Street, W.1.—Mr. R. Weaver and Mr. R. A. J. Brett have dissolved partnership. Mr. Weaver will attend to debts and continue the business under the same style.

Book Notices.—We have received a copy of the Glasgow Convention number of the *Electrical Age for Women* (6d.), the organ of the Electrical Association for Women. We cordially welcome our new contemporary and congratulate the editress, Miss Haslett, on the interesting appearance of this the first quarterly issue. Greetings received from many sources are published, also notes respecting E.A.W. activities, and a number of articles on such subjects as how electricity is made; light for the modern home; electrical refrigeration of food; electric cooking, &c.

"The Priestman-Atkinson System of Co-operative Production." (7 pp. and 4 diagrams.) London: Henry Atkinson and Co.—This pamphlet is one of a series (No. 5) in which is set forth a profit-sharing scheme involving the payment of a collective bonus on the increase of a whole workshop above a certain standard. It is claimed that this method eliminates the disadvantages of both day rates and piece rates.

"Science Abstracts" (A and B). Vol. XXIX, Part 5, May 25th, 1926. London: E. & F. N. Spon, Ltd. Price 3s. each.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV, June, 1926, No. 354. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"Elements of Alternating Currents and Alternating Current Apparatus," by J. L. Beaver. Pp. viii + 370; figs. 301. London: Longmans, Green & Co. Price 18s. net.

"Modern Telpherage and Ropeways," by H. Blyth. Pp. xv + 156; figs. 127. London: Ernest Benn, Ltd. Price, 27s. 6d. net.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLX, No. 6. June, 1926. New York: The Institute. Price $1.

The Summer Number of *Punch*, which has this week made its appearance (1s.) is quite up to the usual standard of excellence in respect of both humour and illustrations.

"Coal- and Ash-Handling Plant," by J. D. Troup. Pp. viii+148; illustrated. London: Chapman & Hall, Ltd. Price 13s. 6d. net.

The Timber Trade.—Our Timber Trade correspondent reports that the troubles in the coal industry have retarded the long overdue improved demand for soft timber for general and building purposes. Imports, however, were much lighter last month, and have been much lower this year compared with the early months of 1925. Consumption is fairly good, and stocks on the market, although ample, are not too large, especially in view of the much larger demand expected when trade generally resumes. Prices are steady. In the hardwood trade, imports have shown a decline; stocks, however, are still large and the demand dull, but merchants are anticipating much better inquiries from general consumers when trade is once more set going. Mahogany of the poorer qualities is obtainable at reasonable rates, as are also British and American woods. The better qualities of all descriptions, however, continue to be firm in value.

Industrial Relations.—The annual general meeting of the National Industrial Alliance, originally arranged for May 11th but postponed owing to the general strike, has been fixed for Wednesday, June 30th, at Gatti's, London. At a luncheon meeting at 1 o'clock speeches are to be delivered by the Rt. Hon. J. H. Thomas, Colonel F. Vernon Willey, Mr. Charles Sitch, M.P., and Mr. W. L. Hichens. The speeches, together with that of the chairman, Sir Edward Manville, are to be broadcast. Trade union and employer delegates from some sixty centres are to attend the meetings.

Big Turbo-Generator Contract.—MESSRS. BRITISH BROWN, BOVERI, LTD., inform us that the American Brown-Boveri Electric Corporation has just obtained an order from the United Electric Light & Power Co., New York, for a turbo-generator designed for a continuous output of 160,000 kW, to be installed in the Hellgate power station. This plant is about three times as large as the biggest turbo-generator set yet built and put into operation. We understand that the business was secured against the keenest American competition. The reason for a set of this size being ordered is to be found in the great value of floor space in and around New York. Plant of the greatest possible capacity has to be got into the space still available in this power station, amounting to 67 ft. by 39 ft. The set now on order will be of the cross compound type, *viz.*, one high-pressure cylinder at 1,800 r.p.m., and one double-ended low-pressure cylinder at 1,200 r.p.m., driving respectively generators of 75,000 kW and 85,000 kW, wound for 13,800 volts.

American Competition in Chile.—The Valparaiso correspondent of the Federation of British Industries reports that in Chile prices generally seem to be higher and steadier again, and competitive price-cutting would appear to have become less prevalent. United States prices, however, now seem lower than they have been for some time, and on a recent quotation for electrical goods, British firms were under-quoted by 10 per cent. on the actual cost of the goods, without taking into consideration commission of any kind.

The National Radio Exhibition.—The National Association of Radio Manufacturers and Traders informs us that an erroneous impression is abroad that this exhibition, which is to be held at Olympia in September, is being organised solely by that body. Such an impression could not have been gained by our readers as we made it clear in our recent note and leaderette on the subject that the Society of Radio Manufacturers was associated with the N.A.R.M.A.T. in the promotion of the show.

Social Events.—The Peterborough and District Electricity Users' Association recently gave a dinner to the volunteers and staff who maintained the supply from the Corporation's power station during the general strike.

An informal golf match was played on June 6th between golfing members of the directorates and staffs of the Automatic Telephone Mfg. Co., Ltd., and Peel-Conner Telephone Works, on the latter's course. In the singles, comprising 18 contests, the A.T.M. secured 9½ points and their opponents 8½ points. In the foursomes the Peel-Conner representatives made the best showing (4½ points to 3½); a notable victory was secured by Sir Alexander Roger and Mr. E. A. Mellinger over Sir Wm. Noble and Mr. W. Cook.

The fourth annual sports and gala of Siemens Sports Club took place on the club's sports ground, Charlton, on June 19th. The weather was excellent and the heavy programme of fifty-five events was carried through well to time without a single hitch. Callender's Prize Band played throughout the afternoon, and in addition to the actual racing, jumping, &c., there were numerous side shows and the children were not forgotten. The attendance at the sports amounted to about 5,000. Sir Walter R. Lawrence, Bt., a vice-president of the club, presented the prizes.

Coal Shortage.—It is reported that the Stanton-Holwell and Riddings works of the Stanton Ironworks Co., Ltd., are closing this week-end owing to lack of coal. About 7,000 employés are affected.

Insurance Against Bad Debts.—In a recent issue of the *Financial Times*, Sir Drummond Drummond Fraser, K.B.E., dealt with the value of credit in the commercial world, touching upon the collapse of credit caused by the war. From this he turned to the question of bad debts, and stated that before the war German banks and insurance companies performed a great work in stimulating German business at home and abroad by insuring those debt risks. Little had been done in this country, but the present time gave an exceptional opportunity to the Government to complete its work of assisting our overseas trade by encouraging private enterprise to undertake the insurance of all kinds of bad debts. Men to work such a scheme with the necessary machinery were available. But the capital required was not so easily obtainable owing to the demand being in excess of the supply. The Government should arrange for the incorporation by Royal Charter of a Credit Insurance Corporation. The capital would be subscribed by the public, and all that the Government would need to do would be to guarantee the corporation against loss. That would secure the subscription of the capital. "In my opinion there would be no risk of loss to the Government, for the premiums charged would include a percentage to reimburse the Government. The experience of the Trade Indemnity Company, in England, and of the many German companies before the war, amply demonstrates the feasibility of the idea. At the present moment the need for such an institution as I have advocated is particularly felt by those engaged in the engineering industries. They could do plenty of export business if long-term credits, insured by a first-rate corporation, were forthcoming. They would be readily forthcoming if the Government established such a scheme, as I have suggested."

Summer Holidays.—MESSRS. ALFRED GRAHAM & Co. announce that their St. Andrews and Amplion Assembly Works will be closed from Friday evening, July 23rd, until Monday morning, August 9th. The Kilmorie Works will be closed from July 30th to August 16th.

Local Exhibition.—MANCHESTER.—In our note on the recent Better Housing and Housekeeping Exhibition we omitted to mention that among the exhibitors were Messrs. Vac-Tric, Ltd., who displayed their electric suction cleaner.

Unemployment.—The Employment Exchange registers for June 7th showed a total of 1,609,100 unemployed persons, as compared with 1,614,212 on May 31st and 1,291,191 on June 8th, 1925.

Price Reductions.—THE BRITISH THOMSON-HOUSTON CO., LTD., has notified the trade of a series of substantial reductions which it has made in the list prices of its radio apparatus. Allowance is being made for existing stocks. At the same time an alteration has been made in the scale of discounts. The alterations came into effect on June 21st.

Copper, Lead, and Rubber Prices.—Messrs. F. Smith and Co. and Messrs. James & Shakespeare report, June 22nd: No change in copper prices.

Messrs. James & Shakespeare report, June 22nd: English pig lead, £31 5s., 15s. dec.

Messrs. Edward Till & Co. report, June 22nd: India-rubber, Para fine, 1s. 8d., 1½d. inc.

For Sale.—Mr. H. J. Shaw, in conjunction with Messrs. Seymour, Seymour & Co., will sell by auction on June 29th and 30th, at 550-556, Oxford Street, W.C., wireless and X-ray apparatus, headphones, loud-speakers, accumulators, transformers, &c. Messrs. Geo. Cohen & Armstrong Disposal Corporation has for disposal the electric generating plant at the Central Power Station of H.M. Factory, Gretna. Westminster Electric Supply Corporation invites offers for two battery boosters. (See our advertisement pages to-day.)

Lighting and Power Notes.

Barugh.—DEMONSTRATION AT SUPPLY STATION.—Three men have been arrested in consequence of a demonstration recently at the Barugh electricity works of the Yorkshire Electric Power Co.

Beckenham.—NEW SUB-STATION.—The Electricity Committee has obtained a site near Lennard Street for the erection of a sub-station.

Belmont.—SUPPLY AGREEMENT.—The Town Council has decided to approve the draft agreement with the Electric Supply Co. for the supply of electricity.

Blackpool.—APPLICATION FOR SPECIAL ORDER.—The Town Council is considering applying for a Special Order to supply electricity within the urban district of Poulton-le-Fylde and the parishes of Carleton and Marton.

Bournemouth.—OIL FUEL APPARATUS.—The Corporation has authorised the provision of oil-fuel burning apparatus at the generating station in consequence of the coal dispute.

Bromley.—ELECTRICITY UNDERTAKING.—The Town Council is considering exercising its option to acquire the local electricity undertaking during the current year.

Caerphilly.—REVISED CHARGES.—The Urban Council has revised the electricity charges to 7d. per kWh for lighting, and 3½d. for power.

Colne.—YEAR'S WORKING.—The accounts for the year's working (ended March 31st last) of the Electricity Department (engineer: Mr. J. H. Thompson) show an income of £33,676, representing an increase of £754 over the previous year. The expenditure (revenue) amounted to £19,503, as compared with £18,659, leaving a gross profit of £14,173 (£14,263). The net result is recorded as £3,180 profit. The maximum demand on the undertaking for the year was 1,858 kW, an increase of 152 kW. The kWh sold amounted to 3,171,103 and the average price obtained per kWh was 2.37d. The working costs per kWh sold amounted to 1.4d.

Continental.—FRANCE.—The Société de l'Energie de Seine et Yonne, of Paris, has secured the concession for the supply of electrical energy to the rural areas of the Department of Yonne and to a number of villages in the Côte d'Or department.

La Société d'Electricité de Nantes has recently entered into a contract for the distribution of electricity to 37 small communes in the Department of Maine-et-Loire.

CZECHO-SLOVAKIA.—In order to meet the increasing demand for electrical energy, the Anglo-Bohmische Steinkohlen Gewerkschaft, of Lany, has recently installed a 3,750-kVA turbo-generator.

SPAIN.—A new small hydro-electric station has lately been completed by the Sociedad Electrica de Olloniego to utilise the water power of the River Nalon in the province of Asturias. The plant comprises two 500-h.p. Escher Wyss turbines coupled to "Asea" alternators, 50 cycles, three-phase, 6,000 V.

POLAND.—The Société d'Entreprises Electriques en Pologne continues to make steady progress. During the past year concessions were secured for the distribution of electric power in the town of Czenstochowa, for the construction of a regional power station to supply the industrial area between Nowo-Radomsk and Czenstochowa, and for the establishment of a central station at Kielce, where the work is already well in hand.

ITALY.—Among the new electricity transmission lines lately authorised by the Italian Government is an 18,000-V line which the Società Generale Pugliese di Elettricita is erecting to afford a supply of power from the Sila hydro-electric power station to a number of small villages in the province of Taranto. The Società Elettrica del Biferno has also been empowered to erect a 30,000-V line from its power station on the River Biferno to Occhito in the province of Campobasso. The Società Emiliana di Esercizi Elettrici is erecting a 15,000-V line between Mirandala and Vall Alta and between Mirandola and Secchia. A 35,000-V line and also one for 60,000 V are being erected between Polinago and Forneta in the province of Modena by the same company.

Dalkeith.—ELECTRICITY SCHEMES.—The Town Council is to submit three alternative schemes for an electricity supply in the borough.

Dartmouth.—BULK SUPPLY.—The Town Council has decided to offer no objection to the borough being included in a scheme put forward by Torquay Town Council for a bulk supply to surrounding towns, including Dartmouth.

East Grinstead.—APPLICATION FOR LOAN.—The Urban Council has applied for a loan of £5,300 for electricity purposes.

East Ham.—APPLICATION FOR LOAN.—The Electricity Committee is to seek sanction for a loan of £10,000 for the extension of distributor cables.

LOAN SANCTIONED.—The Committee has obtained sanction for a loan of £2,500 for the provision of meters.

Grange-over-Sands.—LOAN SANCTIONED.—The Urban Council has received sanction to a loan for its new electric lighting scheme.

Grays.—NEW CONVERTER.—The Council is to install an additional converter with a capacity of 750 kW.

Hamilton.—BULK SUPPLY CHARGES.—The Town Council has accepted reduced rates for the bulk supply from the Clyde Valley Electrical Power Co., based on a coal clause at 15s. to 10s. per ton.

Hull.—COAL RESTRICTIONS OFF.—The restrictions upon the use of electric power have been lifted from June 18th.

Irish Free State.—BLACKROCK (CO. DUBLIN).—The Urban Council is applying for sanction to a loan of £800 for electric lighting installation.

KINGSTOWN.—The Urban Council has reduced the price of electricity for lighting from 10d. to 8d. per kWh.

Japan. — HYDRO-ELECTRIC DEVELOPMENT. — The Korean Hydro-Electric Co. is about to commence the construction of its first generating station, which is to have an initial capacity of 50,000 kW, to be extended to 100,000 kW.

Leeds.—YEAR'S WORKING.—We have received from Mr. C. Nelson Hefford, manager of the electricity department, a copy of his annual report and revenue account for the year ended March 31st last. The total receipts for the year amounted to £563,901, as compared with £540,917 for the previous year. The working expenses amounted to £222,609, against £215,191, leaving a gross profit of £341,292 (£325,725). The net profit, after the deduction of income tax and loan charges, was £74,018, as against £79,593, out of which £32,362 was contributed to capital expenditure, leaving a surplus profit of £41,656. The capital expenditure during the year was £312,221, bringing the total expenditure up to £4,124,997. The sales for the year amounted to 100,779,954 kWh, and the average price obtained per kWh was 1.34d., as compared with 1.38d. for 1924-25. The working expenses per kWh amounted to 0.53d., as against 0.55d. in the previous year. The maximum load on the undertaking during the period under review was 48,400 kW, the figure for the previous year being 43,500 kW. The addition of a 15,000-kW turbo-alternator has brought the capacity of the station up to 82,000 kW.

Llanfair Caereinion.—INCREASED SUPPLY.—Steps are to be taken to obtain a further supply of electricity.

London.—ISLINGTON.—*Special Rates.*—The Electricity Committee has recommended that any factory solely using electricity for power and using electricity for lighting in at least 75 per cent. of the premises, both factory and offices, be charged a special lighting rate, from 7.30 p.m. to 2 p.m., of 2d. per kWh, plus 10s. per quarter meter rent.

SHOREDITCH.—*Mains Expenditure.*—The Electricity Committee has voted an expenditure of £11,000 for mains, house services and meters.

ST. PANCRAS.—*Mains Extensions.*—The Electricity Committee is to extend mains at a cost of £728.

Ludlow. — ELECTRICITY UNDERTAKING. — The Shropshire, Worcestershire and Staffordshire Electric Power Co. is to take over the electric light undertaking; the charge for electricity is not to exceed 9d. per kWh.

Manchester.—YEAR'S WORKING.—Mr. H. C. Lamb, engineer and manager of the Manchester Electricity Department, has sent us a copy of an abstract of the accounts of the undertaking for the year ended March 31st last. The income for the year amounted to £1,426,238, as compared with £1,445,495 for the previous year. The working expenses are recorded as £789,314, against £767,421, leaving a gross profit of £636,924 (£678,074). After the payment of capital charges and income tax a net profit of £32,856 is left, compared with £63,468 for 1924-25. £365,062 represents the total capital expenditure for the year, which includes £9,635 spent on machinery at the generating stations, £82,530 on the transformer and distributing stations, and £183,762 on mains. The total capital expenditure upon the undertaking now stands at £8,616,715. The number of kWh sold during the year was 300,440,765, as compared with 257,352,920 for the previous year, and the kWh unaccounted for amount to 58,989,726, or 15.24 per cent. of the quantity generated (387,008,090). The maximum demand on the undertaking during the period under review was 136,110 kW, an increase of 15,720 kW on the figure for the preceding year. The average price obtained per kWh during the year was 1.12d., a reduction of 0.21d.

N.E. Lancashire.—COAL SUPPLIES.—A number of municipal authorities in North-East Lancashire are discussing the desirability of restricting power supplies to conserve the existing stocks of fuel.

Newport.—OVERHEAD MAINS.—The Electricity Committee is to erect overhead mains, at a cost of £700, to the Llanwern Garden City Estate.

NEW SUB-STATION.—The Electricity Committee has decided to erect a sub-station at Ebbw Junction.

Northern Ireland.—AHOGHILL.—The local electricity undertaking has been destroyed by fire.

LIMAVADY.—The Urban Council has adopted a scheme for the improvement of the local electric lighting system. It is recommended that a flat rate of 6d. per kWh be charged.

LISBURN (CO. ANTRIM).—The Urban Council has approved a plan for the purchase of energy from the Belfast Corporation.

Norwich.—APPLICATION FOR LOAN.—Application is to be made for sanction to borrow £40,000 for the provision of mains and services.

Oswestry.—SPECIAL ORDER APPROVED.—Subject to certain conditions regarding rates, the Rural District Council has decided not to oppose the proposed Special Order of the Oswestry Electric Lighting and Power Co., Ltd.

Rothesay.—GENERATING STATION AND LOAN.—The Town Council has received permission to erect a generating station, for which it is applying for sanction to a loan of £14,000.

Rugby.—SUPPLY CONSENT.—The Rural Council has consented to the application of the Midland Electric Light and Power Co., Ltd., for an Order to supply electricity to parishes in the Council's area.

Russia.—KAMENEC POWER STATION.—It is announced that the construction of the Kamenec hydro-electric power station will shortly be completed. The cost is estimated at about £73,000.

Southend-on-Sea.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £10,500 for feeders and distributors.

Southmolton.—APPLICATION FOR SPECIAL ORDER.—The Rural Council has referred an application by Dr. J. A. Purves for consent for a Special Order to supply electricity in the rural area and to the parishes in the area for their opinion.

Spalding.—BULK SUPPLY.—The Urban Council has decided to use underground cables for the bulk supply from Peterborough.

Special Orders.—Applications have been made to the Electricity Commissioners for special orders by the following authorities:—The Linton Mills Estates Co., Ltd., to distribute electricity within the parishes or townships of Grassington, Threshfield and Linton, in the rural district of Skipton, in the West Riding of Yorkshire; the Shoeburyness Urban District Council, to supply electricity within the urban district of Shoeburyness, in the county of Essex; the Urban District Council of Bolsover, to supply within the urban district of Bolsover, Derby; the County Borough of Hastings, to supply within the borough of Rye, the urban district of Battle, the rural districts of Hastings, Rye, and Battle, and the parish of Ninfield in the rural district of Hailsham.

St. Helens.—NEW MAINS.—The Electricity Committee has decided to lay mains to supply the Moss Bank district at an estimated cost of £3,005.

Swansea.—LOANS.—The Electricity Committee is seeking sanction to borrow £150,000 for a scheme of electrical development, and £15,000 for public lighting mains. The Committee has obtained sanction to borrow £20,000 for mains.

Walsall.—MAINS EXTENSIONS.—The Town Council is to spend £1,500 to supply electricity to the Palfrey housing scheme.

Weymouth.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,000 for mains and services.

Tramway and Railway Notes.

Australia.—RAILWAY ELECTRIFICATION.—About £6,250,000 has been spent on the electrification of the railways in the Commonwealth, the result being an increase of £325,000 per annum in the revenue and an annual increase of 21,000,000 passengers.

Continental.—SWEDEN.—The electrification of the railway between Gothenburg and Stockholm has now been completed, with the exception of a little work on the Stockholm-Sodertalje section.

AUSTRIA.—The lines Salzburg-Worgl, Kufstein-Worgl, and Innsbruck-Brenner, a total of nearly 190 miles of double track and nine miles of single track, are being electrified. Energy is being supplied by the Mallnitz and Stubach electrical power stations.

Colne.—YEAR'S WORKING.—The results of the working of the tramways (engineer: Mr. J. H. Thompson) for the year ended March 31st, 1926, show a total income of £24,971, an increase of £219 on the previous year's working. The working expenses amounted to £20,999, a decrease of £745, leaving a gross profit of £3,974, or £965 in excess of the figure for the previous year. After the deduction of loan charges the net balance for the year is £4,969 loss, in addition to which £2,750 has been contributed for the earlier extinguishment of debt, making a total loss of £7,719, as compared with £6,054 for 1924-5. The car-mileage was 275,515, an increase of 161, and the working expenses per car mile amounted to 18.3d.

Glasgow.—FUEL OIL.—In order to conserve its coal stocks, the Tramways Department has adopted oil fuel for generating purposes at the Pinkston power station.

Huddersfield.—PURCHASE OF 'BUSES.—The Tramways Committee has authorised the purchase of not fewer than six new 'buses.

Japan.—RAILWAY ELECTRIFICATION.—The Choshu Railway has been granted a charter to construct an electric railway in Shimoniseki. The Komyo Electric Railway Co. is about to construct a line from Nakaizumi-machi to Kemyaji-mura. The Sendai-Shiogama section of the Miyagi Electric Railway Co. was opened on April 14th.

London.—UNDERGROUND SERVICES.—Normal services of trains were introduced on the Hampstead and City tube railways on June 21st. Improvements can be expected on the District Railway shortly.

STRIKE VOLUNTEERS.—All the men who volunteered as drivers or conductors on the L.C.C. tramways during the general strike have been retained in the service where they so desired.

TRAMCAR AFIRE.—An L.C.C. tramcar on the homeward journey to Streatham on June 15th caught fire at the Elephant and Castle. The traffic was temporarily disorganised.

Wolverhampton.—DISCARDING OF TRAMS.—The Town Council has adopted a recommendation to discard the existing tramway services, with the exception of the Bilston route, for which powers are not held, and to substitute trolley vehicles and motor-omnibuses.

Telegraph and Telephone Notes.

Australia.—"BEAM" STATIONS.—In the House of Representatives on June 14th, replying to Mr. Charlton, leader of the Labour Party, Mr. William Gerrard Gibson, Postmaster-General, stated that the delays in the completion of the "beam" wireless stations in England and Australia were due to causes beyond the control of the Amalgamated Wireless Co. The Government had received a cable from Marconi's Co. stating that the coal strike was holding up the supplies of material. In consequence, the Amalgamated Co. did not anticipate "beam" communication between England and Australia until October, or that there would be a service between Australia and Canada until about December.—*Reuter* (Melbourne).

Austria.—TELEPHONE CABLES.—The League of Nations having released £1,000,000 of the loan to Austria, for underground telephone cables, it is expected that the cable from Vienna to the German frontier at Passau will be finished by the New Year. It will then be possible to talk direct between London and Vienna, says the *Evening News*. Preparations are being made also for the laying of new submarine telephone cables between England and France and Belgium.

Iceland.—TELEGRAPH CONCESSION.—The concession of the Great Northern Telegraph Co., Ltd., in respect of the Iceland cable expires this year. Negotiations between the Danish and Icelandic Governments and the Company have, however, resulted in an agreement granting the Company a prolongation of its concession until the end of 1934, unless previously terminated by notice by either party. The agreement, which has been approved by the Parliament of Iceland, has only been secured by the company's making considerable sacrifices on various points, the total telegraph traffic exchanged with Iceland not being sufficiently large to make both cable and radio services remunerative. Under the new agreement the whole of the telegraph correspondence of Iceland, with the exception of news messages and meteorological telegrams, is retained for the cable route. In return, the company has agreed to make considerable tariff reductions, and to hand over the working of its telegraph station at Seydisfjord to the Icelandic Telegraph Administration.

Irish Free State.—LIMERICK TELEPHONE EXCHANGE.—The telephone exchange at Limerick is being transferred to the General Post Office, where it will be installed in a portion of the telegraph instrument room. A new switchboard, of American type, will be provided, which, it is said, will give more accelerated service for dealing with trunk calls.

Persian Gulf.—MARINE RADIO-TELEPHONY.—Very satisfactory results are reported from the working of the Marconi wireless telephone sets installed on harbour vessels some twelve months ago by the Basrah Port Trust. The ships so equipped in the Persian Gulf are the control vessels *Alert* and *Yenan*, the pilot vessels *Nearchus* and *Liger*, and station ship *Harmaq*, working with shore stations at Tanoomah and Fao. A wireless bell is included in each installation, which is of the Marconi YB type, so that there is no necessity for maintaining a continuous watch; any vessel or station can call any of the others with the facility of an ordinary telephone. The transmitters have a power of 100 watts, and the range for telephony, depending on local conditions, varies from 35 to 80 miles; the radius for telegraphy is from 100 to 200 miles. According to an official report, "all the stations are giving excellent results, and a considerable amount of traffic is effected." Indian signalmen man the stations, and they have rapidly gained proficiency in their work, speech generally being used.

The Telephone Service.—FOREIGN TRUNK CALLS.—Trunk telephone calls over the Anglo-Continental routes during the year ended April 30th are said to have numbered 902,571.

PHONOGRAMS FROM KIOSKS.—The latest development in popularising the telephone is the facility provided for sending a telegram by 'phone from the public kiosks. The system was inaugurated at Coventry recently. When the person has "called" the exchange in the usual way, the payment of twopence is made as if it were a local call. Then the Post Office clerk asks how many words it is proposed to include in the phonogram, and the cost is stated accordingly. All phonograms are prepaid.

Radio Notes.

Egypt.—MARCONI CO. AGREEMENT.—The Ministry of Communications has published the text of an agreement between the Marconi Co. and the Egyptian Government regarding wireless broadcasting. The agreement is for a period of 30 years, and will be renewable subsequently for periods of 10 years.—*Reuter* (Cairo).

Esthonia.—NEW STATION.—The recently-constructed broadcasting station at Tallinn is to commence operation shortly. Some 500 subscribers are said to have been registered.

Holland.—REOPENING THE HAGUE STATION.—The Commercial Secretary at The Hague (Mr. R. V. Laming, O.B.E.) informs the Department of Overseas Trade that the N.V. "Idzerda-Radio" at The Hague has again received a transmitting licence. The call sign will remain the same as that allotted to this station from 1919 to 1924, when it was closed down owing to the bankruptcy of Mr. Idzerda, namely PCGG; a wave-length of 1,150 metres will be used.

Irish Free State.—DUTY ON APPARATUS.—In Dail Eireann on June 15th, Mr. Norton moved the exemption from the 33⅓ per cent. *ad valorem* duty of component parts and accessories of wireless apparatus. Mr. E. Blyth, Minister for Finance, said it was proposed to confine the tax to completely-manufactured parts; such parts were to be exempt from duty; dismemberment would take place in such a way that the parts could be put together quickly again with very little trouble, and duty in this way avoided. Mr. J. J. Walsh, Minister for Posts and Telegraphs, saw nothing in the proposal that would increase industry. The net result would be that parts of instruments could be imported as against whole instruments, and he had not seen any considerable amount of employment given by the assembling of parts; on the other hand, the tax would create an industry there, certainly in respect of crystal sets. There were parts of valve sets which could not possibly for some time, if at all, be made there. He was satisfied that through this medium an industry would be born which would be helpful to a great many people. The amendments were lost.

New Zealand.—FOREIGN APPARATUS.—Despite New Zealand's 10 per cent. preference on British wireless goods, British manufacturers are being driven from the market, says the *Daily Mail's* Christchurch correspondent, who reports that British manufacturers are sending a crystal set which is useless in New Zealand; consequently importing firms have been forced to abandon British goods. Americans, on the other hand, are sending five-valve sets, which New Zealanders prefer, and have captured the market. In addition, the United States makers give discounts three times larger than those offered by the British firms.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Asia Minor.—BAGDAD.—June 28th. Direction Générale des Chemins de fer d'Anatolie. One electrically-driven semi-portal crane. (A.X. 3191.)*

Australia.—MELBOURNE.—June 28th. Electricity Commission of Victoria. 22,000-V transformers and spares. (B.X. 2528.)*

August 23rd. 10-in. disk suspension insulators. (B.X. 2614.)*

July 14th. Victorian Government Railways. A.c. power interlocking machine. (B.X. 2596.)*

September 1st. Automatic sub-station equipment for Elwood sub-station. (B.X. 2598.)*

August 11th. City Council. H. and l.p., 3-phase sub-station switchgear.*

August 3rd. Postmaster-General's Department. Telephones and dials.*

August 10th. Telephone exchange indicators. (B.X.2597.)*

BRISBANE.—August 26th. City Electric Light Co., Ltd. One 12,500-kW turbo-alternator.*

Belfast.—June 29th. Harbour Commissioners. Two electrically-driven main pumps, &c. Specification, &c., from the Harbour Engineer, Harbour Office, Belfast.

Belgium.—September 29th. Service de l'Armement et des Munitions, 10, Rue du Meridien, Brussels. Wireless-telegraphy sets for use on Belgian military aeroplanes. Particulars (Cahier des Charges Special No. 688) for 4 fr. from 15, Rue des Augustins, Brussels.

ANTWERP.—July 12th. Municipal Council. One single-phase converter, 1 mercury-arc rectifier, 4 static transformers for sub-station. (B.X. 2,637.)*

Brazil.—PORTO ALEGRO.—July 8th. Municipal Council. Electrical material for street lighting. (B.X. 2571.)*

Croydon.—July 5th. Electricity Department. Electric locomotive coal-handling crane and grab and electric crane track. (See this issue.)

Dublin.—June 28th. One steam turbo boiler feed pump, three air filters, two electric vehicles, and steam and water meters. (June 11th.)

Egypt.—CAIRO.—June 30th. Ministry of the Interior. One Diesel engine, direct coupled to an 80-kW generator, complete with switchboard. (B.X. 2537.)*

October 15th. Installation of electric power station equipment at Keneh and Luxor. (B.X. 2627.)*

July 10th. Director-General, State Domains Administration (Commercial Service), Savoy House, Qasr el Nil Street, Cairo. Three semi-Diesel engines and two centrifugal pumps.

August 2nd. Director-General, Mechanical Department, P.W.M., Cairo. 400-b.h.p. Diesel engine, driving an air compressor, together with auxiliary machinery.

Glasgow.—June 28th. Corporation. Electric lighting and telephone installations at the Kelvin Hall. Specifications from Office of Public Works, City Chambers, 64, Cochrane Street.

Grays.—June 30th. Grays Thurrock Urban District Council. H.p. switchgear, 3,300-V, 3-core cable, and transformers. (June 18th.)

Greetland and Stainland.—The Education Sub-Committee has decided to obtain tenders for installing electric lighting at Holywell Green school.

Huddersfield.—July 7th. Electrician's work in connection with the conversion of premises, St. George's Square and Station Street, into shops, for Huddersfield Building Society. Particulars from Messrs. Stocks, Sykes & Hickson, architects, St. Peter's Street, Huddersfield.

India.—July 2nd. India Store Department. E.h.p. armour-clad switchgear. (June 11th.)

July 16th. 500-kW rotary converters with step-down transformers. (See this issue.)

July 16th. Coal- and ash-handling plant for power station. July 30th. Steel-frame buildings and overhead electric travelling crane. August 6th. Complete boiler-house equipment or, alternatively, complete boiler-house installation, including pulverised-fuel equipment, &c. Particulars from the Department, Belvedere Road, S.E.1.

August 9th. Electrical generating plant for Peshawar power station of the North-Western Railway. (B.X. 2644.)*

Littleborough.—June 26th. Electric lighting installation, Zion United Methodist Church, Caldermoor. Tenders to Mr. R. Whipp, 10, Shore Road Littleborough.

London.—BERMONDSEY.—July 15th. Borough Council. Electrical installation for lighting, heating, and power at the baths and washhouses, Grange Road. (June 11th.)

Manchester.—July 7th. Electricity Department. Two 130,000-lb. water-tube boilers, flues, coal chutes, ash hoppers, pipework, valves, induced- and forced-draught plant and chimneys, one 40,000-kW turbo-alternator, with condensing plant, &c. (June 4th.)

Annual contract for supply to various sub-stations of 6,600-V, 3-phase switchgear. Specification from Mr. H. C. Lamb, manager, Electricity Department, Town Hall.

July 5th. 33,000-V trunk feeders, pilot cables, and telephone cables. (June 11th.)

New Zealand.—CHRISTCHURCH.—October 19th Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

WELLINGTON.—August 24th. Public Works Department. Synchronous condensers for the Waikaremoana Electric Power Scheme. (B.X 2608.)*

July 20th. Phase transformer for Mangahao electric power scheme.*

August 30th. 400-V, 3-phase, slip-ring induction motors and starters.*

September 28th. Three electrically-driven low-lift pumps, with control apparatus, for the Taleri drainage. (A.X. 3274.)*

November 2nd. Electric generators and turbines for Waikaremoana electric power scheme. (B.X. 2622.)*

Normanton.—July 5th. Urban District Council. 1,400 yd. feeder cable. (June 18th.)

Electric wiring of 34 houses, Hanson House estate, and 86 houses, Snydale Road. Specification from Mr. J. Hopton, Council Offices, Normanton.

Nottingham.—July 6th. Electricity Department. Twelve months' supply of general stores. (June 18th.)

South Africa.—July 8th. South African Railways and Harbours. Telegraph material, poles, cross arms, &c. (A.X. 3173.)*

August 12th. Electric cables and wires and bare copper wire (for 12 months). (B.X. 2639.)*

JOHANNESBURG.—July 29th. Municipal Council. Transformers. (B.X. 2636.)*

Southend-on-Sea.—Electricity Department. 300 Relay switches for distant control of street lamps. (See this issue.)

Uruguay.—MONTEVIDEO.—July 6th. State Electricity Works. 1,000,000 metres of insulated conductors. (B.X. 2523.)*

July 9th. 137,500 metres of rubber-insulated wires and cables. (B.X. 2548.)*

40,000 metres of coloured twin conductor cords. (B.X. 2549.)*

July 22nd. 35,000 electric lamps.*

Whitley Bay.—July 1st. Whitley and Monkseaton Urban District Council. Wiring for electric lighting 66 houses. Specifications from Mr. A. J. Rousell, surveyor, Council Offices, Whitley Bay.

Wolverhampton.—July 10th. West Midlands Joint Electricity Authority. Two turbo-alternators, condensing plant, &c., for Birchills power station. (June 18th.)

The Transport Committee has decided to obtain tenders for vehicles, equipment, &c., in connection with the conversion of Penn Fields route to trolley-vehicle working.

July 24th. West Midlands Joint Electricity Authority. Three steam boilers, pulverised fuel plant, ash and coal handling plant and boiler house auxiliaries, for Birchills Power Station. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Beckenham.—Electricity Committee. Accepted:—
H.p. cable (£15,610).—British Insulated Cables, Ltd.
16,000 yd. .007 cable (£14,791).—Hackbridge Cable Co., Ltd.

Brighton.—Electricity Committee. Accepted:—
1,000-kW motor converter (£8,471).—Bruce Peebles & Co., Ltd.
Two complete units of steam generator plant for Southwick Works (£44,967).—Combustion Steam Generator, Ltd.

Devonport.—Royal Albert Hospital. Accepted:—
Electric lift (£600).—Smith, Major & Stevens, Ltd.

East Ham.—Electricity Committee. Recommended:—
1,450 yd. lead-covered cable (£513).—Enfield Cable Works, Ltd.

Edinburgh.—*The Times* states that on Tuesday last the Electricity Committee decided to recommend the Town Council to accept a Swiss tender for the installation of two 25,000-kW turbo-alternators at a cost of £138,000. The lowest British offer was £52,000 more.

Faversham.—Town Council. Accepted:—
Installation of electric fire bells at the residences of the members of the fire brigade.—Jabez Smith & Son.

Government Contracts.—The following Government contracts were placed during May, 1926:—

ADMIRALTY CONTRACT AND PURCHASE DEPARTMENT.

Aluminium alloy electrical fittings.—General Electric Co., Ltd.; W. McGeoch & Co., Ltd.; Engineering & Lighting Equipment Co., Ltd.
C.T.S. electric cable.—Anchor Cable Co., Ltd.; General Electric Co., Ltd.
Underground cables and switchgear.—Johnson & Phillips, Ltd.
Conduits and accessories.—Eureka Conduits & Fittings Co.; Electric Conduits, Ltd.; Barton & Sons, Ltd.; General Electric Co., Ltd.; Talbot Stead Tube Co., Ltd.
Electric light installation.—G. E. Taylor & Co.
Lifts.—Smith, Major & Stevens, Ltd.
Motor.—Laurence Scott & Co., Ltd.
Motor alternators.—Small Electric Motors, Ltd.
Motor generators.—Small Electric Motors, Ltd.
Switchboards.—Park Royal Engineering Co., Ltd.
W/t attachments.—Radio Instruments, Ltd.

WAR OFFICE.

Electrolyte.—Spencer, Chapman & Messel, Ltd.
Wireless sets.—Marconi's Wireless Telegraph Co., Ltd.

AIR MINISTRY.

Inert batteries.—Edison Swan Electric Co., Ltd.
Voltage control boxes.—Pyne Manufacturing Co., Ltd.
Duralumin.—J. Booth & Co. (1915), Ltd.
Electric cable.—W. T. Henley's Telegraph Works Co., Ltd.
Magneto spares.—British Thomson-Houston Co., Ltd.
Motor-alternator set.—Newton Bros. (Derby), Ltd.

POST OFFICE.

Manufacture, supply, drawing-in and jointing cable.—Holborn-Chiswick: Standard Telephones & Cables, Ltd.
Private branch telephone exchange equipment.—Burberry's (W.); Corporation of Bootle; British Celanese Ltd. (S.W.); Metal Agencies Co., Ltd. (Bristol); Stelp & Leighton, Ltd. (E.C.); Corporation of Glasgow Housing Department and City Improvements Department; Corporation of Glasgow; Manchester and Salford Equitable Co-operative Society, Ltd. (Ardwick); Walsall and West Bromwich Union Joint Committee: Relay Automatic Telephone Co., Ltd.
Telephone exchange equipment.—Putney, Brixton, Darlaston: Standard Telephones & Cables, Ltd. Leamington, Chatham, Gillingham (Kent): Siemens Bros. & Co., Ltd.; sub-contractors—Small Electric Motors, Ltd., for dynamotor; Chloride Electrical Storage Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines; Crompton and Co., Ltd., for ringing machines. Strood (Kent), Snodland (Kent), and Rainham (Kent): Siemens Bros. & Co., Ltd.; sub-contractors—Small Electric Motors, Ltd., for dynamotors. Harrow, Sketty, Leek: Siemens Bros. & Co., Ltd. Bearsden (Glasgow): Automatic Telephone Manufacturing Co., Ltd. Nelson, Burslem, Hanley: General Electric Co., Ltd.; sub-contractors—D.P. Battery Co., Ltd., for batteries; Crompton & Co. for machines. Stoke-on-Trent, Longton (Staffs), Newcastle-under-Lyme (Staffs.): General Electric Co., Ltd.; sub-contractors—D.P. Battery Co., Ltd., for batteries; Crompton and Co., Ltd., for charging machines; Automatic Telephone Mfg. Co., Ltd., and W. Jones & Co. for ringing machines. Trentham (Staffs.), Chesterton (Staffs.): General Electric Co., Ltd.; sub-contractors—W. Jones & Co. for ringing machines.
Fire alarm apparatus.—A. C. Brown.
Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works; Siemens Bros. & Co., Ltd.; Standard Telephones and Cables, Ltd.; Telephone Mfg. Co., Ltd.
Miscellaneous apparatus.—Phœnix Telephone & Electric Works, Ltd.
Distributing boards.—Cable Accessories Co., Ltd.
Cable (various).—British Insulated Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Connolly's (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Macintosh Cable Co., Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Dry cells.—Ever-Ready Co. (Great Britain), Ltd.; General Electric Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Reliance Electrical Wire Co., Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—Albion Clay Co., Ltd.; Donington Sanitary Pipe & Fire Brick Co., Ltd.
Battery plates.—Accumulators of Woking, Ltd.; Alton Battery Co., Ltd.; Tudor Accumulator Co., Ltd.
Battery charging sets.—Stuart Turner, Ltd.
Jointing sleeves.—Dugard Bros., Ltd.; C. M. Powell Bros.
Flameproof wire.—Macintosh Cable Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Insulated cables.—St. Helens Cable & Rubber Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.
Cable and wiring material.—Siemens Bros. & Co., Ltd.
Cableway aerial.—J. M. Henderson & Co., Ltd.
Electrical equipment.—J. Stone & Co., Ltd.
Overhead line material.—Bullers, Ltd.
Static transformers and spares.—Ferranti, Ltd.
Telephone switchboards.—British L.M. Ericsson Mfg. Co., Ltd.
Electric truck.—Ransomes, Sims & Jefferies, Ltd.
Copper wire.—Shropshire Iron Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.

Hemsworth.—Rural Council. Accepted:—
Wiring 50 houses at Great Houghton, at 25s. per point, including the provision of plain shades and globes.—Houghton Main Colliery Co., Ltd.

London.—ISLINGTON.—Electricity Committee.
10,000-kW turbo-alternator (£51,320).—Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)
Installation of interlinking mains with Hackney and St. Pancras.—British Insulated Cables, Ltd. (Recommended.)

HACKNEY.—Works Committee.
One 40-cell I.M.V.8 "Exide-Ironclad" accumulator, less allowance for the old battery (£158).—Chloride Electrical Storage Co., Ltd. (Recommended.)

Southend-on-Sea.—The Town Council has renewed for another year the existing contract with Callender's Cable and Construction Co., Ltd., for cables based upon the daily market price of copper and lead as disclosed by Bagot's list.

Wirral.—Board of Guardians. Accepted:—
Installing electric lighting, heating, &c., at the extensions to the Institution at Clatterbridge (£12,322).—Ashwell & Nesbit, Ltd.

Forthcoming Events.

Second British Electro-Farming Conference.—Thursday, July 8th. At the Royal Agricultural Society Show Ground, Reading. At 12 noon.

Notes.

Electric Arc-Welding a Bridge.—The Worcestershire County Council has now decided, after investigation, to strengthen Holt Fleet bridge (over the River Severn) by the method of electric-arc welding as applied to the bridges on the Paris, Lyons and Mediterranean Railway. The cost of the welding is estimated at about £4,000 and the masonry abutments at a further £4,300.

Inventions Commission.—The Inventions Commission, sitting at the Law Courts in London on June 14th, under the chairmanship of Mr. Justice Tomlin, heard the claim of Prof. Miles Walker in respect of supersonic signalling. Prof. Walker claimed for an exceedingly small fraction of the effort that was made by a large number of experimenters to solve a very difficult and important problem—how to detect and locate a silent submarine. He did not claim that his work on the solution of that problem was as great as that by many other experimenters in that field, but he was the first to suggest to the Admiralty a very promising line of attack on submarines. His first experiments in submarine echoes were made in 1899 after the sinking of the *Stella*, when he was a student at Cambridge. He thought it was possible for a ship to get warning of hidden rocks by means of a submarine echo. In 1912, when he was appointed to Manchester, a student under his direction made experiments for the detection of high-frequency sounds. In 1913 he was sold a patent which had been evolved for the detection of icebergs. After the war broke out he explained his device to the Admiralty, and experiments were carried out with a water siren for the detection of submarines, but his suggestion was not adopted. Another method, however, was found to be more satisfactory. The Commission reserved its decision.

Flood Interruption of Supply.—The energies of some 30 men employed for the past three weeks by Captain J. A. Ritter in endeavouring to repair a breach in the "lead" which supplied the water power to the power station at Limavady have again been nullified through the recent abnormal rainfall, causing a heavy flood in the River Roe. A large tree, brought down by the flood, broke the sluice gates in the river, and caused the torrent to rush into the "lead," breaking the river bank. Captain Ritter has been able to supply light to the town for a few hours each evening, generated from a dynamo in the Rectory grounds. It will be some time before current can be generated at the station, so inconveniently interrupted.

Development of French Electrical Works.—M. de Monzie, the French Minister of Public Works, referred at length to the question of the development of the national electrical equipment at the recent annual dinner of the Union des Syndicats d'Electricité. Reference was made to the law passed recently by the Chamber, intended to impose a tax of 5 per cent. on consumers of energy so as to provide funds for the provision of electrical works. It is stated that the Professional Syndicate of Producers and Distributors of electrical energy, which mainly represents the steam power stations, is particularly interested in the matter, and has unanimously expressed its agreement with the scheme in principle, and that the Chambre Syndicale des Forces Hydrauliques is equally favourable. The Union des Syndicats d'Electricité, which combines all the electrical syndicates, will examine the problem at its meeting in July.

Chromium Plating.—The electro-deposition of chromium is exciting considerable interest owing to its anti-corrosive property when deposited upon non-ferrous metals being strongly marked. Articles of brass, nickel silver, copper, &c., when plated with chromium, appear to withstand climatic conditions and exposure indefinitely. In the case of non-ferrous metals, the deposit is unique; it is virtually glass hard, and is capable of receiving a brilliant polish which will withstand rough handling without becoming scratched or the polish in any way diminished. The colour is of a silvery whiteness tinged with blue, and its great hardness is allied with heat resisting properties. The deposition of the metal is slightly more difficult than the deposition of nickel, but the plant required is only a slight departure from the standard equipment. Messrs. W. Canning & Co., Ltd., have furnished us with a sample article finished in chromium, and have, we understand, installed several plants for the deposition of the metal, which have been a proved success.

Association of "Old Cromptonians."—The members of this Association held their second annual dinner on Friday, June 18th, at the Royal Automobile Club. Originally the meeting was fixed for the nearest Friday to Col. Crompton's birthday, but the strike caused a postponement, while the new date found very many members at the Glasgow Convention, and this reduced the attendance, which otherwise would have reflected the desire of all to welcome the grand old president on his return from the United States. We learn that the "Guv'nor" was in excellent form in giving a brief account of his American impressions. These may be crystallised with the observation that you can say to an American anything except that "It's a young country and has room for improvement." The general meeting re-elected Mr. C. S. Peel as hon. secretary and Mr. M. Whitgift as hon. treasurer and assistant secretary, and a committee consisting of Messrs. E. J. Fox, H. D. Harris, Lt.-Col. H. M. Leaf, D.S.O., J. W. Meares, C.I.E., A. E. Mohring, E. Reeves, A L. Stevens, and J. Swinburne, F.R.S.

Royal Air Force Display.—The seventh Royal Air Force display will take place at the Royal Air Force aerodrome, Hendon, on July 3rd. The object is to demonstrate the progress in the work, training, and equipment of the Royal Air Force, and as participation in the display is largely competitive it affords a valuable stimulus to training. The proceeds are given to the Royal Air Force Memorial Fund, which has already benefited to the extent of more than £34,000 since the display was established six years ago. An event which will have a popular appeal will be squadron drill carried out by wireless telephony, orders being given by the squadron leader from his machine in the air, or from the wireless ground station. The use of wireless telephony, although still somewhat in the experimental stage, has already shown that it greatly facilitates squadron operations; it enables the leader to pass his instructions with certainty, and it enables the pilots to understand clearly what air manœuvres they are to carry out. Arrangements are being made to develop the use of "public address" equipment by the incorporation of 20 or more Marconiphone loud speakers erected on pylons in the different enclosures, each pylon being connected with the control room in the hotel by means of underground cables.. Precautions are being taken this year to guard against the interference experienced while receiving from aeroplanes last year. Four receiving stations will be used, each one receiving independently of the other. All will be connected by land lines with the control room, but it is expected that the main reception will take place at a point within five miles of the Hendon aerodrome. This reception point will be coupled by Post Office land line to the control room. It has been found that the best reception is obtained when aeroplanes are some distance from the receiving point.

The Magnetic Elements at Greenwich.—The report of the Astronomer-Royal for the past year states that in 1925 the declination W. was 13 deg. 10 minutes; the horizontal force was 0.18413, and the vertical force 0.43081, c.g.s. units; the dip was 66 deg. 51.5 mins. Magnetic observations at Greenwich will shortly be discontinued, the work being transferred to Abinger, on account of the electrification of the railways near the Royal Observatory.

The wireless time signals received from the Continent are slightly late on Greenwich, the Eiffel Tower lagging 0.11 sec. and Nauen 0.05 sec.

The Shortt free-pendulum clock is working well, and a second clock of this type is being installed; the rate of the first one is increasing by 0.011 sec. per day, per month.

Water Power in Newfoundland.—In a recent report (Stationery Office, 2s. 3d. net) upon conditions in Newfoundland, Mr. F. W. Field, Senior Trade Commissioner in Canada and Newfoundland, says that there is considerable water power in the Colony, but recent estimates are not available. Little has been done to develop them, with the exception of the work of two paper companies. The Anglo-Newfoundland Pulp and Paper Company has utilised power both at Grand Falls and Bishop's Falls. About 23,000 h.p. has been developed out of an available 30,000 to 35,000 h.p. The water is conveyed from the forebay to the power house, a distance of about 2,000 ft., by means of two steel pen-stocks 15 ft. in diameter. The net maximum head is 110 ft. The maximum head to which it was possible to develop the power at Bishop's Falls was 36 feet. Eight sets of 1,700 h.p. each were provided, and seven of these were fully developed, six of them being directly connected to three pulpwood grinders each, and one driving a 500-kW generator and, by means of rope drives, various pieces of machinery throughout the plant. The remaining set will eventually be used for the generation of more electrical power when required. The power required by the Newfoundland Power and Paper Company, which established its pulp and paper mills at Cornerbrook, is obtained from Deer Lake, 32 miles away. Construction of the hydro-electric plant and of the paper mills by the general contractors was commenced in June, 1923. Paper was produced in July, 1925, very little over two years after the inception of construction. The power plant at Deer Lake has a capacity of 100,000 h.p., which is transmitted to the mills over four transmission lines. The average head on the turbines is from 250 to 265 ft. The flow of water for the power development is obtained from Grand Lake, which has an area of 215 sq. miles and a drainage area of 1,650 sq. miles. From this an average yearly flow of 5,000 cu. ft. per second is available. Owing to the large seasonal variations in the flow of water from this area, Grand Lake is being used as a regulating storage reservoir with a capacity of about thirty thousand million cubic feet. To control this reservoir, a hollow reinforced concrete dam, 800 ft. long and 75 ft. high, was constructed. The dam has a spillway with a capacity of 26,000 cu. ft. per sec. for the purpose of discharging the occasional heavy floods which occur. This consists of eighteen 15-ft. wide electrically-operated sluiceways. Owing to the increased height of Grand Lake, which is raised some 30 ft. by this dam, a diversion of the railway was necessary, and it is carried over Junction Brook on the dam. To convey the water from Grand Lake to Deer Lake power house, a canal seven miles long was built. Formerly pulp and paper mills were always erected at or very near the hydraulic power. To-day many of them are located to suit other conditions—housing of operatives, pulpwood supply, shipping, etc., the hydraulic power being converted into electrical power and transmitted to the pulp and paper mills.

Electricity v. Gas at Weymouth.—The Estates and Housing Committee of the Weymouth Council recently made a recommendation that the local Gas Company should not be allowed to install gas cookers in certain of the Council's houses. A great deal of discussion occurred when the matter came before the Council. The Committee's view was that the municipal electricity undertaking should be given preference over the Gas Company in municipal houses, but a number of members objected to such a "monopoly" and thought that the tenants should be free to choose electricity or gas. A councillor stated that before the houses were erected the Gas Company was asked if it would install gas cookers, but it refused to do that unless it was also permitted to fit gas coppers, geysers and lighting. The chairman of the Electricity Committee said that they could install electric cookers at as low a cost as the Gas Company could do gas cookers. It was decided to refer the recommendation back to the Committee with a proposal that consent to install gas cookers only should be given to the Gas Company.

The Shannon Scheme.—Recent developments in connection with the work on the Shannon hydro-electric scheme at Ardnacrusha, Co. Limerick, include the erection of a fire station, with hydrants at danger points, three miles of hose being provided; and the erection of a school for about 35 or 40 German children, whose fathers are engaged on the scheme.

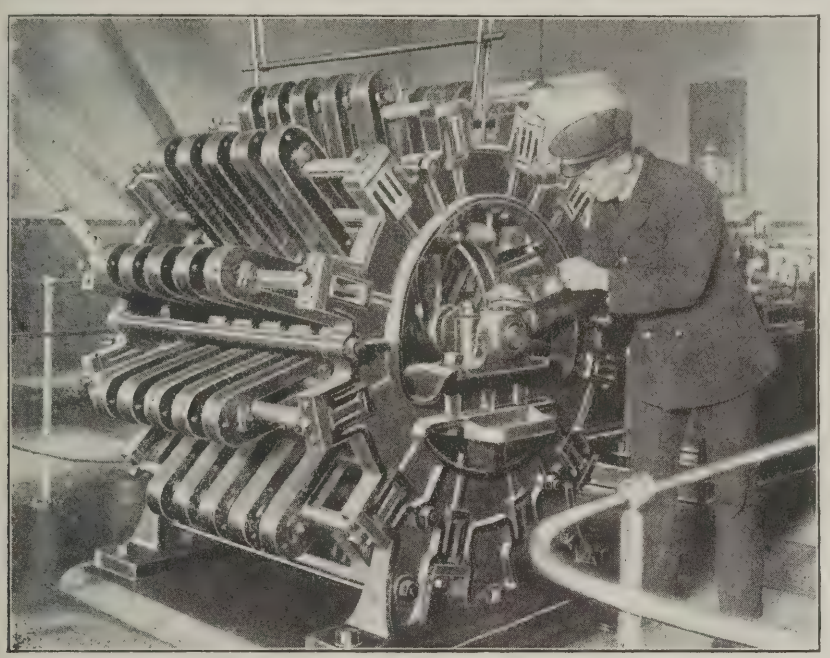
Fatality. — George Chrich (13), of Rossington, was killed recently when climbing an 11,000-V transmission standard of the Yorkshire Electric Power Company, after a bird's nest. The boy apparently touched the transmission wire and received a fatal shock, his legs being severed at the knees and the fingers on one hand burnt off. He appeared to live for a few minutes before falling dead to the ground. At the inquest a verdict of "Accidental death" was recorded.

Gold from Mercury.—The claims by Drs. Miethe and Hantaro Nagaoka to have produced gold from a base metal, mercury, have for some time been subjected to sceptical criticism in the scientific world, and the subject was discussed at a recent meeting of the German Chemical Society in Berlin. It was suggested by one professor that the presence of gold even at a distance, as in the operator's spectacle frames, or in metal compounds in an adjoining room, might spoil the experiment through its being drawn in ultramicroscopic quantities into the electric current, by an effect like that of the cathode rays. Other criticism pointed to the suggestion that there were always traces of gold in mercury which would vitiate the results of the experiment. Prof. Miethe said that in 42 experiments the output of gold was constantly proportional to the current and the time of the process. The claims of Prof. Miethe are supported by those of Dr. A. Gaschler to have produced mercury from gold. The process consisted, according to *Science*, of sealing a gold electrode in a vacuum tube and bombarding it with a stream of positive hydrogen atoms shot through the tube at a high velocity. After 30 hours' bombardment the spectrum lines from the gold indicated the presence of mercury, which became stronger as time elapsed.

Village Water Power.—At the annual meeting of Messrs. James Finlay & Co., Ltd., Glasgow, Mr. W. Brown, who presided, said that at Deanston, where most of their employés lived on property owned by the company, they were arranging for the erection of more houses, which they hoped would enable all their looms there to be run. They had water available for power purposes and intended to light not only the new houses but the whole village electrically.

Exhibition of Inventions.—The second International Exhibition of Inventions, organised and managed by the Institute of Patentees (Inc.), is to be held at the Central Hall, Westminster, from October 13th to 26th next. The exhibits will be arranged in two sections, A for inventions on the market, open to any potential exhibitor, and B for inventions on the market, open to members of the Institute of Patentees. Applications for space in both sections are invited. Full particulars may be obtained on application to the Institute, 39, Victoria Street, Westminster, S.W.1.

Lighthouse Electrical Equipment.—We reproduce herewith a photograph of the electrical generator installed at the Lizard Lighthouse, Cornwall, for supplying the signalling apparatus. It is a De Meritens alternating current magneto-electric machine of French make. The field system consists of five sets of twelve permanent magnets, sixty in all, each magnet being made up of eight steel plates. The armature is 2 ft. 6 in. in diameter, and is composed of five rings with twenty-four bobbins in each ring arranged in six groups of four bobbins each. The machine develops, with the arc lamp in the circuit, a current of about 150 A at 30 V. The slip-rings and the brushes are arranged so that 2/5ths, 3/5ths, or the whole of the current can be used. The machine runs at 600 r.p.m., giving a periodicity of 120 cycles. The machine was installed at the Lizard in 1893, having been previously used for experimental work at South Foreland Lighthouse. A smaller machine of the same type, which runs at 910 r.p.m., is also used as a stand-by. A pair of similar machines have run the light at St. Catherine's Lighthouse, Isle of Wight, since 1887.



Permanent-Magnet Alternator at the Lizard Lighthouse.

New Uses for Beryl.—The Canadian Department of Mines reports a great increase in the demand for beryl, a mineral whose new uses include substitution for feldspar in the manufacture of sparking-plug and insulator porcelain.

Power Line Communication.—What is claimed to be the first repeater for high-frequency telephone communication over power transmission lines has recently been installed by the Westinghouse Electric & Manufacturing Co. in America, as a result of which Indianapolis is now connected to Terre Haute by means of a 132-kV line and to Kokomo by means of a 66-kV line (both generating stations, while that at Indianapolis is a transformer sub-station). The lines from Terre Haute and Kokomo terminate in their respective transformer banks, the two systems being electrically isolated in so far as the high-pressure lines are concerned. High-frequency wireless telephone equipment had previously been installed at all three points, and the system load dispatcher is located at Indianapolis, where the repeater installation is also located. The two-frequency duplex system employs one frequency for transmission and a different frequency for reception, which function entirely independently, and both may proceed simultaneously. Mr. C. A. Boddie, of the Westinghouse Co., states that simultaneous transmission and reception is an absolute necessity, and the repeater must perform both operations at the same instant. The achievement of repeater action at Indianapolis required no additional apparatus nor alteration in the normal mode of operation—only the insertion of a suitable transformer between the output circuit of the high-frequency receiver and the speech-input circuit of the transmitter, thus coupling the circuits together. An incoming signal or talk from either direction is thus applied directly to the transmitter, which is accordingly modulated just as though the distant speaker were at Indianapolis instead of at one end of the line. The transmitter, therefore, faithfully repeats what comes into it, to the station which it is desired to reach, and also feeds back to the station where the signal originated; when the operator at Terre Haute is talking to Kokomo all three stations are in action, each transmitter delivering its normal high-frequency output to the line.

The "tie-back" between the receiver and transmitter which converts the Indianapolis equipment into a repeater not only enables it to function as a repeater, but also permits three-party conversation between the load dispatcher at Indianapolis and the Terre Haute and Kokomo operators. It is claimed that the ease and simplicity with which a standard two-frequency duplex system can be made to function as a repeater permits extremely long lines to be operated, and dissimilar systems which are electrically isolated, tied together in a communication system. It offers a valuable means of getting past a break in a line, for if a line is sectionalised at a point where a telephone set is installed, such a set can be converted into a repeater, and the break by-passed without loss in signal strength or resort to special coupling devices.

The Position of the Combustion Engineer.—Referring to recent correspondence in the technical Press on this subject—obviously that which appeared in our pages some time ago—and an article by "a well-known combustion expert," evidently that of Mr. Charles F. Wade, published in our issue of December 25th, 1925, p. 1014, Mr. E. B. Pausey discussed this question in the April issue of *The Electrical Power Engineer*, pointing out that the term "Combustion engineer" needs definition, and that the Schedule of Salaries and Conditions should be expanded to define the duties and responsibilities of the engineers employed in power stations. He puts forward the following suggestion for a standardised technical staff for a power station of about 10,000-kW installed capacity: "Assistant Shift Engineer, to attend to the switchboard and look after the turbine room in the shift charge engineer's absence, Grade 9 or 8b; Testing and General Assistant to Boiler-House Superintendent, to test coal and water, attend to recording and other instruments and assist in the work of the boiler house as required, Grade 8a; Shift Charge Engineer, who, being provided with an assistant to relieve him of much of the turbine-room routine work, should devote most of his attention to the operation of the boiler house, Grade 8; Boiler House Superintendent, complete charge of boiler operation, repairs and maintenance of boilers and plant connected therewith, Grade 6; Power-Station Superintendent, generally responsible for the operation, repairs and maintenance, and organisation of the whole of the power-station plant, Grade 3. A scheme like this would have several advantages over the haphazard arrangements in vogue at the present time. It would provide a logical ladder of promotion, at each step of which the engineer would be able to fit himself for the next step; it would define the duties and fix the minimum salaries for the different steps; and it would ensure a well-organised staff, which need contain no elements of discord, and would be capable of working together as a unit and manifesting a team spirit. It will be noted that there is no excrescence of the nature of an independent 'combustion engineer' to introduce discord into what should be a harmonious whole; on the other hand, at each step of increasing responsibility, the engineer would continue to be responsible to his superior until finally the Power Station Superintendent would be responsible to the Chief Official, either directly or through the Deputy Chief where such an official exists. At the same time, with the exception of the member in the lowest grade, all the officials will be combustion engineers, for their duties consist, at least to a very important extent, of the supervision of combustion or processes subservient thereto. I think the staff I have now described would be typical of efficiently organised power stations of that capacity and somewhat larger; in still larger plants, of course, the personnel of the technical staff would correspondingly increase by the addition of various assistants."

Lecture.—"Is Scientific Invention becoming a Nuisance?" is the subject of the lecture at the London School of Economics on July 6th at 5-30 p.m. in aid of the King Edward's Hospital Fund. Prof. A. M. Low is one of the speakers.

Appointments Vacant.—Telephone engineer (£800) for the United River Plate Telephone Co., Ltd. Electrical engineers (£250+) for the Tropics. (See our advertisement pages to-day.)

Direct Electric Iron Production.—At a meeting of shareholders of the Uddeholm Company at Stockholm it was stated that trials had been made during the past few months at the Hagfors ironworks of the method of direct electric iron production invented by the chief engineer, M. Flodin. The trials proved the possibility of producing forgeable iron in this way, but nothing is yet known definitely of the economic aspects of the process. The Uddeholm company has not yet acquired the method, but has reserved priority of the right to do so if it proves economically profitable.—*Reuter's Trade Service* (Stockholm).

Institute of Transport.—ANNUAL CONGRESS.—The Council of the Institute, after considering certain alternative venues to Birmingham, has reluctantly been constrained to abandon the idea of holding a congress this year. The annual dinner of the Institute, originally fixed for April 21st last, will take place at the Hotel Cecil, London, on November 18th.

EXAMINATIONS.—The next examinations will be held in the last week in April, 1927. Centres tentatively decided upon are: London, Birmingham, Bristol, Leeds, and Manchester. Arrangements will be made for holding examinations in South Africa, India, Australia, New Zealand and South America, or other centres overseas from which a satisfactory number of candidates may be forthcoming.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements).

The Monmouth Town Council has decided to increase the salary of the electrical engineer by 10s. weekly and to grant him a coal allowance up to 10 tons annually.

The *Daily News* states that Mr. JAMES W. MCKAY, Birdhurst Rise, South Croydon, has been appointed general secretary of the Electrical Wholesalers' Federation, Ltd.

Sir ERNEST RUTHERFORD has been elected a member of the Academy of Sciences of Cracow.

It is announced in the Press that Mr. ARTHUR HYLAND, the Special Commissioner of the Australian Government and Director of Trade and Publicity, has arrived in London.

Mr. HARRY HALL, of Nelson, has accepted an important post with Messrs. Parkinson (Australia), Ltd., of Sydney, and is sailing on July 2nd from Tilbury. Messrs. Parkinson are associated with Messrs. F. & A. Parkinson, Ltd., of Guiseley, Leeds, for whom Mr. Hall has been the Manchester manager for two years.

The Faversham Town Council has increased the salary of the electrical engineer, Mr. G. SOMERVILLE, from £416 to £500 per annum.

The Marconiphone Co., Ltd., announces that Mr. F. W. PERKS, who until recently was its London manager, has been appointed general sales manager. The duties of London manager will be taken over by Mr. E. A. OAKMAN.

Mr. HAMLYN DRAKE, B.A., who served in the Horse Artillery in Palestine, and acted as A.D.C. to General King, has been elected a director of Messrs. Drake & Gorham, Ltd. Mr. Hamlyn Drake, who is the only surviving son of Mr. Bernard Drake went through the B.T.-H. works at Rugby, and made a study of electric furnaces in America.

Upon the thirtieth anniversary of the granting of the first Marconi wireless patent, Senatore MARCONI was honoured by his native town, Bologna, Italy. Among other things, a number of annual prizes and gold medals were instituted for award to students.

It is announced that Sir ALEXANDER B. W. KENNEDY having, owing to advancing years, resigned his position as director and engineer-in-chief of the Westminster Electric Supply Corporation, Ltd., the board has appointed the general manager, Mr. W. A. PEARMAN, to fill the vacant seat on the board. Mr. P. L. RIVIERE, who is resigning the position of electrical engineer in the L.C.C. Tramways Department, has been appointed engineer-in-chief of the company. Sir Alexander Kennedy was born in March, 1847.

Mr. G. S. W. MARLOW, B.Sc., F.I.C., has been released by the Association of British Chemical Manufacturers to devote part of his time to the appointment of secretary and editor to the Faraday Society and secretary of the Institute of Physics, pending the completion of final arrangements for carrying on the official work of these bodies. Mr. Marlow was assistant secretary to the Institute of Chemistry from 1919-1925.

Mr. W. J. E. BINNIE (Sir Alexander Binnie, Son & Deacon) has been elected chairman of the committee of the Association of Consulting Engineers for the year 1926-1927.

Mr. F. W. FIFIELD has resigned his position as manager of the Bristol depôt of the Edison Swan Electric Co., Ltd.

Brighton Lighting Committee recommends that Mr. J. CHRISTIE, chief engineer and manager, be authorised to visit the United States to study electricity developments, particularly in relation to the new machinery, and that he be granted for the purpose an allowance of £400.

Mr. W. A. BENGER has taken up the agency for Yorkshire for the Electrical Apparatus Co., Ltd., London.

Obituary.—MR. A. V. DOWNTON.—The death took place at Southbourne, Bournemouth, on June 14th, of Mr. Albert Victor Downton, of Lesney View, Lesney Park, Erith, who was up to the time of his death general manager and technical adviser of the Enfield Cable Works. He was 53 years of age, and commenced his career at Callender's works at Belvedere, where for some years he was manager of the cable department. Before becoming associated with the Enfield Cable Works he was for some time with the Pirelli cable works at Southampton.

LADY NOBLE.—We desire to tender our condolences to Sir William Noble, formerly engineer-in-chief to the G.P.O., and now a director of the British Broadcasting Co. and of the General Electric Co., Ltd., on the death of Lady Noble, which occurred at Leamington on June 21st, at the age of 61 years.

MR. J. CORSON.—Mr. John Corson, of the Shanghai Municipal Electricity Department, Shanghai, has died in the General Hospital there at the age of 26 years. Mr. Corson, who began his career in the Kilmarnock Corporation Electricity Supply Department, was engaged by the Shanghai department in 1922 as meter assistant.

Will.—The late Sir T. A. COGHLAN, Agent-General in London for New South Wales and a director of the West India and Panama Telegraph Co., Ltd., left property of the value of £1,420 in England, with net personalty £239.

New Companies Registered.

C. H. Rees & Co., Ltd. (214,363).—Private company. Registered June 14th. Capital, £3,000 in £1 shares (2,500 preference and 500 ordinary). Objects: To adopt an agreement with L. Jacobs (London), Ltd., and to carry on the business of agents for, or merchants of electrical supplies and glassware, referred to therein. The life directors are:—W. Rose, Stonington, Station Road, Hendon, N.W.4, manufacturer (chairman); C. H. Rees, 3, Mayfair Road, West Jesmond, Newcastle-on-Tyne, merchant; F. P. Onate, 70, Wandsworth Bridge Road, Fulham, S.W., merchant. Qualification, £100. Remuneration as fixed by the company. Secretary: W. J. Braine. Solicitor: F. H. Stollard, 73, Basinghall Street, E.C.2. Registered office: 6, Dyers Buildings, Holborn, E.C.1.

Bel Canto Radio Reproducer Co., Ltd. (214,392).—Private company. Registered June 16th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in loud speakers, gramophones and sound producing or reproducing or recording instruments of all kinds, &c. The first directors are:—Charles Mahe de Chenal de la Bourdonnais, Prince de Mahe (permanent governing director), Loventor Manor, near Totnes, Devon; John B. D. Mahe de Chenal de la Bourdonnais, Prince John de Mahe, Loventor Manor, near Totnes, Devon. Solicitors: Johnson, Weatherall, Sturt and Hardy, 7, King's Bench Walk, Temple, E.C.4. Registered office: 68, Farringdon Street, E.C.

Cablon, Ltd. (214,394).—Private company. Registered June 16th. Capital, £2,000 in £1 shares. Objects: To buy, manufacture, import, export and deal in and generally to exploit and promote the manufacture and use of super-high-tension cables, high and low tension cables and cables of all kinds, wires, switches, fuses and all other accessories, machinery, plant, apparatus, and materials of all kinds used in connection with electricity or in the electrical or other kindred trades, &c. The subscribers (each with one share) are:—F. E. Smith, 4, Langford Place, N.W.8, solicitor; H. E. Callow, 1, Edward Avenue, Morden, managing clerk. The first directors are to be appointed by the subscribers. Qualification, £1. Remuneration as fixed by the company. Solicitors: Freshfields, Leese and Munns, 31, Old Jewry, E.C.2. Registered office: Lincoln House, 296-302, High Holborn, W.C.1.

Crosland, Ltd. (214,364).—Private company. Registered June 14th. Capital, £2,000 in £1 shares. Objects: To carry on the business of wholesale dealers in electrical, mechanical and motor goods, motor, mechanical, electrical and general engineers, machinists, smiths, cleaners, fitters, &c. The first directors are:—M. A. E. Crosland, 13, Furlwell Lane, Batley, electrical engineer; W. Burnley, 1, Camden Terrace, West Park Street, Dewsbury, accountant. Qualification, £1. Secretary: W. Burnley. Solicitor: R. W. Stapleton, 24, Union Street, Dewsbury. Registered office: Russell Street, Batley, Yorks.

Cornwall Power Co., Ltd. (214,395).—Registered as a "public" company, on June 16th, with a nominal capital of £210,000 in £1 shares. The objects are to carry on in England or elsewhere the business of an electric light and power company in all its branches, and to adopt an agreement with the Urban Electric Supply Co., Ltd., for the sale to this company of all shares held by the "Urban" Company in the Cornwall Electric Power Co. Minimum cash subscription, 7 shares. The directors are:—P. D. Tuckett, 17, Durham Villas, Kensington, W.8, barrister; H. T. Crosthwaite, Little Bowden, Pangbourne, stockbroker; H. B. Grotrian, Knolls, Leighton Buzzard, barrister; E. Charrington, Ice Wood Cottage, Limpsfield, electrical engineer; F. E. Gripper, 14, Malbrook Road, Putney, electrical engineer. Qualification, £1 or such other amount as may be fixed by the company. Remuneration as fixed by the company. Secretary: C. H. Jones, 67, Hayes Road, Bromley. Solicitors: Linklaters & Paines, 2, Bond Court, Walbrook, E.C.4. The registered office is at Broad Sanctuary Chambers, Westminster, S.W.1.

Ceag, Ltd. (214,442).—Private company. Registered June 18th. Capital, £1,000 in £1 shares. Objects: To acquire the business carried on by the "Ceag" Miners' Supply Co., Ltd., Barnsley, also to acquire the registered trade mark "Ceag," No. 346,135, and to carry on the business of manufacturers, importers and exporters of, and dealers in electrical and other safety lamps for use in mines, &c. The first directors are:—E. R. J. Plummer, Wellfield House, Barnsley; W. Plummer, "The Elms," Ashford, Middlesex. Qualification, one share. Remuneration as fixed by the company. Secretary: J. Lees. Solicitor: A. P. Williamson, 19, The Square, East Retford, Notts. Registered office: Queen's Road, Barnsley.

Yorkshire Ignition Co., Ltd. (214,464).—Private company. Registered June 18th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of battery and magneto manufacturers, manufacturers of, and dealers in electrical ignition apparatus and motor accessories of all kinds, general and mechanical engineers, manufacturers of, and dealers in wireless instruments, &c. The first directors are:—L. S. Hargreaves, "Rosebank," Totley Brook Road, near Sheffield; C. O. Birtles, 264, Main Road, Darnall, Sheffield. Qualification, 150 shares. Solicitor: R. B. Grayson, 10, Figtree Lane, Sheffield.

Midland Tube Co., Ltd. (214,383).—Private company. Registered June 15th. Capital, £1,000 in £1 shares. The objects are to acquire the branch of the business of the Midland Tube and Forging Co., Ltd., relating to the manufacture and manipulation of tubes carried on at Bournbrook, Birmingham, and elsewhere, and to carry on the business of manufacturers and factors of, and dealers in metal tubes, conduit tubes for electric wiring and all kinds of apparatus, articles and accessories used in connection with the erection and fitting up of electrical installations, plant, and apparatus, manufacturers of, and dealers in cycles, motor carriages, and other vehicles, &c. The subscribers (each with one ordinary share) are:—J. H. Rice, 81, Oxford Road, Moseley, Birmingham, solicitor's managing clerk; G. J. Withington, "The Gables," Francis Road, Stechford, Birmingham, accountant. The first directors are to be appointed by the subscribers. No qualification required. Solicitors: Pinsent & Co., 6, Bennett's Hill, Birmingham.

H-S Electric, Ltd. (214,330).—Private company. Registered June 12th. Capital, £3,000 in 2,850 7 per cent. preference shares of £1 each and 3,000 ordinary shares of 1s. each. Objects:—To carry on the business of electrical engineers and contractors, manufacturers of, and dealers in electrical, magnetic, galvanic, and other apparatus, &c. The first directors are:—W. Holt, "Marmora," Goldieslie Road, Wylde Green, Birmingham; W. L. Sames, Ryde House, 227, Alcester Road, King's Heath, Birmingham; H. J. Fitton, "Gawsworth," Ridgeview Road, Whetstone, N.20 (director, Fitton, Smith & Co., Ltd.); and P. G. Marr, 59, Cheyne Street, Chelsea, S.W. (director of Fitton, Smith & Co., Ltd.). Messrs. Fitton, Smith & Co., Ltd., may, so long as they hold 65 per cent. of the ordinary shares, appoint all directors in excess of two, one of whom shall be chairman. Qualification of directors (except such nominees), 100 ordinary shares. Remuneration as fixed by the company. Registered office: 32, Charlotte Street, Birmingham.

Official Returns of Electrical Companies.

British Mica Co., Ltd. (72,187).—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated June 10th, 1926. 885 preference and 2,194 ordinary shares taken up. £1,079 paid on 885 preference and 194 ordinary shares. £2,000 considered as paid on 2,000 ordinary shares. Mortgages and charges, £2,300 debentures and £650 mortgage.

F. W. Bland & Co., Ltd.—Particulars filed of £100 debentures authorised by resolutions of May 3rd and June 7th, 1926, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Napier-Kimber, Ltd.—S. H. Gillett, of 24, Basinghall Street, E.C.2, ceased to act as receiver or manager on June 9th, 1926.

Acme Production Co., Ltd.—T. G. Weavers, of 4, Drapers Gardens, E.C.2, was appointed receiver and manager on June 8th, 1926, under powers contained in mortgage debenture dated April 10th, 1924.

Reflex Radio Co., Ltd.—F. Davies, of 245, Kingsland Road, E.2, ceased to act as receiver or manager on May 27th, 1926.

C. J. Thursfield & Co., Ltd.—Satisfaction to the extent of £3,000 on June 7th, 1926, of debentures dated April 1st, 1912, securing £4,000.

L. Weekes, Ltd. (old company).—B. T. Crew, of George Street West, Luton, C.A., ceased to act as receiver or manager on May 31st, 1926.

Electrical Trading Association, Ltd. (formerly Nottingham Electrical Contractors' Trading Association) (208,897).—Capital, £1,000 in £1 shares. Return dated February 19th, 1926. 1,000 shares taken up. £1,000 paid. Mortgages and charges at date of return, nil. Since registered, debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated June 7th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Contraflo Engineering Co., Ltd. (110,264).—Capital, £80,000 in £1 shares. Return dated February 5th, 1926. All shares taken up. £9,450 paid (being 7s. per share on 27,000 ordinary). £53,000 considered as paid on 53,000 shares. Mortgages and charges, nil.

H. J. Cash & Co., Ltd. (79,701).—Capital, £25,000 in £1 shares. Return dated March 9th, 1926. 15,000 shares taken up. £10,000 paid. £5,000 considered as paid. Mortgages and charges, nil.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Brush Electrical Engineering Co., Ltd.

The annual meeting was held on June 14th last, Mr. E. Garcke presiding. In proposing the adoption of the report, the chairman said that the total credits for the past year were £155,227, or about £1,000 more than in the preceding year. The total debits were £100,618, about £5,200 less. The proposed dividend of 10 per cent. on the shares, amounting to £45,856 less tax, was the same as they had distributed for each of the three preceding years; and there was a surplus of £8,751. The orders booked and executed during the year 1925 were larger in the aggregate than in the year 1924; moreover, they began the present year with a larger order list, so that the total volume of work done and in view was satisfactory. Their policy of confining themselves to definitely established types of manufacture continued to be justified. The popularity of the Brush-Ljungström turbo-generator grew from year to year and in the home market many installations had been completed during the year under review. There had been a decrease in the number of smaller equipments, due to the policy of the Electricity Commissioners in closing down or refusing extensions to certain of the smaller stations and compelling them to take their supply or part of it from larger stations. But during the year it had again been proved that many of those moderate-sized stations, when equipped with Brush-Ljungström plant, were able to generate their electricity at a figure lower than that at which they could purchase from the bigger stations and they were, in consequence, allowed to continue. At the same time, they had been preparing to meet the requirements for larger units. For example, they had during the year booked a contract for a set of 10,000-kW output, for St. Pancras. Their foreign market had also been increasing in a satisfactory manner and during the year installations had been completed or undertaken in India, the Malay States, South Africa, Australia and South America. In the transformer department the company had continued to make good progress throughout the year. In the foreign field their experience was that transformer prices were so keenly cut in many instances that the business was not worth while for them, so long as they were able, as they had been, to keep their shops fully occupied with moderately profitable home business. Nevertheless, they were able to keep their name well to the front in the foreign field by representative orders undertaken from time to time. Proceeding to deal with the proposed co-partnership scheme between the company and its employés, Mr. Garcke said that in the relations between labour and capital there were faults on both sides. The trade unions were organised to fight capital; the employers' associations were organised to fight labour. So long as that organised warfare continued there could be no real peace in industry. How was this deplorable state to be altered? It was no use any individual capitalist or individual worker holding up both arms between those opposing forces in the hope that, at his bidding, they would cease to fire. He would be crushed and it would be impossible to say whether by friend or foe. The time had come when on this subject they ought to be able to speak plainly without fear of giving offence. In the conferences of the two sides there was a disinclination to go to the root of the troubles. They heard many platitudes about goodwill, co-operation and mutual confidence. But the most important factor which was tacitly kept in the background was the fact that in every social problem in an old country they were buried up to the eyes in vested interests of every description, and no one could move without treading on somebody's toes, without disturbing the equanimity and balance of others. He, too, had his vested interests in electricity, and that was why he was opposing the vested interests of bureaucracy. The vested interests in the relations between labour and capital were represented by the powerful organisations on both sides which had been called into being as a consequence of large-scale production on a basis of economic doctrines devoid of moral interpretation. He had not a word to say against officials who recognised as their guiding principle the law of self-preservation. It was only a one-sided theorist who could say that the only principle in life to be observed was that of self-sacrifice for others—he had a noble and lofty text, but taken alone it had little validity and was no solution of their difficulty. On the side of the worker three things were needed—a fair reward for his labour, more security for continuous and permanent employment, and a higher status. On the side of the employer, the chief need was the removal of trade union restrictions upon increased output, so that a fuller use of toil-reducing machinery, and a more efficient and economic use of fuel energy could be made. Dealing with the company's proposals, he said that the directors did not make the mistake of presenting a cut-and-dried scheme. They met the trade unions, the federation of employers, and representatives of all the employés, both on the wages list and on the salaries list and said to them: "Here is a statement of the present position of the company and of the rights and obligations of the various parties interested in the company. If the principle of co-partnership has any value it must be capable of producing something more, something better, than the *status quo*. That something more we will call the surplus; and we will postulate as a basic principle that this surplus shall be distributed among all who have contributed to its production and we will discuss and collaborate on the details." Secondly, they said: "The employés will desire to have in addition to a fair share of the surplus also some voice in the welfare of the business which they are asked to promote. Therefore we propose to collaborate with you also on this point." The tentative scheme was the result of many discussions extending over nine or ten months, and he had every confidence that the proposed scheme would be accepted by the employés. They now asked the shareholders to say whether or no they approved the scheme in principle, or whether they wished any amendments to be made. If the meeting approved the scheme in principle, they would not be irrevocably committed to its adoption; they would refer it to a provisional Co-partnership Council. That Council would draw up a definitive scheme which would be submitted to the shareholders at a later date. Mr. W. Johnstone, in seconding the motion, remarked that from his knowledge of the employés he was convinced that they would carry out the proposed co-partnership scheme in a thoroughly loyal manner. After a short discussion, in which general approval of the proposed co-partnership scheme was voiced by the shareholders, the report was adopted.

W. T. Henley's Telegraph Works Co., Ltd.

The annual meeting was held on June 18th, Sir George Sutton, Bart., presiding. In moving the adoption of the report (*vide* our last issue, p. 924), the chairman, after referring to the death of Mr. Martin Roberts, who had been a director for 16 years, said the Tyre and Rubber Co. showed a very large increase in sales, but the year's work was not satisfactory from the profit point of view. Had there been stability in the market price of rubber that company would have shown a satisfactory profit for the year. With regard to the result of the year's work, it was the best in the long history of the company. Nearly all departments had been fully employed. The large expenditure on the works in recent years had made them capable of a large output, and the sales last year made a record. For the current year, the orders brought in were of greater value than they started the year with. Given peace in industry generally, they looked to the future with confidence. Their relations with their workpeople were excellent, but troubles in other industries had a direct detrimental influence on their business. The efficiency of their machinery and plant had been maintained at the highest level, and costs being reduced to the lowest practicable point, they were in as favourable a position as their British competitors to secure business. With regard to foreign competition, they had to meet conditions as to cost of labour and overhead charges which placed them at a disadvantage. They had done all they could to meet the difficulty, and further relief must come from an advance of labour rates in foreign cable factories and a reduction in our own taxation. Referring to the financial policy of the board, he said that, as he had told them at previous meetings, their first consideration was the stability of the undertaking, the conserving of the capital, and dividends were made subservient to that. He had said that they need not think that the dividend would never be raised because it had remained the same for several years; but that when the directors were satisfied that they could safely

raise it they would do so; and they had redeemed that promise this year. The cash available, including British Government stock, was £425,000. It was a large sum, but it fluctuated considerably in the course of a year, and was not too large to provide for all reasonable eventualities. Electrical manufacturing was continually developing new methods which made new demands for capital expenditure for new processes and machinery. There was a large carry forward, £503,000; that, of course, was in the nature of a reserve. They could transfer it to the reserve account and change a part into shares as a bonus to the shareholders without depleting their cash. They did not see any advantage in doing that. They believed the wiser course was to pay an increased dividend if they could earn it, and that was the course they had adopted this year. There could hardly be a manufacturing undertaking in the British Isles which had a stronger financial position than their business, which this year had reached 35 years of unbroken dividend record. In concluding, Sir George referred to his approaching retirement as managing director. This year, he said, he had completed 45 years of active service. He had not come to his decision to retire without mature consideration. He felt that he should not alter that decision, and that the interests of the business would be best served by his retiring from the managing directorship at the end of September next. It was the desire of the board that he should remain in the company's service as an active chairman, having his place at headquarters and keeping in touch with the company's many activities, and that he had agreed to do.—Mr. W. J. Potter seconded the motion, and the report was adopted.—Subsequently a sum of £500 was voted to each director as a special bonus on account of last year's results, and a cordial vote of thanks was accorded the chairman, directors, and staff.

Telephone Manufacturing Co., Ltd.

The annual meeting took place on June 17th. Mr. F. T. Jackson, who presided, said that the combined accounts of the subsidiary companies showed a profit of £73,822 for the year, subject to depreciation and taxation, as against £68,576 in the preceding year. The net value of the Installation Companies' properties was £315,586, from which a revenue of £124 489 was derived. The annual rentals credited to revenue account rose from £111 1 to £113,629. It had to be borne in mind that the company's policy was to maintain the position as to revenue, and capital expenditure had been limited to that end. The chairman then dealt with the accounts of the parent company, which were reviewed in our last issue (p. 924), and said that their investments in the French and Belgian companies had been written out of the balance-sheet. The whole of the contingency reserve (£32,000) might not be required, in which case a portion would be available for general reserve. During 1925 the Belgian company was able to pay several thousand pounds off its past indebtedness. Very little new capital was required; the purpose of the new financial scheme was to convert their bank and bond indebtedness into capital of a permanent nature. The scheme had been approved by a very large majority, and they could now look forward to a future untrammelled by the load of debenture and interest charges which had burdened them in the past. A sum of £80,000 per annum would thus be released for working capital, or, they hoped, for dividends. The reorganisation of the capital had already had a marked effect upon the business. The orders in hand and in sight would be sufficient to cover their overhead expenses for 12 months, leaving practically the whole of the gross profit from further orders available for reserves or dividends. The factory which for three years had been too large for their limited financial resources was fully equal to turning out the greater volume of work which was now coming their way. His confidence in the future was complete. The report and accounts were adopted.

Oriental Telephone and Electric Co., Ltd.

The report of the directors for the year ended December 31st last records a net revenue of £67,017. After adding £11,889 brought forward and deducting interim dividends, there remains a balance of £55,141, out of which the final preference dividend is to be paid and a final dividend of 6 per cent., plus a bonus of 2 per cent., free of tax, on the ordinary shares, leaving £14,218 to be carried forward. The business of the Singapore branch continues to progress steadily, but there was again a loss on the Mauritius branch. The Mauritius Government has held an expert inquiry, and it is hoped that the result will be an outlet from the present impossible situation. The Bombay Telephone Co., Ltd., recorded an increase in the number of subscribers, but the results did not permit of the declaration of a dividend. Since the last report, however, considerable economies in administration have been effected. The Oriental Company has taken up Rs.6,66,150 8½-per-cent. mortgage debenture stock in the company. Other companies in which the Oriental Company is "interested" have paid the following dividends:—Madras Telephone Co., Ltd., 7 per cent., free of Indian income tax; Rangoon Telephone Co., Ltd., 8 per cent., free of Indian income tax; China and Japan Telephone & Electric Co., Ltd., 20 per cent., plus a bonus of 10 per cent., both free of tax; and Hongkong Telephone Co., Ltd., at the rate of 8 per cent. per annum for the first six months of its working. The death of the chairman, Sir George S. Gibb, is recorded, and it is stated that Sir A. H. McMahon, G.C.M.G., has joined the board as chairman. Meeting: June 29th.

Whitehall Electric Investments, Ltd.

Presiding at the annual meeting on June 17th, the Hon. Clive Pearson (chairman) said that the increased net income had permitted of the payment of a 2½-per-cent. dividend on the ordinary shares and the reduction of discount on debenture stock; within the next two years the latter item should be completely eliminated. The Cia. Chilena and the Cia. Valparaiso were maintaining good progress. In four years their sales of energy had risen from 55 to 120 millions of kWh. The 47,000-kW plant was already fully loaded, and plant with a capacity of 22,000 kW which was being installed would be in the same position shortly after its inauguration. The Santiago tramway properties had been transferred to a new subsidiary of the Chilena Company, and the net earnings had shown a moderate increase. Improvements were in hand, and the new company was also to operate the power and light distribution system in Santiago. The return in Chile to constitutional government and to a gold standard had led to improvements which would benefit traders. The net operating results of the Mexican companies had shown a considerable advance over those of 1924, although they were still below the 1922 level. The company's investments did not appear to be affected by the new Alien Law in Mexico, but further investment might be affected. In conclusion the chairman expressed his confidence in the future of the company.

Madras Electric Supply Corporation, Ltd.

Mr. James Gray (chairman) presided at the annual meeting on June 16th and in presenting the report and accounts (*vide* ELEC. REV., June 11th, p. 883), said that the results were not striking but they showed the continuation of the company's steady improvement. The 6 per cent. first mortgage debentures had been entirely redeemed out of an issue of 5½ per cent., tax-free, preference shares. The debenture sinking fund contribution had consequently been transferred to the depreciation and renewal account, which, after writing off debenture and preference share issue expenses, stood at £123,836. During the year additions had been made to sub-stations; new boilers and generating sets had been installed; and further converting plant, switchgear and cable, had been provided. Agreements had been concluded with the Madras and Southern Mahratta Railway Co. and the Madras Harbour Trust for the provision of large supplies of electricity, but some time would elapse before those supplies commenced and the company felt the benefit of them. The additions at the power station would keep the company in advance of the demand. The sanctioned capital had been exhausted and it would be necessary to increase the capital at no distant date. A dividend of 6 per cent., free of tax, had been received from the Madras Electric Tramways (1904), Ltd., but the company's receipts had been affected by motor-omnibus competition, which, however, was being countered by the tramway company's own 'bus services. The report and accounts were adopted.

United Electric Tramways of Montevideo, Ltd.

The report for the year ended March 31st last states that the operation of the tramway system for the year 1924-25 resulted in an increase of the gross receipts by £13,438 to £678,100. The profit and loss account shows a credit balance of £79,294, and to this is added £7,222 brought forward, making £86,516. Interim dividends absorbed £12,000, capital redemption allocations have been made to the extent of £10,204, and £27,223 has been provided for depreciation and renewals, and after paying the final preference dividend it is proposed to pay a dividend of 4 per cent. on the ordinary shares, leaving £9,088 to be carried forward. The passengers carried by the tramway system increased from 80,074,936 to 81,544,137, but the car miles run were reduced by 205,307 to 11,003,731. The installation of additional plant at the power house was completed during the year, and a new 3,750-kW turbo-alternator was put into service in November last. Two new sub-stations were completed, and two more are in hand. The question of an increase in fares is under consideration. The meeting is to be held to-day (Friday).

Underground Electric Railways Co. of London, Ltd.

The long-awaited scheme for the reorganisation of the share capital was published last week. The present issued capital consists of 500,000 ordinary shares of £10 each (fully paid) £5,000,000, and 1,198,980 "A" ordinary shares of 1s. each (fully paid) £59,949, making a total of £5,059,949. It is proposed that the capital shall be reorganised and increased so as to be £5,068,878 divided into 5,068,878 ordinary shares of £1 each all ranking *pari passu* and each carrying one vote on a poll at general meetings. This will be effected as follows:—(*a*) The existing 500,000 £10 ordinary shares shall be subdivided into 5,000,000 £1 ordinary shares; (*b*) Of these 3,550,000 shall be retained by the existing ordinary shareholders and the remaining 1,450,000 shall be surrendered to the company and be available for re-issue; (*c*) All the 1,198,980 issued "A" ordinary shares of 1s. each shall be surrendered to the company and consolidated into 59,949 ordinary shares of £1 each and be available for re-issue; (*d*) 8,843 new ordinary shares of £1 each and 4 new ordinary shares of 1s. each shall be created; (*e*) The 1,716 unissued "A" ordinary shares of 1s. each in the present capital and the 4 new ordinary shares of 1s. each to be created shall be consolidated into 86 ordinary shares of £1 each. In addition to re-arranging the capital the scheme will cancel the contingent certificates and thus consolidate the interests of those persons who have contingent rights in the

undertaking with the interests of the shareholders, thereby eliminating a charge, even though it may be a remote one, upon the future profits. The effect of the scheme is that the £10 ordinary shareholders are asked to sacrifice a portion of their capital rights in return for slightly increased rights in the distribution of profits and the "A" ordinary shareholders to sacrifice a portion of their rights in the distribution of profits, in order that they may in future rank, *pari passu*, with the present £10 shareholders in the distribution of capital. A comparison between the present and proposed appropriation of profits available for dividend, is as follows:—

	Proportion of Profits.	
	Present. Per cent.	Proposed. Per cent.
To the present £10 ordinary shares ...	66.66	70.03
To the present "A" ordinary shares ...	33.33	26.02
To the contingent certificates	—	3.95

The directors are taking steps to raise the money which is required for paying off the temporary bank loan, acquiring further interests in some of the subsidiary companies, and for other capital purposes. Extraordinary meetings are to be held on July 29th for the purpose of considering the proposals and approving them if thought fit.

French Companies.

The *Société d'Eclairage et Force* proposes to pay a dividend at the rate of 40 fr. per share, as compared with 50 fr. in 1924, the share capital participating being considerably greater than in the previous year.

The *Union d'Electricité* records an increase in the net profits, from 15,354,000 fr. in 1924 to 18,372,000 fr. last year. The dividend is at the rate of 20 fr. (8 per cent.) per share, as compared with 17.50 fr. in 1924.

The *Compagnie Parisienne de Distribution d'Electricité* reports gross profits of 82,388,000 fr. for 1925, as against 62,692,000 fr. in the previous year. Including the balance forward the accounts show net profits of 37,409,000 fr., permitting of the payment of a dividend of 65 fr. per share, as against 60 fr. in 1924.

The report for 1925 of the *Compagnie de Forges et Ateliers de Constructions Electriques de Jeumont*, whose financial results were recently recorded, states that, despite the economic crisis, the different departments continued to be well provided with orders, and their activity was greater than in the preceding year. At the end of 1925 the manufactures still to be invoiced represented a value of over 100,000,000 fr. The various subsidiary companies in France, Belgium, and other countries also yielded satisfactory results.

Norwegian Company.

The *Norske A.S. for Elektrokemisk Industri*, reporting on the year ended March 31st, 1926, states that the business made satisfactory progress in the individual departments. On the other hand, the situation of the exchange had an adverse effect. The chief receipts are paid direct in gold values, and these receipts, converted into Norwegian kronen, declined in accordance with the rise in the value of the krone. It is proposed to apply the surplus of 25,000 kr. for 1925 and the reserve fund of 236,000 kr. for the purpose of writing down investments upon which a loss has been incurred. The electrode branch still occupies the first place in the business; 11 new licences have been granted for the use of the Soderberg electrode so that contracts have now been entered into with 51 works. Contracts on a larger scale have been concluded with aluminium works for the introduction of electrodes, this branch having so far progressed as to have become quite an international business. Among the participations reference is made to the A.S. Kinsarvik, whose shares held by the Elektrokemisk Industri are now being disposed of to the Aluminium Company of America.

Swedish Company. — The *Svenska Akkumulatoraktiebolaget Jungner* reports a net profit of 201,000 kr. for the last financial year, as compared with 137,000 kr. in 1924. The directors proposed a dividend of 3 per cent. on the ordinary shares, as against 6 per cent., and 14 per cent. on the preference shares, as compared with 11 per cent.

Swiss Company.—The directors of *Brown, Boveri and Company*, Baden, recommend an increase in the dividend from 6 per cent. for 1924 to 7 per cent. for last year.

Czecho-Slovakian Company.—The *Krizik Electrical Engineering Co.*, of Prague, reports a net profit of 7,799,720 crowns for last year and is declaring a dividend of 5 per cent.

Burndept Wireless, Ltd.—The company's first report, covering 10 months ended December 31st last, states that the "slump" which was experienced prevented the company from maintaining or increasing its turnover, and in spite of the exercise of drastic economies, which were too late to affect the period under review, there was a loss of £3,563, and therefore no dividend can be paid. In February the directors entered into negotiations for the amalgamation of the company with two other leading radio and electrical companies, but the general strike intervened and the necessary financial support was not forthcoming, and negotiations were discontinued. Lord Lurgan and Mr. G. E. Duveen have resigned from the board, and Messrs. J. B. Close, H. I'Anson Jones, and C. F. Trippe have joined it. Sir C. G. C. Hamilton has been elected chairman. Meeting: July 16th.

Sevenoaks and District Electricity Co., Ltd.—After providing for depreciation (£3,500) and paying the interim preference dividend there is a net profit of £3,529. It is proposed to pay the final preference dividend, one of 7 per cent. on the ordinary shares, and to write off £1,639 against development account, &c., leaving £821 to be carried forward. During the year further capital was raised by an issue of preference shares; this has been used principally in the extension of the company's mains. Further extensions are necessary, and proposals for raising the additional capital required were to be placed before the shareholders at the annual meeting on Wednesday last.

Globe Telegraph and Trust Co., Ltd.—The directors' report for the year ended May 31st shows a net revenue of £337,110, to which is added £51,222 brought forward, making £388,332. From this amount £15,000 has been transferred to the reserve for contingencies and interim dividends absorbed £241,756, leaving £131,576, which is to be distributed as follows:—Final dividend on the preference shares and 5s. per share on the ordinary shares, free of tax, making 10 per cent., tax-free, for the year, leaving £80,991 to be carried forward. The report records the retirement of Sir Robert M. Kindersley from the board and the appointment of the Hon. A. G. V. Peel in his place. The meeting was held on Tuesday last.

Edmundsons' Electricity Corporation, Ltd.—The net profit for the past year, after providing for debenture charges and taxation, amounts to £84,431, as against £74,784 in the preceding year. To this is added £15,159 brought forward, making £99,590. After paying interim dividends there remains a balance of £73,590, which it is proposed to allocate as follows:—To reserve account, £20,000; final preference dividend, £14,000; final dividend of 5 per cent. on the ordinary shares (making 8 per cent. for the year), £20,000; carried forward, £19,590. The meeting was held on Wednesday last.

Ransomes, Sims & Jefferies, Ltd.—The profit balance for the past year, including £56,630 brought forward, is £144,599. From this £25,000 is put to a special reserve against strike losses, £25,000 is transferred to the ordinary reserve, and a dividend of 5 per cent. is to be paid on the ordinary shares, leaving £58,599 to be carried forward.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Madras Electric Supply Corporation.—23,600 5½ per cent. (free of income-tax) preference shares of £1 each fully paid, Nos. 303,201 to 326,800 (cumulative).

Reading Electric Supply Co.—£150,000 6 per cent. first mortgage debenture stock.

James Keith & Blackman Co., Ltd.—The report for the year ended March 31st last records an increase in the volume of orders received. The available balance is £31,272, out of which it is proposed to pay a dividend of 10 per cent. on the ordinary shares, to transfer £5,000 to reserve, and to carry forward £10,272. The meeting is to be held to-day (Friday).

British Columbia Telephone Co.—The available balance from the past year's working was $738,302, as against $667,688 in the preceding year. A total dividend of 8 per cent. has again been paid on the ordinary shares, $50,000 is contributed to the pension fund, $80,000 to fire and loss reserve, and $83,387 is carried to surplus.

Para Telephone Co., Ltd.—The profit for the past year was £4,570, and the addition of £6,454 brought forward makes £11,024 available. A dividend of 3 per cent. is to be paid (against *nil* for 1924), £5,000 is allocated to depreciation, and £3,924 is carried forward.

John Brown & Co., Ltd.—The directors consider it inadvisable to pay an ordinary dividend out of the disposable profit of £279,683. They are accordingly paying the final preference dividend and carrying forward £192,183. The previous year's ordinary dividend was 5 per cent.

Reduction of Capital.—DICTOGRAPH TELEPHONES, LTD., AND REDUCED.—A petition for the confirmation of the reduction of the capital of the above-named company from £80,000 to £61,000, has been presented to High Court and will be heard in London on June 25th.

Cape Asbestos Co., Ltd.—The profit for 1925 was £26,485, and the addition of £6,237 brought forward makes £32,722. It is proposed to pay 10 per cent. on the ordinary shares and a further dividend equal to the ordinary dividend on the preference shares. £10,491 is carried forward.

Richard Johnson, Clapham & Morris, Ltd.—Out of a net profit of £5,262, plus £8,080 brought forward, making £13,342, the directors propose to pay the preference dividend and to carry forward £8,199. Meeting: June 26th.

Edgar Allen & Co., Ltd.—The directors propose to pay a dividend of 1s. per share, free of tax, on the ordinary shares out of the profit and amount brought forward, totalling £70,775.

Northern Mexico Power and Development Co.—A preference dividend of 1¾ per cent. has been declared in respect of the current quarter.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—A quarterly dividend at the rate of 10 per cent. per annum has been declared.

International Light and Power Co., Ltd.—A dividend of 3 per cent. has been declared on the preference shares in respect of the half-year ending June 30th.

Stocks and Shares.

MONDAY EVENING.

THE principal feature this week in the markets for electricity companies' shares is the publication of a scheme dealing with the Underground Electric Railways of London. Readers of these notes have probably grown weary of the constant references made over the past half decade to the anticipations of the finances of this company being taken in hand in an endeavour to unify the diverse interests which prevail. When the American exchange stood so much against this country, it was impossible for anything to be done, owing to the fact that the company's income bonds are redeemable at par, payable in American as well as in other currency. Coupons, it will be recalled, became saleable at a premium, and were, indeed, so negotiable until fairly lately. Now that the American exchange is practically normal, the Underground Electric Railways of London board is able to approach the matter without being handicapped by this factor.

A plan has been evolved, which is to be submitted to the proprietors at a meeting next week, whereby the £10 ordinary, the "A" shares and the contingent certificates will be brought into something like line. Keen criticism has already arisen from holders of the "A" shares and market disappointment with the terms is reflected in the sharp fall in prices. The board has not yet announced what it intends to do in regard to the 6 per cent. income bonds, the price of which remains at 101. It is hoped that the directors' statement will include an estimate of what prospect there is for an early payment of dividend on the shares. The £10 at 3½ are 10s. down, while the 1s. shares, which were 12s. 6d. about ten days ago, have reverted to half a guinea. Districts are better at 54, on the contention that the stock looks reasonably-priced when compared with the current quotations for Underground shares. Metropolitan Consolidated at 65 is ½ higher.

The electricity supply market is inclined to be better. Rises have occurred in City of London ordinary and preference. Countys are 1s. up. Edmundsons both gained 1s. and Notting Hill preference rose 10s., to their par price of £10. The demand for stocks and shares in every part of the House continues to be on a large scale, and any security which offers good value is eagerly taken. Jobbers state that stock is not allowed to remain long on their books. New issues are subscribed with remarkable facility.

There is about £5,000 6 per cent. first debenture stock of the Lancashire United Transport & Power Company which can be obtained at 92. This represents a discount of 1 per cent. on the issue price of 93. A partial payment of interest is due in January next. On the present price the yield comes to 6½ per cent. on the money. The amount required for interest annually is £15,000, and last year's available profits were £43,000. No dividends have yet been paid on the shares, of which there are issued 193,000 ordinary of £1 each fully paid, and which at present are worth very little.

Cable stocks and shares are again better, the Eastern group leading the way. With the exception of Great Northern Telegraphs, which are down 10s., the whole of the list shows improvement. Easterns are up to 182½, Eastern Extensions to 18¼. Westerns are still relatively the cheapest of the group, and stands at 17⅞. Anglo-Argentine preferred continues to improve, advancing to 104½. Oriental Telephones are better at 45s., on the issue of the report.

United River Plate hold their rise at 8. Expectation, of course, is looking for an issue of new shares at some price that will provide a bonus. It may be well not to build too much hope upon this at present, as the new issue is hardly likely to be made before the autumn. Before then, it is likely that the Telephone Manufacturing Company may place 10s. shares on the market. In fact, the possibility of an issue of this sort being made, comes within the near future. Marconis are quiet. Burndepts have fallen, owing to the issue of a disappointing report.

Mexican stocks and shares of all kinds are better, on the statement that the Mexican Government is going to pay some of the coupons due on July 1st. This confirms the nebulous impressions that have been afloat for the past few weeks, and to which reference has already been made here. Mexican Light & Power, and the Mexico Tramways issues are all better. Amongst other dollar stocks, Shawinigan Water receded to 200. Submarine Cables Trust gained 5 points to 265.

Prices of manufacturing firms are firm, with rises in British Aluminium, Callenders, General Electric preference and Telegraph Constructions. On the other hand, Metropolitan-Vickers ordinary at 23s. 9d. and Babcocks at 51s. show declines. The dragging out of the coal dispute is making its influence felt in certain directions, though nothing like the extent to which it might have been expected to do. Business throughout the Stock Exchange is fairly active. There is a good deal going on in speculative investment stocks, while the prices of sound securities continue steadily to mount. Rubber shares have enjoyed a spurt, although the price of the raw produce remains about 1s. 9d. per lb.

Southern Counties Electric Light & Power Supply, Ltd., is circularising with prospectuses of 8½ per cent. preference shares, ordinary shares and first mortgage debentures. The chairman of the company is Sir Charles B. H. Soame, Bart. Readers of the ELECTRICAL REVIEW probably require no reminder that this is a company whose issues are best left severely alone.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1924	Dividend. 1925.	Price June 21 1926.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	57/6	—	4 17 5
Brompton Ordinary	1	10	10	31/9	—	*6 6 1
Charing Cross Ordinary	1	15	15	45/9	—	6 10 10
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 5 11
Chelsea	1	12	12	2	—	6 0 0
City of London	1	15	15	49/6	+2/6	6 1 3
do. do. 6% Pref.	1	6	6	22/6	+6d.	5 6 8
Clyde Valley	1	8	8	27/-	—	5 18 6
County of London	1	15	15	58/3	—	5 3 3
do. do. 6 % Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	7	24/6	+1/-	5 14 2
do. 7% Pref.	1		7	23/-	+6d.	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13¾	—	5 9 1
Lancs. Light and Power	1	7½	7½	24/6	—	6 2 5
London Electric	1	10	10	32/6	—	6 3 1
do. do. 6% Pref.	5	6	6	5 1/16	—	5 10 8
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/-	—	5 5 11
Midland Counties	1	5½	6	21/-	—	5 13 1
Newcastle-on-Tyne Ordinary	1	7	7	22/-	—	6 7 3
do. 5% Pref.	1	5	5	18/-	—	5 11 1
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	6	10	+½	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	17½	16⅝	—	5 8 6
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref.	1	7	7	26/3	—	5 6 8
Urban Ordinary	1	4	7	1 1/16	—	6 11 9
do. 6% Pref.	1	6	6	1	—	6 0 0
Westminster Ordinary	1	15	15	44/6	—	6 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 0
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	65	+½	7 13 10
do. District	,,	3½	3½	54	+1	6 9 8
Underground Electric Ordinary	10	Nil	Nil	3½	—½	Nil
do. do. "A"	1/-	Nil	Nil	10/6	—1/6	Nil
do. do. Income	Bonds	6	6	101	—	*5 18 10

TELEGRAPHS AND TELEPHONES.

		Dividend. 1924	Dividend. 1925.			
Anglo-Am. Tel. Pref.	Stock	6	6	104½	+½	5 14 10
do. Def.	,,	1½	1½	24½	+¼	6 3 9
Automatic Telephone	1	3	6	2½	—	4 0 0
Chili Telephone	5	6	5	6¾	—	*3 12 9
Cuba Sub. Ord.	10	5	5	6¾xd	—	7 8 2
Eastern Extension	10	10	10	18¾	+¾	*5 9 7
Eastern Tel. Ord.	Stock	10	10	182½	+1½	*5 9 7
Globe Tel. and T. Ord.	10	10	10	18¼	—	*5 9 7
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	22	20	27⅞	—½	7 5 6
Indo-European	25	8½	10	45⅜	—	*5 10 0
Marconi	1	10	10	1 3/16	—	8 8 10
Marconi Marine	1	10	7½	21/3	—	7 1 2
Oriental Telephone Ord.	1	12	12	45/-	+1/3	*5 6 8
United R. Plate Tel.	5	8	8	8xd	—	*5 0 0
Western Telegraph	10	10	10	17⅞	+⅛	*5 13 6

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8½	—	8 16 0
do. do. 2nd Pref.	5	6	6	2⅞	—	10 8 8
do. do. 5% Deb.	Stock	5	5	71½	—	6 19 10
British Electric Traction Ord.	,,	7	8	148	+8½	5 12 0
do. do. 6% Pref.	,,	6	6	112	+1	5 7 1
Brazil Traction	100	4	5	100	—	4 19 6
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	86½	—	5 17 0
do. do. Preferred	,,	96/-	126/9	105½xd	—	*6 0 2
do. do. Deferred	,,	129/5	8	127xd	—	*6 6 0
do. do. Deb.	,,	4¼	4¼	77	+1	5 10 5
London & Sub. Trac. 5% Pref.	1	2½	Nil	6/-	—	Nil
London United Tram. Deb.	Stock	4	4	49	—	8 3 4
Mexico Trams 5% Bonds	—	5	5	73½	+4	7 4
Mexican Light Common	100	Nil	Nil	3½	—	Nil
do. Pref.	100	Nil	Nil	76½	+2	Nil
do. 1st Bonds	—	5	5	71½	—	6 19 10
Yorkshire (West Riding)	1	5	—	14/-	—	7 2 10

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	18	51/-	—1/-	*5 2 0
British Aluminium Ord.	1	5	10	46/-	+1/-	4 6 11
British Elec. Transformer Pref.	1	Nil	7	18/9	—	7 9 4
British Insulated Ord.	1	15	15	3⅜	—	4 10 9
Brush Ord.	1	10	10	27/-	—	7 5 6
Callenders	1	15	15	4 3/16	+1/3	3 11 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	15/-	—	... ...
Edison-Swan	4/-	10	10	9/9	—6d.	4 2 0
do. 5% Deb.	Stock	5	5	84/-	—⅓	5 19 1
Electric Construction	1	10	10	32/6	—	6 3 0
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	19/-	—	6 6 4
Gen. Elec. Pref.	1	6½	6½	23/-	+6d.	5 13 1
,, Ord.	1	5	7½	30/3	—	4 19 2
Henley	1	16	20	4	—	5 0 0
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	3⅛	—	5 15 8
Met.-Vickers Ord.	1	8	8	23/9	—1/9	6 14 9
do. Pref.	2	8	8	2⅜	—	6 8 6
Siemens Ord.	1	7½	7½	28/6xd	—	5 4 4
Telegraph Construction	12	20	10	25½	+½	*4 5 0

*Dividends paid free of Income Tax.

The Incorporated Municipal Electrical Association.

Annual Convention at Glasgow.

(*Continued from page* 927.)

In spite of the adverse conditions that prevailed, the Convention opened with every indication of success. There was a large attendance at St. Andrew's Halls on Monday evening, June 14th, to meet the President and Dr. D. McK. Dewar, and an enjoyable evening was spent in an informal fashion. Besides music and dancing, there was a very good display of kinema films,



Starting from St. Andrew's Halls for Alexandra Park.



The Ladies "entraining" for the Electrical Exhibition.

organised by the E.D.A., which attracted an interested "audience."

At the formal opening of the Convention on Tuesday morning, the Lord Provost, Sir Matthew W. Montgomery, in welcoming the members on their third visit to Glasgow, emphasised the importance of cheapening the price of electricity as the main factor of successful development; in Glasgow, he said, electricity was as cheap as anywhere else, or cheaper, but they must endeavour to reduce the price still further. Referring to the Electricity (Supply) Bill, 1926, he asked whether it would have that effect; if so, he would welcome the Bill, but he thought Glasgow was big enough to look after its own electricity supply, and he expressed the hope that nothing would be done which would in any way interfere with the expansion of the Corporation's electrical undertaking. He referred in eulogistic terms to the high merits of the City electrical engineer, Mr. R. B. Mitchell, who thanked the Lord Provost for his words of welcome to the I.M.E.A., and afterwards delivered his presidential address, an abstract of which appeared last week.

Mr. S. E. Britton, M.I.E.E. (Chester), then read his paper on "Supplies to Outlying Districts," in abstract, and after the discussion, which is reported on pp. 973-4, the members assembled in the Grand Hall, where they were entertained to luncheon by the Lord Provost, Conveners, and members of the Electricity Committee of the Glasgow Corporation. After the loyal toast had been honoured, the toast of "The Corporation of the City of Glasgow" was proposed in a humorous speech by Ald. E. Huntsman, chairman of the Nottingham Electricity Committee, and was responded to by the Lord Provost.



Photographing the "Group" in the Park.



The President and Mr. A. W. Blake at Dalmarnock.

From the Hall the members were conveyed to Alexandra Park in a procession of charabancs so lengthy that it occasioned a considerable sensation in passing through the heart of the city to the east end; the traffic,

however, was admirably handled by the police, whose methods were observed with interest. In the park a group was formed on the terraced slope in front of the bandstand, and several photographs were taken, the process occupying considerable time owing to the painstaking care of the artist. A move was then made to the Dalmarnock power station of the Corporation, over which the visitors were conducted by members of the staff. Some particulars of this fine station will be found in our last issue; it has now, with the recent extensions, a maximum continuous capacity of 131,250 kW, and a maximum overload capacity of 147,000 kW, the ultimate capacity contemplated being 200,000 kW.



Some Members of the I.M.E.A. at Gleneagles Hotel.

The boiler-house efficiency is about 78.5 per cent., that of the turbine house 23.7 per cent., and that of the whole station 18.3 per cent. on the basis of generated energy. The best daily efficiency recorded is 20.5 per cent., and the estimated overall efficiency of the plant in the new section of the station is 22.5 per cent. The maximum load on the station last winter was about 90,000 kW, and the demand applied for is over 230,000 kW. The output in 1925 was 220 million kWh. The plant was inspected with great interest, and the leading particulars were imparted to the visitors in the form of an admirably produced souvenir brochure.

One of the new Parsons turbo-alternators gave, on test, the following results for steam consumption:—

18,750 kW, 9.609 lb. per kWh,
15,000 kW, 9.215 lb. per kWh,
11,250 kW, 9.444 lb. per kWh,

the true mean for the three loads mentioned being 9.379 lb.; the guaranteed figure was 9.73 lb., upon which a notable improvement has therefore been made. At 21,000 kW the consumption was 9.803 lb.

In the evening the Lord Provost and magistrates held a reception in the magnificent salons of the City Chambers. There was a large attendance, and a very happy evening was spent, the entertainment including music and dancing, and an excellent concert rendered by Mr. Thorpe Davie's choir. The dancing of the reel was watched with great enjoyment, especially by the many members of the "subject race south of the Border" who were present, and the hospitality of the Corporation was thoroughly appreciated, although, in accordance with the self-denying ordinance recently adopted by that body, all municipal functions are "dry."

On Wednesday the first business was the reading and discussion of a paper on "Operating Costs of Electric Battery Vehicles," by Mr. C. W. Marshall (Glasgow), which is abstracted on a later page. A number of the electric vehicles used by the Glasgow Corporation were paraded outside the Hall at the end of the meeting.

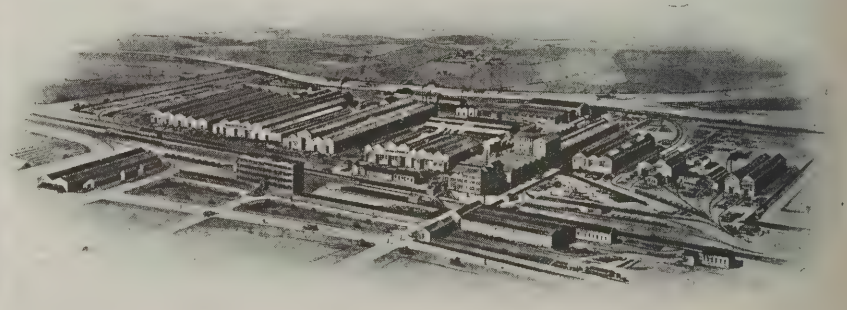
In the afternoon an early start was made by special train to the Renfrew works of Messrs. Babcock and Wilcox, Ltd.; the weather conditions were very unpleasant, but did not prevent the visitors from enjoying the tour through this huge establishment, which occupies nearly 100 acres. It was interesting to learn that, owing to the forethought of the management, the factory had not had occasion to shorten the working hours or restrict its operations during the shortage of coal; the boilers, air-heaters, superheaters, conveyors, and cranes in course of manufacture were inspected with great interest. It was noticeable that many of the boilers were designed for very high pressures, with shells $1\frac{3}{4}$ inches in thickness, and the accuracy with which the parts were made was a marked feature of the work, the large rings being turned all over.

The projected steamer trip in the Firth of Clyde being impracticable owing to fuel restrictions, an admirable alternative was found in a visit to Gleneagles, whither the members were conveyed in two special L.M. & S. trains, tea being served *en route*. Fortunately the weather improved in the course of the afternoon, and on their arrival at the "Eighth Wonder" the visitors were able to enjoy a round on the famous golf links or to walk to points whence the splendid views of the mountains and the beautiful country surrounding the hotel could be enjoyed. Dinner was served in the ball room of the hotel, at the invitation of Messrs. Babcock and Wilcox, Ltd., and the President took the opportunity of expressing the members' appreciation of the lavish hospitality of that Company; Sir James Kemnal, to whom a hearty vote of thanks was accorded, with musical honours, briefly acknowledged the compliment.

On Thursday morning a paper on "Industrial Heating," by Messrs. A. P. M. Fleming and J. H. Crossley (Metropolitan-Vickers Electrical Co., Ltd.), was read and discussed, and in the afternoon the chairmen and the engineers respectively held their private meetings.



The Rainy Day, at Renfrew.



The B. & W. Boiler Works, Renfrew.

A special meeting for women, arranged by the I.M.E.A. in collaboration with the Electrical Association for Women, also took place in the afternoon, at which Dr. Christina Barrowman delivered a lecture on "The Remedial Uses of Electricity," with interesting demonstrations; afterwards a move was made to the Electrical Exhibition, where tea was served.

(*To be concluded.*)

Electricity Supply to Outlying Districts.

By S. E. BRITTON.—*Abstract.*

(*Concluded from page 930.*)

For the present purpose it is assumed that transmission at 6,600 volts can economically serve thinly-populated areas having a radius of about six miles, say 120 square miles, and proportionately smaller areas depending on the magnitude of the demand, and that the largest areas which can be dealt with at higher pressures are as follows:—

11,000 volts, radius of 10 miles, say 300 square miles.
22,000 volts, radius of 20 miles, say 1,250 square miles.
33,000 volts, radius of 30 miles, say 2,800 square miles.

The demand for low-voltage electricity in rural areas is unlikely to exceed the capacity of low-pressure sub-stations equipped with 100-kVA transformers, except in rare cases.

Individual demands of 50 kVA and upwards can usually be most cheaply supplied by taking the high-voltage supply to the consumer. Several tables are incorporated in the paper giving the comparative costs of various components of a rural supply system, to meet specified conditions.

Table 1 shows that the cost of an indoor sub-station of 100 kVA ranges from £525 for 6,600/440 V to £1,250 for 33,000/440 V; the outdoor type similarly costs from £225 to £460.

Table 2, relating to a 0.1-sq. inch line, shows that underground cables laid and buried cost from £2,000 per mile at 6,600 V, to £3,300 at 33,000 V. Overhead lines for the same conditions cost from £965 to £990, with wooden poles.

Table 3, for low-pressure 4-wire distributors, covers the range from 3×0.035+1×0.029 sq. inch overhead conductors, at £550 per mile, to 3×0.082+1×0.042, costing £685; underground cables of similar capacities cost about twice as much.

Table 4 relates to low-pressure 2-wire service lines of various lengths and sizes. A 40-foot service, 0.0225 sq. in., costs 105s. underground, whilst an overhead service of 0.020 sq. in. costs 62s.

Table 5 compares complete transmission systems, including 100-kVA sub-stations three miles apart, for 100 consumers, with six miles of 4-wire low-pressure distribution, at transmission voltages of 6,600, 11,000, 22,000, and 33,000 volts. Data are given for underground cables with indoor sub-stations, and for overhead lines with outdoor sub-stations, using steel poles or wooden poles. In the case of underground cables of 0.04 sq. in., the average cost per inch at 6,600 V is £2,103; at 11,000 V, £2,258; at 22,000 V, £3,328; at 33,000 V, £3,628. With overhead lines, using steel poles, the conductor section being 0.035 sq. in., the average cost per mile at 6,600 V is £1,124, increasing to £1,185 at 33,000 V; with wooden poles the figures are £1,073 and £1,175 respectively.

Table 6 (the first two sections of which are reproduced below) gives the average price per unit required to meet the charges (1) with secondary transmission and distribution by underground cables; (2) with transmission and distribution by overhead lines on wooden poles; also the percentage increase required in the income per unit to meet the charges on the underground system compared with overhead lines on wooden poles.

TABLE VI.

6,600 VOLTS SECONDARY TRANSMISSION.

AVERAGE COST PER UNIT.

	50 Units per head.	100 Units per head.	250 Units per head.	500 Units per head.
	d.	*d.*	*d.*	*d.*
Underground cables ...	3.6	2.40	1.66	1.44
Overhead wooden poles	2.362	1.771	1.432	1.316
	Per cent.	Per cent.	Per cent.	Per cent.
	52.4	36.28	15.92	9.42

11,000 VOLTS SECONDARY TRANSMISSION.

	d.	*d.*	*d.*	*d.*
Underground cables ...	3.75	2.48	1.71	1.46
Overhead wooden poles	2.371	1.786	1.434	1.317
	Per cent.	Per cent.	Per cent.	Per cent.
	58.16	38.86	19.25	10.86

The problem of supplying outlying districts therefore resolves itself into preparing a scheme, the cost of which can be met by the inhabitants of a particular village, or thoroughfare, or individual. A convenient method of allocating the revenue required from those who are to be supplied from the distributors of a single sub-station is to distribute equally the amount of income required to the total assessable value of the premises to be supplied, and then determine to what extent the inhabitants of the particular locality can afford to pay for the service it is proposed to give. This can be tested by a circular letter to the occupiers of the property, accompanied by a postcard for a reply. In the Chester rural area of supply the income required varies from 6s. to 12s. for each £1 of assessable value of buildings. Electricity for lighting only is approximately no more costly than oil lamps when the cost does not exceed 8s. per £1 of assessable value.

A substantial percentage of the inhabitants in rural districts cannot be supplied at a price which would at once be remunerative to the suppliers and attractive to the supplied. The economic area of supply will, however, be automatically enlarged when electrical legislation and the rules and regulations for overhead lines are amended so as to be in accordance with practical requirements, remote contingencies being left to take care of themselves. Obviously, a supply of electricity to outlying districts cannot be inaugurated and operated successfully for some time, if at all, or a cheap supply given, if the electricity is purchased and distributed in small quantities by a local authority, company, or person.

The secret of successful supply to small and scattered communities in outlying districts would appear to lie in the encouragement of existing authorised undertakers to extend their distributing systems to the widest possible limits. It is to bring about this state of affairs and to remove rules and regulations which now make it impracticable to carry electricity into many of the outlying districts, owing to the cost, that legislators should devote themselves.

If the provisions of the 1926 Bill are adopted by Parliament, private interests will acquire the territory which is not held under statutory powers by authorised undertakers. The distribution and use of electricity will, in future, make greater progress in the hands of enterprising local authorities than in those of companies and persons, especially where the local authority declares that it will not take any surplus monies from the undertaking for the relief of the rates, establishes an attractive showroom, and undertakes wiring and the supply of electrical apparatus. Consumers and prospective consumers have instinctively more confidence in, and prefer to obtain all their requirements from, a municipal authority than from a dividend-paying undertaking.

Discussion.

Mr. W. A. TURNBULL (Aylesbury) said he was supplying electricity for a distance of 10 miles around and was running three transmission lines. One line had been operating at 11,000 volts for 18 months. As to wayleaves, he did not study the legal aspect too much, but endeavoured to come to agreements with the landowners; if it was quite impossible to come to terms, then there was nothing to be done but wait until compulsory powers could be obtained. He had been able to construct lines more cheaply than was indicated in the paper; for instance, he was putting down an underground 0.075 sq. in. 11,000-volt cable at £1,323 per mile, compared with £2,300 mentioned by the author for a 0.1 sq. in. cable. He was putting up an overhead 0.075 sq. in. cable at a cost of £520 per mile, against Mr Britton's £875 for 0.1 sq. in., and there was not much saving between 0.075 and 0.1 sq. in; it was not economic, however, to go below 0.075. He had got out a design for a galvanised 7/12 steel-wire cable of 45 lb. quality, and with 400-ft. spans was putting it up for £295 per mile; it would carry 300 kW for a distance of 5 miles with a 5 per cent. drop. A better proposition, however, would be a copper-clad high-tensile steel wire, which would enable greater spans to be used, but at present it was not being manufactured in this country, although he hoped it soon would be. He warned Electricity Committees against expecting to economise on the staffs for carrying out rural schemes, because there was a great deal of work to be done in calculating the sags and stresses.

Mr. R. W. L. PHILLIPS (Bedford) said the Bedford Corporation had recently increased its electricity supply area 100-fold and he contended that such councils as his were the right people to supply the surrounding districts, in preference to the supply being given from the big "grid-iron" scheme of which so much had been heard. There was, he said, very little difficulty in getting Special Orders for giving such supplies, and his experience had been that the outside authorities much preferred to deal with a neighbouring municipality than with a power company.

Mr. R. BORLASE MATTHEWS said that 18 months ago there were 200 farmers in this country using electricity, but to-day there were over 600. There was much cheap and nasty overhead construction on the Continent, but, at the same time, the standards of this country were too high and it was only by improved design that the end in view would be accomplished; by that he meant that most of the work on the poles would have to be done in the factory so that the poles could be put up in any position on the site and reduce the cost of alignment; the cross arms and bearers should be clamped on and not drilled, so saving expense again. In connection with wayleaves, it was common practice on the Continent to have a schedule of prices. The owner of any land could call for an inquiry and, if he did so, the assessors would also assess his land in respect of betterment consequent on electricity being brought into the area. It obviously made the land more valuable so that the owner of the land had really to contribute something towards the cost of wayleaves. After carefully studying the suggested amendment of the low-voltage overhead-line regulations which the I.M.E.A. had placed before the Electricity Commissioners, he felt that they were still too drastic and that too high a standard was set, at any rate for the future if not for the present. There were too many regulations, and they ought to be left alone; there should be no necessity for submitting every calculation for approval in connection with lines of which the engineering principles had already been settled. Users in rural areas would rather put up with a little less security of continuity of supply in order that the supply should be cheap, and also would tolerate a greater voltage variation than was now allowed by the Commissioners. How did Mr. Turnbull get the cost of a pole line below £300 per mile? He, personally, knew of a line which had been approved by the Electricity Commissioners, the cost of which had been £120 per mile and he had mentioned one to Mr. Turnbull which cost £25 per mile, this low cost being possible by getting the farmers to provide the poles and labour for erecting the line, under the supervision of the electricity supply authority's staff, there being no better people for stringing an overhead line than farmers, owing to their experience in straining wire fences. This had been done in South Wales and it was common practice in America. In Sweden the usual

cost of a low-voltage line was about £100 per mile and in America, notwithstanding the higher cost of labour and material, it was usual to put up a 6,600-volt line for about £150 per mile. Where underground cables were necessary, there was a method of laying them cheaply in clay pipes by means of a machine which ploughed the soil, laid the pipe, and drew in the cable. The great point in rural electrification was to create the load; if electricity were offered at ¼d. per kWh to-day, the demand would not be very great; the public must be educated how to use electricity in every possible way. In France the development of large rural areas had been found to pay eventually, and in various Continental districts there was a consumption of 5,000 kWh per mile of road in such areas, which was a paying proposition, although naturally everybody would like to increase that figure in this country.

Lieut.-Col. W. A. Vignoles (Grimsby), owing to the cost of making new roads, anticipated that most building in rural areas would be along the existing main roads, and that the houses would be close together. In that event, instead of overhead lines, they would have to use underground cables because the former would be unsightly; probably they would have to have a high-voltage main along each main road with transformer stations at intervals. Moreover, there would be difficulties in running overhead lines owing to the existence of Post Office wires already. In a case at Scunthorpe and Frodingham the overhead wires were stretched from gable to gable of rows of villas and it was not at all a pleasing sight. He was not at all convinced of the view stated in the paper that underground mains cost more for maintenance than overhead lines, because from the small amount of experience he had had with overhead lines this did not appear to be the case. He also gathered from the paper that if they could have less stringent regulations, the cost of constructing overhead lines would be reduced, but he could not help noticing when he was on the Continent a year or two ago, where they were told that the regulations were easy, that they were putting up steel and concrete poles where timber poles could be had almost for the asking and were of no value at all. As a matter of fact, the standard of pole construction in certain parts of the Continent was extremely high. If they were to use that type of construction, the cost of maintenance would be very considerable.

Mr. R. A. Chattock (Birmingham) said the hesitation of municipalities to go into rural areas was justified because of the difficulty of showing a profit, but large municipalities could afford to take a little risk in the matter and wait until development was such that it became a paying proposition. Certainly, industrial centres were more fitted to develop the rural areas around them than anybody else, but he did not think the proper means of doing it was by what had been called a "grid iron" all over the country. They should be developed by thin lines radiating out from the big centres, because such an arrangement would enable electricity to be supplied most cheaply. No reference was made in the paper to supplies at low voltage for farmhouses and similar premises. Col. Crompton had been instituting a campaign in favour of 50 or even 30 volts and it seemed to him that, whilst the wiring could be reduced in cost very materially (because such a voltage could be dealt with by bare wires cleated up anyhow) the cost of getting the electricity to the farmhouse would be very materially increased owing to the need for a very big section of cable, and in the end there would not be much difference in the cost of the kWh. Whilst d.c. might not be suitable in rural areas, it was suitable in the residential portions of larger areas.

Councillor R. Dalton (Carlisle) said Carlisle had been considering this subject carefully for two or three years and now intended to apply for an extended area to embrace all the rural areas which touched Carlisle. The great difficulty was want of commercial enterprise on the part of Electricity Committees. The first question always asked was: "Will it pay"? but municipal electricity undertakings should be a little venturesome and take a little risk.

The Mayor of Aylesbury spoke on similar lines, and expressed the hope that the farming population would come forward in the Aylesbury and other areas and support what was being done in this direction.

Councillor A. E. Gough (Cardiff) said that although Cardiff was situated in the area of a power company, the Corporation had been successful in obtaining some fringe orders. His complaint with regard to them, however, was that they took too long to get through. It was not due to the Cardiff electrical engineer that supply was not being given in the outside areas, but to difficulties with some of the members of the Council who would not agree to anything that would not show an immediate profit.

Alderman Senington (Bristol) said Bristol had been making similar endeavours and, at the same time, suggested that it was not unreasonable to ask the outside areas, in certain circumstances, to pay a little higher price than that paid in the area of the supplying authority. The great point, however, was to get supplies of cheap electricity to the rural areas.

Mr. S. E. Britton, replying to the discussion, hoped Mr. Turnbull's cheap overhead lines would turn out to be economical, with low maintenance and reasonable continuity of supply. He, himself, had been more concerned with getting a really reliable supply and he was installing cables to meet the demands of the next few years. The very low figures that had been quoted seemed quite impossible, having regard to the figures he had before him of the cost of copper; for instance, taking three 0.1 sq. in. copper cables, copper at £70 per ton amounted to £400 per mile, which did not seem quite consistent with the figures that had been mentioned. The increased value of land when electricity suply was taken into a district was very important, and there were cases in the rural areas around Chester of farmers, who had bought land at £40 or £50 per acre for agricultural purposes, selling off the fringes at £250 per acre for building purposes. As to the cost of maintenance, the first overhead line put up by him 18 years ago, half a mile long, had not had £5 spent on it in repairs; a 6,000-volt line erected 6 years ago had not entailed the expenditure of £1, and a 33,000-volt line in use since 1921 had not had anything spent upon it except the cost of replacing three insulators. During the past three years he had put up between 50 and 60 miles of overhead lines and the cost of repairs had been between £3 and £4; the maintenance of overhead lines was not an expensive matter, and repairs could be carried out very quickly as compared with underground cables. He knew of Col. Crompton's campaign, but there was likely to be great danger in adopting such a policy because it would mean that householders would have to handle apparatus consuming a large current. For instance, at 30 volts a 500-watt electric iron would mean 10 amperes and a 3-kW radiator would mean 100 amperes; he considered the thing perfectly ridiculous and unworthy of consideration. The kWh consumed per member of household, taking different types of houses, varied from over 800 (in one case 999) to about 50, and it had been the general experience that immediately a power line was taken into the country development went on at a rapid pace and people from the outlying districts came into the town to see the showroom. The amount of money which people would thus spend upon electrical apparatus was surprising, and in a few years' time he confidently anticipated that users in the rural areas of Chester would be consuming more electricity per head than were the consumers inside the city. In connection with voltage variation, it was satisfactory to know that the Electricity Commissioners had sanctioned 8 per cent. for the Chester rural areas, as compared with the usual 4 per cent., whilst even in France the figure was 7 per cent.

Electric Battery Vehicles.

Their Operating Cost and Competition with Rival Types.

By C. W. Marshall.—*Abstract.*

Electric vehicles have been used in the transport services of the Glasgow Corporation Electricity Department since 1913, the experience gained in this period affording a sound base for estimating operating cost and the extent to which such vehicles can compete with rival types.

The actual types of vehicles in use range from a half-ton lorry to a ten-ton tractor, and machines of almost every available make have been tried. The working conditions have been very varied, ranging from light delivery work on good roads to refuse collection on routes with extremely bad surfaces.

The types of batteries which have been tried in Glasgow included thin- and thick-plate lead types from several makers, and nickel-iron batteries from three makers. The present position is that the lead battery is in favour, due in a great part to the fact that it is much cheaper in initial cost and at the same time gives service at least as good as that obtained from the alkaline battery. The relative merits of thin- and thick-plate lead batteries is still an open one, although the three years' guarantee now issued with the latter type has done a great deal to decide the matter in its favour. The thin-plate battery lasts only 12 to 15 months and costs about 60 per cent. of the price of the thick-plate battery, which lasts 30 to 36 months. It is, however, possible to get a much greater capacity for a given weight and volume with the thin-plate battery and so in some cases the vehicle becomes much more useful. For example, vehicles in the service of the Glasgow Corporation Cleansing Department which could only do one shift on refuse collection when fitted with thick-plate batteries can do two shifts with thin plates. When this is the case the extra cost of the battery is thoroughly justified.

It is of interest to note that an Italian firm uses extremely thin plates (.6 mm.) and gets extraordinarily high capacity per unit weight (approximately twice that obtained in a normal thin-plate battery, or two-and-a-half times that of a thick-plate battery). The life of such batteries is only about four months, but the originators of the system seem to think that the results obtained are quite satisfactory; the vehicles in this case are passenger omnibuses.

Alkaline batteries cost from two to four times as much as the best lead batteries. Although they last at least five or six years under hard service conditions, and eight or ten years under easier conditions, their low watt-hour efficiency and high internal resistance counteract the long life to some extent. There are, however, some conditions which are specially suited for alkaline batteries. The principal characteristics of the different types of batteries are summarised in Table I.

TABLE I.—Battery Data.

Type of battery.	Alkaline.	Lead (thin plate).	Lead (thick plate).
Watt-hour efficiency ...	59%	75%	75%
Watt-hours per cu. in. ...	0.74	0.8	0.6
Watt-hours per pound ...	15	12	9
Initial cost (approx.) £/kWh	30	4	8
Life in years	6-8	1	3
Life in cycles of charge and discharge	1,800/2,400	300	900

The operating costs have been calculated, and are illlustrated graphically in fig. 1, which shows the running cost per vehicle mile of electric lorries of 0.5 to 5-ton load capacities for varying annual mileages. To assist in reviewing the relative importance of the various items, they are arranged in descending order of magnitude in Table II for a 2-ton vehicle.

TABLE II.—ANNUAL OPERATING COSTS OF 2-TON ELECTRIC LORRY.

Item.	£	Per cent.
Driver's wages	150	34.5
Depreciation and interest ...	75	17.3
Battery renewals	34	15.9
Tires	26	7.9
Electrical energy	25	6.0
Licence	22	5.8
Garage	19	5.0
Maintenance	14	4.4
Insurance	—	3.2
Total	434	100.0

Cost of complete vehicle, £552.
Cost of battery, £208.
Cost of energy per kWh, 0.75d.

Driving a good electric vehicle is so easy that it may be considered correct policy to employ the cheapest type of labour. In the opinion of the writer it is much more satisfactory to employ a good class of men and to teach them to look after the machine in an intelligent way; if this is done, there is very little need of any other maintenance staff. The recent extension of the guarantees of lead batteries from two to three years marks an important step in the direction of reduced costs. The plain fact is, however, that users of electric vehicles must have some assurance that the supplies of batteries will be certain and that there is little danger of a serious increase in price. Tire cost is now among the primary cost items of all mechanical vehicles. The basic price of electrical energy used in these calculations is ¾d. per kW hour, but as the item represents only a small percentage of the total cost, it has very little effect on the general economic position. The electric vehicle has already been granted a concession when used by non-trading municipal departments; the annual tax under these conditions is only £6. In view of the very desirable characteristics of the "electric" from the standpoints of small road wear, this concession should be extended to all users. The electric vehicle has a great advantage in respect of maintenance, as the number of moving parts need not exceed 10 per cent. of those in a petrol vehicle.

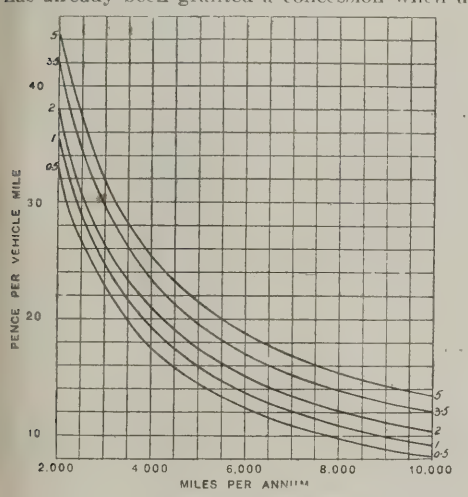


Fig. 1.—Total Cost per Vehicle Mile of Electric Lorries.

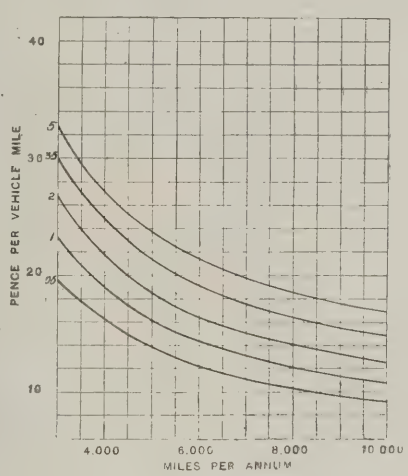


Fig. 2.—Total Cost per Vehicle Mile of Petrol Lorries.

Assuming that the available supply of electricity is at 440 volts, 3-phase, 50 cycles, the cost of battery-charging plant varies from £10 per kW at a capacity of 10 kW to £7 per kW at a capacity of 100 kW, these prices including converting plant, control gear on both the a.c. and d.c. sides, wiring, and erection. Taking 15 per cent. per annum to cover all charges on the plant, the cost is 0.124d. per kWh for the smaller and 0.087d. per kWh for the larger plant, the load factor being assumed to be 33 per cent. When, as is the case in Glasgow, vehicles which operate at night are kept in the same garage as those which operate by day, the load factor of the charging plant can easily reach 60 per cent., or more; the efficiency of the charging plant should not be less than 75 per cent. even with an output of 10 kW.

The battery vehicle should be confined to cases where the daily distances do not exceed 35 to 45 miles. The horse does not appear to be losing much ground as yet; the working cost of horse-drawn vehicles (Table V) are the lowest compatible with the use of good-class horses and vehicles

Analysis of the figures will show that the average rate of working of the horse does not exceed 0.5 kW, and that the energy expended per day is only about 4 kWh; the horse, therefore, compares very unfavourably with the battery in both power and energy capacity. The price paid for energy in this form is 9d. per kWh, taking only feeding charges into account, and if the whole of the charges directly connected with the horse are considered, the price of the kWh rises to about 1s. 6d. If the characteristics of the horse-drawn vehicle are considered to be desirable, it would be an easy matter to produce an electric vehicle which would reproduce these characteristics, but while everyone seems to be satisfied that a low-speed horse-drawn vehicle is all right, a mechanical vehicle is considered of no account if it cannot attain a speed of at least twelve miles per hour.

TABLE V.—ANNUAL OPERATING COSTS OF HORSE-DRAWN VEHICLE.

Item.	£ s. d.
1. Driver's wages	141 5 0
2. Feeding, bedding, and stableman's wages	52 10 0
3. Rent of stables	10 0 0
4. Horse depreciation	7 10 0
5. Repairs to vehicle	7 10 0
6. Insurance	7 10 0
7. Horse shoeing	6 5 0
8. Taxes	3 3 0
9. Saddler	1 17 0
10. Veterinary surgeon	1 5 0
Total	£238 15 0

Average daily cost	16s.
Average cost per vehicle mile ...	10.7d.
Average number of hours' work per day (six days per week) ...	8 hours.
Average speed	2.75 miles/hour.
Average mileage per day	14/18 miles.
Weight of load	25 cwt.
Weight of vehicle	12.5 cwt.
Weight of harness	98 lb.
Weight of horse	16 cwt.

It appears from Table VI (annual mileage=10,000) that the real competitors are the petrol and electric vehicles for mileages and loads of the order under consideration. The table shows that half-ton and one-ton "electrics" are respectively 15 and 5 per cent. more expensive to run than petrol vehicles, but that 2-, 3½-, and 5-ton "electrics" are cheaper than the corresponding sizes of petrol vehicles by 2, 7, and 15 per cent. It could, therefore, be argued that there is no room at all for light electric vehicles, but some British firms of high standing continue to build electric vehicles for light delivery work. The operating cost of petrol vehicles is further illustrated in fig. 2, which shows the cost per vehicle mile of ½-, 1-, 2-, 3½-, and 5-ton machines for annual mileages up to 10,000. The petrol vehicle is, of course, quite capable of distances up to 70,000 miles per annum; there are, however, many cases in which the mileage requirements are well within the capacity of the battery vehicle, and a concrete example of this kind is the German postal delivery system. The German Government has now in use 800 electric vehicles for postal deliveries, and the magnitude of this undertaking is so great that it is worthy of further description. Only two types of vehicle are used, and they are very similar in design; the load capacity is two tons, and a single motor drives the rear wheels through a differential countershaft and chains. Pneumatic tires are used; the batteries are of the thin-plate lead type, and each consists of 40 250-amp.-hour cells. The mileage per charge obtained regularly is 36 to 42 miles, but it is stated that it is not a rare occurrence to get 60 miles per charge. The battery life is 6,000 to 7,000 miles for positive plates and 12,000 to 18,000 miles for negative plates. It is said that the use of pneumatic tires reduces the energy consumption by from 10 to 15 per cent. on stone-paved roads, and by from 3 to 5 per cent. on asphalt roads, as compared with solid tires.

TABLE VI.—WEEKLY OPERATING COST OF PETROL, STEAM, AND ELECTRIC VEHICLES.

Load (tons).	Petrol.	Steam.	Electric.
0.5	117/-	—	137/-
1	146/-	—	153/-
2	176/-	—	173/-
3.5	212/-	249/-	198/-
5	246/-	275/-	224/-

There is hardly anything more reliable than a really good electric vehicle, and an engineer who purchases wisely will never be worried by vexatious reports of breakdowns. The jobs which an electric vehicle can do in connection with a large electricity department are very numerous, and there is usually work for lorries, vans and tractors. In the case of the Glasgow Corporation Electricity Department, the light lorries and vans are used in connection with the showroom, meter, and welfare departments, the heavier lorries and tractor on the mains department services, while the heaviest tipping lorries are used for the removal of ashes from the power stations. A well-operated fleet of machines is also a good advertising medium and cannot fail in the end to impress on other transport users that there is really something in electric vehicles.

Discussion.

Mr. A. NICHOLS MOORE (Newport, Mon.) said the author had done a good service in jogging the industry a little, because he believed there were many opportunities for useful service for the electric vehicle. It must, however, be kept to its right sphere. A good deal of trouble had been due to enthusiasts, in pushing the electric battery vehicle forward, advocating it for every possible kind of service, whereas it was quite clear that it was not suitable for many classes of service. At Newport he had had 6½ years' experience with electric vehicles for refuse collection and in some respects the figures he had obtained differed strangely from those in the paper. For instance, the energy costs were 0.0624d. per mile, as against 2d. in Newport for the 2-ton vehicle. It appeared that the author took 15 years as the life of the vehicle, which he did not consider at all reasonable. Apparently, too, a mileage of 10,000 per annum was taken as the basis, but that mileage was not obtained in practice; if from 3,000 to 4,000 miles per annum were run in practice, then they were doing very well. The cost of renewals in the paper rather agreed with his own figures, but he had depreciated his batteries on a three years' basis, although he managed to get 4½ years out of most of them. The cost of maintenance of the vehicle, apart from the batteries, had been very heavy indeed at Newport, and that had been due to faulty construction. The result was that he had scrapped the earlier vehicles and was using them as trailers behind the later ones. One of the reasons why the electric battery vehicle had not made greater progress was the direct opposition and antipathy of borough surveyors, and he said, without hesitation, that that was one of the greatest difficulties to be got over. At the same time, there was a great deal to be said for that opposition, based on experience of such vehicles for refuse collection. When used for the delivery of refuse at a tip such vehicles were hopeless owing to the rough handling they received; when used for delivery at a destructor they could be built with a low loading line and could be used under the most favourable circumstances. The fact was that in recent years the design of petrol vehicles had been considerably improved, whereas the manufacture of electric vehicles had stood still.

Mr. A. W. BLAKE (Willesden) had little fault to find with the figures in the paper as they confirmed his own experience. He urged supply station engineers to develop the use of the electric vehicle because the load of one vehicle was worth that of 10 cookers and was off the peak, while cookers were not always. His own policy had been to keep the men thoroughly interested in the vehicles and arrange to teach them how to look after every part of the vehicle. In that way, he had been able to create quite an intelligent interest and the men had been able to win a few prizes. As the result of thorough attention in the garage it had been possible last year to run 14 vehicles for 307 working days, and a great deal of overtime, with a loss of only 14½ hours' stoppage on the road. With regard to the life of 14 or 15 months mentioned in the paper for thin-plate batteries, he had found that by renewing the positive plates at the right time it was possible to get something like another year's life out of the batteries.

Councillor J. THICKETT (Walsall) urged a progressive policy on the part of supply station engineers as regards the use of electric vehicles, which were not advertised enough.

Mr. J. W. BEAUCHAMP (E.D.A.) said that if the electric vehicle had not some virtues it would have disappeared long ago. In spite of their neglect in developing it, there were 2,500 electric battery vehicles in this country in addition to a large number of platform trucks. It was necessary, however, to discriminate very carefully in handling the main electric-vehicle business for road transport and not endeavour to push it for unsuitable purposes. Endeavours should be made to push the vehicles, not in cases where only one vehicle would be required, but where a dozen or more were necessary. He had been very much impressed, from recent inquiries, by the fact that so few municipal electricity departments had any mechanical transport at all; it was time every supply department had mechanical transport, preferably electric, not only because of its practical use, but because of the advertisement offered. What was required was a very distinct and concentrated salesmanship effort.

Mr. A. H. SHAW (Ilford) said that in Ilford the first vehicle was started 11 years ago (a 4-ton wagon) and as the result of that experience it was found that a 4- or a 5-ton wagon for coal-carrying for the Electricity Department was very much cheaper than any other means of transport; that was short-distance heavy-haulage, for which purpose the electric vehicle would easily beat steam or petrol. He was glad to say that the Ilford Public Health Department had also taken up electric vehicles for house-refuse collection, whilst the Electricity Department had now a second vehicle for coal haulage. Last year he purchased a small tractor for hauling cable drums, but the registration authorities asked for a tax of £22 because they said it was not an electric vehicle, but a tractor. After considerable protest and much assistance from the Electric Vehicle Committee, a tool box was added and the vehicle was called a truck, with the result that the usual tax of £6 was imposed by the taxation authorities.

Mr. C. W. MARSHALL, replying to the discussion, said his figures were all taken from actual Glasgow experience; 10,000 miles a year was certainly a good annual mileage, but it was being obtained and anybody who would accept 3,000 miles was easily satisfied. Perhaps the reason why the maintenance was heavy at Newport was because they had some of the early vehicles which were badly constructed; he had had some of them himself. On the other hand, he had vehicles which had needed practically no repairs; they did from 25 to 35 miles a day and gave no trouble at all. The reason was that there were only 10 working parts in the whole of the vehicle. As to refuse collection, he had found it paid handsomely to use electric vehicles for delivering to tips. He agreed as to the value of educating the workmen in the care and maintenance of the vehicles and Birmingham was also doing work on the same lines. The renewing of the positive plate, as mentioned by Mr. Blake, did add to the life of the battery, but the output was reduced. Generally, he claimed, that it was the business of the station engineer to push the electric vehicle, and they should not blame the public health authorities for not adopting them if they were not pushed.

Alderman H. LEESE (Stoke-on-Trent), in proposing a vote of thanks to Mr. Marshall, said that at Stoke they paid the drivers of their electric vehicles about one-third more than was paid in Glasgow, and added that as the result of using electric vehicles it had been possible to halve the cost of getting coal from the sidings to the works.

Mr. W. C. P. TAPPER (Stepney), who seconded, expressed the hope that the suggestion in the paper that an electric vehicle should be constructed to correspond with the horse vehicle so far as speed was concerned, would not be acted upon by manufacturers because they wanted to rid the streets of slow-moving traffic.

The I.M.E.A. Exhibition.

(*Continued from page* 932.)

Messrs. ELECTROLUX, LTD., displayed and demonstrated the "Electrolux" household refrigerator, model "D," and cooling unit (ELECTRICAL REVIEW, February 26th, 1926, p. 327). This model has a white-enamelled finish and is designed as a handsome piece of kitchen furniture. The walls contain 3 in. of cork insulation and are lined on the inside with washable white enamel. Well-spaced glass shelves provide accommodation for a large amount of food.

Messrs. SADIA ELECTRICAL APPARATUS exhibited several types of electric storage water heaters of from 2-gallon capacity upwards. The special feature of the stand was the new 2-gallon type of water heater, fig. 7. This boiler, which combines all



Fig. 7.—Electric Storage Water Heater.

the special advantages of the larger Sadia apparatus, has the additional advantage of being compact and of small dimensions, and is therefore suitable for use over wash-hand basins and sinks in flats and small houses. Some new designs of electric quick-heating plates were also shown. These were of the enclosed type and mark a new departure in this apparatus, combining efficiency with speed in operation.

An interesting selection of storage geysers were displayed on the stand of the BASTIAN METER CO., LTD., including some arranged over both a suitably-arranged bath and sink. It is interesting to note that "Bastian" geysers are now hired or hire-purchased to their consumers by more than 20 different municipal undertakings in England alone. The "Imperator" stove, some models of which were also shown, is designed to replace the steam radiator. Three new "Imperator" 1-kW fires and a number of pigmy heaters for table use added to the interest of the exhibit, while a feature was the "Little Wonder" grill ovens, which were fitted with "Bastian" quartzalite elements. Various types of these elements were included in the large number of articles on the stand. A few electric steam boilers were also included in the exhibits. These were of the fire-tube type and fitted with "Quartzalite" elements, which, it is claimed, can be taken out and replaced while the boiler is actually under steam. This type of apparatus is claimed to have an efficiency of 98 per cent. A feature of it is that it will produce superheated steam up to 500 deg. F. at a pressure of only 5 lb. per sq. in. "Bastalite," a product of the company, is of some interest. It is a preparation which is painted on the bottom of the kettle, to improve the efficiency of absorption, and which, it is claimed, will not wash off.

As might be expected, the feature of the exhibit by Messrs. BERRY'S ELECTRIC, LTD., was a display of the "Magicoal" electric fire, which imitates a blazing coal fire, introducing flickering flame effect. Several new models were shown, of which the following is a selection:—The "Newberry" fire is designed on new and novel lines with overhead heating, which incorporates a new patented 2-kW circular heating bar. The heating efficiency of this apparatus is claimed to be particularly high. The "Fyglo" model has been produced to meet the requirements of hiring schemes, particular attention having been paid to the cheap renewal of element wires. A good fire effect is obtained without the use of a lamp. A new design of the "Mulparvo" model is being introduced. This is built on similar lines to that of the existing fire of the same name, but it is improved greatly in appearance and has a loading of 2 kW with three-heat control, against 1 kW on the old model. Other examples of fires shown included some of the dog-grate type of period designs. Extreme care has been taken with a view to economy in the cost of production of these hitherto expensive models, which has resulted in considerable reductions in some of the very attractive fires.



Fig. 8.—The B.T.-H. Stand.

A large stand occupied by the HOTPOINT ELECTRIC APPLIANCE CO., LTD. ("Hotpoint-Falco") occupied the whole of one side of the Main Hall. The feature of the exhibit was a representative display of electric cooking apparatus, including heavy cooking appliances for hotels, restaurants, and ships. The heavier appliances consisted of pastry and baking ovens, roasting ovens, boiling pans and fish fryers. In the last mentioned, three different methods of heating were shown, radiation, conduction (clamp-type elements), and direct heating by induced currents (ELECTRICAL REVIEW, April 2nd, p. 561). The domestic cookers were in sizes for from two to three people, such as the No. 3,252 bungalow model, increasing up to the double-oven range for 25 to 30 people, which is suitable for small restaurants and large private houses; baking plates, wash boilers, and grills were also included in the display. A few cookers were in actual service, demonstrations being continually carried out, and these included the following novel features in the boiling plate elements:—A new standard semi-enclosed boiling plate, a plate with "Globar" elements, and a new solid-type plate. The electroducer cooking was also demonstrated.

The JACKSON ELECTRIC STOVE CO., LTD., showed some improvements which have been incorporated in its existing models of cookers. These included a new type of grill with easily-removable elements on the lines of the maker's No. 84 boiling plate. This grill can be arranged with 3-heat regulation. A cooker with side and bottom elements was shown by request, and a stainless-metal hob fitted to one of the cookers was an item of interest. A feature of the exhibit was a new type of electric kettle fitted with an automatic cut-out. No fusible plugs or replacement parts are needed to put the kettle in operation again after the cut-out has been in action, the connection being remade by the consumer. The contact is a positive make-and-break switch, and this apparatus should prove of interest to those dealing with hiring schemes.

A particularly pleasing and informative exhibit was shown by the E.L.M.A. LIGHTING SERVICE BUREAU, the arrangements of which were largely carried out by the Scottish Section under the direction of Mr. H. E. Hughes, the district engineer. An ingenious lamp display cabinet, illustrating the wide range of standard electric lamps, was a feature of the stand. Each lamp could be switched on, and at the same time the number of hours' burning per kWh was indicated on a luminous sign. This was particularly appreciated by the public. In addition to standard gasfilled lamps, there was a display of daylight, white, and coloured-sprayed lamps. Home-lighting cubicles were included in the display to represent the different aspects of home lighting and to contrast the effects that could be obtained by modern methods of lighting with those of bad design. To represent the vast progress in electrical illumination during recent years, special demonstration cabinets were included in the stand equipment. These were in four series each. The cabinets represented home, loom, factory, and colliery lighting. In each case the lighting equipment, whether modern or old, was illustrated by appropriate backgrounds. To emphasise the value of shop lighting and to illustrate how maximum efficiency could be obtained by electric lighting in properly-conceived reflectors and glare entirely eliminated, model shop windows were featured. These were designed so that a shopkeeper could actually experiment for himself and be thoroughly convinced of the efficiency of modern shop-window lighting equipment. A well-produced booklet, "Lighting Service," which was issued by the Bureau in connection with the Exhibition, outlines the work of that body, and shows the necessity for good lighting in all directions.

The Glasgow Corporation Electricity Department had a splendid display. Chamberlain & Hookham special prepayment two-part meters, a minimum power-factor meter, and a demand indicator with a self-contained synchronous motor were prominent and attracted much notice. Visitors interested in housing paid considerable attention to the "Selfix" electric installations; by using the special materials supplied with a "Selfix" outfit it is claimed to be possible for any man to put in a complete electric-light installation which will meet the requirements of the Institution of Electrical Engineers. The Corporation also showed cookers and fires, British-made vacuum cleaners, Venner time switches, a British Resistor hot-plate, fire, and furnace, and Wilkinson thermostats. The fittings on the stand were by Osler & Faraday.

Messrs. SMITH & PAGET, LTD., had an interesting display of electric washing and mangling apparatus.

The MOCLARY, CANADA, company showed some excellent designs of electric cooking apparatus.

The Electrical Association for Women had an attractive stand, displaying pamphlets, &c., while the British Electrical Development Association (Inc.) also displayed leaflets relating to their work.

In addition to the new "Cosmos" electric boiling plate, described fully in our last issue, MESSRS. METRO-VICK SUPPLIES, LTD., exhibited several new types of electrical domestic appliances, some new internally frosted lamps, a selection of chromium-plated Harcourt fittings, and a new type of lampholder, the "Emvee," which is designed with solid plungers and has a large current-carrying capacity. A Brighton street lantern was also shown.

A variety of domestic apparatus was shown by Messrs. L. G. HAWKINS & Co., LTD., and the "Universal" cookers occupied a large portion of the stand. A "Kelvinator" refrigerator was also on show, and also a whole line of "Universal" coffee percolators, irons, kettles, toasters, some "Miller" fittings and a selection of "Ivanhoe" glassware. The "Junior" model "Vio-ray" high-frequency apparatus also proved interesting. The high-frequency coil of this apparatus is of special design, which prevents, it is claimed, any sparking back or risks of breakdowns. The kicking coil and break are assembled in a "Bakelite" container, and the high-frequency coil is assembled in a high-grade ebonite handle.

Included in the exhibits of the GENERAL ELECTRIC CO., LTD., which we referred to in our last issue, was a new design of "Magnet" electric suction cleaner. The feature of this device is that the nozzle brush is so designed to straighten out any loose threads on the surface to be cleaned ready for absorption, and simultaneously to press back the pile of the carpet, so that the suction may withdraw the dust and grit from the weave and knots of the pile, and even from the underside of the carpet. It is claimed that the brush does not become choked and dirty as in the case of the ordinary broom, because the constant suction of the cleaner swallows every particle of dirt and grit over which the cleaner passes; the suction is applied evenly across the nozzle. This is designed to facilitate cleaning under low furniture. A swivel-type rear wheel enables easy operation in any direction; all the wheels are rubber-tired and leave no track, it is claimed, in the rug or carpet. The control switch is at the extreme end of the handle and a stop locks the handle in a horizontal position for the cleaning of stairways and difficult objects. The bag is composed of a strong material of fine texture, and is fitted with an aluminium airtight coupling. The lubricating system is automatic, the oil being injected through two spring-closed ball oilers and passed into small reservoirs, from which it is conveyed to the bearings by wick and spring devices. All the accessories are easily and instantly adjustable.

Fig. 8 is a view of the B.T.-H. stand to which we referred in our last issue. *(To be concluded.)*

An Electric Light-ship.—The *Royal Sovereign*, a light-ship stationed seven miles off Eastbourne, at present an oil burner, is to be fitted with a powerful electric light.

Exports and Imports of Electrical Goods and Machinery in May, 1926.

In the appended table giving details of our foreign electrical trade during May, the export comparisons both with April, 1926, and the preceding May need qualification, as neither shows the true position. In the first place April was a bad month and the decline of £40,878 is really a further fall from an already low figure. On the other hand, the decline of £550,135 in comparison with May, 1925, is not so serious as it looks, as the violently-fluctuating item, "submarine cables," accounted for £373,351 of the fall. In the face of the general strike, there were several notable increases, of which that in the traction motor section was the most marked.

The imports were seriously affected, having been reduced by a third from the April total, although the difference between the May totals for the two years was not quite so great.

The re-exports were less than half the April value, and only a third of the May, 1925, total.

Further reference to the statistics is made in our "leader" pages.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for May, 1926.	Inc. or dec. as compared with Apl., 1926.	Inc. or dec. as compared with May, 1925.	Electrical imports for May, 1926.	Inc. or dec. as compared with Apl., 1926.	Inc. or dec. as compared with May, 1925.	Electrical re-exports for May, 1926.	Inc. or dec. as compared with Apr., 1926.	Inc. or dec. as compared with May, 1925.
Electrical goods and apparatus (unenumerated)	£120,269	−£29,189	−£13,778	£80,192	−£26,685	−£8,155	£4,267	−£3,895	−£12,152
Insulated wires and cables	199,238	+ 16,111	+ 4,143	21,918	− 25,616	− 13,102	755	− 319	− 2,611
Glow lamps	30,403	− 5,454	− 2,143	11,542	− 5,922	− 30,674	103	− 429	− 161
Arc lamps and parts	67	− 663	− 492	1,545	+ 803	+ 45	120	+ 113	+ 92
Batteries and accumulators	63,727	+ 5,503	− 32,473	24,513	− 13,955	+ 3,527	599	− 1,523	− 970
Meters and instruments	36,335	+ 3,920	+ 8,152	14,148	− 5,183	− 3,282	236	− 551	− 951
Carbons	1,475	+ 594	+ 553	7,249	− 3,615	− 1,629	21	− 33	− 34
Electrical Machinery—									
Electrical machinery (unenumerated)	243,190	+ 30,173	− 83,538	80,996	− 30,408	− 18,299	2,449	− 5,511	− 3,160
Railway and tramway motors	54,769	+ 31,425	+ 16,374	—	—	—	—	—	—
Other motors and generators	128,224	− 49,277	− 54,391	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	2,837	− 6,654	− 9,591	28	+ 2	− 42	—	—	− 95
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	51,469	− 14,303	− 18,167	4,356	− 8,033	− 9,997	15	− 45	− 218
Submarine telegraph and telephone cable	246	− 11,911	− 373,351	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	226,987	− 11,153	+ 8,567	23,167	− 12,744	− 23,972	2,822	− 1,524	− 2,610
Totals	£1,158,236	−£40,878	−£550,135	£269,654	−£131,356	−£104,838	£11,387	−£13,717	−£23,870

	Exports.	Imports.	Re-exports.
Decreases for five months of 1926	£1,109,770	£385,491	£35,080

The Electricity (Supply) Bill.

The Proceedings in Committee.

(*Continued from page* 938.)

The appeal tribunal to be set up under Clause 4 was discussed when Standing Committee "C" of the House of Commons resumed consideration of the Electricity (Supply) Bill on June 14th. Sir R. Sanders presided.

Mr. R. Hudson (Gateshead, U.) moved the insertion of the following proviso at the end of Clause 4, which deals with the duty of the Board to prepare and carry out the scheme:—"Provided that if any authorised undertakers on whom obligations are imposed by the scheme consider that the carrying out of those obligations would be prejudicial to them, they may, within one month after the publication of the scheme as adopted, by notice in writing, specifying the nature of the complaint and of the relief sought by them, require the Board to refer the matter complained of to the arbitration of a barrister (or in Scotland an advocate) of not less than ten years' standing appointed by the Minister of Transport, and the Board shall refer the matter accordingly, unless they amend the scheme by relieving the complainants of such obligations as aforesaid, and shall not, pending the determination of the complaint, carry the scheme into effect so far as it affects the complainants.

"(4) The arbitrator to whom any such matter is so referred may, if satisfied as to the justice of the complaint, either order such pecuniary compensation to be made to the complainants as seems equitable in all the circumstances or order the scheme to be amended in such manner as he may direct.

"Provided that the arbitrator shall not grant any relief other than pecuniary compensation in any case where the Board certify that the grant of such relief would conflict with the basic principles of the scheme or would prejudicially affect the efficiency of the scheme." Mr. Hudson explained that his proposal, which had been very largely discussed in advance, was merely an attempt to set up an appeal tribunal on the lines of the compromise which he had suggested earlier in the discussions.

Sir J. Nall (Manchester, Hulme, U.) moved to amend the amendment by leaving out the words "on whom obligations are imposed by the scheme," and to insert in their place the words "or any local authority or other body or person." It was essential, he said, that all those who might be legitimately concerned, should have an opportunity of stating their case to the tribunal. Mr. Hudson's amendment provided that authorised undertakers on whom obligations were imposed might appeal to a barrister to be appointed by the Minister, and the barrister, on such appeal, could not alter the scheme if the Board, which was one of the parties to the Bill, certified that such alteration would conflict with the principles of the scheme, or affect its efficiency, and the barrister could only order compensation to be paid to that authorised undertaker. That seemed to be rather a one-sided arrangement and would largely nullify the value of an appeal. The amendment which he (Sir J. Nall) was proposing would ensure that the very narrow limit of authorities on whom obligations were imposed should not be the full scope of the appeal tribunal.

Col. Ashley, Minister of Transport, thought it would be unwise to accept Sir J. Nall's amendment, which was then defeated by 28 votes to 16.

Sir J. Nall moved a further amendment to the amendment to leave out the words "carrying out of those obligations," and to insert instead the words "provisions of the scheme." Schemes of the kind indicated would contain provisions which did not involve the carrying out of obligations, and, in effect, Mr. Hudson's amendment was so drawn that not only would the parties who could come to the tribunal in the first instance be severely restricted, but the points on which they could appeal would be equally restricted if the words proposed to be deleted were left in.

Sir D. HOGG resisted the amendment, which was ultimately withdrawn.

Sir J. NALL moved to leave out the words " arbitration of a barrister (or in Scotland an advocate) of not less than 10 years' standing appointed by the Minister of Transport " in order to insert the words " tribunal of appeal by this Act constituted," because he intended later to move an amendment for a definite and permanent appeal tribunal, to consist of five members, who should be appointed for a term of five years by the Lord Chancellor.

The amendment was under discussion when the Committee adjourned.

On resuming on June 15th, Sir D. HOGG said that the Government would not object, later on, if the tribunal proposed in Mr. Hudson's amendment were utilised for other clauses and for other appeals which might come at a later stage of the Bill. The qualification of a barrister of not less than ten years' standing was the highest form of legal qualification that could be imposed. The Government, in accepting Mr. Hudson's amendment, was trying to meet the desire to give an appeal to some impartial lawyer. He could not accept Sir J. Nall's amendment.

Mr. G. BALFOUR (Hampstead, U.) wished to make the strongest possible protest against the proposed appeal tribunal. There was to be one arbitrator, with the power to say that rights which had been granted in perpetuity could be repealed on the *ipse dixit* of one man, without any appeal to Parliament.

Mr. ATTLEE (Limehouse, Lab.) suggested that there might be a panel of barristers from whom the chairman of the appeal tribunal should be selected.

Sir J. NALL'S amendment was then negatived by 35 votes to 12.

Mr. ELLIS (Wakefield, U.) moved to leave out the words " of not less than ten years' standing appointed by the Minister of Transport," in order to insert " qualified for appointment to high judicial office appointed by the Ministry of Transport from panels set up by the Lord Chancellor, or, in Scotland, the President of the Court of Session, respectively, for that purpose."

The amendment was accepted by the Government and agreed to.

Mr. LOOKER (Essex, S.E., U.) moved an amendment to permit the arbitrator, in any case in which he thought it expedient to do so, to call in the aid of one or more qualified assessors and to hear the case wholly or partially with the assistance of such assessors. The amendment was agreed to.

Sir J. NALL then moved to leave out the words :—" Provided that the arbitrator shall not grant any relief other than pecuniary compensation in any case where the Board certify that the grant of such relief would conflict with the basic principles of the scheme or would prejudicially affect the efficiency of the scheme." His object was to ensure that any monetary compensation ordered to be paid to the appellant by the tribunal should come out of the guaranteed fund; it was necessary to ensure that the cost of giving compensation should not fall on the industry.

The amendment was negatived.

On the question that Mr. Hudson's amendment, as amended, be added to the Bill, Sir J. NALL protested against what he termed a travesty of the tribunal which Sir D. Hogg had agreed to accept. The Board was left, for all practical purposes, the unfettered arbiter in its own house, able to override the statutory rights of municipalities, of great corporations, of county councils and urban and rural authorities, who would have no redress of any kind unless they came within the very narrow limits of the amendment, and, to secure redress, they must prove some financial loss. That was an entirely novel departure from the ordinary procedure of Parliamentary control of legislation, and was even a departure from the Act of 1919.

Mr. G. BALFOUR also protested against the tribunal, and urged that the Board should be made answerable to Parliament.

Mr. Hudson's amendment, as amended, was agreed to and added to the Bill.

An amendment, moved by Sir J. Nall, to add at the end of the clause the words :—" Provided that a generating station included in a scheme as a selected station shall not cease to be a selected station without the consent of the owners thereof," was accepted by Sir D. Hogg and agreed to.

Clause 4, as amended, was then agreed to, and the Committee adjourned.

On June 17th, consideration was given to Clause 5, which sets forth the procedure to be adopted by the Board for dealing with existing selected stations.

Sir F. HALL (Dulwich, U.) moved an amendment to provide that, with regard to the scheme, the owners of selected stations should be consulted in all cases in order that there should be no material alterations in schemes that had already been put into operation. In view of the money that had been spent on generating stations the owners should know exactly what was to happen.

Lt.-Col. MOORE-BRABAZON, the Parliamentary Secretary to the Ministry of Transport, said that Sir F. Hall was really trying to re-open a question which had already been decided.

Mr. G. BALFOUR pressed for an outline of the scheme. The Committee had not the slightest information to guide it as to what was the intention of the Government in setting up these selected stations.

Sir C. WILSON (Leeds, Central, U.) declared that the profits made by certain existing concerns were, under the Bill, to be confiscated in order that certain areas might benefit. The scheme was, apparently, to be a second " Post Office scheme," but even the General Post Office was careful not to take over any concern or interest that did not pay. The whole of the people of Leeds, and all the Chambers of Commerce, were against this scheme, which he would do his utmost to expose on every possible occasion.

Sir G. HUME (Greenwich, U.) said he would be very disturbed if the Government had to prepare a scheme. Under the Bill it had been decided that the preparation of the scheme should be left in the hands of the Electricity Commissioners, who were highly competent to deal with these matters. He hoped the Government would be very careful not to put any scheme forward.

The amendment was negatived.

Sir J. NALL moved an amendment to provide that, where alterations or extensions to selected stations were required by the Board, they should be made under the scheme or under an amending scheme. Under the amendment, he said, the owners would be protected against unreasonable requirements in regard to large capital expenditure by having the right of appeal to the arbitrators appointed under Clause 4. The Board, under the Bill, could require the owners to undertake such extensions and alterations as it might think fit without having any opportunity of repeal or redress.

Sir D. HOGG accepted the amendment, which was agreed to.

Sir J. NALL then moved a further amendment to provide that large additional alterations or extensions should be dealt with under an amending scheme, and that the owners of the stations affected should have the right of appeal to the arbitrators.

Lt.-Col. MOORE-BRABAZON contended that Sir J. Nall was endeavouring to start *de novo*.

Mr. G. BALFOUR protested against the final decision in a matter of this sort being left in the hands of a " bureaucratic Department." Alterations might be made involving £1,000,000 or £1,500,000, and they, he thought, ought certainly to come under an amending scheme with the right of appeal.

The amendment was negatived.

Sir D. HOGG next moved an amendment to ensure that the additional extensions and alterations which the Board might direct to be undertaken must be approved by the Electricity Commissioners before being put into operation. He explained that under the Clause as it at present stood there was to be an appeal by the owners to the Electricity Commissioners and a further appeal to the Railway and Canal Commission, but it was now desired to have one appeal tribunal throughout the Bill and the Government had agreed to that principle, and would provide for that in a later amendment. That procedure would involve there being no real safeguard, apart from the Board's own decision, on technical matters, which would raise a difficulty under the 1919 Act (Section 11) under which the consent of the Electricity Commissioners was required for any extension. It would be ludicrous if the Board directed that extensions and alterations were to be carried out, and then the Commissioners would not give their consent to them. To prevent that difficulty the amendment would provide that the Board should only direct additional extensions or alterations if they were approved by the Electricity Commissioners.

The amendment was agreed to.

Sir D. HOGG then moved to leave out that portion of subsection 1 of Clause 5, which provided that in the event of the Board's directing, with the Commissioners' approval, the carrying out of additional extensions or alterations which might be unreasonable, there should be the right of appeal to the Electricity Commissioners and then to the Railway and Canal Commission, and to insert instead the words " impose upon them an unreasonable financial burden, the matter shall, if they so require, be referred to the arbitration of a barrister (or in Scotland an advocate) appointed by the Minister of Transport from the appropriate panel set up under section 4 of this Act, and the arbitrator may in any case in which he thinks it expedient to do so call in the aid of one or more qualified assessors and hear the case wholly or partially with the assistance of such assessors." He said that as the Clause had been amended, there would be an appeal to the Electricity Commissioners from the Commissioners' decision, which would be impossible. Therefore, the Government had decided that the tribunal established under Clause 4 should hear appeals against unreasonable financial burdens, and his amendment would provide for this.

The amendment was agreed to. The Committee has thus decided that, under the Clause, the appeal by owners of " selected stations " on technical matters should be to the Electricity Commissioners, and, on financial matters, to the arbitration tribunal set up under Clause 4.

Sub-section 2 of the Clause provides that if the owners of any selected stations are unwilling to " carry out such arrangements to the satisfaction of the Board, the Board shall be entitled to acquire the generating station at a price to be determined in accordance with the provisions of the First Schedule to this Act. . . . ."

Sir J. NALL moved an amendment to leave out the words " Board shall be entitled," and to insert the words " Minister of Transport may by order empower any authorised undertaker or any other company or persons approved by the Board or failing such authorised undertakers, company, or persons, the Board." The amendment was accepted by Sir D. Hogg, and carried by 35 votes to 12.

Sir J. MARRIOTT (York, U.) moved to provide that before any generating station could be acquired by the Board, the Board must apply to the Minister of Transport for an order to do so, and then the matter must be referred to the Appeal

Tribunal to consider the substance of the complaint made by the Board in respect of the alleged default of the owners, and the Minister shall not have the power to make the order until the appeal has been heard. He maintained that the Board ought not to have the drastic power of breaking up a statutory authority until a full inquiry had been held.

Sir D. Hogg, however, pointed out that Sir J. Marriott's complaint had been met by the previous amendment which he had accepted. Sir J. Marriott therefore withdrew his amendment, but moved that "any such Order shall be provisional only and shall not have effect unless and until confirmed by Parliament."

Col. W. Ashley considered that the setting-up of the appeal tribunal rendered this Parliamentary safeguard, which would involve considerable expense and delay, unnecessary.

Mr. Hannon (Moseley, U.), in supporting the amendment, felt that to allow a body outside Parliament compulsorily to acquire private property protected by Statute, was an innovation which should be very carefully considered.

Sir D. Hogg considered that there was already sufficient safeguard, but eventually moved an amendment to provide that an order authorising the acquisition of a generating station should not come into force until it had been laid before the House of Commons and the House of Lords for a period of thirty days, and that if either House objected the order should not be proceeded with.

Sir J. Marriott's amendment was then negatived, and the amendment of Sir D. Hogg was agreed to.

Major Attlee moved an amendment to the effect that where a generating station was acquired by the Board, the Board should either operate it itself or make arrangements with an authorised undertaker who should be a local authority instead of 'a company or person.'" The Labour Party, he said, stood for public control in electricity.

Sir D. Hogg resisted the amendment, which was negatived.

Major Attlee next moved to provide that if the Board were to acquire a generating station in the area of a Joint Electricity Authority the Board should first endeavour to arrange with the Joint Authority to operate the station.

Sir D. Hogg accepted the amendment, which was opposed by some of the Government supporters. It was eventually carried by 25 votes to 13.

Clause 5, as amended, was then carried by 22 votes to 7, and the Committee adjourned.

(To be continued.)

Two Small Automatic Generating Plants.

We have received some particulars of the electrical installations at two very old and historically interesting buildings, Dunvegan Castle and Kingsburgh, both on the Isle of Skye, which have been comparatively recently wired for electric light and power and equipped with generating plant. Dunvegan (fig. 1) is the oldest inhabited castle in Scotland, dating back to the 12th century, and has been in the possession of the Clan McLeod for 700 years, the present owner being the MacLeod of MacLeod. There are about 180 lights in the castle and an interesting feature is that in several instances the original ancient lamps have been adapted for electric lighting. The dungeons, which could tell many harrowing tales of prisoners who languished and died in them, now have lost most of their terror, for they too are electrically lighted. The generating plant consists of two 1,500-W, 110-V Kohler automatic generating sets arranged for parallel working. Each set consists of a 4-cylinder petrol engine directly coupled to a compound-wound dynamo. The engine is started and stopped by means of an automatic switch mounted over the dynamo. This switch is fitted with three main relays which, when the first load is switched on, are energised from a small 24-V starting battery which supplies the necessary ignition current for starting the engine and also drives the generator as a motor up to about 50 r.p.m., at which speed the engine starts firing and the controlling relays are de-energised.



Fig. 1.—Dunvegan Castle.

A safety switch-tripping device is incorporated in the automatic switch, which, if for any reason, say, want of petrol, the engine does not start within one minute, throws the switch out.

A similar automatic device is installed for paralleling the machines. When only one machine is running, this equipment carries the main current, and when full load is reached, relays are energised in a similar manner and the second set is run up and put on load with the first. When the load decreases, the reverse action takes place. A d.p. change-over switch is fitted to the paralleling device, by means of which either machine may be put on circuit first. The operation of running up the first machine and also of paralleling in the second, is only a matter of few seconds.

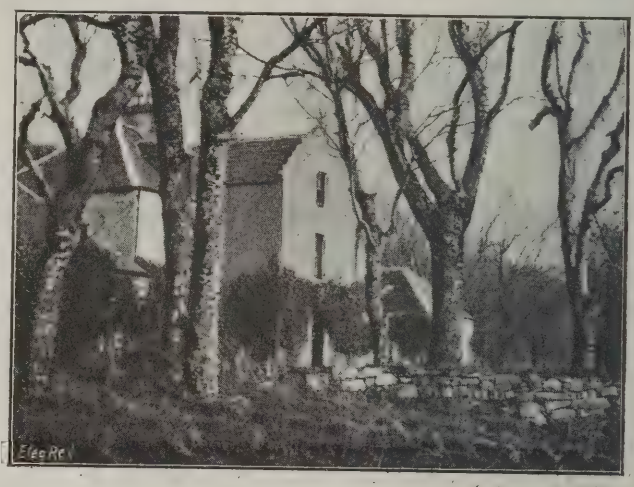


Fig. 2.—Kingsburgh.

Kingsburgh (fig. 2) is famous as the house in which there lived that great lady whose name will for ever be romantically associated with her bravery in conducting the pursued Bonnie Prince "Charlie" to Skye, *viz.* Flora Macdonald. Here there are 65 lights in the installation and the energy is supplied by one Kohler automatic set similar to those installed at Dunvegan Castle. This has been in uninterrupted use for 2½ years.

Both of these historic buildings were wired on the Henley wiring system, and the entire electrical work for both installations was carried out by Messrs. Lowdon Bros. & Co., of Dundee, to whom, and to Messrs. W. T. Henley's Telegraph Works Co., Ltd., we are indebted for the above particulars and the photographs.

New Electrical Devices, Fittings, and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

Vertical Gravity Coal Dryers.

A very simple form of coal dryer and preheater is being marketed by Messrs. Fuel Engineering, Ltd., Parliament Mansions, Victoria Street, London. The "F.E." dryer, fig. 1, consists of vertical hollow louvred columns or walls, headed by suitable hoppers, the size and number of the columns depending on the character and quantity of the material to be dealt with. Waste gases from the boiler or furnace flue are utilised and are drawn through the walls con-

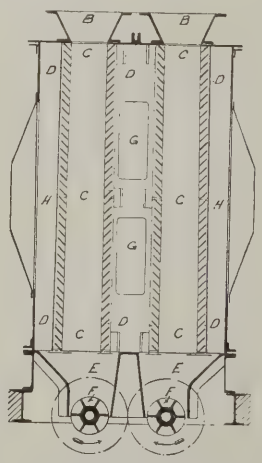


Fig. 1.—Vertical Coal Dryer.

taining the coal, the louvres forming the necessary inlet and outlet. Facilities are provided for controlling the temperature at which the drying is effected; and the rate of travel of the coal through the columns can be varied to suit the conditions and the character of the coal. the device for this control being the only mechanism employed. The dryers can be constructed in single units with capacities of from 1 to 25 tons per hour.

A Solder Compound.

Another solder compound, "Zippo," for use without the aid of fluxes, acids or other cleaning agents, has recently been introduced by MESSRS. ENGINEERING TOOLS, LTD., 11B, Upper Thames Street, E.C.4. This material is produced primarily for use with aluminium and other non-ferrous metals and alloys. We have used "Zippo" and obtained a good joint, and while we would not hesitate to recommend its use where strength is required we would point out the necessity of following closely the instructions issued for working with it. Rather a higher temperature is required for "Zippo" than for ordinary solder. It is made in two grades, medium and hard, the latter being necessary for only exceptional cases. The results of tests carried out on joints made with this new material at the University College, London, show a tensile strength of 3.79 tons per sq. in. for a medium "Zippo" joint, 0.35 in. by 0.34 in.; also a strength of 6.35 tons per sq. in. for a hard "Zippo" joint of 0.32 in. by 0.345 in. The material is made in bars to suit the trade or the domestic user; it has a fusing point of 280 deg. C., and it is claimed to have a heat conductivity equal to that of copper, and that it is unaffected by atmospheric conditions.

A Light Electric Car.

Notwithstanding the ever-increasing popularity of petrol-driven vehicles, it is interesting to learn that the SOCIETE DES APPLICATIONS ELECTRO-MECANIQUES, of 148, Avenue du Roule, Neuilly-sur-Seine, France, has recently introduced a little two-seater car known as the "Electrocyclette" which weighs only 5 cwt., complete with a battery of 10 cells, and is capable of allowing a distance of about 30 miles to be run on one charge at a speed up to 12½ m.p.h. The frame of the chassis is constructed of armoured ash, and suspended fore and aft on semi-cantilever springs. The compound electric motor is rated at 3-4 h.p.; it is located at the rear of the vehicle and drives the rear axle through bevel gearing, the accumulators having a capacity of 250 amp.-hours at 28 volts. A three-position hand

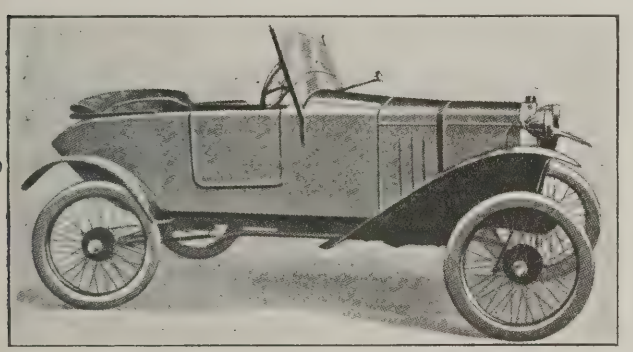


Fig. 2.—The "Electrocyclette" Two-seater Car.

lever (forward, reverse and brake) is provided, while intermediary speeds are controlled by an accelerator pedal; there is also a pedal actuating a brake on the rear wheels. The cost of running is negligible and for those requiring a simple vehicle for conveying them between their residence and place of business, within a distance of 15 miles, or for short out-and-home runs of not more than 30 miles, the makers claim that the "Electrocyclette," fig. 2, is an ideal vehicle. When alternating current only is available for charging the battery a simple rectifying device can be fitted permanently on the car. The vehicle has a wheelbase of 6 ft. 4in. and a track of 3 ft. 3 in., 500 by 50 mm. pneumatic tyres being fitted to the wire road wheels. The Company is also making a single-seated vehicle suitable for the use of invalids. This is fitted with a 150 amp.-hour battery of eight cells, of a capacity for about 20 miles on one charge.

Spiral Rolled-Steel Transmission Poles.

What promises to be of considerable interest to transmission-pole users is a new type of pole, of spiral rolled steel, fig. 3, embodying a new method of construction, which is being made by the BRITISH ROLLED STEEL POLE CO., LTD., 110, Cannon Street, London, E.C.4. These poles are constructed under the Kershaw Walker patents from rolled steel strip. This strip, which varies in thickness from 1/16th in. upwards, in passing through the rolling mill, has impressed on its surface a raised projection, or rib, parallel to the edge longitudinally, and the strip is spirally coiled upon itself with its edge lying close up to, and directly under, the rib, which serves as an interlocking device, and prevents any collapse or vertical or horizontal depression of the pole. It is claimed that the rib adds greatly to the strength and rigidity of the structure, which is further stiffened by the spiral or helical convolutions being hermetically sealed to the body of the pole. The poles are claimed to be remarkably light, rendering them suitable for transport over long distances, and immune from the attacks of insect borers; thus they are suitable for tropical and sub-tropical countries. They are made in lengths varying from 16 to 30 feet, having a diameter of 2¼ in. at the small end and 4 to 6 in. at the base. Longer poles are made of heavier steel.

The spirally-wound poles taper very gracefully, are elegant in appearance, and they can be painted, galvanised, or otherwise protected both inside and outside. Cast iron, concrete

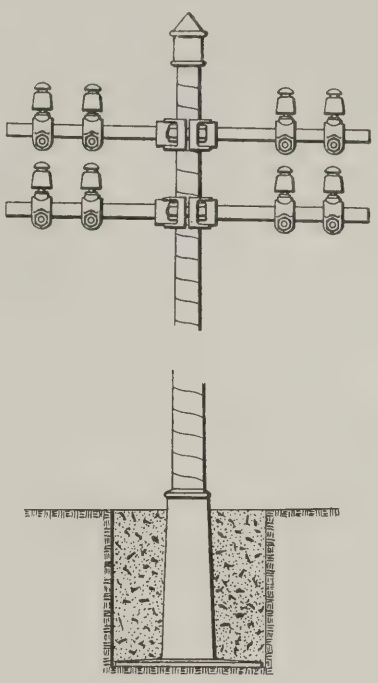


Fig. 3.—Spiral Rolled-steel Pole.

or other shields of various designs to guard the lower ends of the poles from corrosion at the ground line can be supplied with the poles where required.

The weight of the pole varies from 54 and 101 lb. (16 and 30 ft.) in the case of the light steel strip, to 67 and 126 lb. and 88 and 164 lb. for No. 14 and 12 gauge steel respectively.

The Finance of Electricity Supply.

Municipal Accountants' Conference.

AT the annual conference of the Institute of Municipal Treasurers and Accountants, held at Southport last week, a paper was read by Sir Harry Haward on the "Finance of Electricity Supply Undertakings in Great Britain."

At the outset the speaker explained that having regard to his official position as an Electricity Commissioner it was not his intention to raise matters of a controversial nature, but to give a paper which was informative rather than critical. After briefly sketching the development of electricity supply, public control, and the raising of capital, reference was made to capital expenditure, and in making the statement that expenditure on main transmission lines by private companies had been £4,259,241, as against £3,966,441 by local authorities, Sir Harry explained that the reason for this was because the heading "companies" included a number of large power companies. He stated that there was very little "watered capital," and that although a rather large figure was shown in the table which he had prepared under the heading of "Public Authorities—Miscellaneous," he explained that this included the unallocated cost of purchasing certain undertakings, notably the St. Marylebone Corporation's expensive purchase of a London company. The speaker's remarks dealing with working capital were the subject of considerable criticism in the subsequent discussion. The speaker said that under existing legislation a local authority was allowed to borrow for the purpose of providing temporarily for any current expenses, on the condition that the amount borrowed should be repaid out of the revenue received in respect of the financial year in which the expenses were incurred. Several speakers strongly resented this method of dealing with the matter, and it was said that one of the greatest weaknesses of public undertakings was the serious overdrafts. Temporary borrowing only scratched the surface of the matter, and permanent capital was required for working expenses. Mr. J. H. McCall, of Croydon, protested vigorously on this point, and pointed out that public authorities might be in the peculiar position of having invested reserves on one side of the balance sheet and an overdraft on the other. Sir Harry Haward subsequently reminded the speaker, however,

that reserves must of necessity be invested in securities, and could not be utilised for working capital or invested in wasting assets.

The remuneration of capital was dealt with at some length, together with the repayment of loans and depreciation, reserve funds, purchase options, and the allocation of profits, and in the last connection the following statement was received with obvious goodwill. "Further, there is force in the plea that as the local rate is mortgaged for all moneys borrowed for the purposes of the electricity undertaking and is liable for any deficiency thereon, the ratepayers are entitled, if they so desire, to some benefit in return for the risk involved and the advantage which the consumers obtain by the pledging of the municipal credit. So long as the sum taken in relief of rates does not cause the prices of electricity to be raised above ordinary commercial rates the consumers have no just cause for complaint."

Referring to average price obtained, Sir Harry said that the companies received very much more for lighting and domestic purposes, but in the aggregate the amounts received were much the same as those received by the municipalities. The speaker's final remarks dealt with joint electricity authorities and the proposed Central Electricity Board, emphasis being laid on the fact that "it is not contemplated that the Board will ordinarily acquire or construct generating stations or carry on extensions of stations, but that this work will be undertaken and financed as now by the existing undertakers."

In the course of the discussion Mr. ARTHUR COLLINS pointed out the necessity for local authorities to inquire into the terms granted to old customers. There were often ways in which agreements made at the very outset of the undertaking could be revised, and investigation would prove whether this was possible or not. He urged that local authorities dependent for supplies upon private companies should see that their interests and rights were "subject to oversight." Reconsideration should periodically be given to any recurrent purchase options, and the borough treasurer should submit a report on the accounts to the finance committee. The new Bill, he feared, would establish a rival borrowing authority.

Alderman A. J. BLANCHARD (Sheffield) said that he was voicing the views of many authorities when he said that he wished that the Bill only dealt with transmission. In any case, he maintained that local authorities, such as his own, where prices lower than the average were charged, should be left alone. Sheffield was already supplying at a lower price than the Government expected to be able to attain 16 years hence. Further, they had allocated no less than £70,000 to relief of rates. Under the present proposals they would, in any case, be losers to the extent of the capital raised out of revenue. This view was also expressed by Mr. E. J. JOHNSON, O.B.E. (West Ham).

Councillor COTTRELL (West Bromwich) amused the audience by asking the speaker if he could guarantee that West Bromwich would obtain lower charges by entering into an agreement with the West Midlands Authority. They were told that the surrounding district would benefit, but what he wanted to know was whether their local manufacturers would suffer. Sir Harry, in replying, said that whilst, naturally, he could give no guarantee, he could say that the scheme as outlined showed every likelihood of proving cheaper for town as well as country. The number of questions asked and the obvious desire of the members of the Institute Council to know more of the financial provisions of the Bill prompted the speaker to arrange a further meeting with the executive during the period of the Conference.

Correspondence.

***Correspondents should forward their communications* at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Electrical Literature.

Previous mention has been made in the "Correspondence" columns of the ELECTRICAL REVIEW of the vast number of books now published dealing with the design and construction of various classes of electrical apparatus and machinery. Several books of this type are indeed excellent works, but there is one point which I find is very often overlooked, and, in my opinion, it is a point well worthy of consideration.

I venture to suggest that if a few chapters were devoted to a discussion on some of the many practical methods that are at present applied inside workshops in connection with the manufacture of electrical apparatus and machinery, such chapters, apart from being very interesting, would prove to be distinctly helpful.

A book dealing with the design of electric motors might be considered as an example: much may be written regarding the electrical and mechanical design and general construction, but a "chat" on the methods of manufacture as adopted in many foundries, armature winding shops, assembly and testing departments, &c., would tend to the production of a more comprehensive work, for it is possible for one to concentrate very thoroughly on the design of an electric motor and to overlook certain difficulties that might occur in manufacture.

H. Breckell.

Swinton, *June 15th*, 1926.

Parliamentary News.

[By Our Special Parliamentary Reporters.]

Swindon Corporation Bill.—As briefly mentioned in our last issue, this Bill came before the Unopposed Bills Committee of the House of Commons on June 11th, and was ordered to be reported for third reading. The Swindon Corporation already has powers to wire premises on the condition that the work is done through contractors. The opposition on the part of the contractors to the present Bill was in respect of Clause 51, which proposes to relieve the Corporation of the obligation to employ contractors to wire consumers' premises. It is understood that the question was discussed between the Incorporated Municipal Electrical Association and the Electrical Contractors' Association, and that an agreement was come to with the result that the Bill became unopposed by reason of the insertion of the following provisos in Clause 51:—(*a*) That the Corporation should not sell electrical installations and apparatus except at retail prices; (*b*) That it should not sell any such apparatus to the trade save where there was an electrical contractor of whom the consumer or prospective consumer was a customer or prospective customer, in which case it should sell to the contractor at trade price; (*c*) That if such retail and trade prices were agreed, they should be determined by a committee representative of the interests concerned appointed by the Electricity Commissioners on application; (*d*) That the Corporation should so far as practicable adjust the prices and the charges made for materials provided and work done to meet any expenditure incurred in connection therewith (including interest and sinking fund for repayment of moneys borrowed); and (*e*) That the total sums received and expended by the Corporation should be separately shown in the published accounts.

Bristol Corporation Bill.—The Local Legislation Committee of the House of Commons began the consideration of this Bill on June 9th. One of the objects of the Bill relates to the building of a new power station at Portishead, and Mr. TYLDESLEY JONES, K.C., who appeared for the Corporation, explained that the present power station had reached the limit of its capacity, owing to the lack of condensing water. Consequently the Corporation had decided to build a new power station on land which would allow of the installation ultimately, if necessary, of plant having a capacity of 240,000 kW. It was possible for the Corporation to build the station, with the consent of the Electricity Commissioners, without going to Parliament, but it was the custom to obtain legal powers in order to prevent a public utility authority from being sued for nuisance. A local inquiry had been held by the Electricity Commissioners and among those who sought permission to oppose was the West Gloucestershire Power Co., but it was decided that the Power Co. whose boundaries were some miles away from the boundaries of the area of supply of the Bristol Corporation, had no *locus standi*. When the present Bill was deposited in Parliament the Power Co. lodged a petition and the Corporation objected, but the Court of Referees of the House of Commons had decided that the Power Co. should be heard against the Bill. The case of the Power Co. was that the erection of a new power station by the Bristol Corporation would interfere with the development of its business, although it was impossible to understand how this could be the case. At the present moment the Power Co. had an area of 300 square miles and was making application for additions to that of 590 square miles; at present it had one power station for this huge area containing 10,000 kW and capable of extension to 30,000 kW. Obviously that station could not meet the needs of such an important area as the Power Co. possessed.

Evidence in support of Counsel's statement was given by Mr. H. FARADAY PROCTOR (chief electrical engineer, Bristol).

Before the conclusion of the Corporation's case, it was announced by Mr. CRAIG HENDERSON, K.C. (for the Power Co.), that the company would not continue its opposition. The Corporation intended the station for its own needs, and, in so far as it was a station capable of expansion, the company would leave it to the Electricity Commissioners to decide what the future was to be.

The Committee allowed the clause, and considered that the site was most suitable for the erection of a generating station.

Private Bills.—The Royal Assent has been given to the Ayrshire Electricity Order Confirmation Bill, and to the Ascot Gas and Electricity Bill. The Kidderminster and Stourport Tramways Bill has been read a second time in the House of Commons. The London Electric and Metropolitan District Railway Companies' Bill was read a third time in the House of Commons on June 21st.

Telephone Development.—On June 15th, Sir W. MITCHELL-THOMSON, Postmaster-General, informed Captain Fraser that in the year ended March 31st last, 222,494 telephones were installed. During April, orders were obtained at the rate of over 5,300 per week and at the end of that month, omitting those orders for which subscribers were not then ready for service, there were in hand 13,600 orders, representing less than three weeks' work. At the same date, some 800 applications for service were outstanding which could not be met pending the completion of certain engineering works. Telephone publicity work was carried out by a canvassing staff of about 400 and by the exhibition of posters, the distribution of leaflets and booklets through the post, from Post Office counters and through the agency of canvassers. The wages and commission paid to the canvassing staff in the year 1925-26 amounted to about £136,000, but part of this sum was chargeable to other duties which the staff performed.

Special Orders.—The following Special Electricity Orders have been approved:—Bedford (Extension), East Anglian, Petersfield and District, Wrexham Rural District, and Millom.

Radio Music in Parks.—On June 16th, Col. DAY asked the Under-Secretary of State for the Home Department, as representing the First Commissioner of Works, whether it was proposed to introduce wireless concerts in London parks as a substitute for bands.

Captain HACKING said he could only answer for the Royal Parks. It was not proposed to introduce radio concerts as a substitute for bands in any of those parks.

Cutting off Electric Light.—On June 17th, Sir EVELYN CECIL asked the Home Secretary whether, in the case of an offence against Section 22 of the Electric Lighting Act, 1882, by unlawfully or maliciously cutting or injuring any electric line or work with intent to cut off any supply of electricity, which was punishable as felony and liable to penal servitude or imprisonment, the Home Office took the initiative in prosecuting or, if not, what procedure was adopted.

Sir W. JOYNSON-HICKS said that the normal course, in that as in any other case of felony, would be for the police to take the necessary action on receiving information that an offence had been committed.

Shropshire, &c., Bill.—On June 17th, the Shropshire, Worcestershire and Staffordshire Electric Power Co. Bill came before the Unopposed Bill Committee of the House of Lords, which ordered it to be reported, with amendments, for third reading.

Legal.

Francis Polden & Co., Ltd., v. Murless.

IN the Mayor's and City of London Court, on June 16th, before Judge Shewell Cooper, Messrs. Francis Polden & Co., Ltd., electrical contractors, brought an action against Mr. R. A. Murless, of Waltham St. Lawrence, Berks., for £44 12s., for work done in dismantling a "Delco" electric lighting plant, fitting new parts and re-erecting it. Mr. PAUL, for the plaintiffs, said that the defendant obtained the plant in a bad condition from America, and asked the plaintiffs to re-condition it, and fit his premises throughout with electric lighting. The total value of the contract was about £300. The work was finished in April, and everything was found to be satisfactory. Later the engine broke down, and it was found that the breaking of a split pin had allowed a nut to get loose. The machine was again repaired and put in running order, and the sum claimed represented the cost of new parts and labour expended. The defendant had refused to pay on the ground that when the plaintiffs accepted his original order there was a guarantee that if any breakdown occurred through faulty material or workmanship within six months it would be made good by the plaintiffs. The plaintiffs contended that the breakdown was not due to any fault of theirs. When they were first shown the engine they called in an expert and provided such new parts as, in his opinion, were necessary. With the machine that came from America was the split pin which had been the cause of the trouble, and in the view of the Delco expert it was in a satisfactory condition to be used again. Plaintiffs therefore contended that there was no negligence on their part.

For the defence Mr. KINGHAM submitted that the plaintiffs had not fulfilled their duty in replacing in the apparatus a split pin which it had been admitted had already been used and bent about.

Judge SHEWELL COOPER said that in his view the plaintiffs were bound under the contract to replace any parts of the engine which were defective, but he came to the conclusion that there was no negligence on the part of the plaintiffs' servant in re-fitting the split pin. Under the contract plaintiffs guaranteed not to supply faulty material, and that could only refer to material which they did supply. He gave judgment for the plaintiffs for the amount claimed, with costs.

Theft of Electricity.

AT the Llandilo Police Court on June 17th, John Edwards, a mineral water manufacturer, was charged with feloniously and fraudulently abstracting electricity belonging to the Llandilo Urban Council. Evidence was given showing that the defendant rearranged the wiring of a meter so that the electricity did not pass through the instrument. Defendant pleaded guilty and was fined £50 and costs.

A Welding Arbitration Case.

THE *Western Mail* reports that a Divisional Court, composed of Justices Salter and Fraser, recently heard an application made on behalf of the Cardiff Electric and Oxy-Acetylene Welding Co., Ltd. Mr. Joshua Davies (instructed by Messrs. Capron & Co., agents for Mr. Wilfred Rees, Cardiff) appeared for the applicants; Mr. Wilfred Lewis and Mr. Banks (instructed by Messrs. Higman & Randall) appeared for Alloy Welding Processes, Ltd.

Mr. DAVIES explained that in February of this year Professor Low held an arbitration with reference to a counterclaim by the Cardiff company against Alloy Welding Processes, Ltd., claiming damages in respect of an alleged defective portable welding plant sold to it by the plaintiffs. On February 16th Professor Low published his award, giving the Cardiff Welding Co. £227 damages in respect of its counterclaim. Counsel asked that the award should be remitted on the ground that there was ambiguity with reference to the costs. Mr. Wilfred Lewis argued that there was no ambiguity. The Court granted the application, and remitted the award to Professor Low.

Telephone Official Charged.

AT the Southampton Police Court on June 8th, Arthur J. Squire was sent for trial at the Hampshire Assizes upon a charge of embezzling £35 14s., the moneys of the General Post Office. It was alleged that the amount was collected from telephone subscribers in payment of their accounts.

Theft of Cable.

AT the Edinburgh Sheriff Court on June 14th, David Robertson and James Anderson were charged with the theft of 118 ft. of lead-covered cable belonging to the Edinburgh Corporation. The prosecution stated that the lads burned the cable to separate the lead from the copper and later sold the copper, which was valued at £3, for 8s. 6d. The prisoners were fined £2 each, or in default of payment 20 days' imprisonment.

Conspiracy Charge.

AT Leicester City Police Court, on June 18th, the hearing was resumed on charges of conspiracy against Charles Cohen, merchant, Dalston, and Leonard Louis Weiner, tailor's apprentice, London, E., who were accused of obtaining quantities of goods by means of forged references. Among the witnesses was Mr. W. Mills, secretary of Messrs. E. Brook, Ltd., electrical engineers, Empress Works, Huddersfield, who stated that Weiner & Co., of Leicester, wrote for quotations and afterwards ordered electrical machinery. References were asked for and given, and Messrs. Brook wrote to "Douglas Armstrong & Co.," and "Wm. Courtney & Co.," both of London, who replied stating that they had had dealings with Weiner & Co. and had found them quite satisfactory, being good for credit up to £500 per month. Messrs. Brook thereupon despatched to Weiner & Co. electrical machinery to the value of £38 and £29, for which they had never received payment. Evidence was given by Ralph Barcon, Highbury, N., formerly trading as Courtney & Co., that he had no knowledge of the reference produced, and had never signed such a document. His firm had no agents in Paris, Dresden and Cologne, as stated on the notepaper. The accused were remanded for a week, Cohen being refused bail, and Weiner being granted bail in the sum of £250, which was forthcoming.

Reviews.

Dictionary of Costing. By R. J. H. RYALL, F.C.W.A., with a foreword by Sir George Beharrell, D.S.O. Pp. xiii + 377. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

If the author had consulted the Oxford Dictionary, he might have chosen a different title for his book.

"The author's aim has been to produce a work which shall take its place as the standard book of reference in the costing profession." Truly, a huge task for one man to undertake, especially when he himself admits that vast strides have been made in the science of costing during the past few years. We are surprised, therefore, in handling the book for the first time, that it contains less than 400 pages of clear type. Surely this does not cover the whole ground of costing, as we should expect a standard book of reference to do. Again, are not vast strides still being made? We are fearful lest this standard book should very shortly suffer from obsolescence. However, here is a definite attempt to do what has been so obviously needed in the past few years; to collect data from all industries and from the practice of many cost accountants; and it should, at least for the present, give a fair indication of standard practice in the application of costing.

We are inclined to think that the authorship approaches editorship in this case, as there seem to be traces of many hands having made their contribution to the definitions and descriptions included. Naturally, such a book is received with hopeful, yet fearful anticipations, and one must confess that in the treatment of most of the subjects there is a thoroughness and a lucidity which make the book very readable, despite its encyclopædic form.

That the book is up to date is illustrated by the fact that there is described in it the "Paramount Sorting System," which seems to be destined to have a drastic influence upon the costing methods in vogue in many firms which cannot afford the more expensive machinery made for the same purpose.

The Institute of Cost and Works Accountants in 1923 issued a paper upon "Standardisation in Cost Accountancy," which constituted an authoritative pronouncement upon costing terminology, and we are frankly surprised that the author, a member, and a prominent member, of that body, should see fit to set up in some degree a new terminology of his own. Admittedly it is only in a very few terms that he goes astray, such as the use of "Factory Expense" instead of "Manu-

facturing Expense," and it may seem rather a quibble to suggest that this is a vital error, but if this is meant to take the place of the paper quoted, as a more comprehensive survey, it appears to us that a rigid adherence to the prime authority is most necessary.

The book is profusely illustrated with forms, tables and formulæ, which are very clear, and will repay the close study of cost accountants, engineers, and students. Nevertheless, it must be pointed out that such a book is bound to cover far more ground than is required in a small business, employing up to, say, 500 men. This is given in warning rather than condemnation, for, as far as the bigger firms are concerned, we can recommend it as a book of reference, subject to the qualifications already stated. No doubt, as times and customs change, the author will see to it that revised (and, we expect, enlarged) editions will be forthcoming.

This is not a text-book. It is a book of reference, and therefore certain subjects are not treated so exhaustively as they would have been in a text-book, or in a more specialised treatise; but the amount of ground covered is far more than has been covered in any book on costing published in this country. Used in conjunction with such text-books as can be relied upon, its value will easily be appreciated.

The last paragraph of the preface is arresting. If this book will do anything to wake up the vast majority of our manufacturers, who so sublimely think that their own antiquated, home-made, expensive, and inefficient methods bear some resemblance to sound systems or even justify the expense incurred in their upkeep, it will have been supremely " worth while."

Loud Speakers : Their Construction, Performance and Maintenance. By C. M. R. BALBI, A.M.I.E.E., A.C.G.I. Pp. xv+96; figs. 57. London : Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

There is a considerable amount of scattered literature in the form of lecture reports and magazine articles on the subject of loud speakers, but singularly little has appeared so far in a comprehensive form.

This is all the more surprising as it has been recognised for some time that telephone reception for broadcast listeners will soon be confined almost wholly to crystal sets, and Mr. Balbi's little book would for this reason alone be sure of a warm welcome. But it deserves a welcome for other reasons as well, for it is accurate, concise, up-to-date, and as comprehensive as its size permits. The contents include short descriptions of the principles on which every loud speaker of note is constructed, how loud speakers are tested, and what points should be considered when purchasing one; and, in addition, there is a chapter on public address systems. A good summary is given of the outstanding practical characteristics of the various types of loud speakers on the market and the size of the room for which each particular type is suited.

The author sets out to give " an outline of our present-day knowledge in regard to loud speakers in all its branches," and he succeeds admirably, but we must remember that it is essentially an outline, and must not expect any deep delving into a subject which has so many interesting and little-understood depths. In fact the only criticism of the book we offer is that we should have liked more of it.

This little book should prove of considerable practical value to radio manufacturers, traders, and amateur experimenters.

Pyrometers. By EZER GRIFFITHS, D.Sc. Pp. xi+126; figs. 49. London : Sir Isaac Pitman & Sons, Ltd. Price, 7s. 6d. net.

The author of this work gives an account of the most recent developments in temperature-measuring appliances, and deals with the methods of testing and calibrating such apparatus. It is assumed that the reader has made himself familiar with the details of standard apparatus, either by actual experience with these, or by the perusal of makers' catalogue matter. The descriptive portions of the book accordingly deal with special problems in temperature measurement rather than with the most usual apparatus, at any rate, as far as electrical pyrometers are concerned. The portions of the book dealing with the calibration of pyrometers are both interesting and useful.

The opening chapter deals with the important matter of the establishment of a scale of temperature covering the range of industrial requirements. The problem of practically realising the basic thermodynamic scale has been no easy one. The constant volume hydrogen thermometer gives an exceedingly close approximation to the theoretical scale between 0 deg. and 100 deg., whilst the platinum-resistance thermometer scale gives sufficient exactness between the freezing point of mercury and the boiling point of sulphur when standardised at 0 deg. and 100 deg. A number of fixed points ranging from the boiling point of oxygen and the melting point of copper have been established with considerable precision. The calibration of expansion thermometers is dealt with in the second chapter, and the methods of comparison with standards between the limits −80 deg. and 450 deg., are described in detail. There is an interesting account of the problem of measuring surface temperatures. Thermo-electric pyrometers are amply treated and good information is given of the various combinations available for different circumstances. A good description is here given of the recording potentiometer type of thermo-electric instrument. The chapter dealing with resistance thermometers describes the application of this method to the measurement of the temperature of electric cables and of transformer windings. Various types of the disappearing filament optical pyrometer are described, and the theory of this instrument is briefly summarised. A short chapter on the total radiation instrument and an account of some typical electric furnaces for recent investigation work conclude the book.

A useful feature of the work is the reference made to standard text books for the benefit of readers desiring to acquaint themselves with the elementary theory of the instruments described. There is also a list of references to advanced text books and to original papers for those wishing to pursue the subject beyond the limits of the present work. Dr. Griffiths's book will be useful to those requiring a good general account of the present state of the science of temperature measurement, and also to electrical power engineers who have instruments for this purpose under their control.

Published Specifications.

Compiled expressly for this journal by Patent Agents.

The name of the applicant's patent agent, if any, will be found on the printed specification.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1924.

29,372. " Magnetic separators." H. S. Hatfield. December 8th, 1924. (252,034.)

29,554. " Electrical protective arrangements for alternating-current systems." N. P. Hinton and Metropolitan-Vickers Electrical Co., Ltd. December 9th, 1924. (252,036.)

29,808. " Electric furnaces." G. Evreynoff. December 11th, 1924. (252,037.)

1925.

541. " Telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (G. Deakin and L. Polinkowsky). January 8th, 1925. (252,041.)

1,107. " Electric apparatus for indicating and recording quantities at a distance." S. A. Fox and C. H. Offord. January 14th, 1925. (252,049.)

1,269. " Electromagnetic sound recording and reproducing mechanism." H. P. O'Reilly. January 15th, 1925. (252,214.)

3,515. " Automatic telephone exchanges." P. C. Rushen (C. Lorenz Akt. Ges.). February 7th, 1925. (252,052.)

3,629. " Electromagnetic sound recording apparatus and record produced thereby." A. F. Sykes. February 9th, 1925. (Cognate application 12,581/25.) (Patent of addition not granted.) (252,228.)

3,646. " Acoustic amplifying and radiating means." E. A. Graham. February 9th, 1925. (252,053.)

3,866. " Automatic telephone switching apparatus." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (G. Deakin and L. J. J. Schreiber). February 11th, 1925. (252,056.)

3,867. " Automatic telephone switching apparatus." Standard Telephones and Cables, Ltd. (formerly Western Electric Co., Ltd.) (G. Deakin and L. J. J. Schreiber). February 11th, 1925. (252,057.)

4,006. " Electric alarm systems." F. E. J. Horn and O. Schoppe (firm of). February 12th, 1925. (252,229.)

4,007. " Means for controlling rotating field motors." H. Wade (Nederlandsche Technische Handel Maatschappij Giro). February 12th, 1925. (252,060.)

4,088. " Production of telephonic diaphragms and the like." W. J. Palmer. February 13th, 1925. (252,062.)

4,097. " Electric remote-control systems, more particularly for use in controlling or supervising the apparatus at an electric power sub-station." Automatic Telephone Manufacturing Co., Ltd., and A. E. Hudd. February 13th, 1925. (252,230.)

4,098. " Control of apparatus at an electric power sub-station from a central control office." Automatic Telephone Manufacturing Co., Ltd., and C. Remington. February 13th, 1925. (252,231.)

4,192. " Protective devices for electric traction systems." British Thomson-Houston Co., Ltd., and H. S. Holbrook. February 14th, 1925. (Cognate application 4,193/25.) (252,069.)

4,225. " Plug-and-socket electric couplings." J. J. Rider. February 16th, 1925. (Cognate application 28,589/25.) (252,233.)

4,338. " Electric lamps for illuminating bakers' ovens." F. T. Bouckley. February 17th, 1925. (252,235.)

4,377. " Variable-inductance devices." Igranic Electric Co., Ltd., and S. R. Wright. February 17th, 1925. (252,236.)

4,415. " Apparatus for automatically reclosing electric circuit-interrupters." T. W. Ross and Metropolitan-Vickers Electrical Co., Ltd. February 17th, 1925. (252,238.)

4,421. " Manufacture of wires and tapes for loading telephone conductors." W. S. Smith and H. J. Garnett. February 17th, 1925. (252,074.)

4,527. " Four-electrode valves and means for obtaining high-frequency or low-frequency magnification or rectification therewith." Marconi's Wireless Telegraph Co., Ltd., and E. W. B. Gill. February 18th, 1925. (252,079.)

4,546. " Polyphase induction machines." Siemens-Schuckertwerke Ges. February 19th, 1924. (229,710.)

4,625. " Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and H. E. Humphries. February 19th, 1925. (252,244.)

4,626. " Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and G. E. Humphries. February 19th, 1925. (252,245.)

4,631. " Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. February 19th, 1925. (252,246.)

4,751. " Apparatus comprising a combined resistance and capacitance." British Thomson-Houston Co., Ltd., and H. S. Holbrook. February 20th, 1925. (252,083.)

4,877. " Polyphase induction machines." Siemens-Schuckertwerke Ges. May 1st, 1924. (Addition to 229,710.) (233,310.)

5,130. " Transmitting or receiving aerial systems for wireless telegraphy or telephony." C. S. Franklin. February 24th, 1925. (252,272.)

5,216. " Dynamo-electric machinery." E. P. Hill and Metropolitan-Vickers Electrical Co., Ltd. February 25th, 1925. (252,277.)

5,450. " Telephone systems." Standard Telephones & Cables Ltd. (formerly Western Electric Co., Ltd.) (Western Electric Co., Inc.). February 27th, 1925. (252,088.)

5,571. " Electrical relays." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. February 28th, 1925. (252,089.)

5,936. " Tuning of wireless circuits, and apparatus therefor." R. J. T. Morton and B. Stirling. March 4th, 1925. (252,285.)

19,470. " Shock-absorbing devices for thermionic valves." Benjamin Electric, Ltd. August 2nd, 1924. (237,921.)

27,981. " Electric machines for working under liquid." Siemens Schuckertwerke Ges. November 7th, 1924. (242,660.)

30,840. " Casings for electric transformers and the like." O. Wehrle. December 7th, 1925. (252,299.)

31,747. " Electrical current-generating apparatus for electrical treatment or working upon metals." Elektrotrennmaschinen Ges. February 13th, 1925. (247,527.)

31,993. " Electric current-generating apparatus for electrically treating or working upon metal." Elektrotrennmaschinen Ges. June 16th, 1925. (Addition to 247,527.) (252,302.)

1926.

1,148. " Electric machines for working under liquid." Siemens-Schuckertwerke Ges. April 27th, 1925. (Addition to 242,660.) (251,237.)

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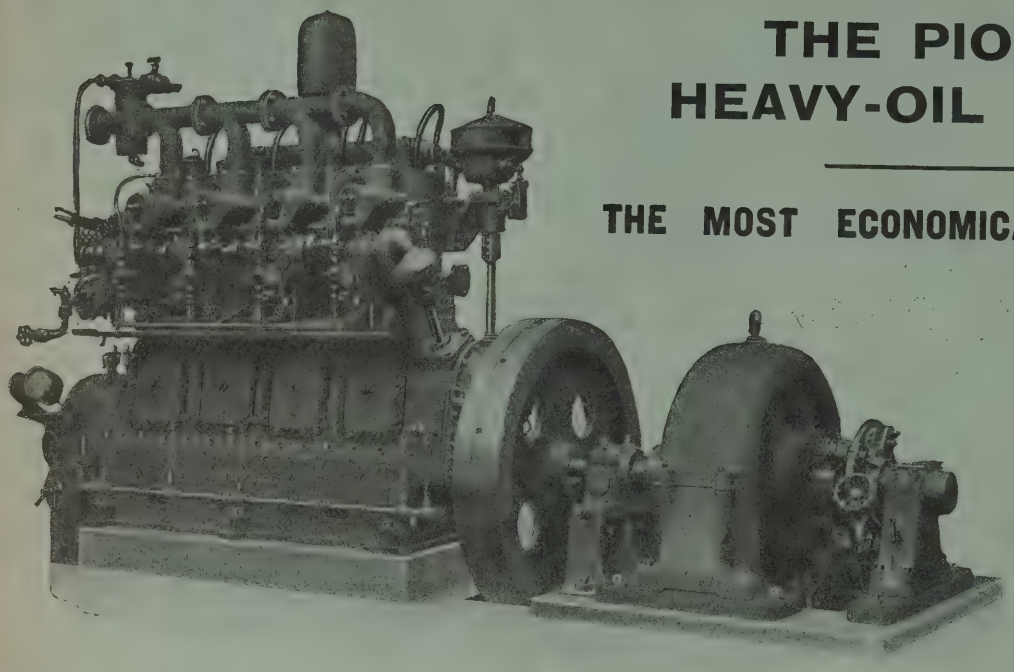
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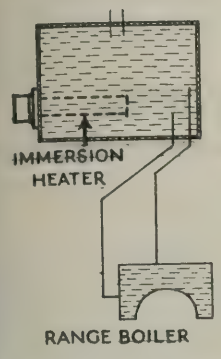
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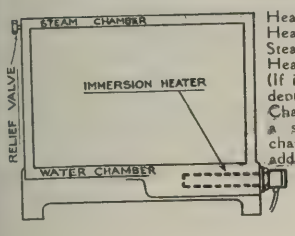
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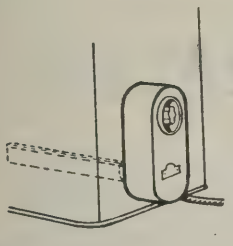
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SUGGESTION 1
Heatrae Immersion Heater fixed in existing Hot Water Tank.



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Heatrae Immersion Heater fixed in Steam or Water Heated Hot Closet. (If insufficient depth in Water Chamber at bottom a small auxiliary chamber can be added as shown.)

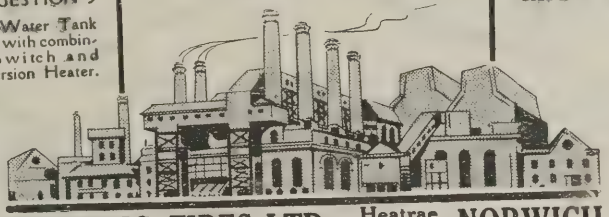


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Made in various sizes and Types.



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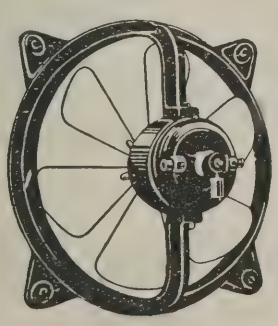
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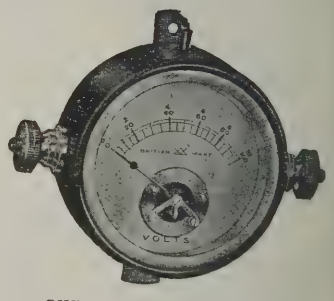
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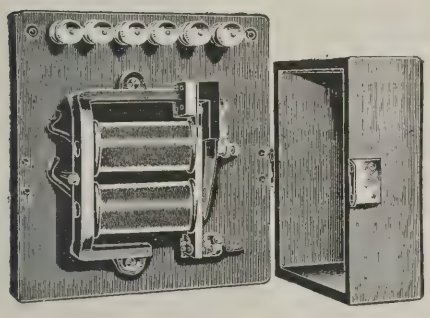


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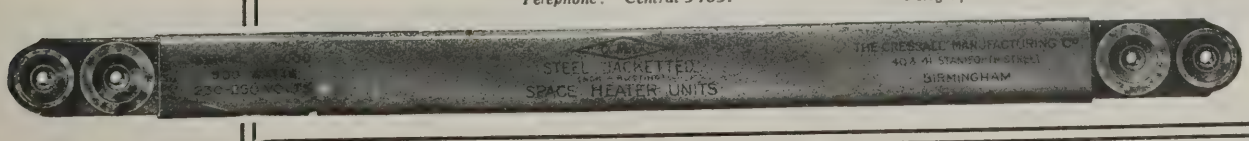
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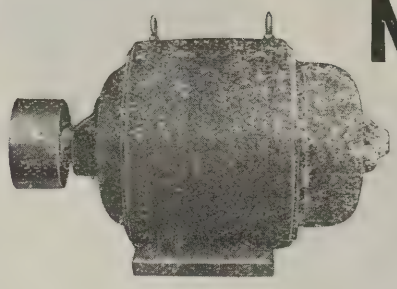
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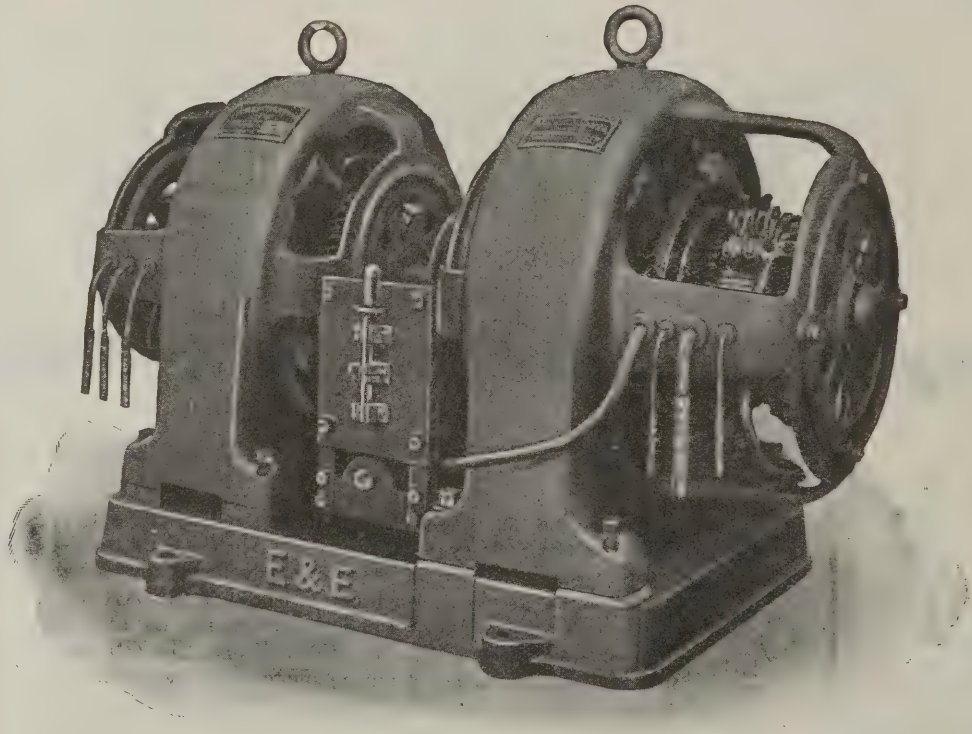
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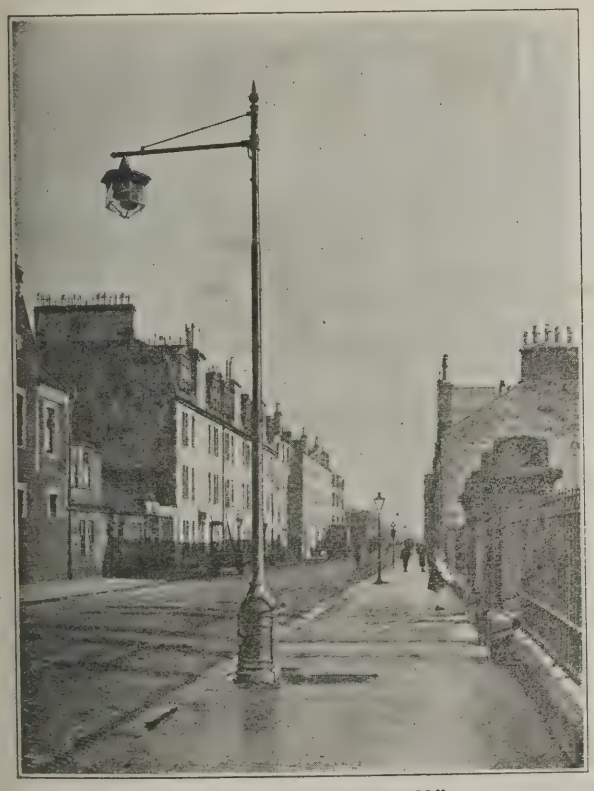
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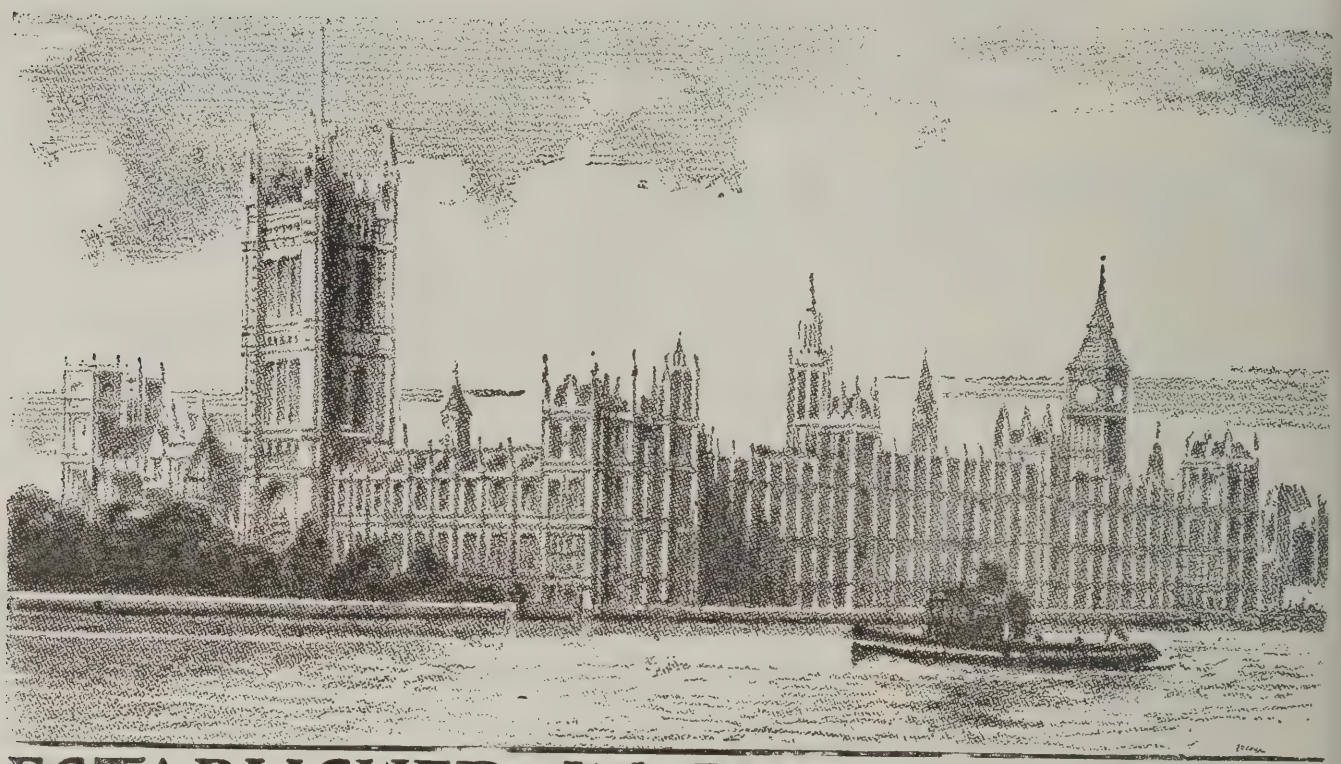
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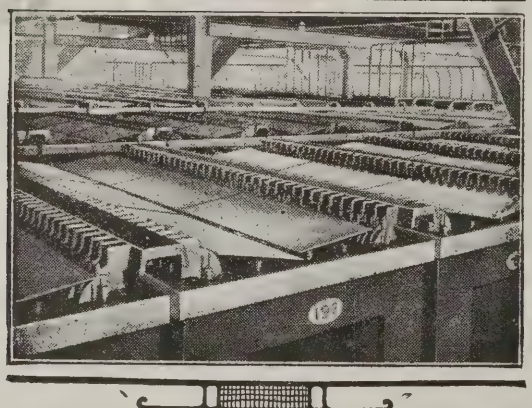
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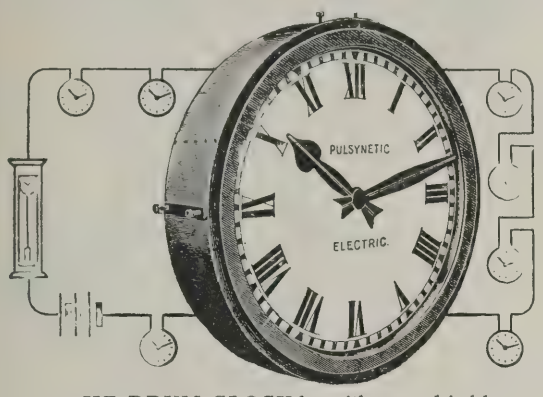
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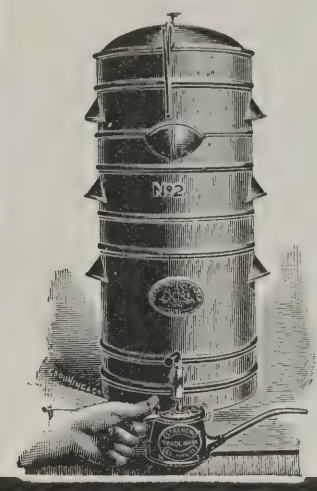
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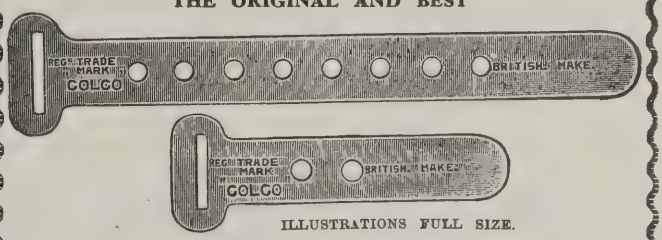
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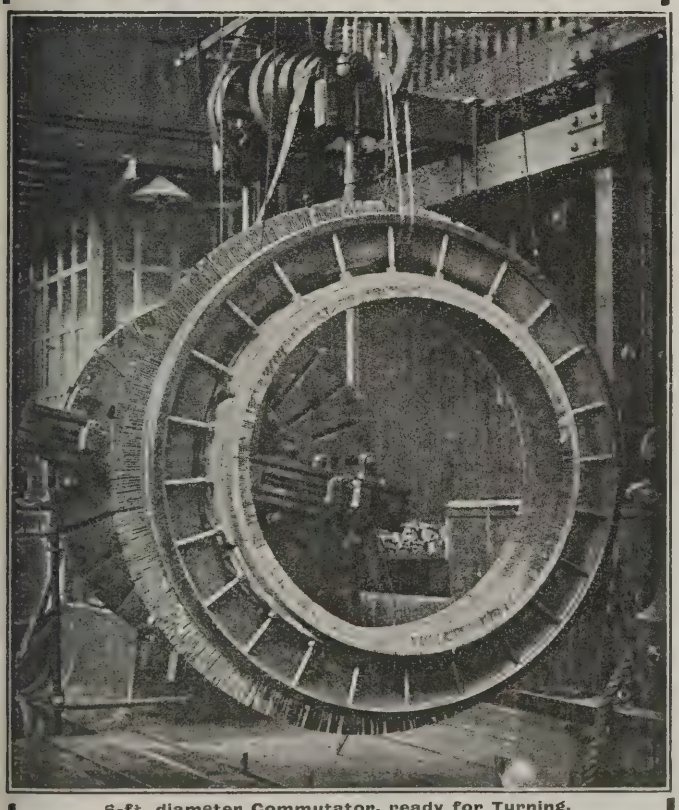
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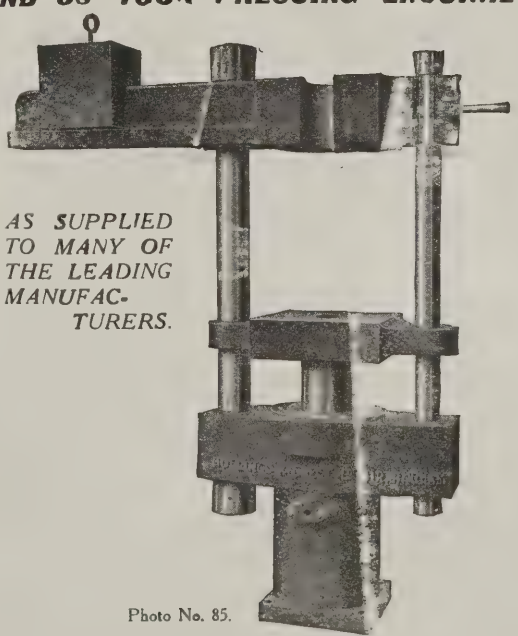
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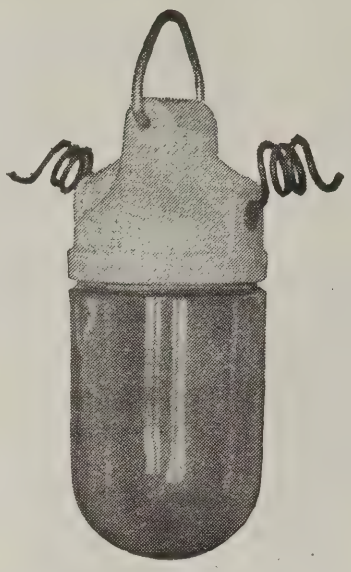


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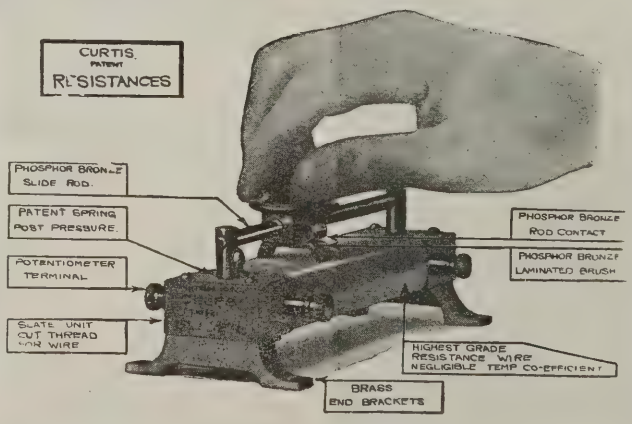
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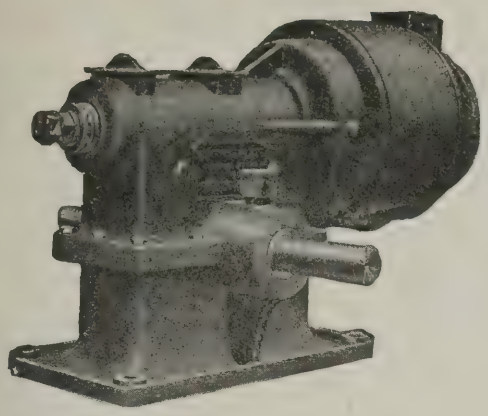
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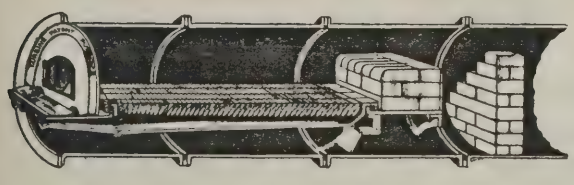
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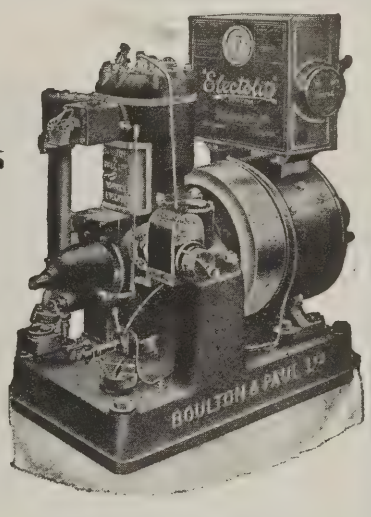
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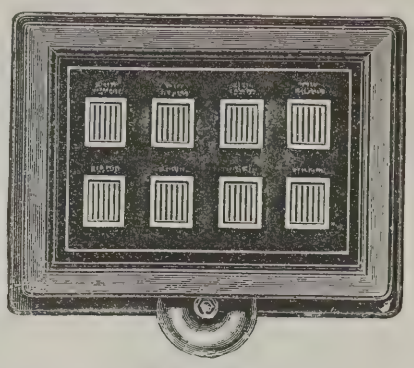
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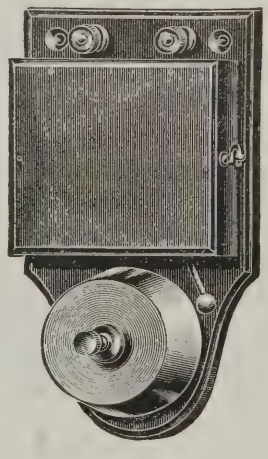
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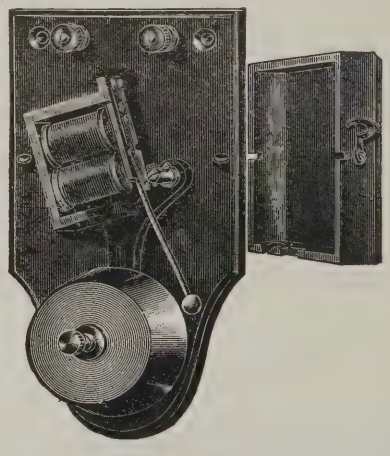
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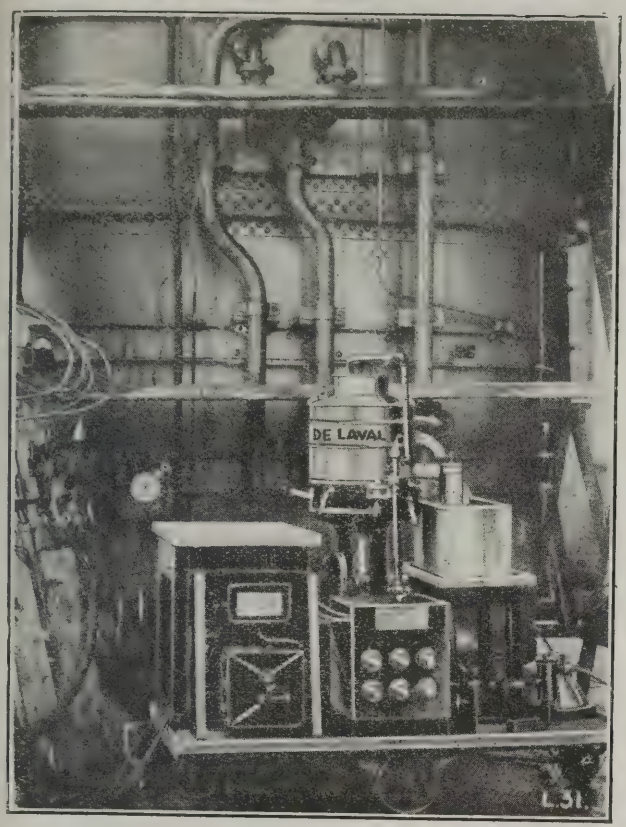
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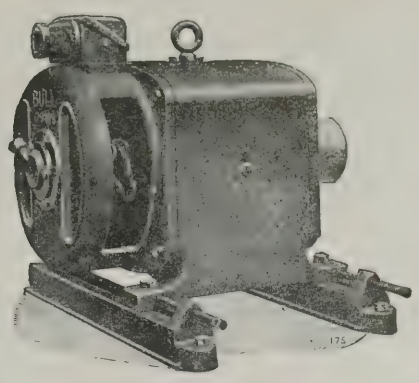
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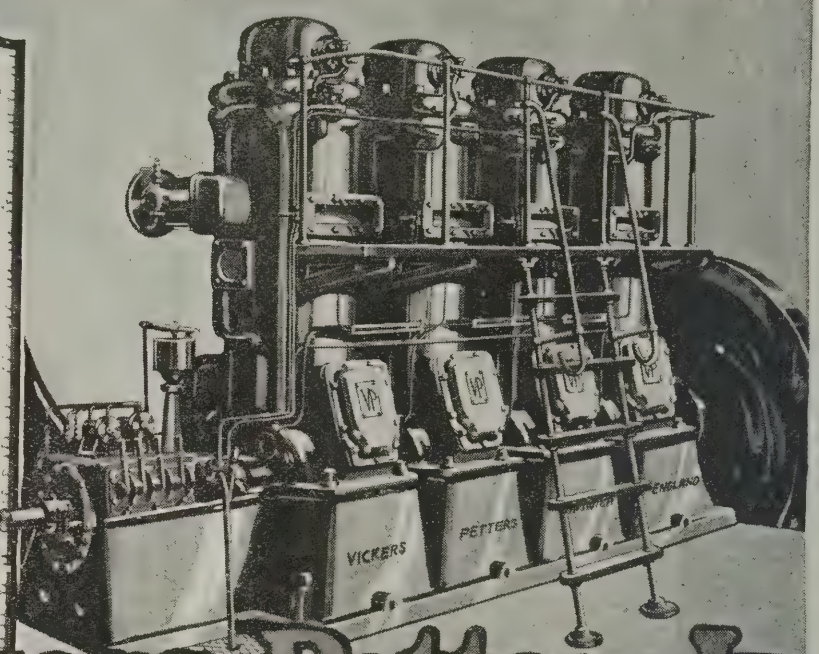
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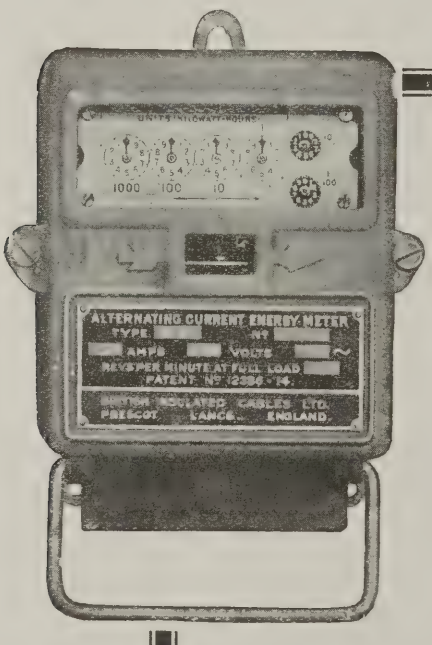
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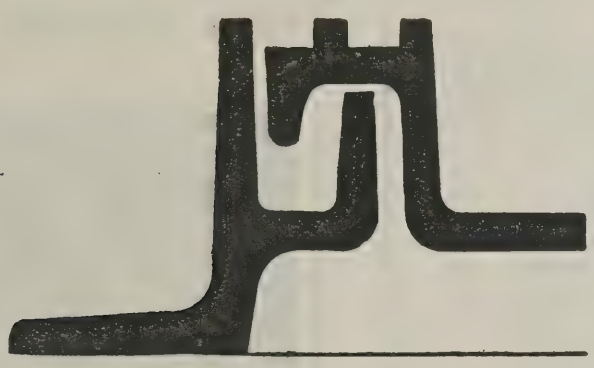
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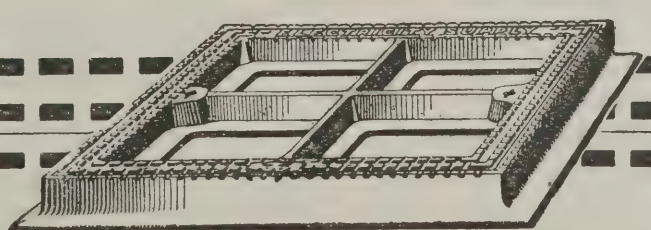
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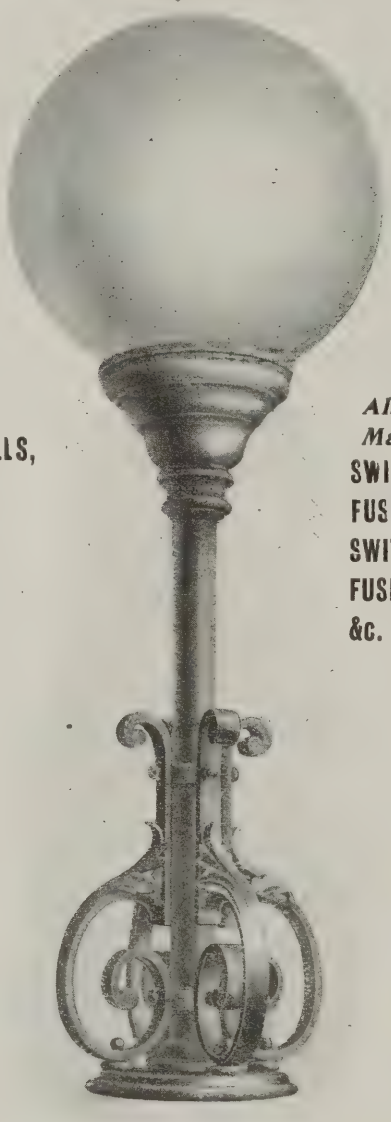
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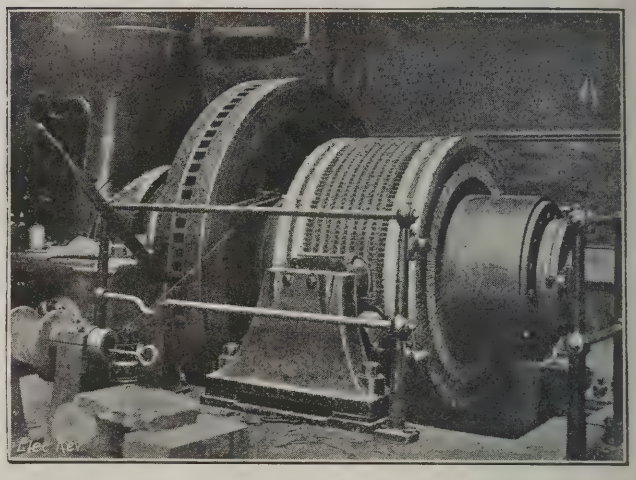
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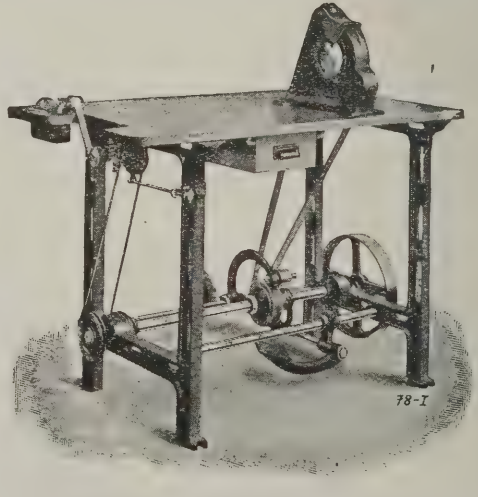
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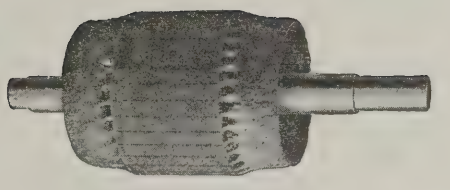
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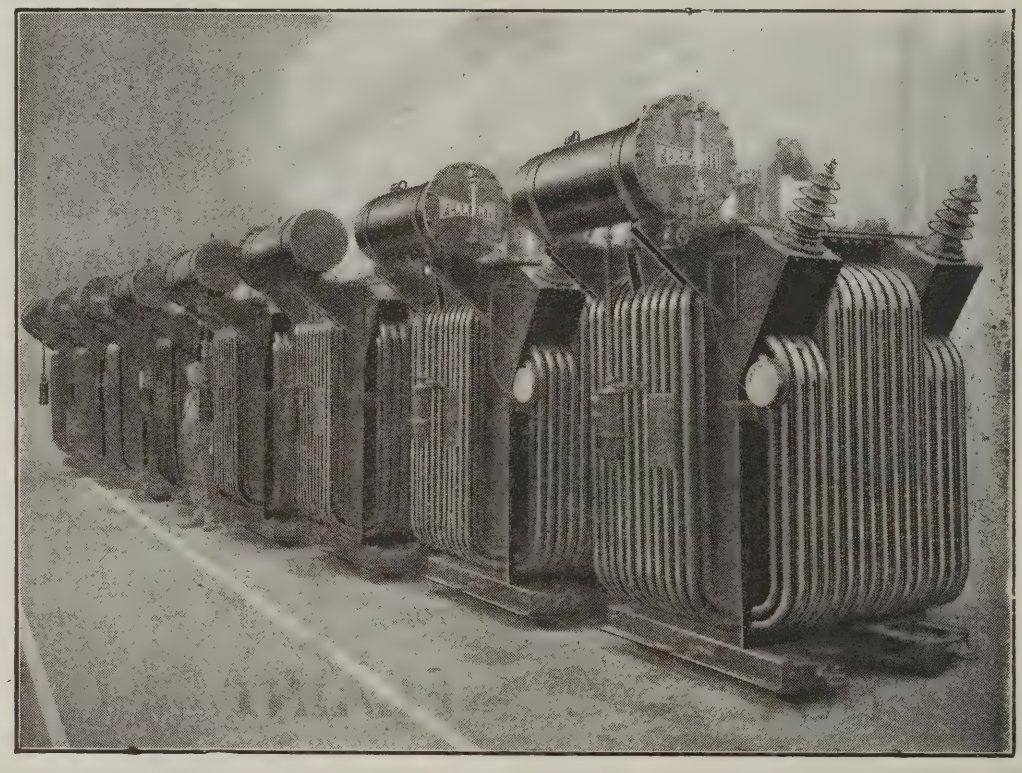


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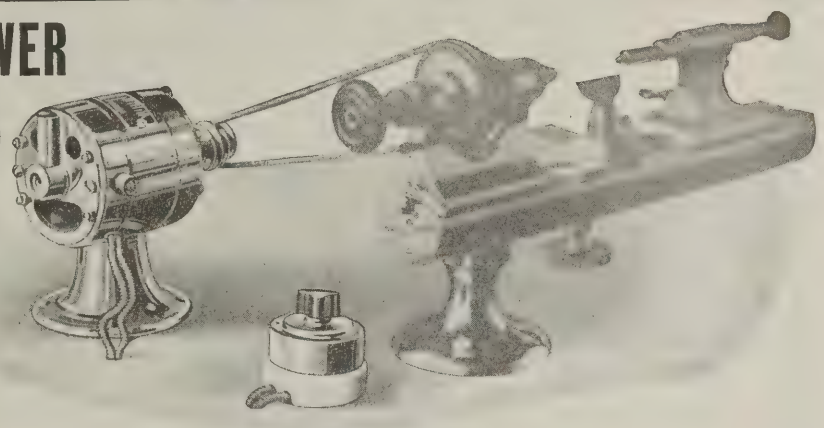
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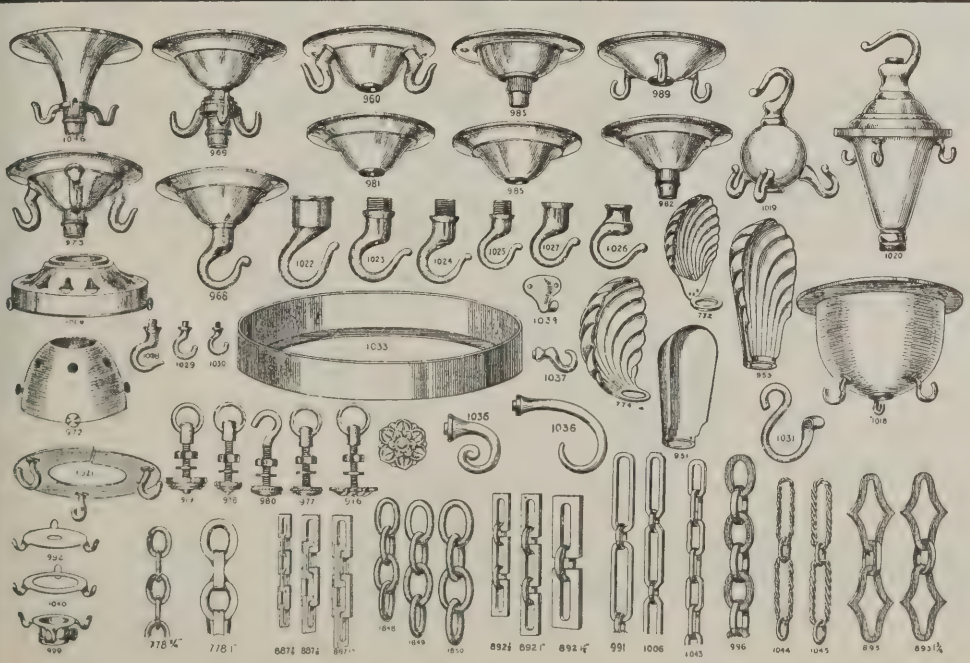


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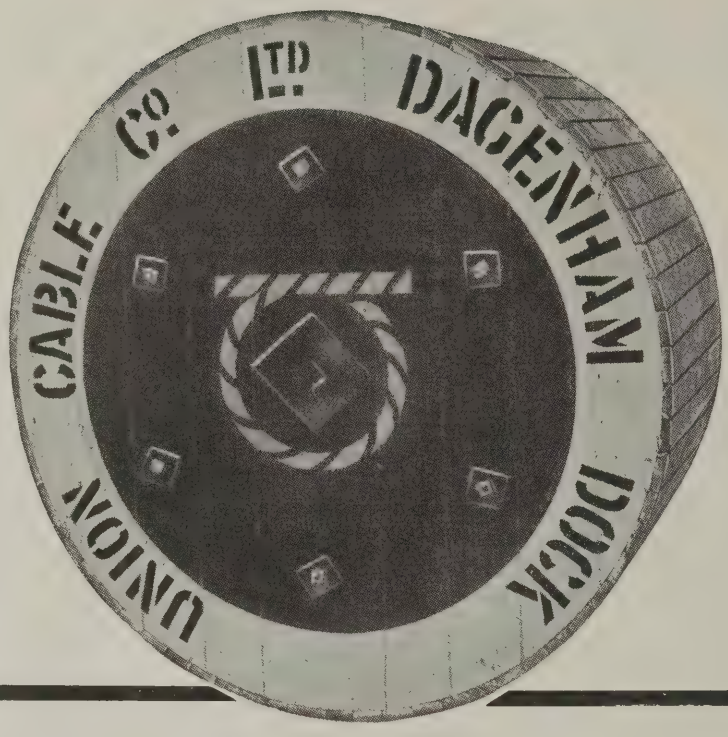
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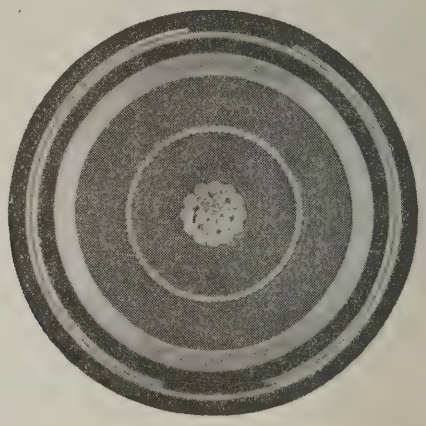
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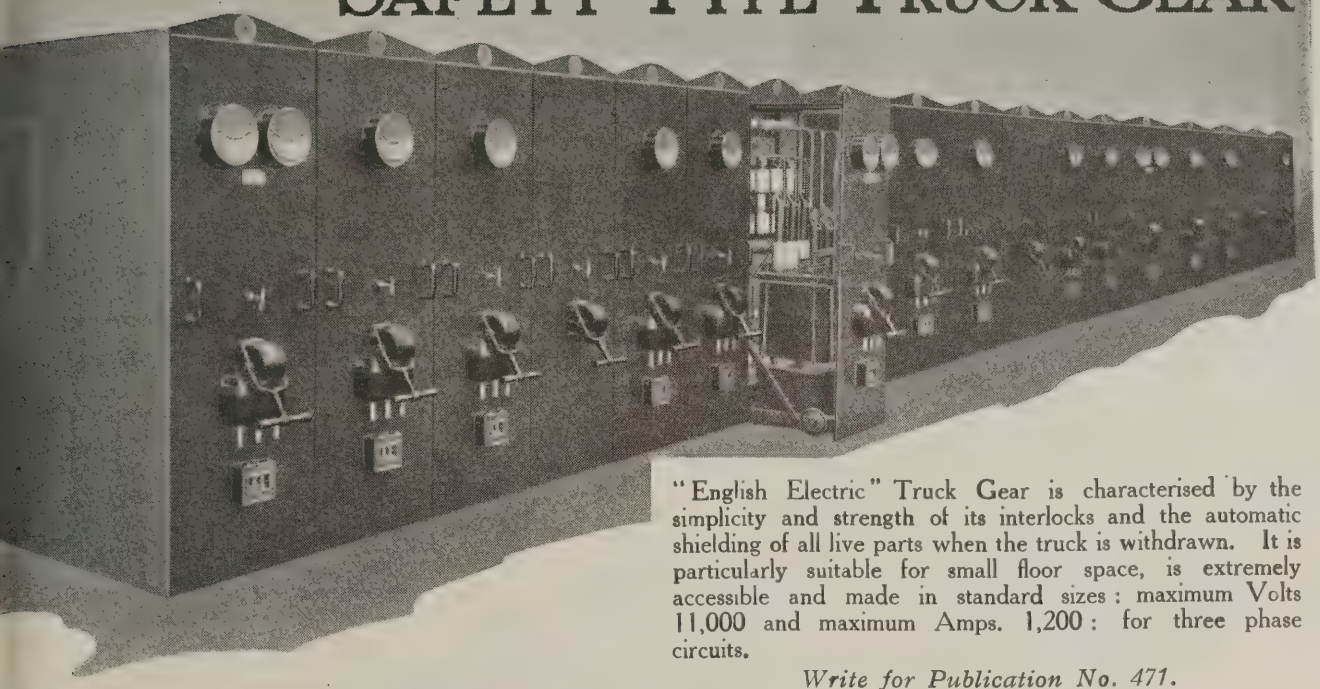
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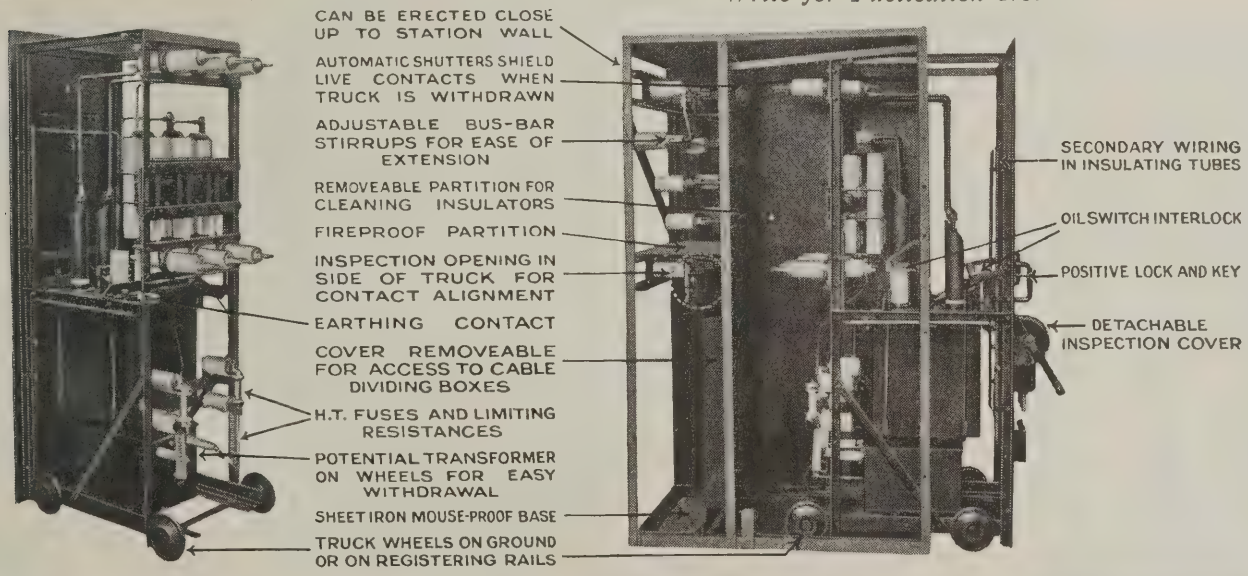
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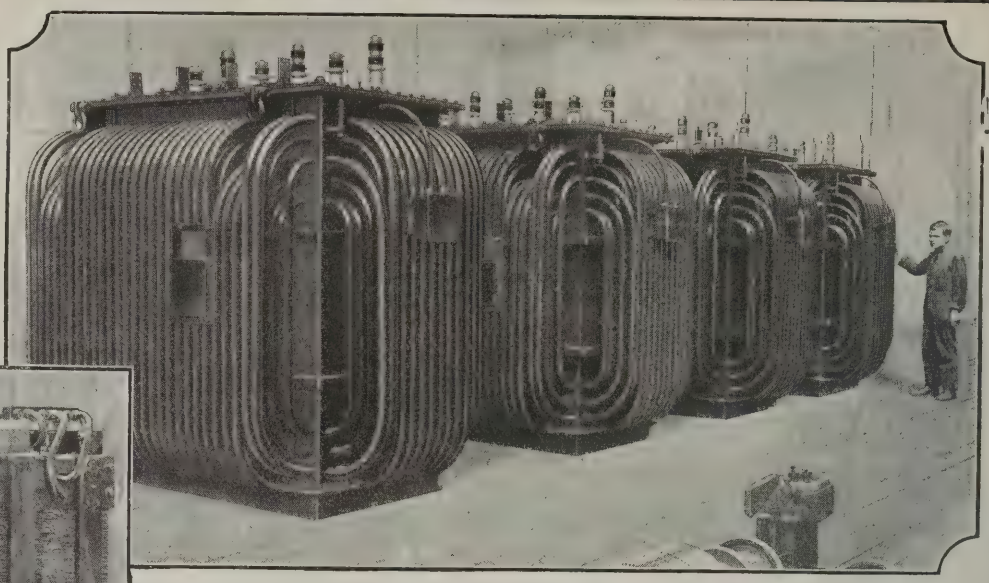
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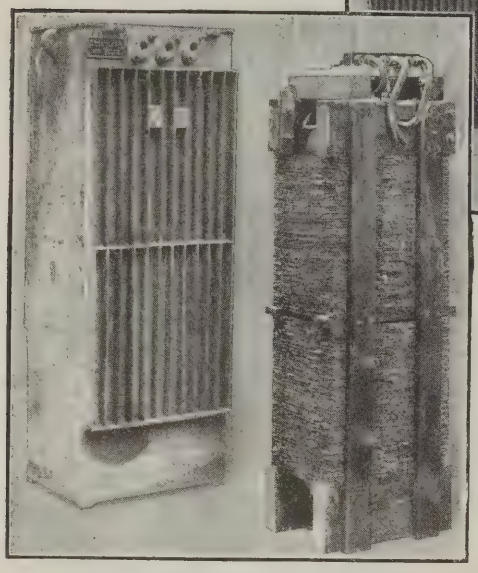
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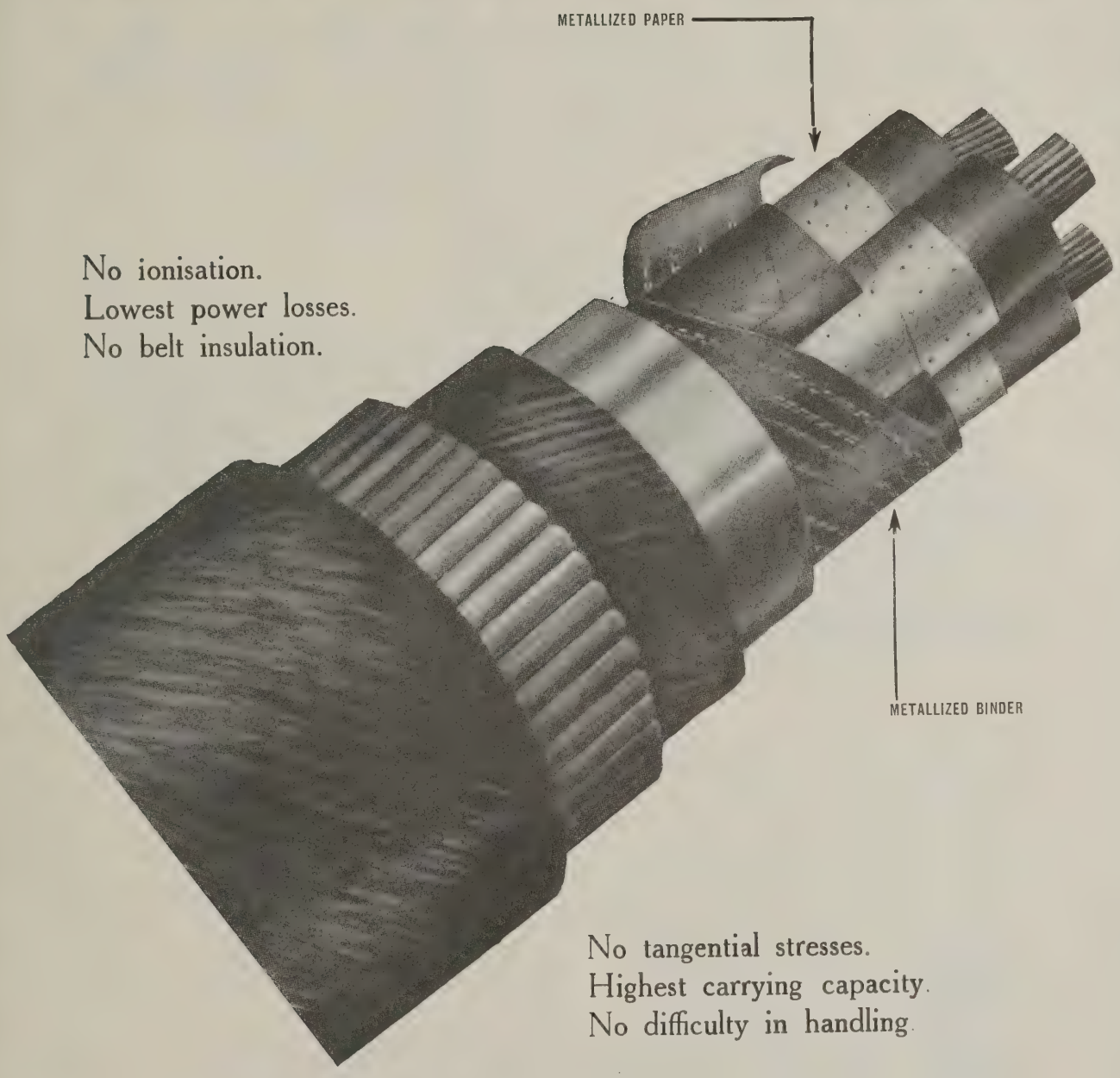
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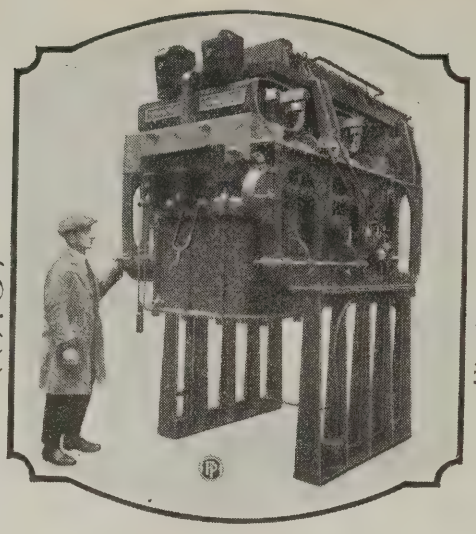


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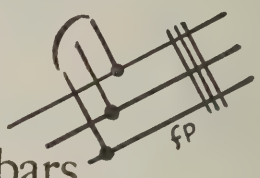
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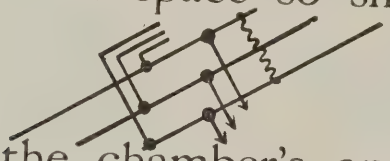
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SIEMENS BROTHERS & CO., LIMITED,
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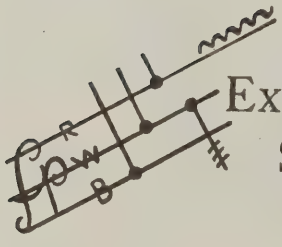


Sing a song of Switchgear
The chambers full of oil
Transformers and the bus bars
Sealed in space so small.





When the chamber's opened
You'll not fail to see
Extensions are so easy
So specify "F.P."





Electrified Nursery Rhymes

No. 2.

There are sufficient outstanding features in Ferguson - Pailin Switchgear to justify "making a song about it."

Sound engineering design, economy in floor space, the damp and vermin-proof features and unique operating facilities all combine to maintain and extend the confidence and popularity enjoyed by this gear.



Our top illustration shows type HVD Duplicate Busbars electrically operated Unit in the operating position.

We invite you to read our latest brochure, "Metalclad Switchgear— Its Advantages and Characteristics," a copy of which will be sent on request, and which deals with the choice of switchgear from an engineering and scientific standpoint.

The following is a list of the chapter headings in this new brochure:—

1. The Evolution of Switchgear.
2. The Electrical and Mechanical Advantages of Metalclad Switchgear.
3. Distinctive Features of Ferguson - Pailin Design.
4. General Description of Gear.
5. Types of Units with current and voltage ratings.
6. Outlines of Various Units.

Write for your copy to-day.

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SWITCHGEAR SPECIALISTS

THREE PHASE MOTORS

HIGH TORQUE SQUIRREL CAGE MOTORS.

MINING MOTORS WITH FLAMEPROOF SLIP-RING ENCLOSURE.

SYNCHRONOUS & AUTO-SYNCHRONOUS MOTORS.



4 100-H.P. SQUIRREL CAGE MOTORS

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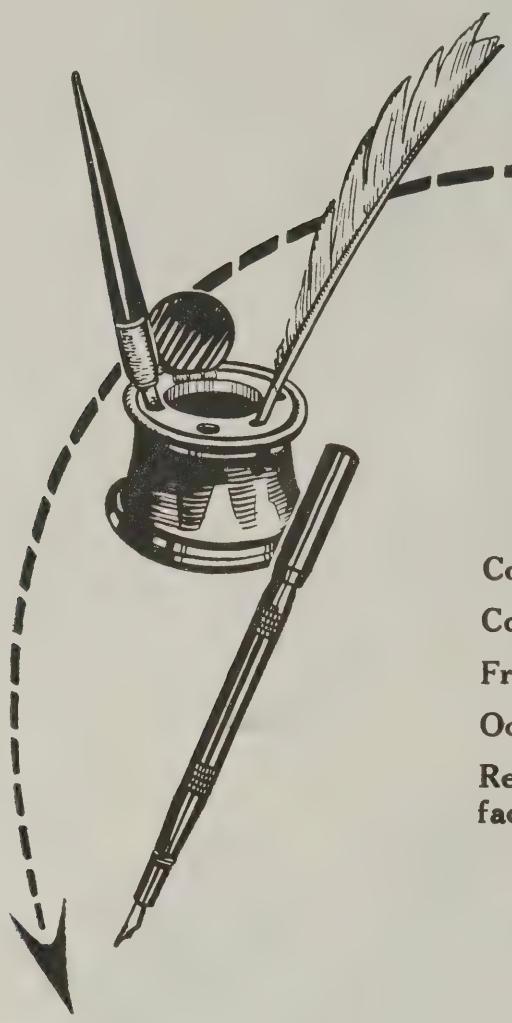
Put our name on your list.

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Progress

.....What the Fountain Pen is to the Stenographer the "INKWELL" GRAPHER is to the Engineer

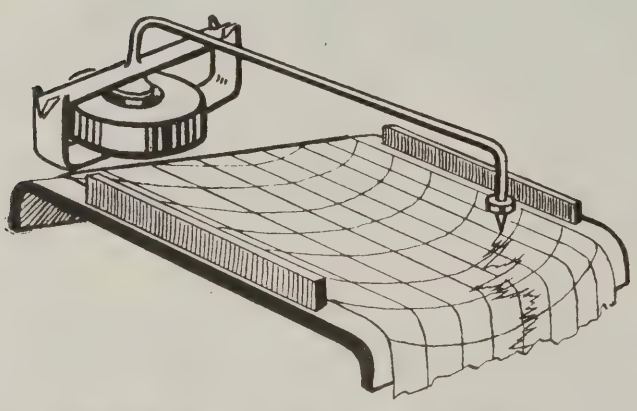
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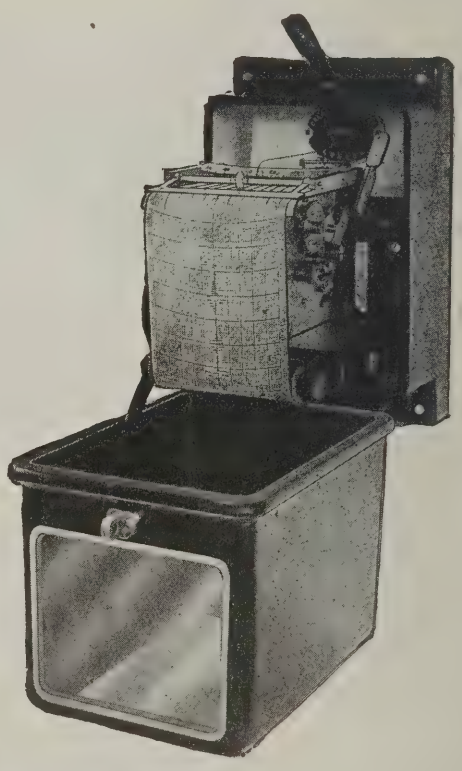
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Friction errors are negligible.

Occupies less space than any other recorder.

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The "ORBIT" REGD.

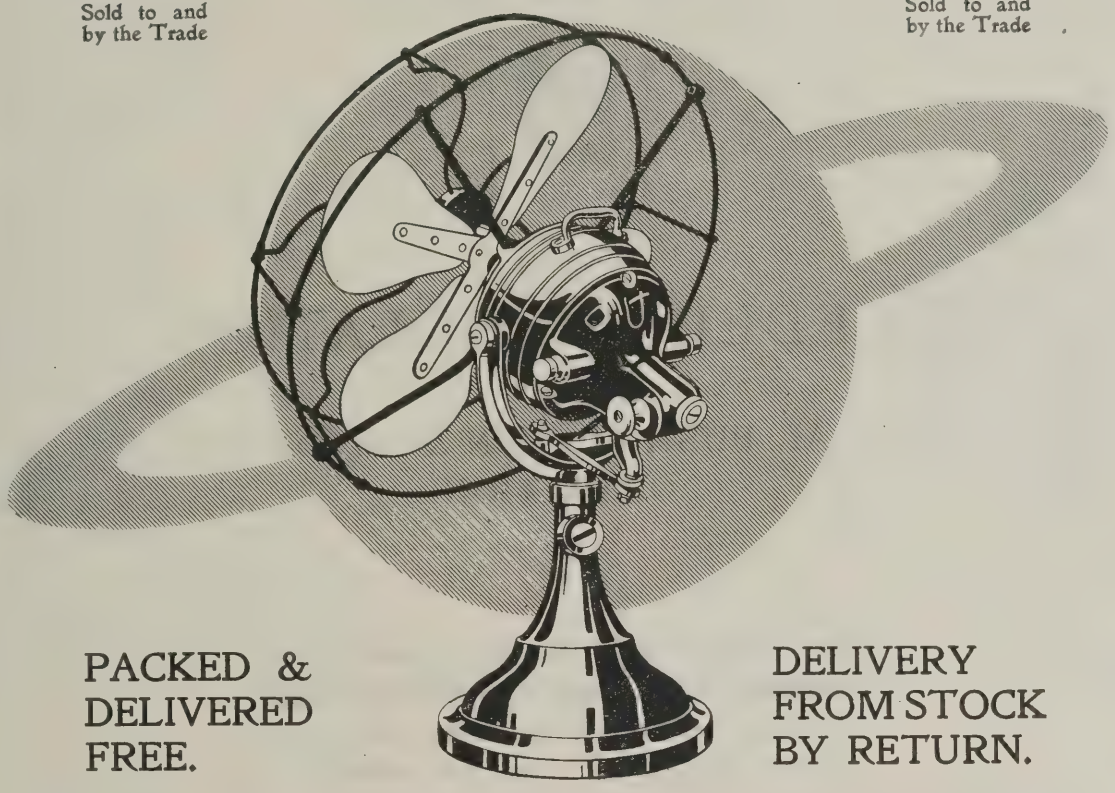
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(Patented all over the World).

12 INCH BLADES.

Sold to and by the Trade

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DELIVERY FROM STOCK BY RETURN.

THE NEW FAN WITH THE ELLIPTICAL TRAVERSING MOVEMENT.
"THE BREEZE IS HERE, THERE, AND EVERYWHERE."

As the blades revolve there is a double oscillating movement, part horizontal and part vertical, so that the circuit of oscillation forms an ellipse, consequently the fanning range is greater than that of any other fan.

The Body and Guard of the Fan is highly finished in Black Enamel with Gold Lines, the Blades being finished imitation Gilt and Lacquered.

The low current consumption of 45 watts makes the "ORBIT" Fan very economical to run, and the full speed of approximately 1500 r.p.m. can be reduced by means of the three speed regulator which is fitted in the Base of the Fan.

The A.C. Fan Motor is of the induction type.

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Cat. No.	Voltage.		Cat. No.	Voltage.
FA 3301	100 — 110	£5-5-0 PACKED & DELIVERED (United Kingdom).	FA 3351	100 — 110
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Lampholder Adaptor and 3 yards Flex wired to Fan, 3/6 extra.

Large stocks are kept of Fans for above voltages and periodicities.

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for

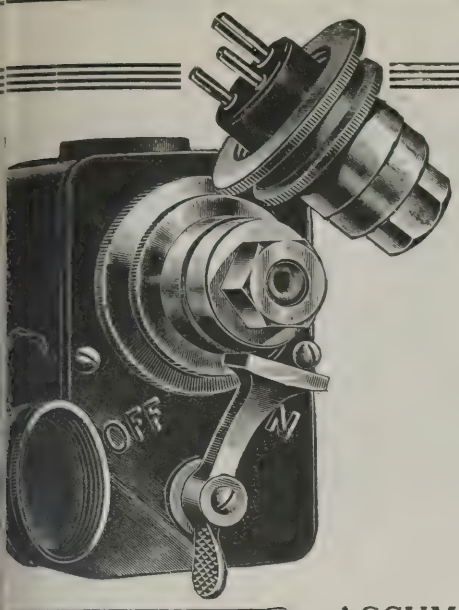
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The Hackbridge Electric Construction Company, Ltd., engineer and manufacture complete installations for feeder regulation by boosting transformers and switchgear.

SCHEMES PREPARED FOR MANUAL, PUSH BUTTON, REMOTE CONTROL AND COMPLETELY AUTOMATIC OPERATION.

Advertisement of the

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"BANQUO"

(REGISTERED).

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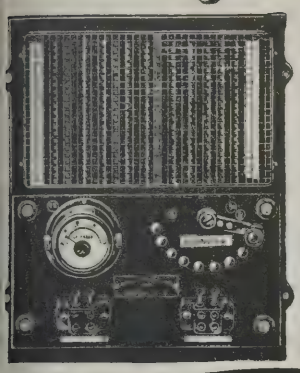
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Specified by leading Consulting Engineers in consequence of the substantial design, neat appearance and reliability.

Iron base screwed ¾-in. electrical conduit thread, with 3-pin plug (two pins and earthing pin), waterproof pattern. The plug is enclosed in gun-metal, fitted with cord grip to take "Cab Tyre" or our "Anti-Shock" Flexible Cord. A cap, fitted with a chain, protects the current-carrying parts when plug is out.

No. A10/10.	5 Amps. Without Plug	**10/6 each.**
No. A10/11.	5 Amps. Extra for 3-pin Plug in Gun-Metal Cover	**6/9** „
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Subject Trade Discount.



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Efficient, Safe and Fireproof.

On all sizes current regulation can be obtained from maximum current to 1/10 maximum current, thus a 7-amp. charging board enables current regulation from '7 ampere to seven amperes.

The Prices quoted include Ammeter on board similar to illustration.

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No.	Cir.Volt.	Approx. Ch'g. Rates. Amps, 1 to 3	1 to 5	1 to 7	1 to 10
A27/57	50 volts	103/6	109/-	118/-	136/6
A27/58	100 to 120	126/-	137/6	150/-	181/-
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As supplied in large quantities to Arsenals, Dockyards, Explosives Factories, Chemical Works, Factories, etc.

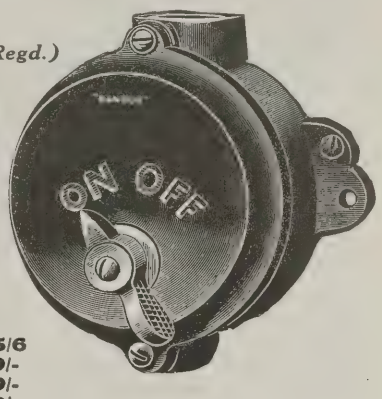
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SINGLE Pole	5 amps. cap.	1 way		**5/6**
DOUBLE „	5 „	„	1 „	**9/-**
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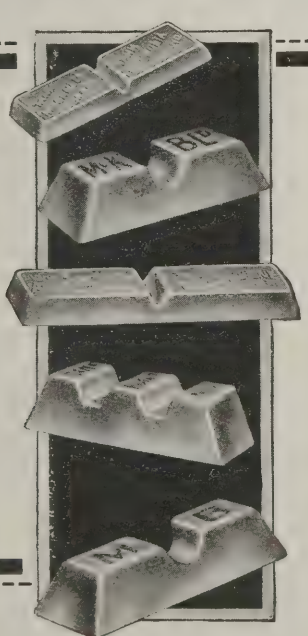


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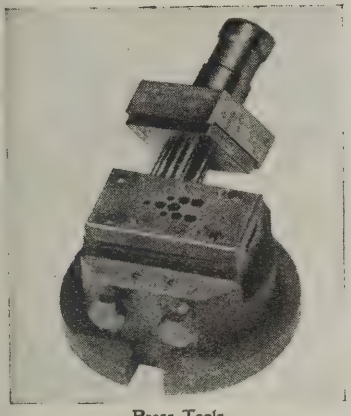
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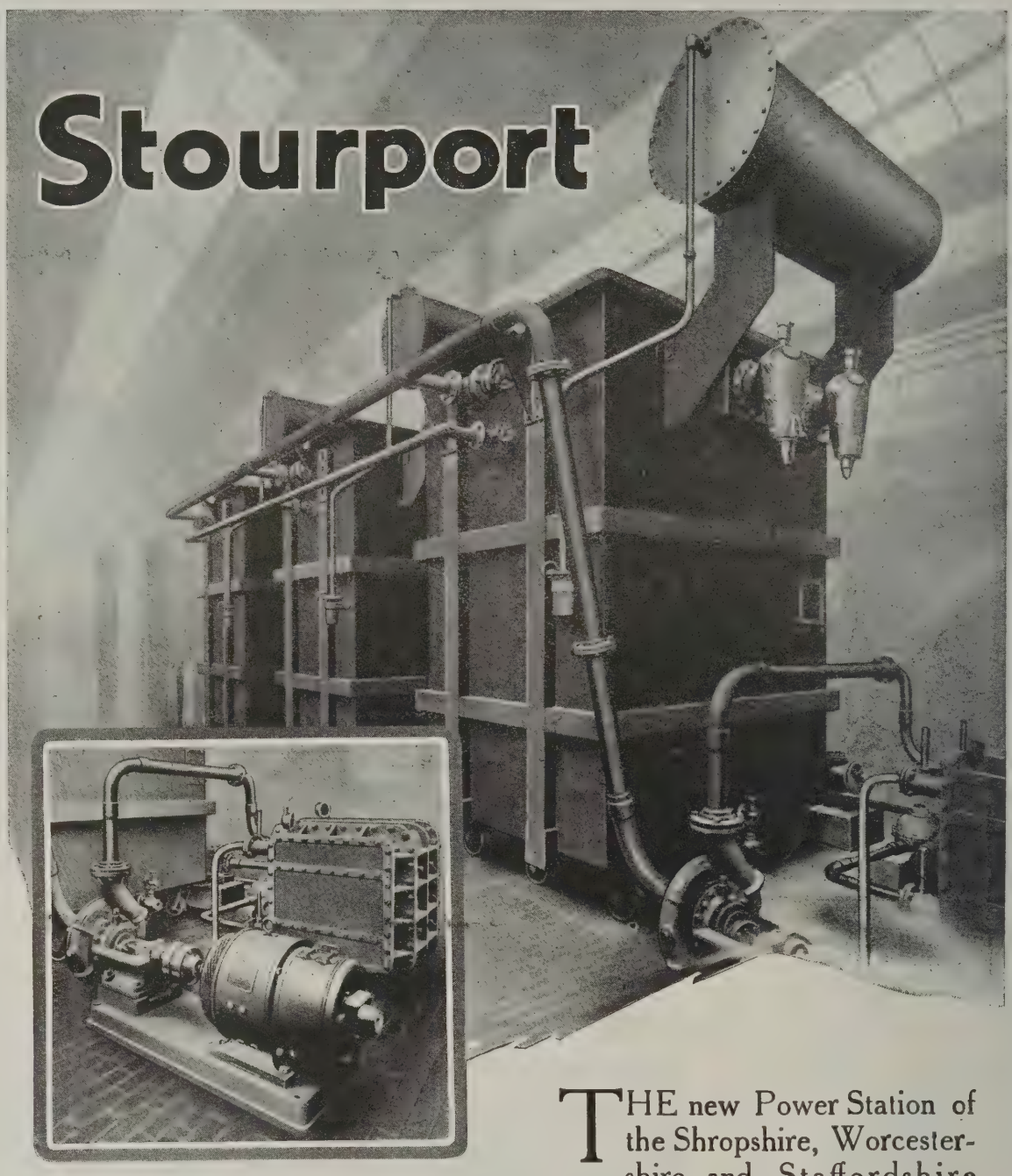
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Send *your* enquiries to :—

The Mark

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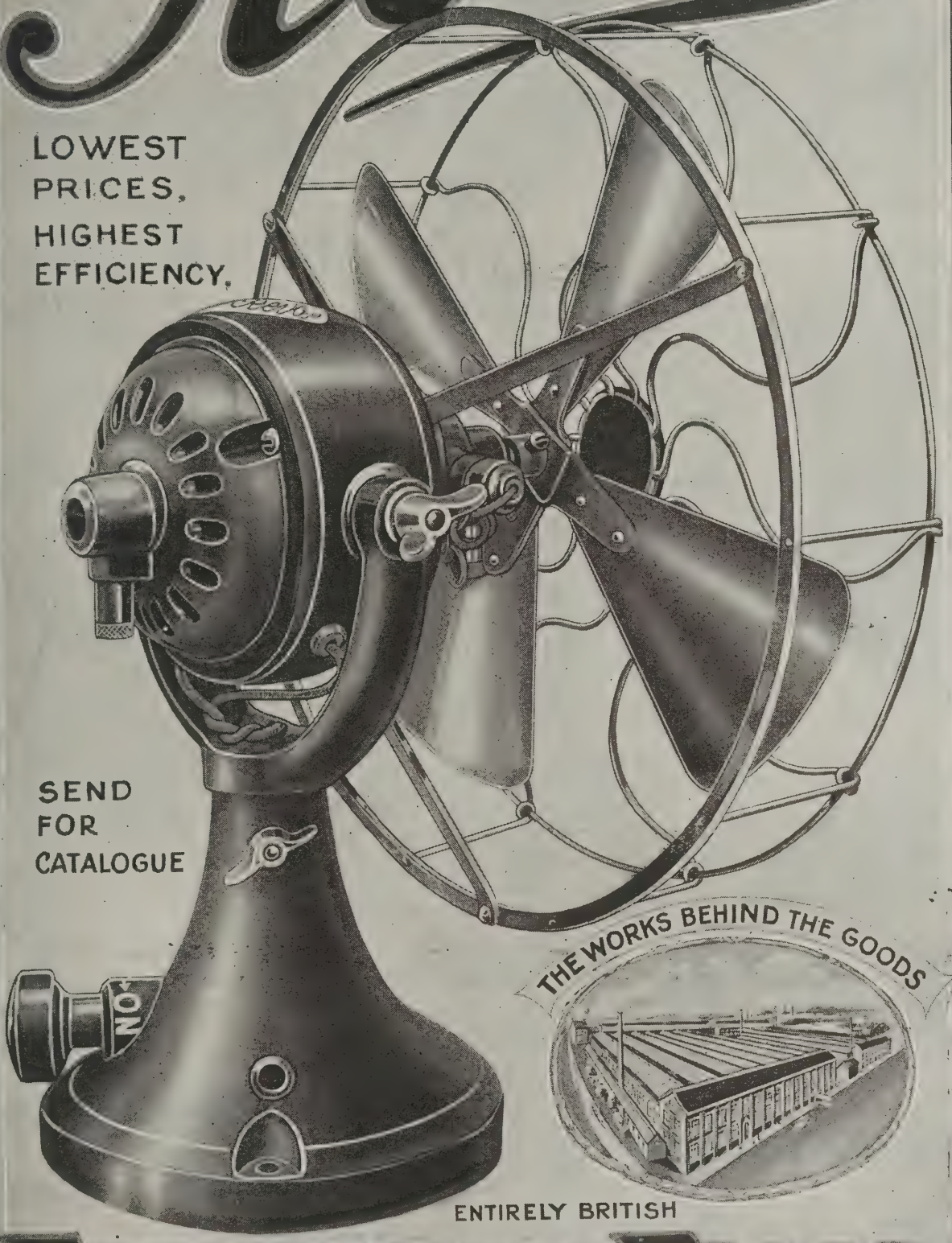
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Ask those who have run PARKINSON Motors for years

Ask them how the bearings stand up to heavy work and they'll tell you that Parkinson Ball and Roller Bearings *never* give a moment's trouble.

Designed to be Foolproof —they run year after year without attention. There's no constant greasing necessary — no cleaning — for Parkinson Bearings are so well housed that no grease can leak out and no dust or dirt get in.

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Such dependability is to be found in every detail of construction. That is why Parkinson Motors are to-day giving such efficient service and performing the most arduous duties with perfect freedom from trouble.

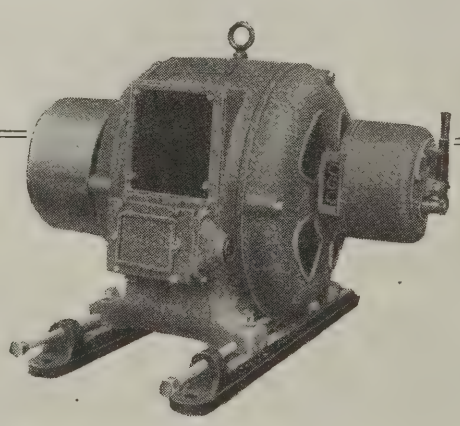
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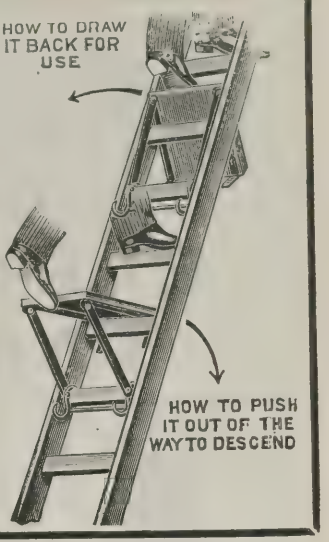
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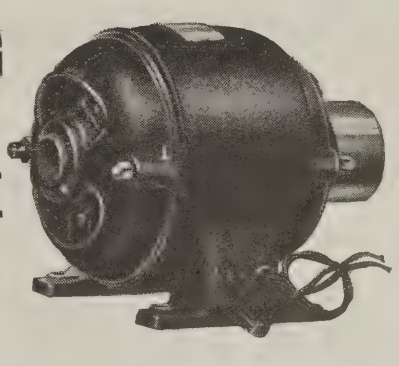
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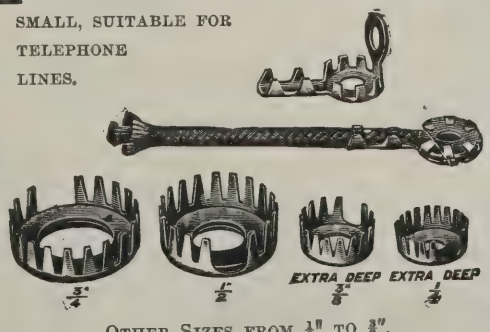
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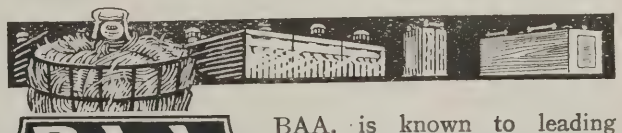


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BAA. is known to leading electrical engineers as the perfect accumulator acid. Manufactured by experts at our own works from natural Brimstone only and distilled water, every gallon is tested.

F. W. BERK & CO., LTD., London, E.C.3; Wks., Stratford. E. Makers of acids since 1870.

The purest & best accumulator acid the world produces

TAS/ba104

BEACON

NON-ASSOCIATION

ELECTRIC LAMPS.

QUALITY SERVICE

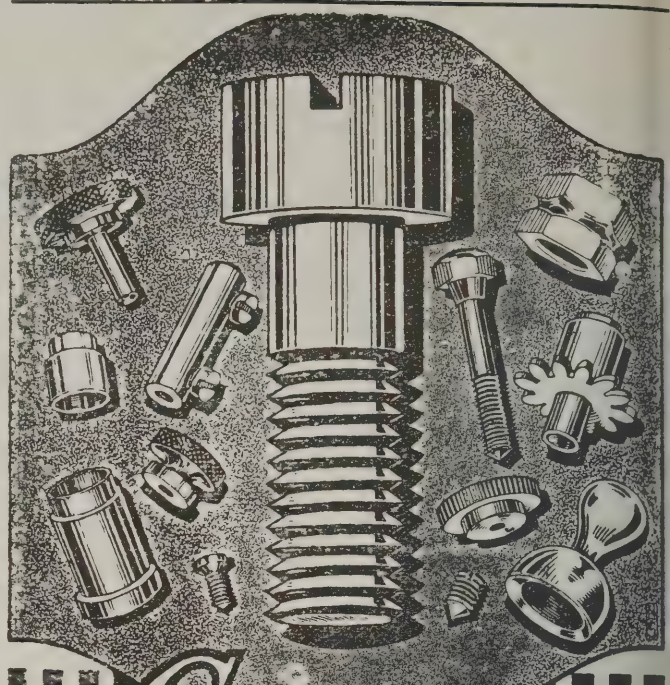


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THE MAYBROOK ELECTRICAL CO., LTD.

19-21, Wilson Street, London E.C.2.

'Phone: Clerkenwell 7336.
Telegrams: Statuesque, Finsquare, London.



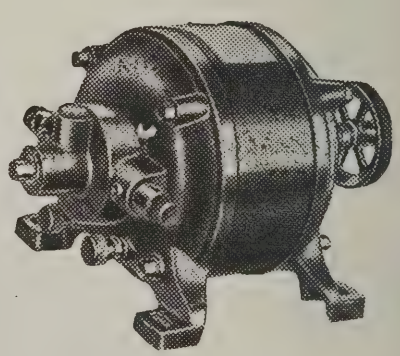
Screws and TURNED PARTS of High Accuracy in BRASS, STEEL, NICKEL, ETC for ELECTRICAL APPARATUS, MAGNETOS, SCIENTIFIC INSTRUMENTS, CLOCKS, ETC.

ANGLO-SWISS SCREW CO. LTD.
TAVISTOCK WORKS WEST DRAYTON
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MIDDX.

SATISFY YOUR CUSTOMERS

BY GIVING THEM THE

BEST BRITISH-MADE (THROUGHOUT) MANDA MOTORS AND EXHAUST FANS.



A Copy of our Official Test is sent out with each Machine.

Send for Lists and Prices to-day.

ANY VOLTAGE, PERIODICITY AND SPEED.
D.C. SINGLE AND POLYPHASE A.C. MOTORS 1/40—1/4 H.P.
EXCEPTIONAL LOW PRICES.
ENORMOUS TRADE DISCOUNTS.

MANDA MOTORS, LTD.,

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Telephone: Royal 7200.

Telegrams: "Atomanda, Ald, London."

All correspondence, enquiries and orders will receive the personal attention of our General Manager, Mr. V. DELEBECQUE.



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THE certainty that the equipment installed in a power station or a factory will steadily improve in efficiency from year to year is of more value than heavy cash reserves. It means that capital has a high and a constant earning capacity.

There is a goodwill in quality which has a potency greater than spectacular display. The customer who knows that the power station or the factory is equipped with plant made by BEAMA firms has no hesitation in opening up business; experience has taught him that the BEAMA tradition for excellence is a very real thing.

Every product manufactured by BEAMA firms bears the stamp of quality—quality which has been established through constant research into materials and processes. BEAMA tradition is based on the combination of the modern manufacturing conditions and skilled workmanship of the highest standard.

BEAMA machinery and apparatus stand at the pinnacle of modern engineering science.

THE BRITISH ELECTRICAL & ALLIED MANUFACTURERS' ASSOCIATION (INC.)
36 KINGSWAY, LONDON
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IMPORTANT NOTICE. PRICE REDUCTION.

Owing to further progress in the manufacture of our NEW TUNGSRAM "D" Type Spiral Filament Lamps we are pleased to announce that as and from JULY 1st next our lamps will be sold at the same list prices and terms as the ordinary straight wire filament lamps.

SELL TUNGSRAM LAMPS AND SATISFY

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Branches : LEEDS : 68, Albion Street. BIRMINGHAM : 44, Severn Street. Scottish Agents : J. J. INGLIS & CO., 144 St. Vincent Street, GLASGOW

YORKSHIRE ELECTRIC TRANSFORMER CO. LTD.

Electricity Bill! The real way to Cheaper Current is through "YORKSHIRE" Transformers.

EMPIRE WORKS, THORNHILL, DEWSBURY.

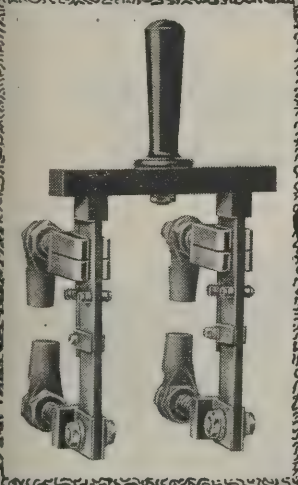


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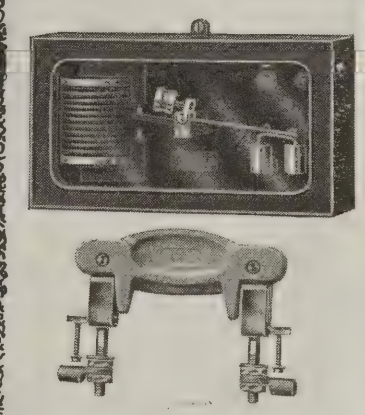
BIRMINGHAM.

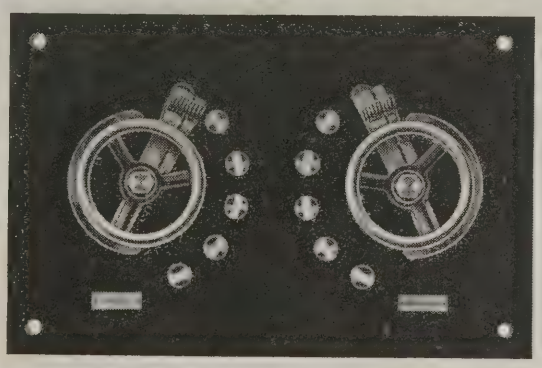
PRICES QUOTED ON APPLICATION.



SEE THAT ALL YOUR—

Switchboard Component





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TELEGRAMS:- "REWIND" BIRMINGHAM

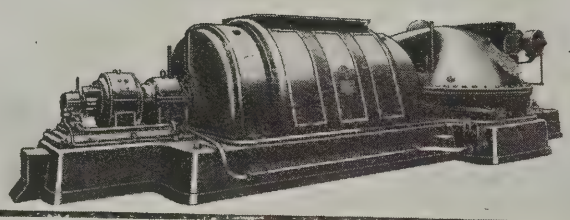
BEAR THIS MARK R&H OF QUALITY & SERVICE.

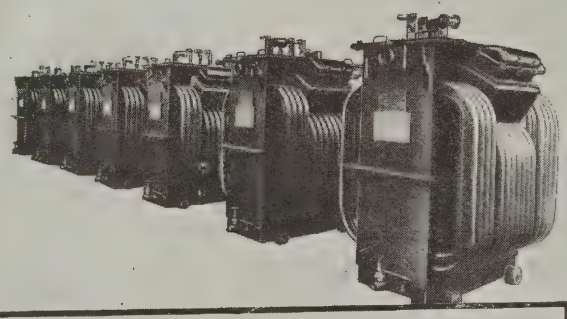
ROBINSON & HANDS ELECTRICAL Co LTD

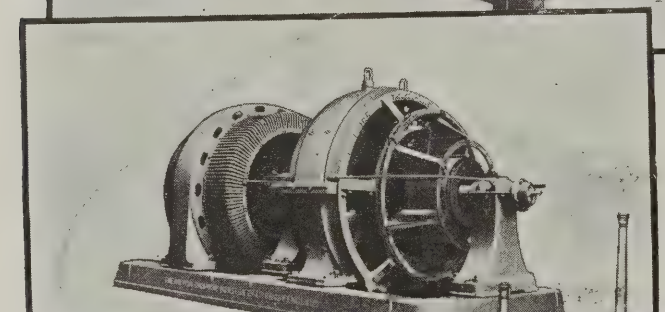
BARWICK ST. BIRMINGHAM

B T-H

Rugby Works





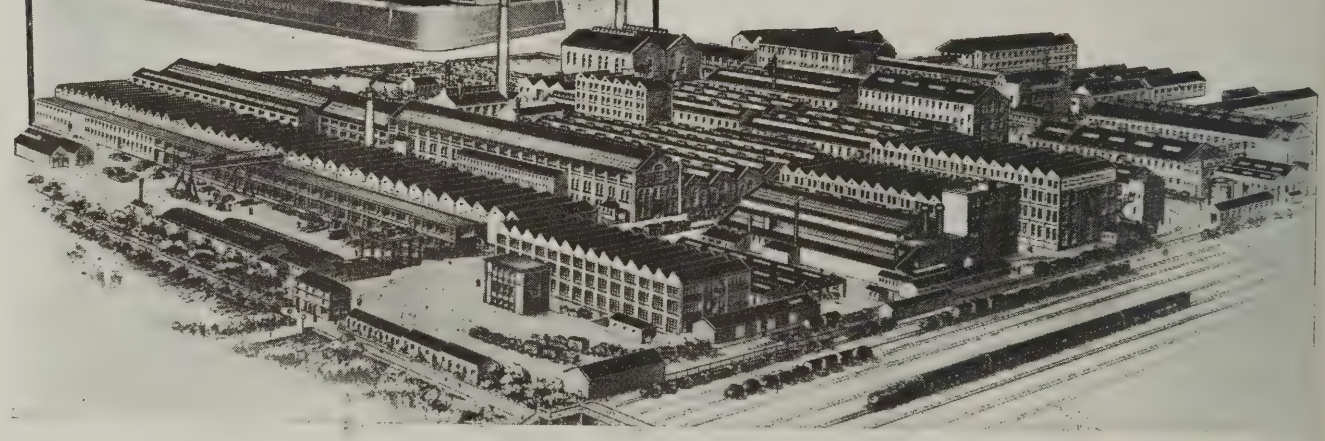


for **Heavy Electrical Plant, Traction Equipments, Mazda Lamps and B.T.H. Radio Valves.**

The B.T.H. Rugby Works, which are illustrated below, are devoted to the production of all types of heavy electrical plant and turbine-driven machinery.

Separate shops are devoted to the different types of plant and, throughout the entire works, the manufacturing facilities are such as to ensure that high standard of production and workmanship which is characteristic of B.T.H. products.

It is in these works also that the Mazda Lamp and B.T.H. Radio Valve factories are situated.



The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

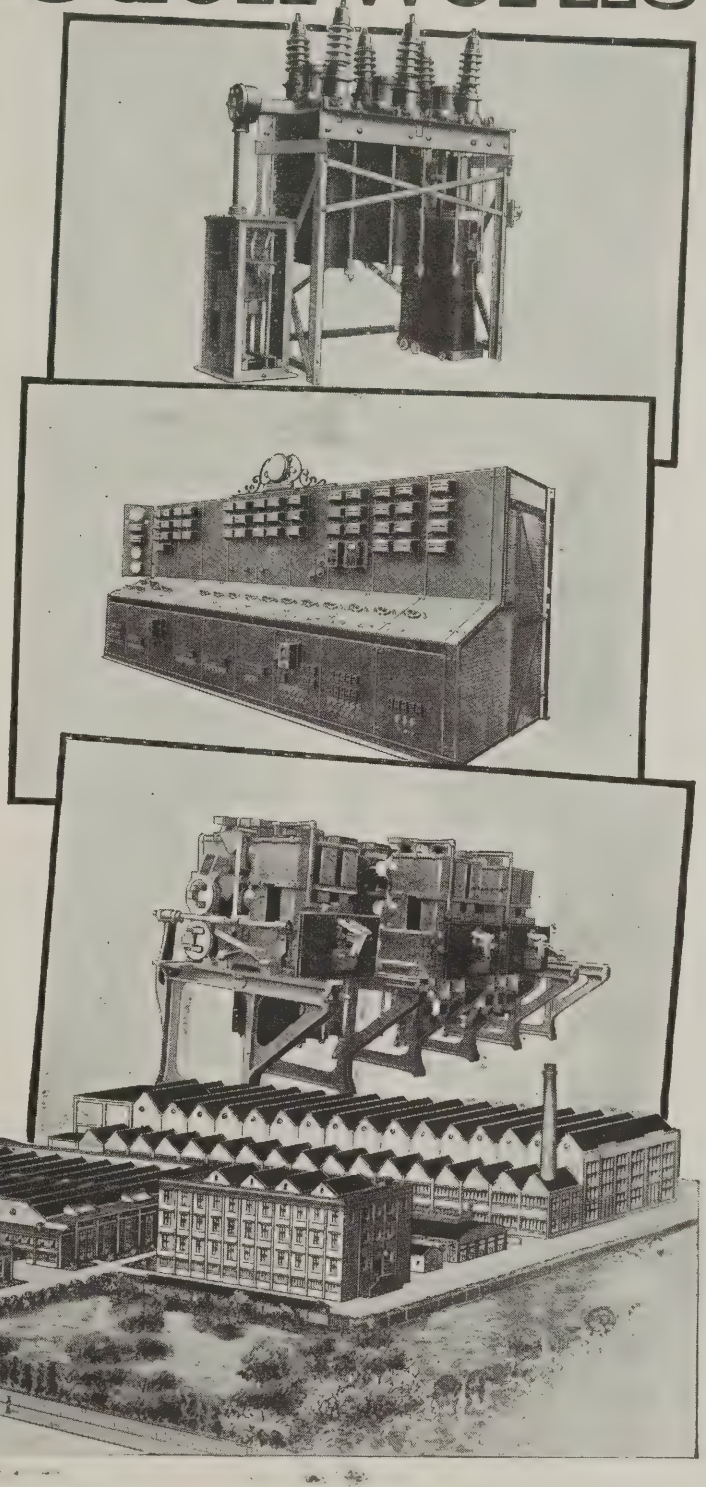
Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

B T-H

Willesden Works

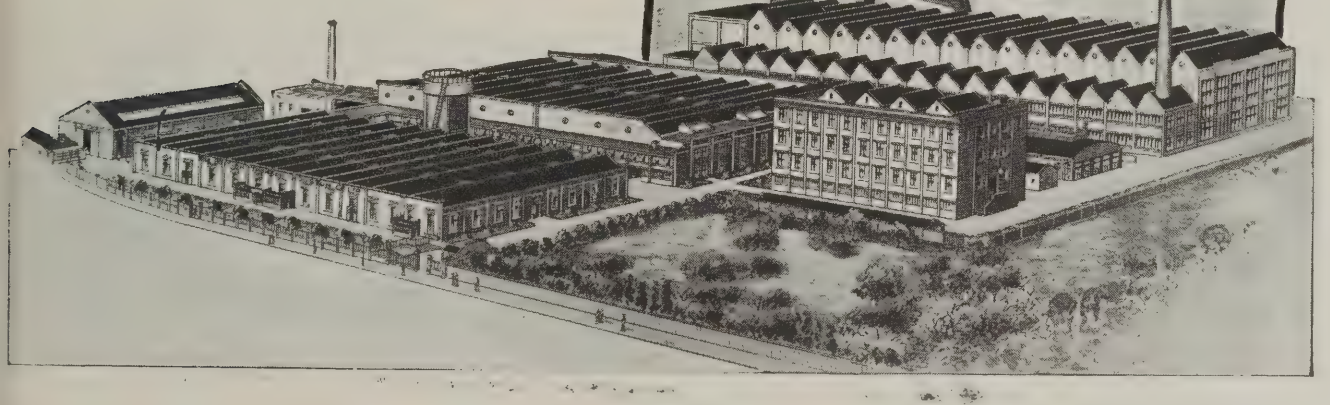
for **Switchgear**



The B.T.H. Willesden Works, shown in the illustration, are devoted entirely to the manufacture of switchgear.

These works produce all types of switchgear for Municipal and Railway purposes and a very large quantity of switchgear, of every variety, for Industrial and Mining services.

In addition to being the originators of the "truck type" and many other forms which are in universal use to-day, this Company has always maintained a very high reputation for reliable switchgear.



The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

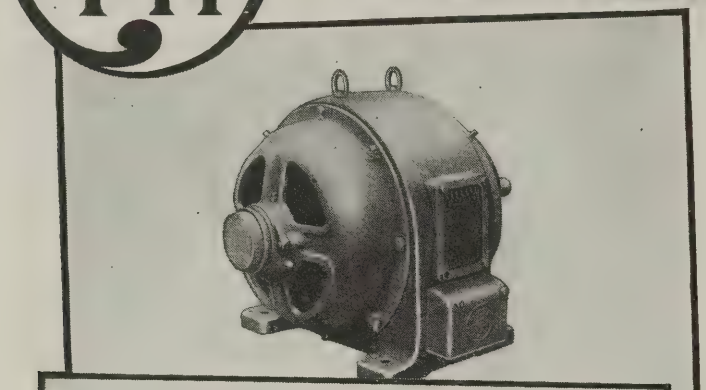
Head Office: Rugby, England. London Office: "Crown House," Aldwych.

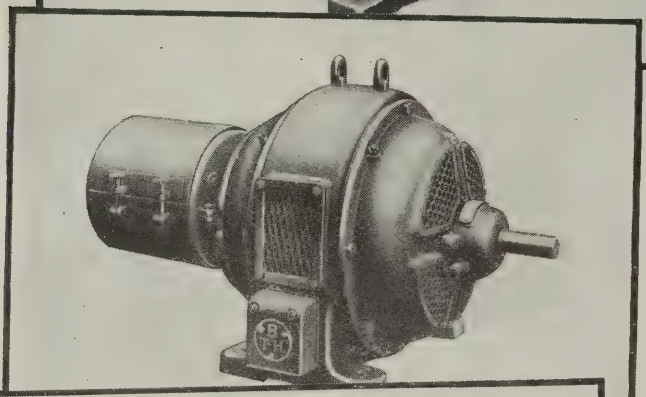
Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

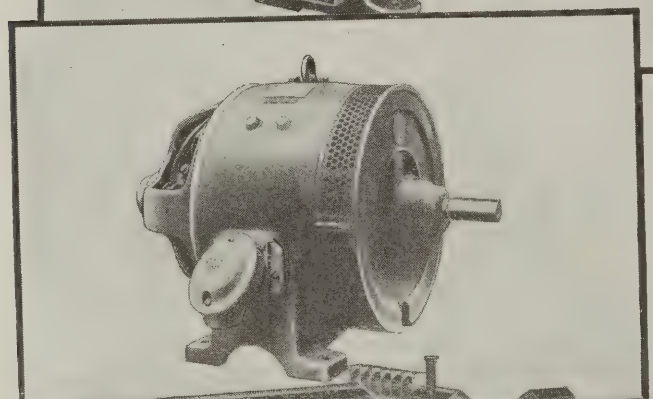
B T-H

Birmingham Works

for **Electric Motors & "Fabroil" Gears.**







The B.T.H. Birmingham Works, at Blackheath, which are illustrated below, are devoted to the production of electric motors of all types.

These works have been designed for the most up-to-date methods of mass production and the alternating and direct current motors manufactured include all sizes smaller than the heavy machines constructed in the Rugby Works.

In addition to motors for every Industrial and Mining service, these works also manufacture the well-known "Fabroil" Silent Gears.



The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

Head Office: Rugby, England. London Office: "Crown House," Aldwych.

Works: Rugby, Birmingham, Willesden, Coventry and Chesterfield.

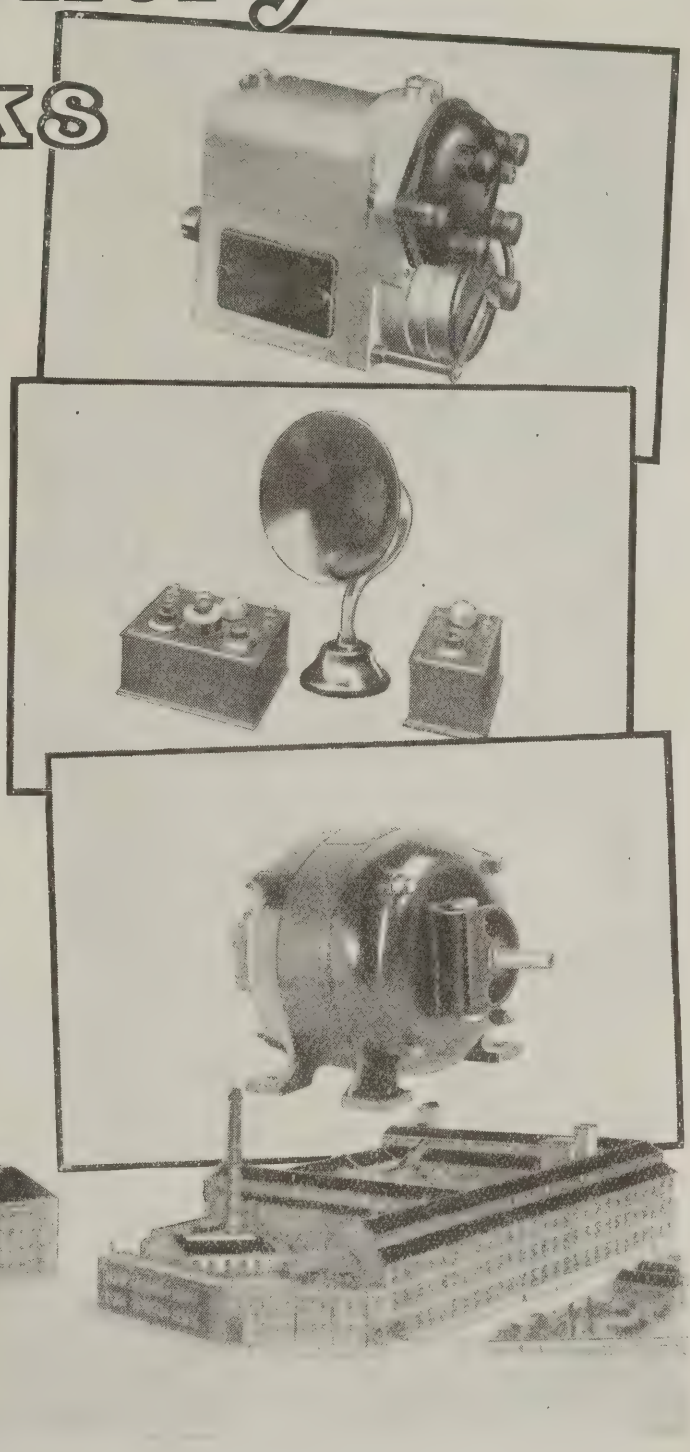
B T-H

Coventry Works

for **Radio Apparatus, Magnetos and Small Electric Motors.**

The B.T.H. Coventry Works, consisting of two adjacent factories, are devoted to the manufacture of Radio Apparatus of every description, Magnetos for motor vehicles and aircraft, and Fractional Horse-power Motors for industrial and domestic use.

The modern methods of production and the good workmanship which prevail in these works are such, that B.T.H. magnetos, for example, have assisted in attaining practically every British aerial record and many other notable achievements abroad.





The British Thomson-Houston Co., Ltd.

ELECTRICAL ENGINEERS AND MANUFACTURERS

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MOULDED INSULATORS AND SHEETS.

Non-Hygroscopic, High Dielectric Strength, Unaffected by Heat or Sunlight.

IN BLACK, WHITE OR MANY COLOURS,

No Surface Leakage.

INSULATORS FOR ALL PURPOSES.

ALL BRITISH MADE.

YOUNG'S PATENT BAYONET JOINT ADAPTOR



EASY TO WIRE UP.
GOOD INSULATION.
GOOD CONTACT.
ROBUST.
ONE PIECE—NO CAPS TO LOSE.

ALSO STANDARD B.J.A.

WRITE FOR PARTICULARS AND PRICES.

Manufactured by—

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BLISS **"BLISS" Power Presses.** BLISS

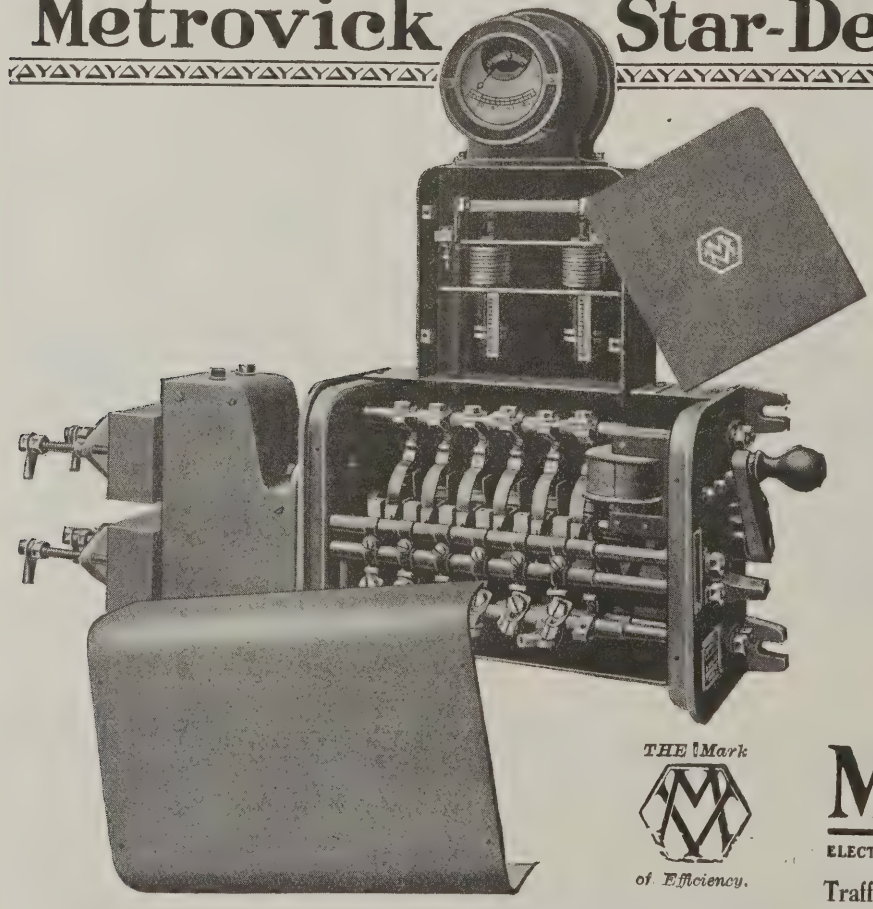


Bliss Presses are to be found everywhere. Here is one punching out Pole Pieces, complete, at the rate of 500 an hour at Newcastle-on-Tyne. Don't experiment yourself, but take advantage of our past experiments. Get into touch with us to-day, we can help you.

E. W. BLISS Co., 4, Pocock St., London, S.E.1.

Birmingham Showrooms & Offices: Ocean House, Navigation St.

Metrovick Star-Delta Starters



Type L.S.

FOR Squirrel Cage Motors up to 650 volts and 30 horse power—2 & 3 phase.

Cannot be operated in wrong sequence. Spring-tension Non-sticking Contacts (Drum Type). Wall-mounting Air Break. Double-break per-phase. No-volt Release. Overload Release.

No Exposed Live Parts. Complete Accessibility.

THE Mark of Efficiency.

METROPOLITAN Vickers ELECTRICAL CO. LTD

Trafford Park, - - - MANCHESTER.

BIRMINGHAM. GLASGOW. NEWCASTLE-ON-TYNE.
BRISTOL. LEEDS. SHEFFIELD.
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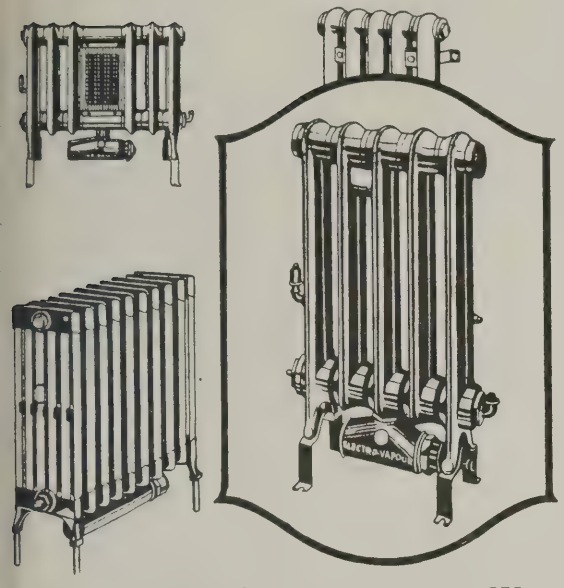
Send for Fully Descriptive List, 5914-1.

Visit the Royal Air Force Display, Hendon, July 3rd, 1926.

H/CO 7

ELECTRO-VAPOUR RADIATORS

PATENT.



For places where . . .
EVEN
Temperatures are desirable.

The most economical and reliable method of Electric Domestic Heating.
Electro-Vapour Radiators are excellently suited for heating Living and Bedrooms, Nurseries, Halls and Passages of Private Houses and Flats; also Offices, Factories, Ships' Cabins, &c., Warehouses and Garages, &c.

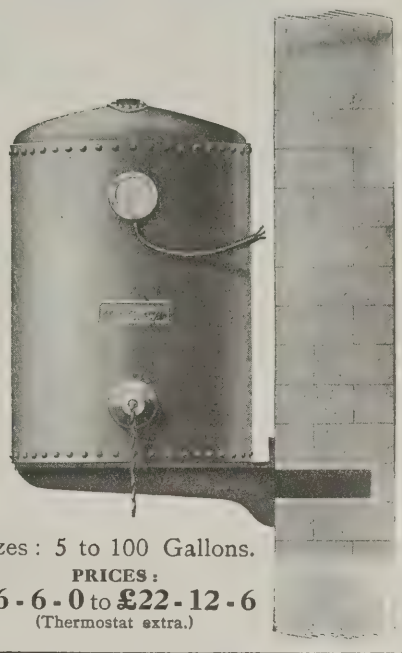


ECONOMICAL.
FIRE-PROOF.
SELF-CONTAINED.
DANGER-PROOF.
BRITISH.

Made in Sizes from 500 to 4,000 Watts and in various patterns ranging from **£7 to £19**
(No extra charge for 3-heat.)

BENHAM'S
LOW-CURRENT HOT-WATER CYLINDERS.

Electrically-heated cylinders, vertical or horizontal, are fitted with Benham's Patent Immersed Electric Elements, and Thermostats (recommended), if desired. They are suitable for Bathrooms, Lavatories, Sculleries, &c., both for Private Houses, Flats, &c., and Factories. Full particulars supplied on application.



Sizes: 5 to 100 Gallons.
PRICES:
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(Thermostat extra.)

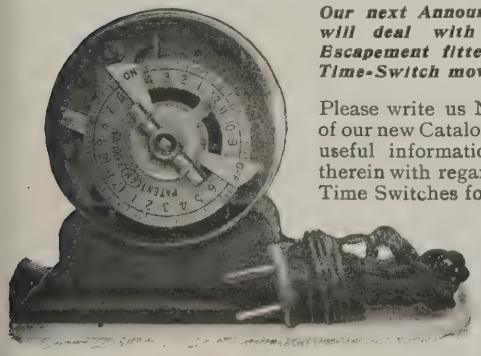
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Works: WANDSWORTH, S.W.

NEWBRIDGE
BRITISH NEWBRIDGE WORKS BATH **MADE**

ELECTRIC TIME SWITCHES

Special Features of their Construction—1.

(*a*) The clockwork movement is centrally wound and winding does not disturb the dial or interfere with the set times of lighting and extinguishing.
(*b*) Winding does not stop the movement, and power is also maintained during this operation.
(*c*) There is no backlash in the dial, resulting in accurate and easy setting to time.
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(*e*) The regulator is easily accessible.
(*f*) All necessary operations are independent of one another, and the tappets can be set to operate at any desired time—and not to a quarter-hour notched dial.

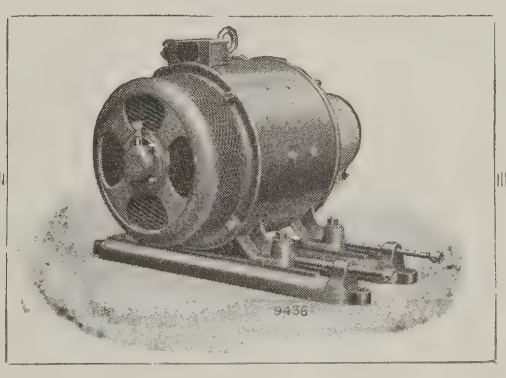


Our next Announcement—No. 2—will deal with the high-class Escapement fitted to Newbridge Time-Switch movements.

Please write us NOW for a copy of our new Catalogue "E." Much useful information is contained therein with regard to Newbridge Time Switches for every purpose.

TYPE F/2, 2·5 amp., 15-day run.

Sole Makers—
THE HORSTMANN GEAR COMPANY, LTD.,
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'Grams: "Horstmann, Bath." 'Phone: Weston, Bath 19.



High Efficiency

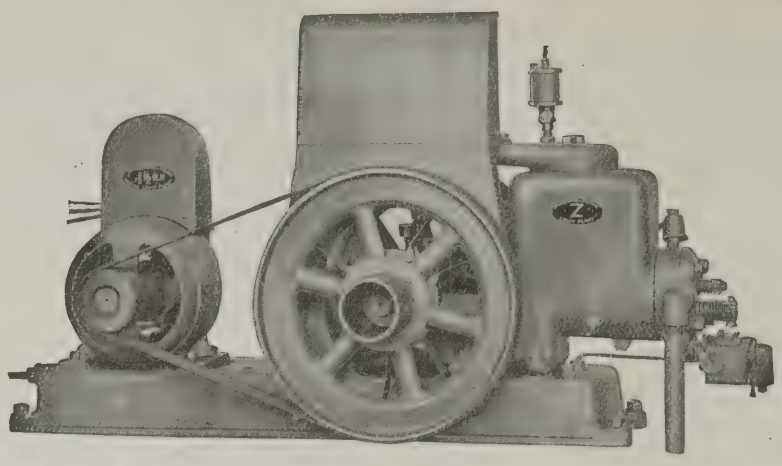
To obtain the maximum possible Brake H.P. Hours from the supply meter readings, use Ransomes' Electric Motors. In them you will find all the best points of modern ideas of trend of design.

DYNAMOS FOR BELT DRIVING OR DIRECT COUPLING. MOTORS FOR EVERY PURPOSE AND EVERY CLASS OF DUTY. MOTOR-GENERATORS FOR BATTERY CHARGING. COMPLETE STEAM OR OIL ELECTRIC GENERATING SETS.

RANSOMES' A.C. & D.C. MOTORS

Write for Catalogues and all information respecting both types of motor.

RANSOMES, SIMS & JEFFERIES, LTD.,
Orwell Works, Ipswich.



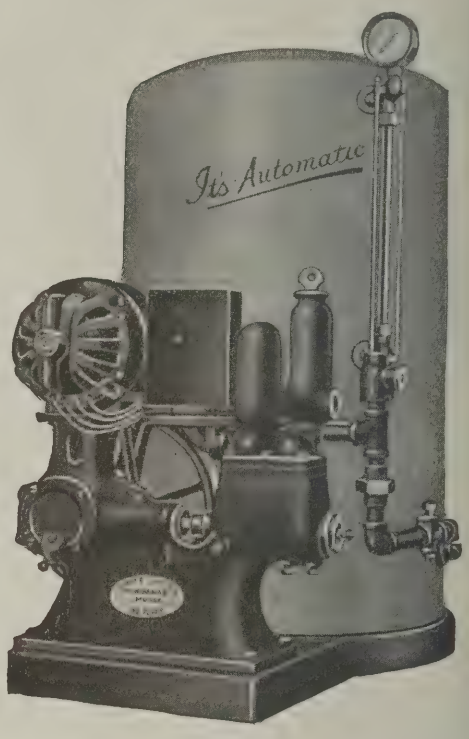
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GIVES

POWER for the Workshop,
LIGHT for the Home

AND IS

Suitable for Battery Charging.



HOME LIGHT SETS.

An Automatic Water Plant will give you all the water you want under pressure.

No need for an overhead Storage Tank. Requires no attention. It's automatic.

HOME WATER PLANTS.

Fairbanks, Morse & Co. Ltd.

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FOR ALL PURPOSES

TRAIN LIGHTING
TRACTION

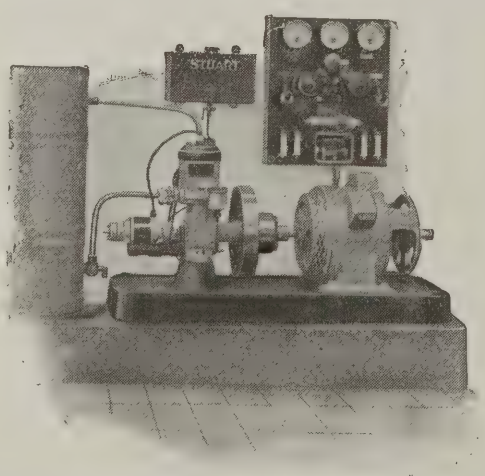
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HOUSE LIGHTING

AUTOMOBILE
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FULLER'S UNITED ELECTRIC WORKS, LTD., CHADWELL HEATH, ESSEX.

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(Machinery in Motion.)

Stuart Lighting & Pumping Plants

120 Watt, ½ kW, 1½ kW, 3 kW and Pumps.

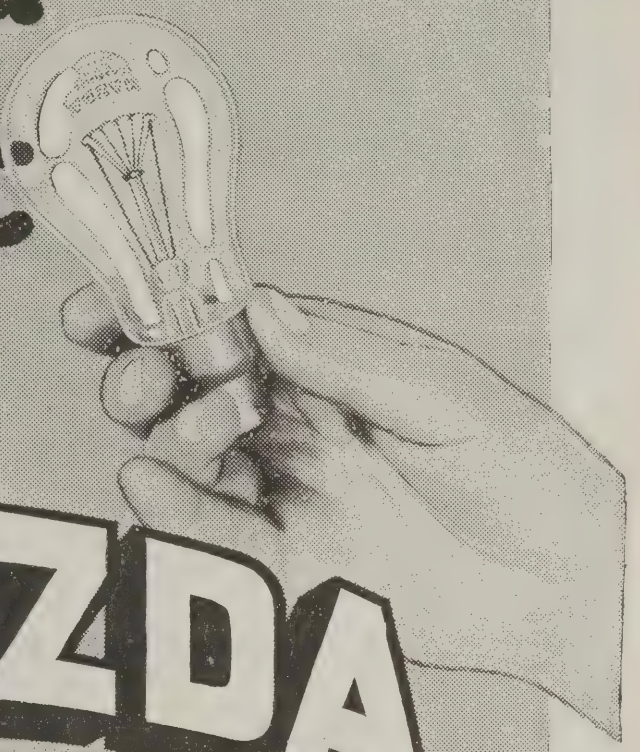
We shall be very pleased to show you and your customers our plants in full operation. If you can't come, ask for List 24 R.

STUART TURNER, Ltd.,

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'Phone : 158.

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Good light and MAZDA Lamps are inseparable

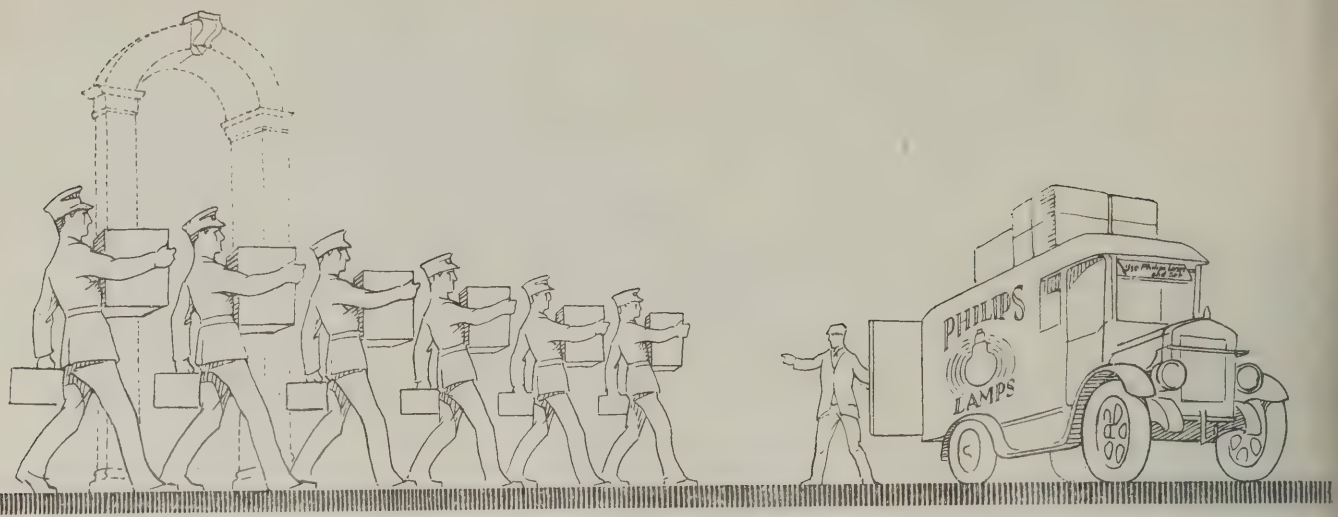


B.T-H

They can be bought wherever electric lamps are sold.

2531

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.

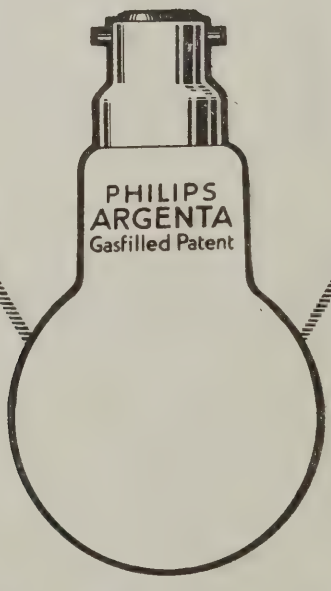


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The Secret of Success
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We fully recognise this!

STOCK PHILIPS LAMPS
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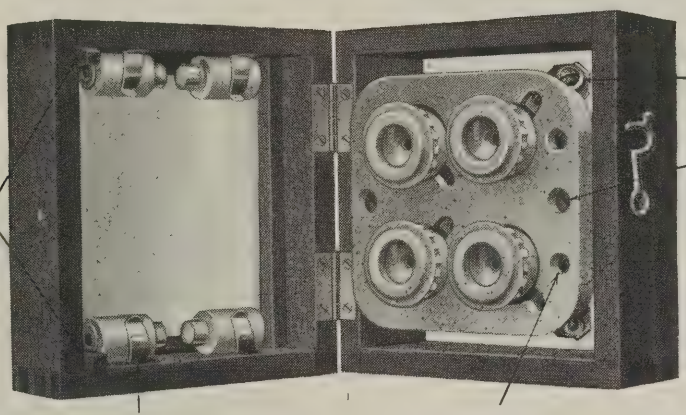
PHILIPS HOUSE
145 CHARING CROSS ROAD LONDON W.C.2
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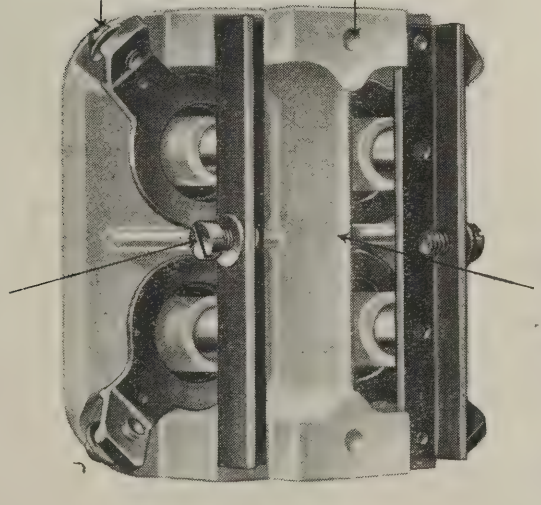
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"ZED" SAFETY FUSE TEAK DISTRIBUTION BOXES

— COMPETITIVE TYPE. —

The smallest and most compact double pole fuse box of robust construction, made to a high standard of quality, perfect in every detail and competing in price with low grade bridge type fuse boxes.





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IMPROVED "ZED" SAFETY FUSES
(INCREASED RANGE).

The advantages of using a fuse system of known dependability cannot be over- emphasised, and to meet this demand the "ZED" Safety Cartridge type Fuses have been developed. These fall into three groups :—

Group 1. **Medium pressure heavy duty Fuses 250-750-volts, available for currents up to 200-amperes.**

Group 2. **Medium pressure heavy duty Fuses 500-750-volts, available for currents above 200-amperes.**

Group 3. **High Tension Fuses 750-3,000 volts, 2-1,000-amperes.**

Supervising Electricians, Central Stations, Tramway and Consulting Engineers, will be specially interested in the higher capacity of "ZED" Fuses, and the new high voltage types, and we should appreciate the opportunity of demonstrating our latest productions.

— NEW ILLUSTRATED CATALOGUE No. Z 110 WILL BE SENT ON APPLICATION. —

Advertisement of

SIEMENS AND ENGLISH ELECTRIC LAMP CO., LTD., 38/39, Upper Thames St., London, E.C.4.

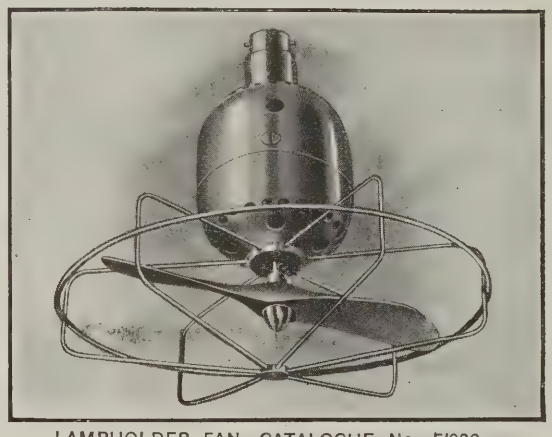
INCREASE YOUR SUMMER SALES BY STOCKING

Charpeeb

ELECTRIC FANS.

EMBODYING ALL THAT IS LATEST AND BEST IN FAN CONSTRUCTION. THEIR INVISIBLE WOODEN PROPELLERS AND SILENT ACTION CANNOT FAIL TO MAKE MANY FRIENDS AMONG YOUR CUSTOMERS AND CREATE NEW ONES.

FIRST-CLASS QUALITY THROUGHOUT.



LAMPHOLDER FAN, CATALOGUE No. F/030.

LAMPHOLDER FAN.

FITS INTO ANY LAMPHOLDER AND CONSUMES NO MORE CURRENT THAN A LAMP. SUPPLIED IN POLISHED NICKEL FINISH.

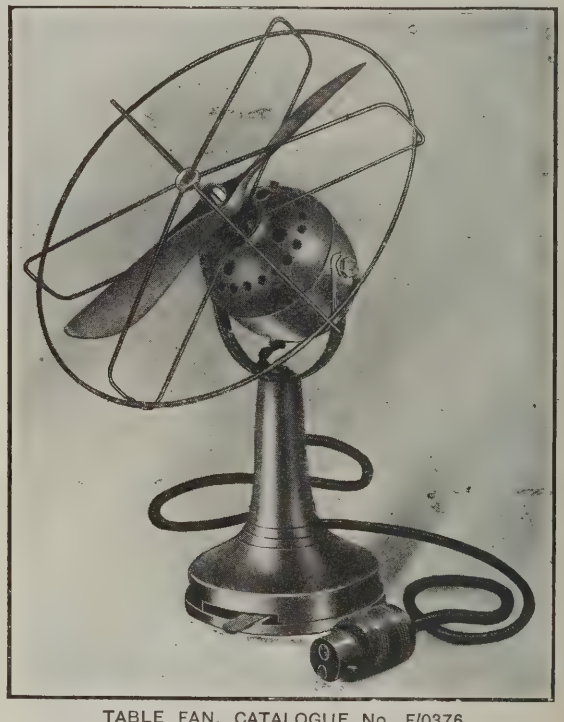


TABLE FAN, CATALOGUE No. F/0376.

TABLE FANS.

FINISHES, POLISHED NICKEL AND DULL BLACK, ALSO DE LUXE MODEL IN GOLD LACQUER DESIGNS.

TABLE FANS ARE FITTED WITH SPEED REGULATORS GIVING THREE SPEEDS AT WILL AND AN OFF POSITION.

ALL TYPES OF FANS ARE WOUND FOR TWO VOLTAGE RANGES VIZ: 100/125 V. AND 200 250 V., AND ARE SUITABLE FOR USE ON BOTH A.C. AND D.C. CIRCUITS.

FAN MOTORS ARE DESIGNED FOR CONTINUOUS RUNNING AND ARE GUARANTEED NOT TO OVERHEAT.

STOCKS, IN ALL TYPES AND FINISHES, AVAILABLE FOR IMMEDIATE DELIVERY.

CHARPEEB MEANS QUALITY.

CHARLESWORTH PEEBLES & CO.,

Wholesale Distributors,

5, EDEN ST., HAMPSTEAD ROAD,

LONDON, N.W.1.

AND AT

276, ST. VINCENT ST.,

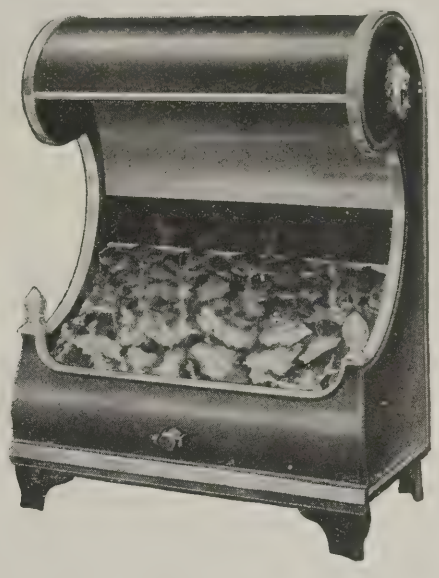
GLASGOW.

Telephone :—MUSEUM 9980. - - - - - - - CENTRAL 3537.
Telegrams :—"CHARPEEB, EUSROAD." - - - - - "METEORITE."



Reg. design.

FIREBLAZE. (3 kW.) Artistic appearance: effective bold front.



Reg. design.

NEWBERRY. The Newberry Model is designed on entirely new lines. A special feature is that the element is completely hidden and does not mitigate the coal fire effect. The heat is directed to the floor level, thus ensuring perfect heating.



FYGLO. (3 kW.) The Fyglo has been specially produced to meet hiring scheme requirements. The problem of cheap renewal of elements has been solved: the initial cost is less than 17/- per kW. The fire effect in this model is obtained without lamps.

PIONEERS

Berry's Electric Ltd., were The Pioneers of the Electric Fire with the coal fire effect.

The Magicoal Fire is the original fire with the flickering enchantment indistinguishable from a living coal fire.

The coals are not just pieces of coloured glass but are manufactured from specially prepared materials to represent coal in its various stages of combustion; and when out they have the appearance of an unkindled fire.

Scientific construction has been made compatible with artistic design.

No dirt and ashes are made, whilst labour is reduced to the touch of a switch.

In addition to its unparalleled heating efficiency the Magicoal Fire gratifies the natural love of the genial fireside.

We welcome enquiries for export terms.

H.H. BERRY'S WORLD PATENTS

BERRY'S
MAGICOAL FIRES

BERRY'S ELECTRIC LTD.,
86, Newman Street, Oxford Street,
LONDON, W.1.
Telephone: Museum 6800 (4 lines).

Works: London and Birmingham.

Birmingham: Ironclad Works, Hall Green. Manchester: 5, Deansgate.
and at Paris and New York.

ONE OF THE J&P. PAGES



Switchgear

This is a broadcast invitation to all readers of "The Electrical Review," who are interested in the purchase of Switchgear, to place their name on our list for the regular receipt of these handy and exceedingly useful booklets.

We are publishing them periodically—month by month—and their reception is certainly rivalling our earlier series of a similar publication on transformers.

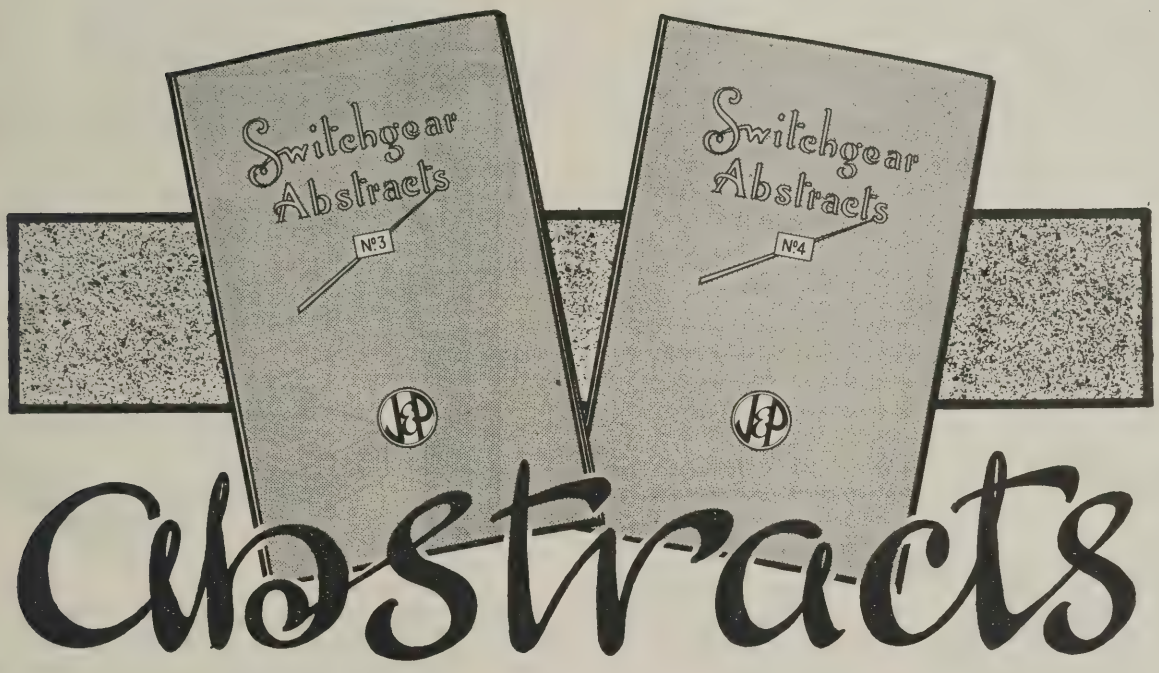
We are endeavouring to make them in every way helpful, and in the series we intend to cover as exhaustively as space permits every phase of Switchgear manufacture, selection and maintenance.

Johnson & Phillips Ltd.

Branches in London (City), Birmingham, Bristol, Cardiff, Glasgow, Liverpool, Manchester, Newcastle-on-Tyne, Portsmouth and Belfast.

THE MARK THAT MEANS THAT "LITTLE MORE" IN QUALITY

ONE OF THE J.&P. PAGES



Abstracts

No. 1 deals with "Types of Switchboards and how to choose between them."
No. 2 with "Desirable features in the design of various types."
No. 3 with "Oil Circuit Breakers," and
No. 4 with "Instrument Transformers."

The booklets are all of uniform size and contain no advertisements, hence when you have collected the series it will be an easy matter to bind and make them into a bookshelf volume infinitely valuable for reference purposes.

Now, let us have your name and business connection.

Charlton, London S.E.7.

Overseas Branches in Austral a, Brazil, India, Spain, New Zealand, South Africa, Singapore.

THE MARK THAT MEANS THAT "LITTLE MORE" IN QUALITY

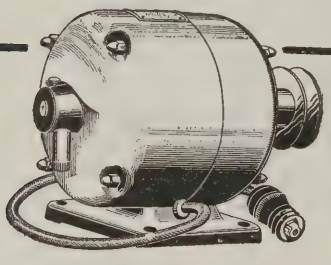
Wagner Quality

WAGNER ELECTRIC CORPORATION

SAINT LOUIS, U.S.A.

Wagner Motors famed throughout the World

The high efficiency of Wagner Induction Motors makes them particularly suitable for any purpose where silent running is essential. Their sound construction throughout will appeal to the critical engineer. Wagner products, which include Single-phase Motors (repulsion-induction and split-phase), Fractional H.P. Motors (for d.c. and a.c.) and Fan Motors, have nearly 30 years' unrivalled reputation. Write for particulars. Delivery from London stock.



WAGNER ELECTRICAL SUPPLIES, LIMITED,
49, Eastcheap,
London, E.C.3

ELECTRICAL CONCRETE

HIGH TENSION CELLS

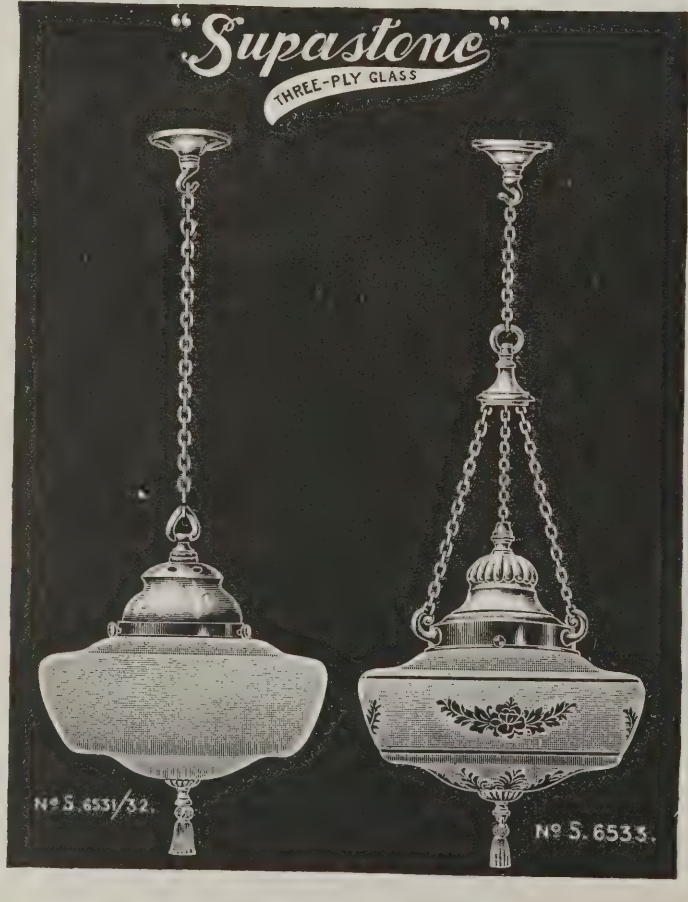


WE INVITE YOUR ENQUIRIES

CONCRETE UTILITIES, LTD.,

Directors: C.R.Belling, M.I.E.E.
C.A.Marques, A.M.I.Struct.E.

Great Amwell, Ware, Herts.
Telephone No.—WARE 84.
Telegraphic Address—"MARBEL, WARE."



SELL "Supastone" THREE-PLY GLASS IT PAYS.

TO sell "Supastone" Lighting Glassware is to deal in the finest value obtainable.

Well made from three-ply glass, the very best of its kind.

Highest Finish and very Ornamental.

SEND for
NEW ELECTRIC LIST, No. S 146,
PRINTED IN ART COLOURS.

New Designs suitable for every up-to-date lighting purpose at Moderate Prices.

NONE GENUINE UNLESS STAMPED ***"Supastone."***

STOCKED BY ALL LEADING FACTORS.

The WHOLESALE FITTINGS CO., Ltd.,

23/27, COMMERCIAL STREET, LONDON, E.1.

MANCHESTER : 78/80, High Street. BRISTOL : 14, North Street, Stokes Croft.

Something Entirely New in Electric Boiling Plates



The "Cosmos" Enclosed Boiling Plate viewed from the underside.

After years of investigation and research, Metro-Vick Supplies, Ltd., take pleasure in introducing an Electric Boiling Plate, which successfully avoids the limitations of all previous designs.

The

"COSMOS"

ENCLOSED TYPE ELECTRIC BOILING PLATE

(Fully Patented)

is manufactured under an entirely new and interesting process, resulting in a totally enclosed plate which is practically indestructible, thoroughly efficient and remarkably quick in operation.

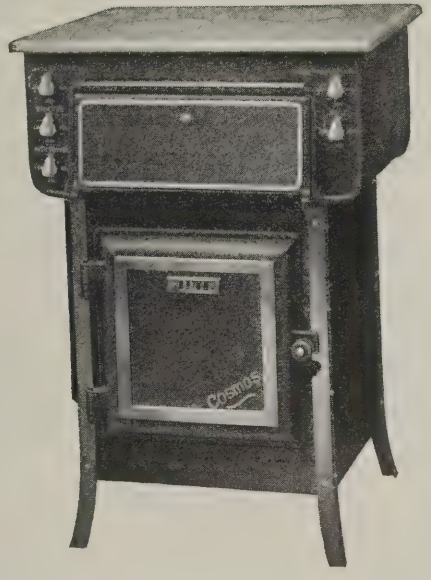
The following figures obtained during tests by the National Physical Laboratory speak for themselves :—

2	pints of water	boiled in	8½	minutes	consuming	285	watt hours
3	"	"	10¾	"	"	360	"
4	"	"	13	"	"	435	"
5	"	"	15	"	"	505	"

Utensils used were aluminium with machined bottoms. These figures should be compared with those for other makes and with the average GAS RING.

"Cosmos" Enclosed Boiling Plates practically cut out maintenance charges and give more satisfaction to users.

For further details send for a copy of List 150/12 (Sup. 1)



"Cosmos" Enclosed Boiling Plates are now fitted to "Cosmos" Cookers.

METRO-VICK SUPPLIES, LTD.

(Proprietors : Metropolitan-Vickers Elec. Co., Ltd.)

Metro-Vick House, 145, Charing Cross Road, LONDON, W.C.2

	Dimensions.	Loading in Watts.	Volts.	Price Each.
SIZES and PRICES.	6½ inch diameter	1,200	100/250	£2 2 0
	8½ inch diameter	2,000	100/250	£3 3 0

"Cosmos" Enclosed Type Boiling Plates are Guaranteed for Two Years.

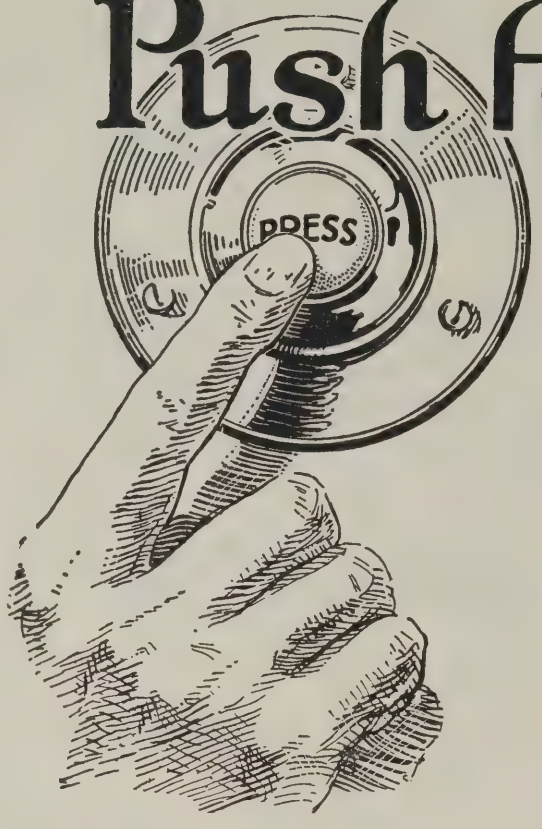
Visit the Royal Air Force Display at Hendon, July 3rd, 1926.

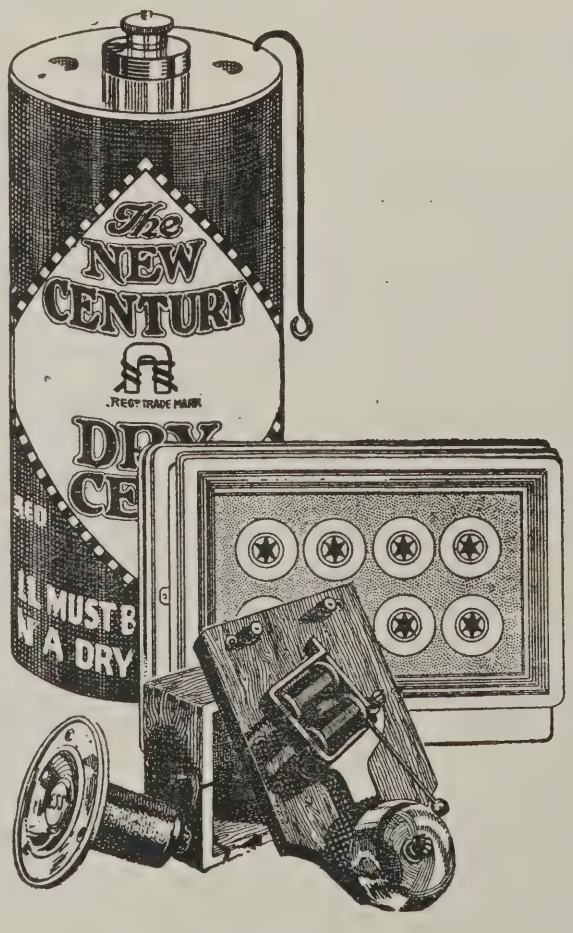
S P04

Push for Business

in

G.E.C. Electric Bells, Cells and Accessories





Do not neglect this field. There are many houses in your neighbourhood not yet fitted with Electric Bells.

All these invite your "push" for business. Why not go after it? It is profitable business, and every installation is a lead to regular sales.

Get G.E.C. quality behind each installation and you will satisfy your customers.

G.E.C. quality is jealously guarded, and only exceptional manufacturing facilities permit of the competitive prices now ruling.

Prompt deliveries can be obtained from all G.E.C. branches.

The G.E.C. - your guarantee

THE GENERAL ELECTRIC CO., LTD.,

Head Office:

MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

Branches throughout Great Britain and in all the principal markets of the world.

FOREIGN AGENTS for the "ELECTRICAL REVIEW."

AUCKLAND, N.Z: Gordon & Gotch, Albert Street; Tait Book Co., P.O. Box 392; R. Hill & Son, Matlock House, 33/34, Quay Street; Trade Publications Co., 302, N.Z. Insurance Buildings, Queen Street.

BERLIN: Hubert Hermanns, Friedrichstr. 218. S.W.48; "Kniga" Kurfurstenstr. 79. W.62; Uberseeverlagsanstalt. G.m.b.H. Leipziger Strasse 101/102. W.8.

BOSTON, MASS., U.S.A.: F. W. Faxon Co, 83, Francis Street, Back Bay; Herman Goldberger, 110, High Street; W. H. Guild & Co., 140, Tremont Street.

BRISBANE: Gordon & Gotch, Queen Street.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

HELSINGFORS (Finland): Akademiska Bokhandeln.

GOETTINGEN (Germany): A. R. Pillai & Co.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MADRID: Editorial "Voluntad" S.A. Serrano 48.

MELBOURNE: Tait Book Co., 39, Queen Street; Gordon & Gotch, Queen Street; "Australasian Electrical Times," 312 Flinders Street; Commonwealth Magazine Agency, 294, Little Collins Street; G. Jervis Manton, 430, Little Collins Street.

MILAN: Fratelli Treves.

NANCY: Librarie Berger Levrault, 18, Rue des Glacis.

NAPLES: Libreria Fratelli Treves, Via Roma, 258.

NEW YORK: D. Van Nostrand, 8, Warren Street; Crowley, The Magazine Man, Inc., 511, E.164th Street.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque; E. Le Francois, 91, Boulevard St. Germain.

PERTH, W.A.: Gordon & Gotch, William Street.

PRAGUE (Czechoslovakia): Fr. Rivnac, Librarie. Na Prikope 21; F. Topic.

ROME: Ditta P. Maglione & C. Strini, 88, Via Due Macelli.

SYDNEY: Tait Book Co., 273, George Street; Gordon & Gotch, Pitt St.; Commonwealth Magazine Agency, 183, Pitt Street; H. A. Goddard, 255a, George Street.

STOCKHOLM: Allmanna Tidningskontoret, Gustav Adolfs Torg.

TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Tori-Sanchome.

TORONTO, ONT.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

ZURICH: E. Rascher & Cie Rathausquai 20.

ILLUSTRATIONS!

BLOCKS intended for use in the advertisement pages of the "Electrical Review" should not exceed 120 screen.

ELECTRICAL

PARTNERS and PARTNERSHIPS

can be obtained through

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

46, Watling Street, London, E.C. 4.

16, Albert Square, Manchester. **26, Collingwood Street, Newcastle-on-Tyne.**

TO WIRELESS AND ELECTRICAL GOODS MERCHANTS, CONTRACTORS, &c.

IMPORTANT TWO DAYS' SALE BY AUCTION, WITHOUT RESERVE.

TUESDAY, JUNE 29th, and following day, at 11-30, at

550-556, OXFORD STREET, MARBLE ARCH, W., Adjoining Marble Arch Station, by

HENRY J. SHAW,

in conjunction with Messrs. Seymour, Seymour & Co.

First day's sale includes 560 CRYSTAL SETS, 2, 3, 4, 6 and 7-VALVE SETS by first-class makers, 5,000 Headphones, 275 various new Loud Speakers, 53 cwt. Sheet Ebonite, 7,000 various Accumulators, 6,000 Chokes, 1, 1½ and 2-kW Transformers, Test Sets, 5,000 Plugs and Jacks, Condensers, Wavemeters, Loose Couplers, Inductances, Earcaps, Tuners, Amplifiers, Crystals, Detectors, Coils, Volt and Ampmeters, Rheostats, Buzzers, 40,000 Microphone Buttons, 30,000 Fuses, Telephone Exchanges, 1,000 Double Telephone Cords, 60 dez. Buzzers, 5,000 Gross Wireless Bolts, Nuts, Screws, &c. 100 Coils Workshop Flex, 60 Coils Admiralty Mottled Flex, 60 Electric Hand Drillers, 120 doz. Ceiling Roses, 60 doz. Wall Plugs, 30 gross C.G.S.C. Lamp Holders, 140 gross Batten Lamp Holders, 120 doz. Adaptors, 100 doz. Pear Switches, 100 2- to 6-way Distribution Boards, 25 2- to 12-way Ironclad ditto, 40 Coils 1/20 Twin Lead-covered Cable, various Cable, Lamps, Pendants, 50,000 ft. ⅝-in. Screwed Conduit Tubing, &c.

Second day's sale will include a large quantity of X-RAY APPARATUS, CHEMICAL APPARATUS, &c., and the Complete Plant of a Wireless and Gramophone Cabinet Maker, Stores, &c. Also a 1925 Riley de Luxe all-weather Motor Car.

On view day previous and mornings of sale.

Catalogues from Messrs. Seymour, Seymour & Co., as above, and H. J. Shaw, 85, Newington Causeway, S.E.1. 'Phone: Hop 3862. 508

SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Tuesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

GENERAL MANAGER AND ENGINEER.

THE Rhondda Tramways Company, Ltd., requires the services of a General Manager and Engineer at the commencing salary of £1,200 per annum.

The Company operates a system of tramways in the Rhondda Valley, South Wales, 21 route miles in length, current being obtained from its own generating station. It also has a fleet of 40 motorbuses operating services mainly outside of the Rhondda Valley.

Application in writing, giving full particulars of qualifications and experience, together with copies of not more than three recent testimonials, should be addressed to the Managing Director of the Company, 62-63, Queen Street, London, E.C.4, and must be received not later than the 5th July, 1926. 464

ELECTRICAL TRADES UNION.

Hackney Borough Council.

THE Hackney Borough Council has been declared "Black." Before any member of the Electrical Trades Union can accept any employment, either directly or indirectly, for this Council he must first obtain permission from the London District Committee of the Electrical Trades Union.

W. J. WEBB,
3121 London District Secretary.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

AN Overhead Line Working Foreman wanted. Must be accustomed to tramway work and able to handle motor derrick.—Apply, giving age and experience, to 482, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder required by old-established firm of Engineers, to take charge as Foreman of a small department.—Address by letter only, with full particulars of experience, age and wages required, to W. G. Walker & Co., Emery Hill Street, Westminster, S.W.1. 494

ASSISTANT required for Sales Department of Electric Motor Manufacturers, age about 23; progressive position. State salary required; personal application preferred.—Higgs, Witton, Birmingham. 486

CANVASSER required temporarily to canvass for Supply Company in Lincolnshire carrying out wiring on deferred payments. Applicants should state salary required or if salary and commission terms are preferred. Knowledge of electrical installation work is desirable.—517, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN, Junior, required in Midlands, experienced in automatic control gear and wiring diagrams.—State full experience, age and salary required, to 493, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN required, experienced in electric light and power plans for ships. Must have knowledge of switchgear necessary for same.—State age, experience and salary required, to 500, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted with experience in mechanical design of d.c. and a.c. dynamos and motors.—Give full particulars of experience, age, and salary required, to 506, Electrical Review, 4, Ludgate Hill, London.

EXPERIENCED Designer wanted to take charge, under the supervision of the Chief Switchgear Designer, of a section engaged on the development of switch and control gear of all descriptions. Only those having an intimate knowledge of present-day practice need apply.—Apply, stating experience and salary expected, to English Electric Co., Stafford. 491

EXPERIENCED Transformer Draughtsman wanted.—Apply, giving full particulars of experience and state age and salary required, to English Electric Co., Stafford. 483

ILLUMINATING Engineer required, capable of designing scientific reflectors and fittings for street, industrial and shop lighting, and fully conversant with their modern application.—Apply, stating age, experience and salary required, to 502, Electrical Review, 4, Ludgate Hill, London.

JUNIOR Assistant Electrical Engineer required, for the introduction and general maintenance of Engineering Equipment of a large firm in London. Must have had a good technical education, some practical experience and must be a fair draughtsman.—Full particulars to 487, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT. – *Continued.*

LEADING Manufacturers of tumbler switches, general lighting accessories, ironclad gear, and switchgear, propose appointing Two or Three Gentlemen as District Superintendents. Necessary qualifications include good appearance and address, and intimate knowledge of a particular area, thorough knowledge of the business, the necessary experience and ability to supervise a reasonably large area of ground and the efforts of two or three travellers.—Applicants will please give details of their technical and commercial experience, age and the particular area in which their connection lies, together with approximate salary required, all of which will be treated in confidence, to Box No. P659, c/o 19-21, Corporation Street, Birmingham. 5274

MAINS Foreman and Plumber-Jointer required by Municipal Electricity Supply Undertaking. Wages £4 per week. A house will be found for the successful applicant, if required. —Apply, stating experience and enclosing copies of recent testimonials, to 509, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES required with good connections in the Electrical and Furnishing trades, to push sales of good class oak and mahogany floor and table Standards, Candlesticks, &c., in the Home Counties, South Coast and Lancashire. Commission basis only, but excellent immediate prospects to the right men.—Apply, stating (in confidence) age, ground covered, firms at present represented and approximate turnover, to F. Witton, 308, Summer Lane, Birmingham. 489

REPRESENTATIVES required for the Sale of insulating materials such as Fibre, Leatheroid, Cloth, Silk Paper, Adhesive Tapes, Ebonite, Mica, &c. Only those having good connections and can influence real business need apply.—Reply in confidence, stating districts covered, and full particulars of experience, &c., to 390, Electrical Review, 4, Ludgate Hill, London.

REQUIRED immediately, for service abroad, young Engineers, good electrical training, experience country house plant installation; good knowledge accumulators necessary. Excellent prospects.—418, Electrical Review, 4, Ludgate Hill, London.

REQUIRED, the services of an Electrical Engineer experienced in stage and cinema equipment. Must be able to supervise and maintain existing plant over a large area and also deal with the commercial side.—State age, experience and salary required, to 5268, Electrical Review, 4, Ludgate Hill, London.

SALES Engineer, young, required by Electrical Engineers to take charge of small sales department. Give full particulars, experience and salary.—5279, Electrical Review, 4, Ludgate Hill, London.

SALES Organiser for home and export trade and publicity. Personal experience of Dominions and foreign markets preferred. Able to undertake travel abroad.—Address full details, experience, references, salary, in writing only, to General Manager, Joseph Rodgers & Sons, Limited, 6, Norfolk Street, Sheffield. 498

SALESMEN. Part-time Salesmen required for guaranteed branded and advertised electric lamps already largely used. To anyone having an existing connection among the electrical trade, this offers a good opportunity to considerably augment his income. Good commission with substantial office support in securing business.—520, Electrical Review, 4, Ludgate Hill, London.

SALESMEN required for London and district by well-known Continental firm of Lamp Manufacturers, to sell all types of electric lamps under E.L.M.A. conditions. Only those with established connection need apply.—Write in first instance, stating age, experience and salary required, indicating in what part of London actual connection exists, to 473, Electrical Review, 4, Ludgate Hill, London.

SHORTHAND Typist required in West End electrical engineers' office, not under 25; first-class experience electrical trade; must be able to work on own initiative.—Apply, stating full particulars, to 503, Electrical Review, 4, Ludgate Hill, London.

THE United River Plate Telephone Company, Limited, require for Buenos Aires a Telephone Engineer with experience in design of aerial and cable trunk lines and routes; also knowledge of circuits, repeating equipment, transmission, &c. Age about 30-35; commencing salary offered about £800 per annum (English living equivalent say £600 per annum for single man); five years' contract; 1st class passage.—Apply by letter, stating full particulars, to 5, London Wall Buildings, Finsbury Circus, London, E.C. 532

TRAVELLER required with connection in London amongst electrical and mechanical engineers and contractors, a useful workshop device on a liberal commission basis.—For particulars, apply in confidence to 5277, Electrical Review, 4, Ludgate Hill, London.

TRAVELLER wanted for London by manufacturers of Domestic Electric Appliances. Wholesale only. Salary and commission to man who can get business.—Particulars and experience to 481, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

TROPICS. Electrical Engineer wanted to take charge of the erection and maintenance of a small a.c. Power Station and Plant. Must have had experience of small power station work and simple overhead line transmission. Useless to apply without these qualifications. There are excellent prospects for a qualified man who can adapt himself to local conditions. Three-year contract, commencing salary £250 with free quarters, servants and passages. Cost of living is low. To sail end of August.—Write Box A.G., c/o Davies & Co., 95, Bishopsgate, E.C.2. 5303

TWO good and experienced Travellers wanted for the sale and rental of Telephone Installations, inter-communication and automatic.—505, Electrical Review, 4, Ludgate Hill, London.

WIRELESS.—Five to ten pounds per week for industrious reliable men seeking permanent employment; applicants must have practical knowledge of installation of set and aerial, be a householder or live with parents, and be able to give references.—State age and experience to 12, Electrical Review, 4, Ludgate Hill, London.

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled may we suggest that advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

BOX 55 (Junior Engineer); Box 366 (Youth for Drawing Office); Box 5186 (First-class Wireman).

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A CAPABLE Electrician desires position of charge, having held similar position on works maintenance; 21 years' experience in all branches of trade.—5203, Electrical Review, 4, Ludgate Hill, London.

A COMPETENT Electrician (29) requires change; quick and reliable all classes of wiring, construction, or maintenance of plant or mains.—5184, Electrical Review, 4, Ludgate Hill, London.

A SKILLED Electrician; installation and maintenance; all systems and plants.—33, Laburnum Road, Wimbledon, S.W.19. 5269

A YOUNG Electrical Engineer, 3 years' articleship central station, all departments, 18 months' a.c. test B.T.H. Co., seeks progressive situation.—"The Glen," Kingswinford, Staffs. 5305

A YOUNG Electrician (25), capable and willing, desires a responsible position where there is scope and initiative required; knowledge of electrical work is both technical and practical. At present in charge of an electrical department.—5219, Electrical Review, 4, Ludgate Hill, London.

ACTIVE Young Electrical Engineer (22), desires opening, technical or commercial; sound theoretical and practical training; good diploma, public school.—5175, Electrical Review, 4, Ludgate Hill, London.

ACCUMULATOR Mechanic seeks berth; 18 years' experience in making and repairing all types.—E.H., 150, Kingsland Road, E.2. 5214

ADVERTISER, A.M.I.E.E., with wide experience, good Salesman and Buyer, seeks representation, London and district; specialist in switchgear; in touch with buyers.—5208, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER (age 27), seeks change, preferably as Traveller. At present in wireless trade. Good knowledge of electrical accessories; keen salesman and traveller.—136, Elthorne Road, Upper Holloway, N.19. 5148

ADVERTISER, Charge Hand or position of trust; installations, motors, electric cookers, vehicles.—"Electrician," 6, Listria Park, N.16. 5181

ADVERTISER desires a position where twenty years' experience as an installation engineer, following seven years' practical and technical training, would be considered worth £250-£300 a year.—5284, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER seeks a trustworthy position in a progressive undertaking. Over 14 years' power house experience, with high speed steam and oil engines, switching operations and regulation of dynamos, single and 3-phase alternators, battery charging, meter reading, installation testing and inspecting, &c.—5304, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER seeks position as Representative. Lamps, accessories, fittings, &c. Area, West of England; live connection; 7½ years with well-known manufacturing concern. —5135, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

ADVERTISER (39) seeks position, any capacity; extensive experience in factory organisation and routine, including rate-fixing, inspection, progress; good controller of labour, either sex; excellent references.—5302, Electrical Review, 4, Ludgate Hill, London.

ADVERTISER, with splendid connection with electrical factors and contractors in all main towns of England, Scotland and Wales, carrying only limited number of lines, would represent wholesale house on commission basis.—5281, Electrical Review, 4, Ludgate Hill, London.

AN Electrical Engineer (26), Stud. M.I.E.E., desires responsible progressive position. 5 years indentured well-known firm. 2 years' supervision erection, sub-station and plant.—5155, Electrical Review, 4, Ludgate Hill, London.

AN Electrical Engineer seeks charge of small supply undertaking; wide experience with steam, gas, oil and hydro-electric practice; overhead and underground transmission.—5151, Electrical Review, 4, Ludgate Hill, London.

AN Electrician requires employment; any kind of work; screw, slip, or lead; references.—Radnor, 3, Oulton Street, Battersea. 5295

AN Engineer (30), accept anything temporary; low salary; Faraday Diploma; works, shift engineer, commercial experiences.—G., 22, Ravensbourne Gardens, Ealing. 5134

ARMATURE Winder, 8 years' experience; repairs, rewinds, maintenance.—G. Cobb, 11, Colistone Road, Wandsworth, S.W.18. 5273

AS General Assistant or Junior Shift Engineer. Young Man (27), keen and reliable; experienced all departments of small supply undertakings; desires post offering scope for ability and initiative. Steam, oil, mains, estimating; good draughtsman.—5286, Electrical Review, 4, Ludgate Hill, London.

AS Technical Correspondent, sound electrical and mechanical experience; accumulators, switchgear, motors, &c.—5301, Electrical Review, 4, Ludgate Hill, London.

AS Junior Draughtsman: Young Man (22), energetic, 6½ years' practical mechanical, electrical experience, thorough Secondary and Technical Schools education, desires post. Good knowledge machine drawing, mathematics; references.—Stanbury, 109, Foleshill Road, Coventry. 5212

B.SC., experienced installation work and control gear, requires post as Junior Assistant, manufacturers or contractors; references.—5278, Electrical Review, 4, Ludgate Hill, London.

COMMERCIAL Engineer desires position with established firm as Sales Engineer, Branch Manager, or other responsible position.—5145, Electrical Review, 4, Ludgate Hill, London.

COUNTER Sales or Ledger Clerk (Male); 11 years' experience with good class wholesale electrical firm.—W. Hatch, 133, The Grove, Hammersmith, W.6. 5289

DESIGNER Draughtsman, 32, electrical, mechanical; London; small machines, instruments, &c.; experience includes factory management.—5239, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (age 22), 7½ years' experience all branches, manufacturing motors, &c., 5 years' indentures, seeks progressive situation any district.—5240, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, age 42, works training, seeks berth; late manager electrical contractors. Sales, estimating, publicity and technical staff experience; also telephone expert; highest references as to character and ability.—5142, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer (23½), Stud. I.E.E., City Guilds final, Higher Grade National, 5 years indentured, good general practical knowledge, seeks progressive position.—5306, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Fitter and Wireman's Mate or Improver (21) seeks situation.—Goddard, 27, Orchard Road, Highgate. 5153

ELECTRICAL Salesman seeks re-engagement; showroom and bookkeeping (London experience); preferably in S.W. or North England.—5169, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Wireman (25), T.U.; all systems; wireless repairs, seeks situation.—R. Dowden, 14, Alpha Place North, N.W.6. 5261

ELECTRICIAN (25), 11 years' varied experience both maintenance and new installations, willing to take job in town, country, or abroad.—F.H., 27, Cresswell Place, South Kensington, S.W.10. 5293

ELECTRICIAN.—Reliable Man, piecework or day work wanted.—S., 30, Ringmer Avenue, Fulham, S.W.6. 5258

ELECTRICIAN, long experience all systems, installations, jobbing, sub-contract, builders' carcasing; reliable; anywhere.—113, Albert Street, N.W.1. 5237

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN, used to plant, maintenance, wiring, engines, batteries, outside lines and house.—C., 5, Windsor Road, Holloway, N. 5264

ELECTRICIAN (young) seeks situation; familiar with screwed slip casing, lead-covered, maconite; 9 years.—F.M., 42, Strickland Street, S.E.8. 5233

ELECTRICIAN, wiring, all systems, plant and battery work, small battery repairs; excellent reference.—Wakely, 14, Roseland Terrace, Exeter. 5229

ELECTRICIAN, all-round reliable wireman, screwed tube, power and lighting, arc lamp mechanic and jointer.—B., 42, Kennedy Road, Barking, E. 5228

ELECTRICIAN, 15 years' practical experience lighting and power; all wiring systems.—A.W., 277, Shirland Road, Paddington, W.9. 5226

ELECTRICIAN (24), good wireman, all systems; experience private generating plants, fitting, dynamo repairs, &c.; good technical knowledge; Sussex or Surrey preferred.—5174, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN or Mate, light, heat, wireless, &c.—Rees, 144, Harrow Road, Paddington. 9682

ELECTRICIAN, good all round, wiring all systems, jobbing, repairs, lighting, power, &c.; 20 years' experience.—Hall, 25, Harringay Grove, Hornsey, N.8. 5157

ELECTRICIANS.—Competent Electrical Improver, age 20, seeks situation; own tools; experience in all classes of wiring; willing to do any kind of work. Rate, 10½d. per hour.—Write, 38, Trinity Street, Shrewsbury. 5255

ELECTRICIAN'S Mate (19) requires situation. Three years' general experience. Strong and willing.—"Mate," 133, Fourth Avenue, E.12. 5173

ELECTRICIAN'S Mate wants job (good practical).—F. Summers, 13, Archibald Place, Farm Street, W.1. 5217

ENGINEER, disengaged July; experienced steam, hot water, turbine, gas, petrol, refrigerating and electricity plants; good all round engineer; 5 years' present experience with large public institutions.—5291, Electrical Review, 4, Ludgate Hill, London.

ENGINEER, 35, single, wants work, home or abroad; sea experience, power station turbines, watertube boilers, oil fuel and general repair work; good references; not afraid of work.—5271, Electrical Review, 4, Ludgate Hill, London.

ESTIMATING Engineer, heavy plant, switchgear, control year, competitive light engineering, telephone equipment from drawings; exceptional electrical and manufacturing knowledge; expert correspondent; factory experience, important companies.—5222, Electrical Review, 4, Ludgate Hill, London.

HOLDER first-class P.M.G. wireless certificate, 8 years' technical, 4 years' commercial wireless and electrical experience, desires Post or Partnership reputable firm, South. Or would represent one or two firms Southern Counties, where he has good connection.—5206, Electrical Review, 4, Ludgate Hill, London.

IMPROVER (22) seeks job; 7 years' experience.—"A.B.," 23, Vassell Road, Brixton, S.W.9. 5294

LIVE Engineer requires appointment with traction undertaking wanting exceptional technical knowledge; varied electrical manufacturing experience; inventive ability; ideas for modernising tramways or developing publicity campaign.—5221, Electrical Review, 4, Ludgate Hill, London.

LONDON Contractor's Representative desires appointment. Six years' recent experience, supervising, office, and travelling.—5195, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer wants change; 28 years' experience; e.h.t., l.t. services, cable laying, sub-station work; 20 years' leading jointer.—5234, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer disengaged, requires situation; 10 years' experience all systems, live mains and services.—5244, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer wants situation; e.h.t., l.t. experience.—45, Colegrave Road, E.15. 5231

POST wanted. Young Man, 19, Blundell's College, 2 years' central station routine and charge of shift; moderate salary; commence at once.—Jackson, Rectory, Parracombe. 5270

POWER Station Chemist and Combustion Engineer, 25 years, desires progressive post; exceptional experience feed water treatment, water tube boilers, iron and steel economisers, burning of low-grade fuel, valuation of fuels, maintenance and efficient operation of modern boiler plant; moderate salary.—5272, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE with excellent connection with electrical factors and contractors in all main towns in the British Isles, is desirous of representing wholesale house, on salary and commission basis.—5282, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

RESPONSIBLE and progressive position at home or abroad wanted by Electrical Engineer (25); B.Sc. Honours, practical and commercial experience with large power company; knowledge French and German.—5223, Electrical Review, 4, Ludgate Hill, London.

SALES Manager, electrical speciality firm; can produce excellent sales record; requires position with progressive firm, in London; at present employed; best references, &c.—5225, Electrical Review, 4, Ludgate Hill, London.

STOREKEEPER-Countersalesman (31) desires berth wholesale house; used entire charge large stocks, also packing and despatch departments; excellent references; moderate salary.—James, 58, Fortess Road, N.W.5. 5292

STOREKEEPER seeks sit. in electrical warehouse; over 12 years' experience; used to packing and despatching; good knowledge of all electrical equipment; 32 years of age; exemplary references.—5248, Electrical Review, 4, Ludgate Hill, London.

SWITCHBOARD Attendant desires situation; general experience in a.c. and d.c.; good references.—5257, Electrical Review, 4, Ludgate Hill, London.

TELEPHONE Switchboard Wireman wants job.—H. Teague, 189, Bravington Road, Paddington, W.9. 5213

WIREMAN (36), quick, competent, 18 years' experience all round.—F., 3, Seymour Place, W. 5166

WIREMAN (38), active, all round, screwed, slip, lead, bells, 'phones, repairs, &c.—A., 82, Harrow Road, W. 5167

WIREMAN (33), tradesman, life experience, recommended.—64, Vespan Road, Shepherd's Bush, S.W.12. 5156

WIREMAN, 'phones, lights, &c., or maintenance work, seeks situation.—S., 15, Stirling Road, E.13. 5216

WIREMAN, long experience; any system, light, power, maintenance.—D., 4, Rossetti Gardens, Chelsea. 5227

WIREMAN, thoroughly experienced all-round hand, requires work. Also good mate if required.—"Electrician," 17, Parkstone Road, Peckham, S.E.15. 5296

WIREMAN, disengaged, single; district rates; London, country town, or district.—Pendred, 62, Byron Avenue, East Ham. 5224

WIREMAN'S Assistant requires job. Five years' experience, conduit, l.c., slip, wireless.—F. W., 33, Seaford Road, Ealing, W.13. 5180

WIREMAN'S Mate, 5 years' experience.—5, Abbey Grove, Abbey Wood. 5137

YOUNG Man (24), with good electrical training, seeks a progressive post in any kind of electrical work, preferably power station; 7 years' apprenticeship; secondary and technical school education.—S.W., Penycroft, Alveley, Bridgnorth. 5218

FOR SALE.

Advertisements are inserted under this heading at 14s. per inch.

AUTO-LAMPS! AUTO-LAMPS!

RADIO, Motor-Cycle, Sign, Bicycle, Train Lighting, Miners', and Flashlight Lamps. Vacuum and Gas-filled.

LOWEST POSSIBLE NON-RING PRICES.

UNSURPASSED QUALITY.

SPECIAL EXPORT TERMS.

WHOLESALE AND FACTORS ONLY.

HENRI ENGEL, "Engelect" Lamp Works, Oxford Circus House, Oxford Circus, W.1.

Telephone: Regent 4354.
Telegrams: Engelesque Wesdo London.

AGENTS WANTED. 117

MOTORS, &c.

200/250 volts, d.c.: 1, 3, 5½, 6, 10, 15, 20, 25, 50, 80, 120, and 150 h.p. Variable speed, 25 h.p.

400/500 volts, d.c.: 1, 3, 5, 7½, 10, 15, 20, 25, 30, 35, 40, and 150 h.p. Variable speed, 5, 10, 15, 20, 22, 26 and 30 h.p.

200/220 volts, 3-ph., 50 per.: 4, 5, 6, and 15 h.p.

400/500 volts, 3-ph., 50 per.: 1, 2½, 3, 4, 10, 20, 25, 30, 40, 50, 200, 250, and 500 h.p.

3,000/3,500 volts, 3-ph., 50 per.: 500 h.p., 291 revs., B.T.H.
Fans: 400/440 V, 3-ph., 50 per.: 42-in. Keith Blackman. New.

Dynamos: 220 V: 20, 60, 100 and 110 kW.

Transformers: Westinghouse Welding Equipment, 10½ kVA.

Automatic starters: 220 V, d.c., 50 h.p.; 440 V, d.c., 80 h.p.; four 400/440 V, 3-ph., 50 per., 80 h.p.

GREENHALGH BROS., Atherton. 1047

FOR SALE.—*Continued.*

OLDFIELD ENGINEERING CO., LTD., Hampson Street, SALFORD.

Telegrams:—"Stalwart, Manchester."
Telephone:—City 8620, Manchester.

400/500-VOLT, D.C. MOTORS IN STOCK.

B.H.P.	Speed.	Make.
110	300	Phœnix.
55	750	L.D.M. Totally enclosed.
50	825/985	Electromotors (with worm gear).
45	700	B.E.P.
40	460	Mather.
34	900	Harland.
30	500	Phœnix.
27	980	Metro-Vickers.

and smaller down to 1 h.p.

200/250-VOLT, D.C. MOTORS IN STOCK.

30	440	L.D.M.
20	1,100	G.E.C.
12	350/1,050	Electromotors.
10	1,140	G.E.C.

and a very large number of smaller down to ¼ b.h.p.

100/110-VOLT, D.C. MOTORS IN STOCK.

50, 20, 10, 6, 5 and 2 b.h.p.

200/250-VOLT, D.C. GENERATORS IN STOCK.

150, 57 and 54 kW.

400/500-VOLT, 3-PHASE, 50-CYCLE, A.C. MOTORS IN STOCK.

200, 70 and 7½ b.h.p., slip-ring.
40, 7½, 6, 5, 4 and 3 b.h.p., sq. cage.
Alternator by Phœnix, 40 kW, 3,000/3,300 volts, 3-phase, 50 cycles, 750 r.p.m., complete with coupled exciter.

All in guaranteed first-class working order. 510

FOR IMMEDIATE DISPOSAL.

IN good order and fully insured:—

Two 100-amp. Switches; eight 100-amp. Cutouts; four 30-amp. Cutouts; two 30-amp. Switches; one 100-amp. Change-over Switch, open type; one Dual Resistance; one Voltmeter, 0-120; one Ammeter, 0-120; two Arcs, Leads and Sockets.

Newton Motor Generator No. 1, 440 volts, d.c., 60 volts, 80 amps.

Newton Motor Generator No. 2, 440 volts, d.c., 60 volts, 60 amps.

Two Shunt Regulators for same, two starters for same, two polished slate panels, 24 in. by 11 in. by 1 in.

The above are drilled for meters and fixing.
The lot, £75, on site.

539, Electrical Review, 4, Ludgate Hill, London.

LAMPS. LAMPS.

LAMPE ELECTRIQUE LOCARNO,
29, Rue du Fbg. Poissonniere, Paris,

are exporters of the highest quality Electric Lamps,

METAL FILAMENTS (Vacuum), ¼-watt GASFILLED,

½-watt GASFILLED OPAL.

All Pipless.

Immediate delivery. 5280

BATTERY BOOSTERS.

WESTMINSTER Electric Supply Corporation, Ltd., 6, Eccleston Place, S.W.1, have for disposal two Battery Boosters.

Each Set consists of two generators driven by a 400-volt, d.c. motor. The generators in each booster can be coupled in parallel or in series, giving an output of 1,050 amperes at 70 volts or 2,100 amperes at 35 volts.

The machines are of the Lancashire Dynamo & Motor Company's manufacture, and can be seen at the Eccleston Place Sub-station of the above Company. 535

EXTRAORDINARY VALUE.

ENGLISH made Charging Dynamos, brand new, shunt wound, ball bearing; very substantially built; 1,400 r.p.m.

1 kW, £9.
½ kW, £6 10s.

WM. E. CULKIN & Co., School Close Mills, Neville Street, Leeds. 5285

FOR SALE.—*Continued.*

MOTORS AND GENERATORS IN STOCK.

440/500 VOLTS, D.C.

100-KW Generator, by Phœnix, 500 revs., 6 poles and interpoles, shunt.
80-h.p. Motor, by B.T.H., 795 revs.
43-h.p Motor, by Electromotors, 640 revs., shunt, interpole, with Igranic starter.
35-h.p. Motor, by Siemens, 400 revs., shunt, interpole.
30-h.p. Motor, by B.E.P., 650 revs., shunt, interpole.
22-h.p. Variable Speed Motor, by Halls, 350/900 revs., compound, interpole, with Brookhirst control pillar.
20-h.p. Variable Speed Motor, by Electromotors, 340/1,200 revs., compound, interpole, with Brookhirst automatic controls.
20-h.p. Motor, by Westinghouse, 2,000 revs.
Three 17-h.p. Motors, by Electromotors, 510 revs., shunt, interpole, and Igranic starters.
16-h.p. Motor, by Westinghouse, 1,520 revs., shunt, interpole.
15-h.p. Motor by Mavor & Coulson, 800 revs., compound, interpole.
Two 12-h.p. Wright Motors, 700 revs.
10-h.p. Variable Speed Motor, by Halls, 1,150/1,250 revs., shunt, interpole, ball bearings.
10-h.p. Motor, by G.E.C., 800 revs.
10-h.p. Motor, by G.E.C., 1,450/1,600 revs., shunt, interpole.
10-h.p. Motor, by Electromotors, 1,000 revs.
New 10-h.p. Motor, by Cutting Bros., 1,000 revs., shunt, interpole, Igranic starter.
10-h.p. Motor, by Westinghouse, 900 revs.
10-h.p. Motor, by Westinghouse, 850 revs., Brookhirst starter.
7½-h.p. Motor, by Westinghouse, 900 revs.
Three 7½-h.p. Motors, by Vickers, 1,060 revs., shunt, interpole.
7½-h.p. Motor, by Mather & Platt, 1,500/1,700 revs., shunt, interpole, ball bearings.
7½-h.p. Motor, by Rees Roturbo, 1,650 revs., shunt, interpole, with Brookhirst starter.
Three 5-h.p. Motors, by Vickers, 700 revs., shunt, interpole.
3-h.p. Motor, by McClure & Whitfield, 600 revs., shunt, interpole.
½-h.p. Motor, by B.T.H., back geared, 1,750/255 revs.

THOMAS MITCHELL & SONS, LTD., Bolton. 429

MACHINERY FOR SALE.

MOTOR-Generator Set, comprising 200-h.p., 400-V, 3-phase, 50-cycles, S/r Motor with S/c and B/l gear, 418 r.p.m., coupled flexible to a d.c. generator, 22.5 V, 5,500 amps., with exciter, 4 pedestal bearings and bedplate, T.P. circuit breaker, liquid starter, d.c., main switch cubicle and rheostat panel, volt and ammeters complete. All by the G.E.C. Condition as new.
30 kVA Brush transformer, 3-phase, 50 cycles, 400 V to 110 V.
5-h.p., 200-V, 2-phase, 50-cycle, 1,440 r.p.m. slip-ring Motor, with S/c and B/l gear.
4½-h.p., 220-V, 1,200 r.p.m., d.c. Crompton Motor; has been running as a generator.
½-h.p., 220-V, d.c. buffing and polishing Motors, 2,000 r.p.m., mounted on cast base with self-contained starters.
½-h.p. ditto, ditto.
All the above are in first-class condition and are offered at very low prices.

WALTER PARKINS & CO., Engineers,
34, Dudley Road, Wolverhampton. 490

LAMPS! LAMPS!! LAMPS!!!

Metal-filament, Half-Watt Type, Gas-filled, Opal, Traction, Motor Car, Carbon, Candle Lamps, and Wireless Valves.

ALL FERRO WATT TRACTIONS IN STOCK.

All Voltages and Wattages Stocked. Our Prices will Surprise You.

UNIVERSAL ELECTRIC LAMP CO.,
35, Hatton Garden, E.C.1.
Holborn 1808 and 2561. Tottenham 1655. 319

FOR SALE.

ELECTRIC Shades. Approximately 5,000 English Glass, satin finished (chiefly bell shaped). Sample, 3 doz. £1 for cash. Carr. paid.
4-volt, 1-c.p., S.B.C. Auto Bulbs, 8s. doz.
Following ring Lamps, 50 per cent. off list:—
80 volt, 300 and 500 watt, G.E.S. gasfilled.
80 V, 30 W, M.F. clear, E.S.
100/110 volt, 8 c.p. Carbons, B.C., Clear.
Subject to being unsold.
Let us quote you lowest cash prices for reliable M.F., &c., and Auto Bulbs.
BEECH BROS., Church Street, Brierley Hill. 5267

FOR SALE.—*Continued.*

MYLAN & SMITH (ENGINEERS), LTD.

KELVIN HOUSE,
St. James' Street, Sheffield.

Every Machine in our own Stock. All Guaranteed.
Thoroughly overhauled and tested before despatch.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Stock	H.P.	Speed.	Winding.	Maker.
One	5	950	slip ring	Phœnix
One	10	570	,,	L. D. & M.
Two	30	725	,,	Phœnix
One	30	585	,,	B.T.H.
One	40	710	,,	Westinghouse
Three	40	710	,,	Siemens
Nine	45	940	,,	Fuller
Three	50	950	,,	,,
One	50	955	,,	Newton Bros.
One	50	730	,,	Siemens
One	50	480	,,	Westinghouse
One	50	333	,,	Siemens
Four	65	720	,,	Brush
One	70	480	,,	B.E.P.
One	85	485	,,	J. P. Hall
One	100	583	,,	E.C.C.
Two	125	485	,,	Brush
One	150	366	,,	E.C.C.
Two	200	750	,,	Newton Bros.
One	330	575	,,	Westinghouse
One	440	490	,,	E.C.C.
Two	24	1435	sq. cage	Phœnix
One	26	1440	,,	B.T.H.
Four	50	964	,,	Newton
Three	60	960	,,	Newton
Three	60	725	,,	B.T.H.
Three	60	720	,,	L. D. & M.
Five	75	970	,,	Newton

DIRECT CURRENT, 110 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	3	1400	shunt	B.T.H.
One	5½	1300	compound	Holmes
One	7	630	shunt	Newtons
One	15	625	,,	L. D. & M.
Two	18	1300	compound	Phœnix
One	30	675	shunt	Laurence, Scott
One	37½	300	,,	Dick, Kerr
One	40	375/625	compound	Mawdsley
One	75	840	shunt	E.C.C.

DIRECT CURRENT, 220/230 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
Two	10	210/360	compound	J. P. Hall
One	14	1260	shunt	Newtons
One	15	365	,,	Crompton
Two	20	780	,,	Laurence, Scott
Two	20	500	,,	Crompton
Three	25	460	,,	Mather & Platt
One	30	1250	,,	L. D. & M.
One	37	420	,,	E.C.C.
Two	48	270	,,	Phœnix
One	50	920	,,	Vickers
One	65	610	,,	Laurence, Scott
One	75	585	,,	Dick, Kerr
One	80	750/1250	compound	Mawdsley

DIRECT CURRENT, 440/500 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	3	1400	shunt	B.T.H.
One	3	360/1080	compound	,,
One	3·4	1490	shunt	,,
One	9	380	,,	Newtons
One	12	310	,,	,,
One	13	335	,,	,,
Two	16	1650/1720	,,	B.E.P.
Two	20	420/720	compound	J. P. Hall
One	28	700	,,	Crompton
One	30	750	,,	,,
One	38	680	shunt	Vickers
Two	40	950	,,	Crompton
One	40	710/780	,,	Vickers
One	40	620	,,	Crompton
Three	50	920	,,	Mather & Platt
One	50	750	,,	Rhodes Motors
Two	52	980	,,	Mather & Platt
One	52	800	,,	Rhodes
One	65	305/610	compound	L. D. & M.
One	70	325/650	,,	,,
One	75	840	shunt	E.C.C.
Two	80	900	,,	,,
One	180	250	,,	,,

The above represents only a Small Selection of our Stock
Please send us your enquiries.

MYLAN & SMITH (ENGINEERS), LTD.,
Kelvin House, St. James' Street, Sheffield.
'Phone: 4976, 4977, Central, Sheffield.
'Grams: "Topical," Sheffield.
Works: Bamford, Derbyshire, L.M.S. Railway. 3

FOR SALE.—*Continued.*

MOTORS! MOTORS!! MOTORS!!!

D.C. Machines only available owing to clients changing over to A.C. supply.

Prices that merit attention.

Make.	H.P.	Volts.	Revs.	Winding.	Price.
J. P. Hall	50 (2)	110	585	Shunt	£45
English Electric	5	230	1070	,,	15
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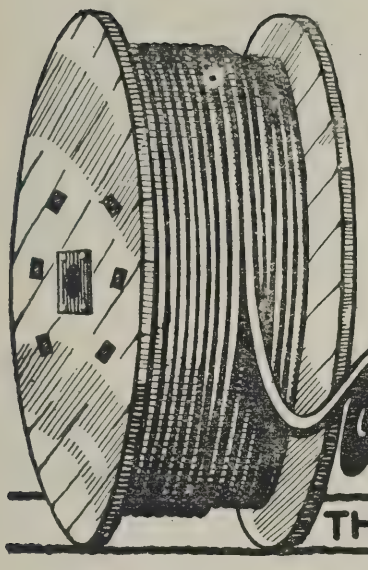
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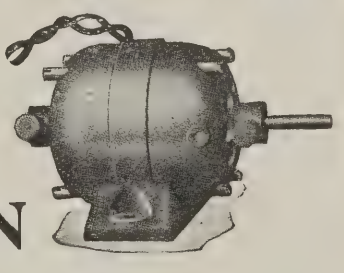
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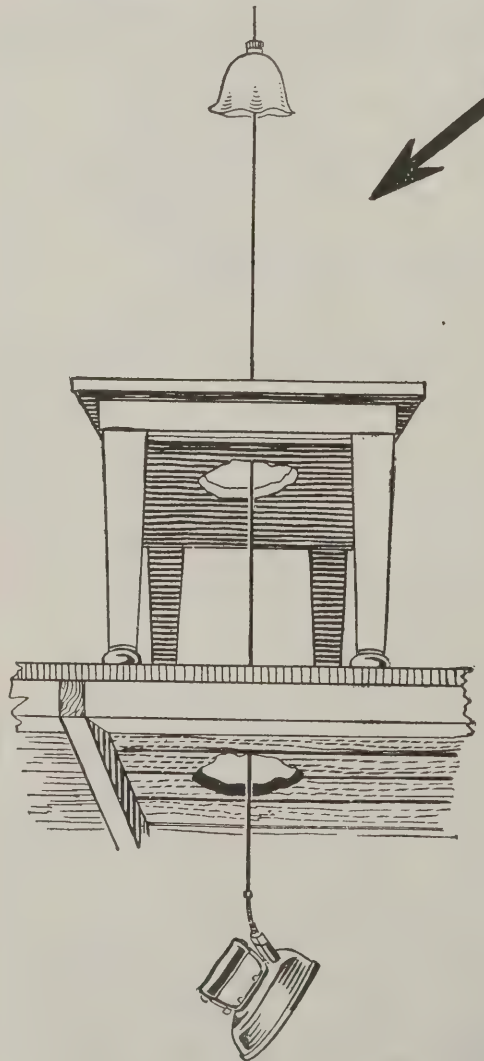
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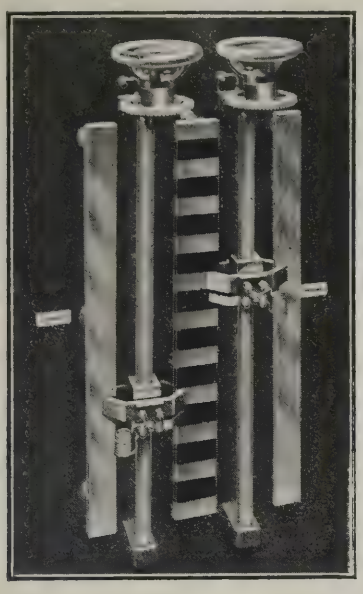
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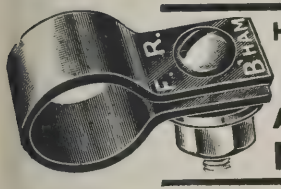
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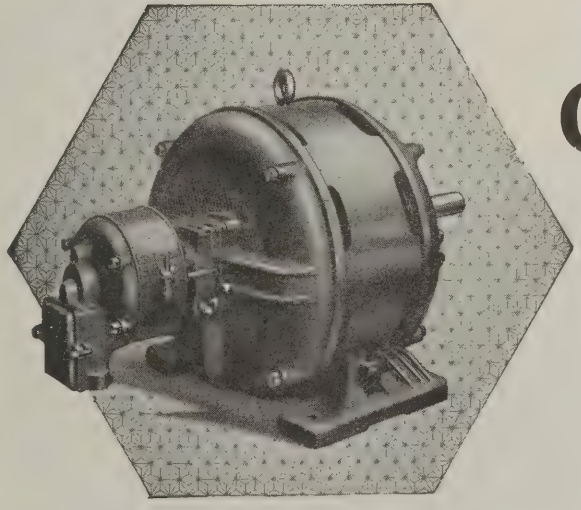
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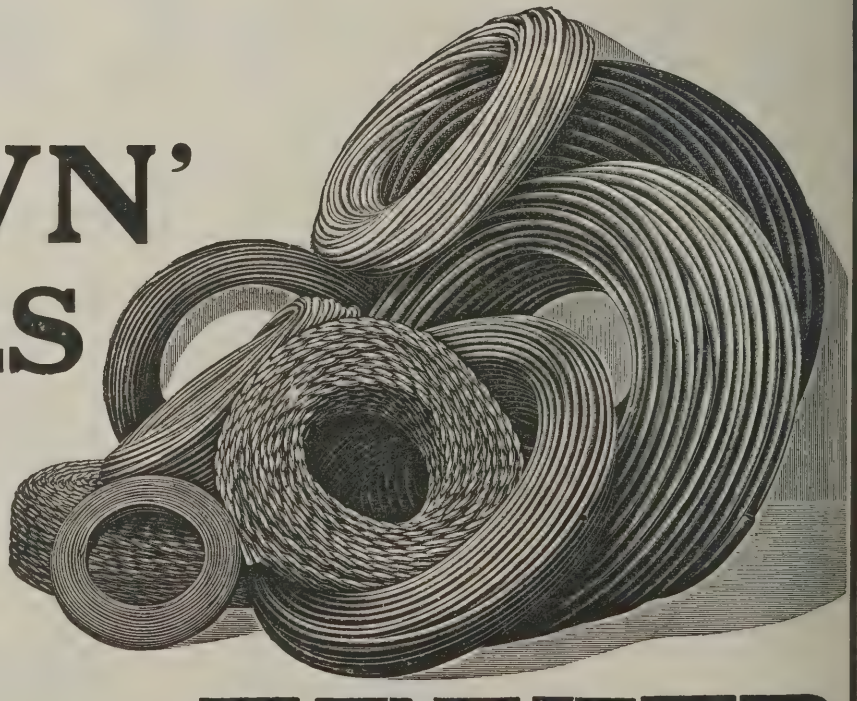
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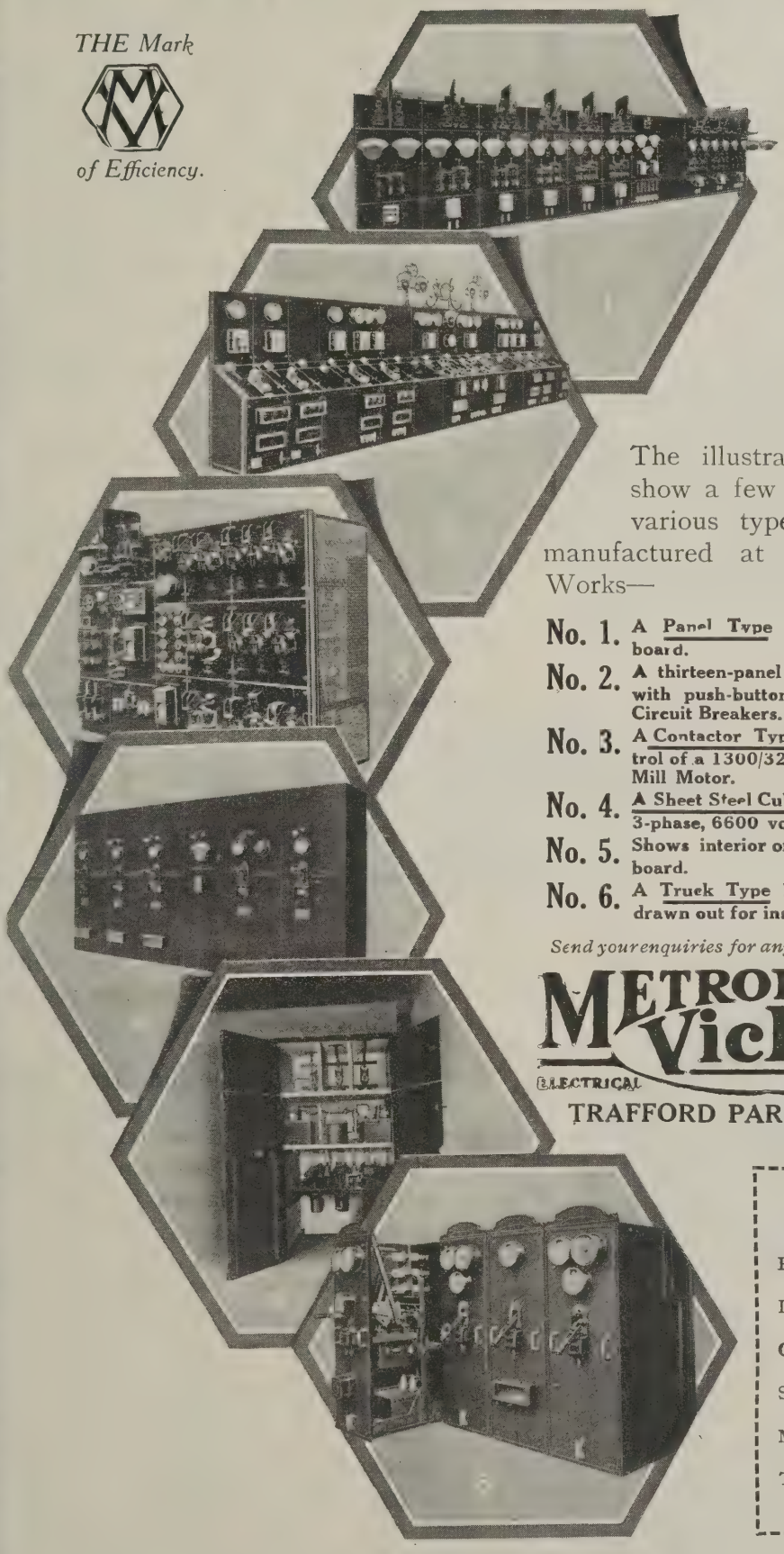
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No. 6. **A Truck Type board showing one panel drawn out for inspection.**

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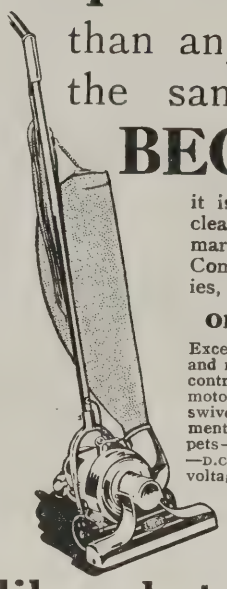
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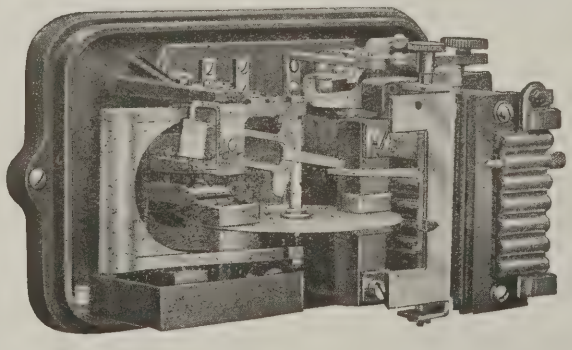
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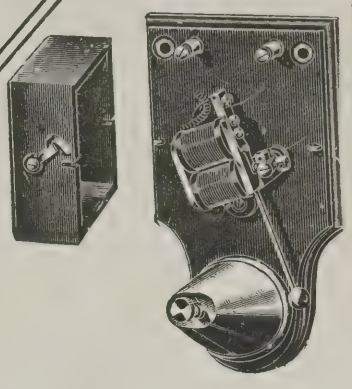
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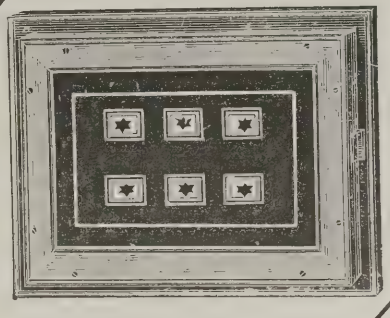
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OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Tuesday.

CITY OF NOTTINGHAM.

Electricity Undertaking.

TENDERS FOR GENERAL STORES.

THE Electricity Committee of the Corporation are prepared to receive Tenders for the supply of General Stores required in connection with the Electricity Undertaking for the period of twelve months, commencing on the 1st day of July, 1926. Particulars and forms of tender may be obtained on application to the Electricity Engineer at the Electricity Station, Talbot Street, Nottingham, on the payment of a deposit of 5s., which will be returned on receipt of a *bona-fide* tender.

The Committee will not consider any tender except on the authorised form, which must be delivered to the undersigned, in the special envelope provided for the purpose, on or before Tuesday, the 6th day of July next.

The Committee do not bind themselves to accept the lowest or any tender, and tenders will only be accepted from persons conforming to the conditions as regards paying the local standard rate of wages, and to the working rules of the Nottingham district applicable to the various trades

W. J. BOARD,
Town Clerk.

Guildhall, Nottingham. 443

COUNTY BOROUGH OF CROYDON.

Electricity Department.

ELECTRIC LOCOMOTIVE COAL HANDLING CRANE AND GRAB.

THE Council are prepared to receive tenders for an Electric Locomotive Coal Handling Crane and Grab.

Plan of site, specification and form of tender may be obtained on application from the Engineer and Manager, Electric House, 38, High Street, Croydon.

Tenders on the prescribed form to be sent to me by noon on July 5th, 1926, endorsed "Tender for Electric Locomotive Coal Handling Crane and Grab—Electricity Dept."

Tenders will only be received subject to the terms of the draft contract deposited at my office, which includes special conditions, and the I.E.E. model general conditions, and which may be inspected during office hours.

The Council will not be bound to accept the lowest or any tender.

J. M. NEWNHAM,
Town Clerk.

Town Hall, Croydon.
June 22nd, 1926. 523

COUNTY BOROUGH OF CROYDON.

Electricity Department.

ELECTRIC CRANE TRACK.

THE Council are prepared to receive tenders for an Electric Crane Track.

Plan of site, specification and form of tender may be obtained on application from the Engineer and Manager, Electric House, 38, High Street, Croydon.

Tenders on the prescribed form to be sent to me by noon on July 5th, 1926, endorsed "Tender for Electric Crane Track—Electricity Dept."

Tenders will only be received subject to the terms of the draft contract deposited at my office, which includes special conditions, and the I.E.E. model general conditions, and which may be inspected during office hours.

The Council will not be bound to accept the lowest or any tender.

J. M. NEWNHAM,
Town Clerk.

Town Hall, Croydon.
June 22nd, 1926. 522

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY.

TENDERS are invited for the supply, delivery and erection at the Birchills Power Station, Walsall, of three Steam Boilers, Pulverised Fuel Plant, Ash and Coal Handling Plant and Boiler House Auxiliaries.

Instructions for tender, the form of tender and specification can be obtained from Mr. E. M. Lacey, 12, Victoria Street, Westminster, S.W.1, on payment of a deposit of £5 5s., which will be returned on receipt of a *bona-fide* tender.

Additional copies may be obtained at £1 1s. each.

Tenders sealed and endorsed in accordance with the instruction for tender are to be delivered to the undersigned, not later than noon on Saturday, the 24th July, 1926.

The lowest or any tender will not necessarily be accepted.

S. T. ALLEN,
Chief Engineer and Manager.

83, Darlington Street, Wolverhampton. 540

OFFICIAL NOTICES.—*Continued.*

COUNTY BOROUGH OF SOUTHEND-ON-SEA.

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TENDERS are required for 300 Relay Switches for Distant Control of Street Lamps. Particulars may be obtained from the undersigned.

ROBERT BIRKETT, M.I.E.E.,
Borough Electrical Engineer and General Manager.

Borough Electrical Engineer's Office,
London Road, Southend-on-Sea.
June 21st, 1926. 516

INDIA STORE DEPARTMENT.

THE Director-General, India Store Department, Branch No. 36, Belvedere Road, Lambeth, S.E.1, invites tenders for :—

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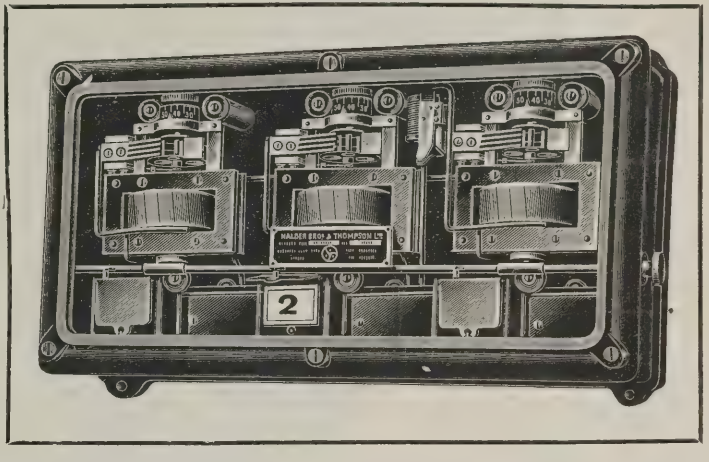
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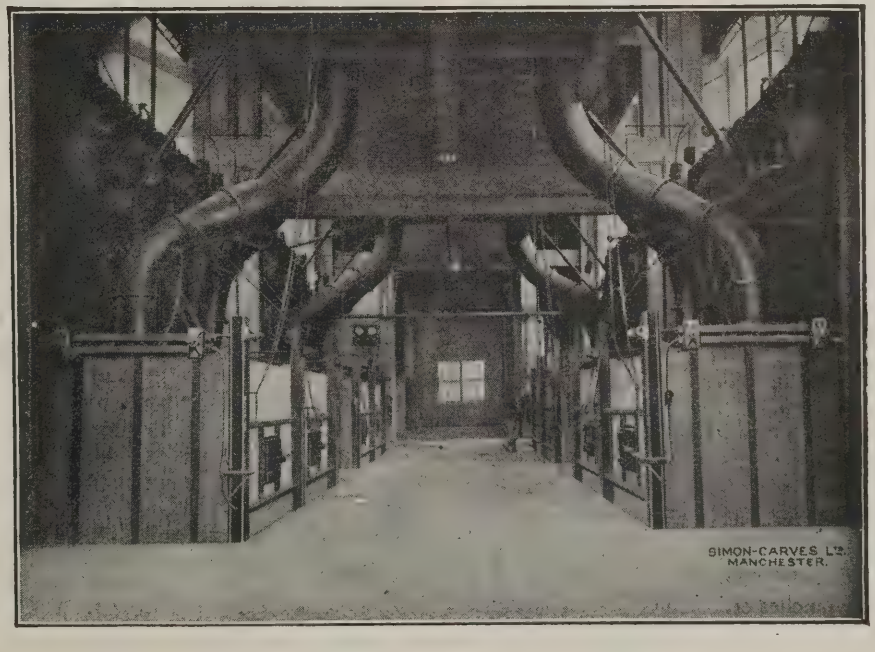


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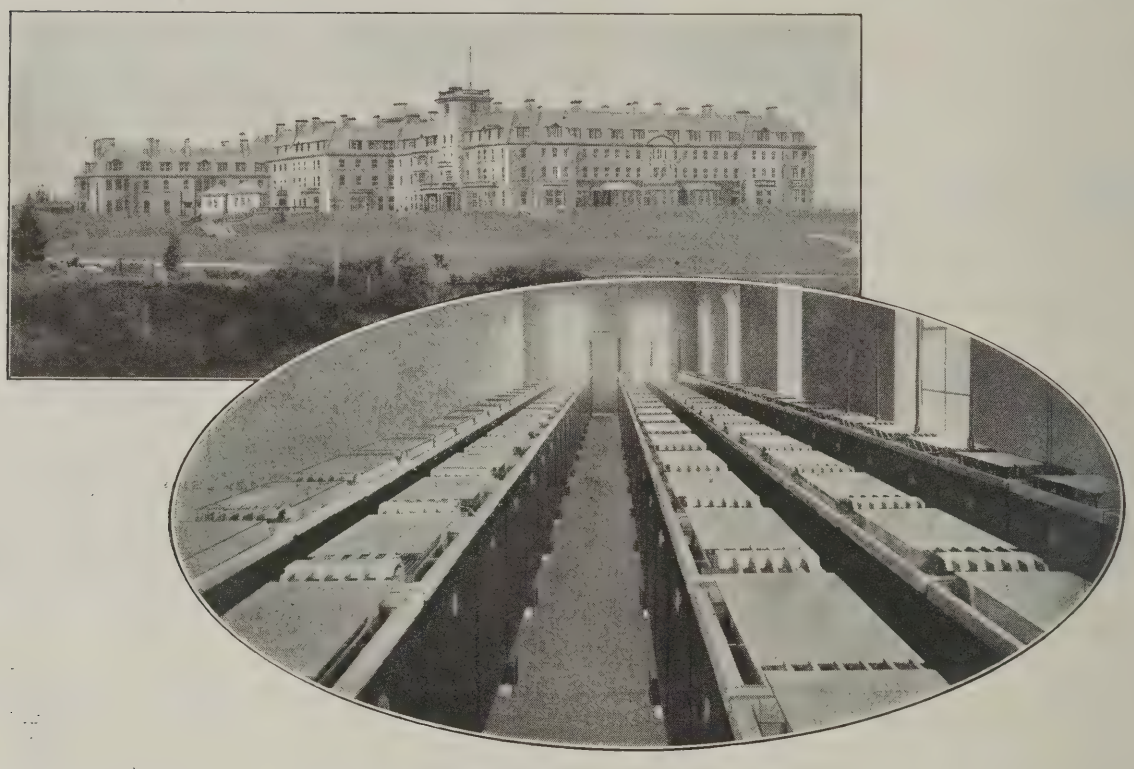
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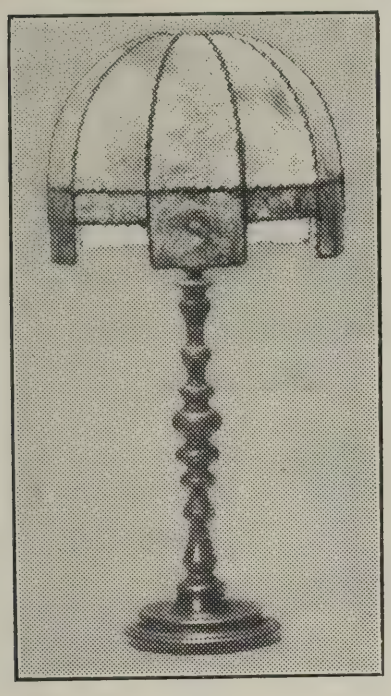
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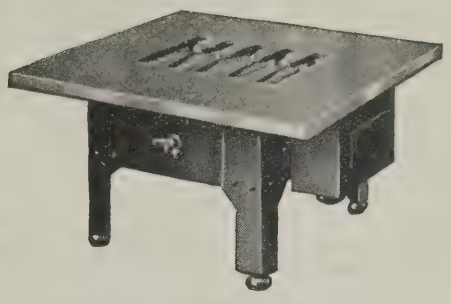
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RAPID BOILING PLATE No. 103.

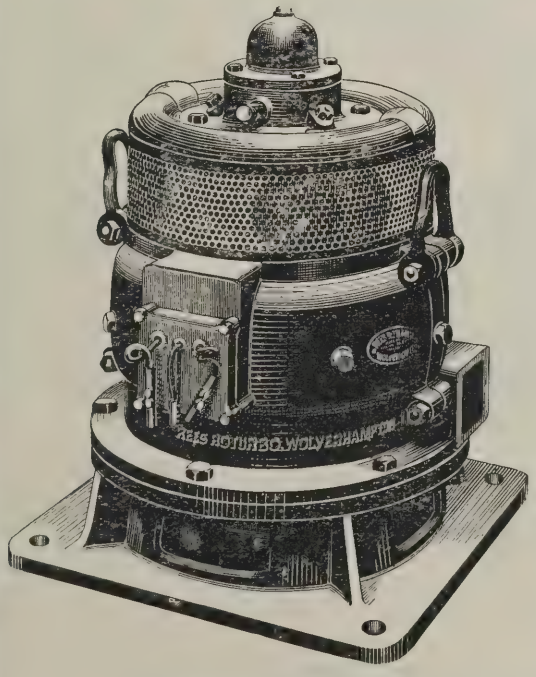
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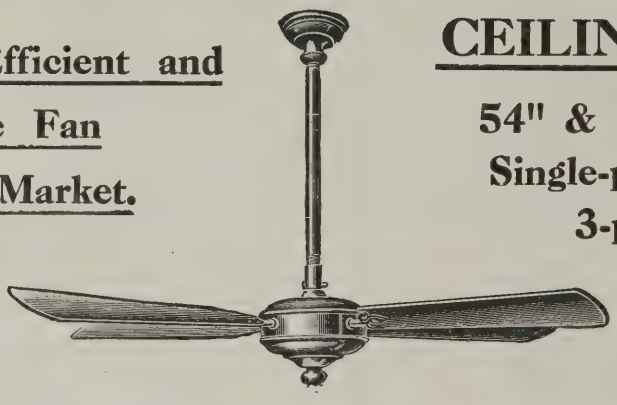
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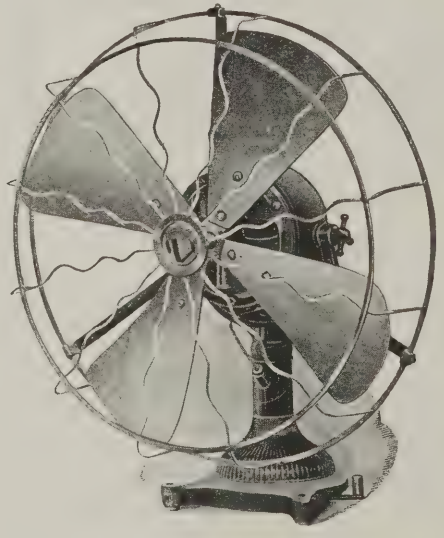
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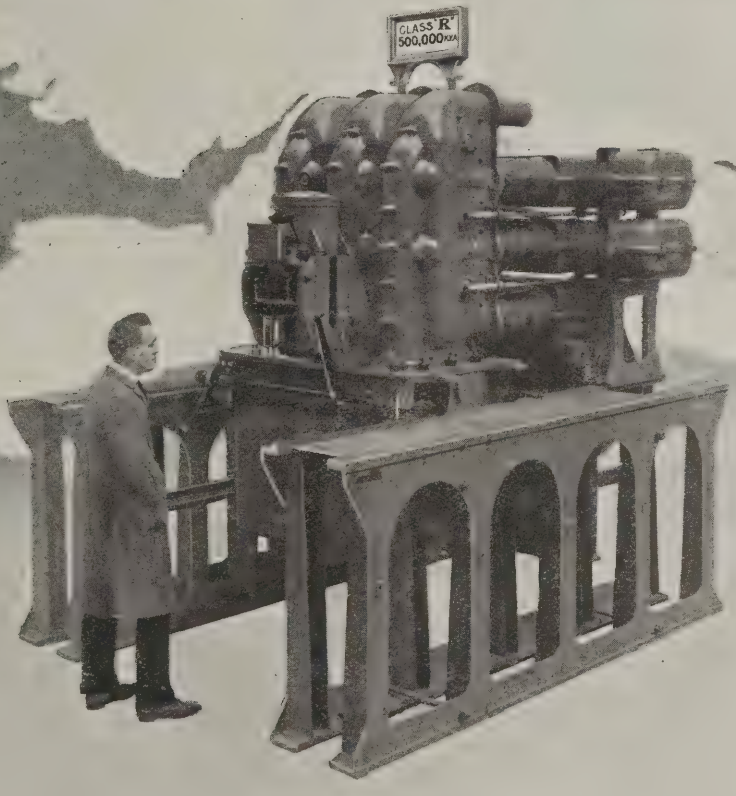
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Above all others

The Switchgear that is BUILT TO LAST and designed to GIVE GOOD SERVICE.

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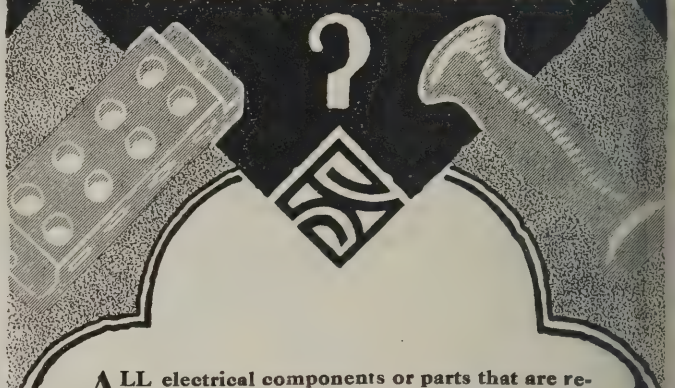
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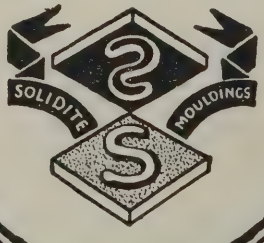
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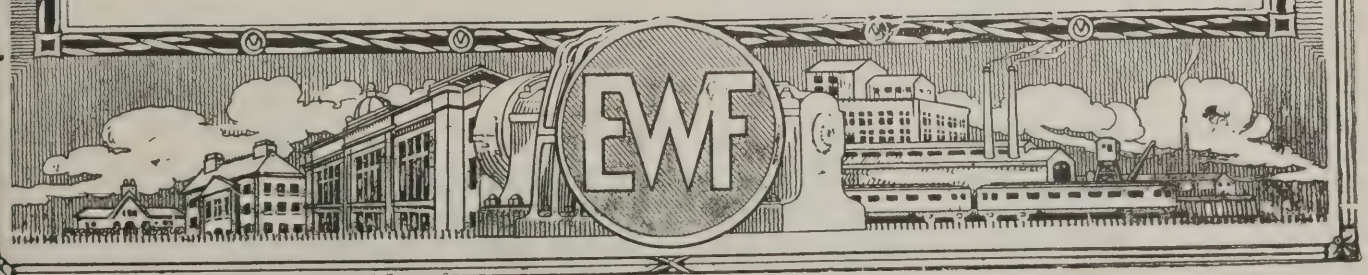
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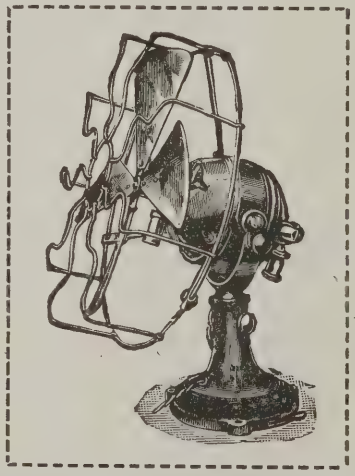
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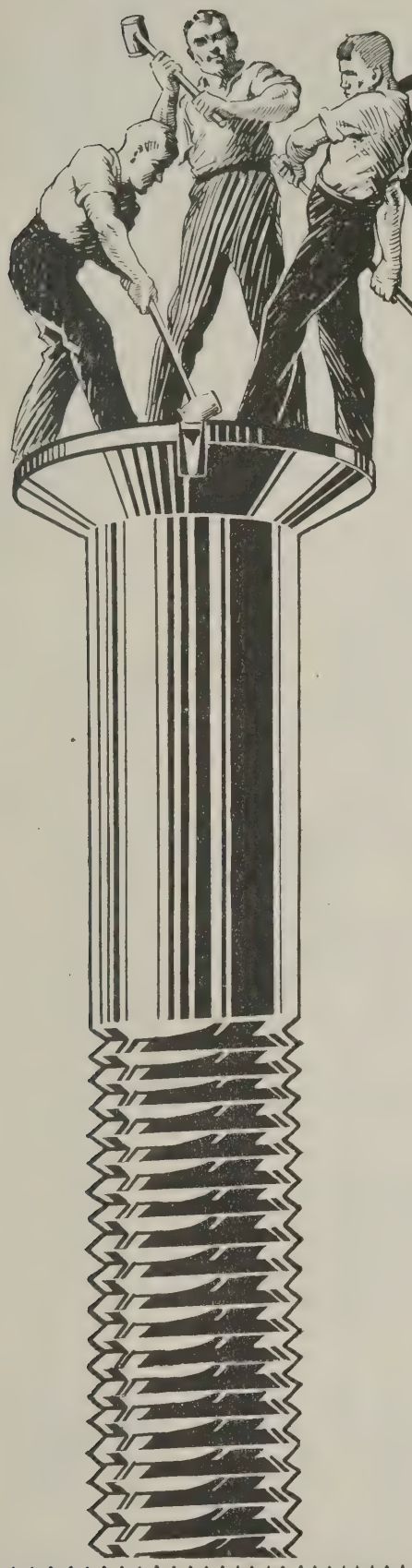
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We agree there are screws *and* screws, and some come jolly near deserving rough measures.

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Large or small get prompt attention.

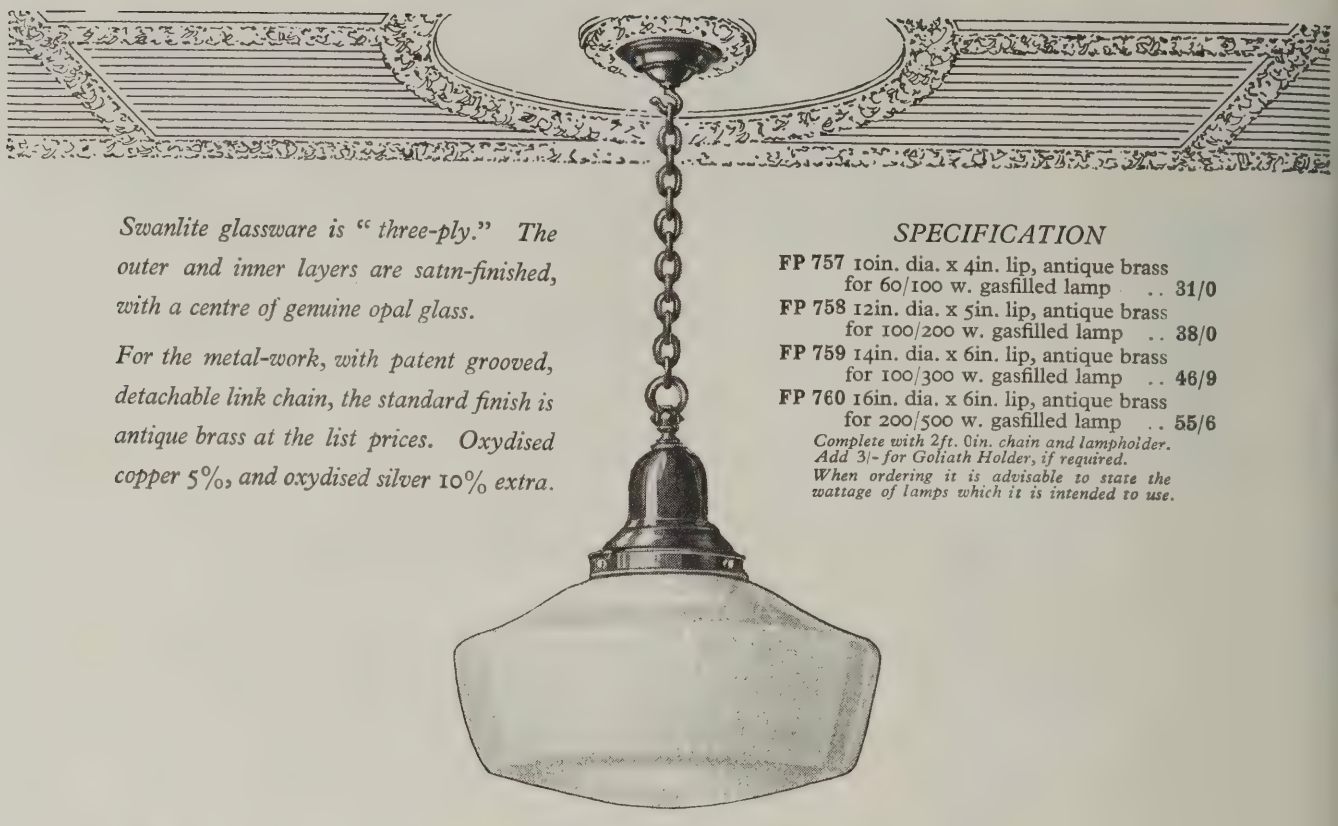
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Complete with 2ft. 0in. chain and lampholder. Add 3/- for Goliath Holder, if required. When ordering it is advisable to state the wattage of lamps which it is intended to use.

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THE DUST-PROOF UNIT

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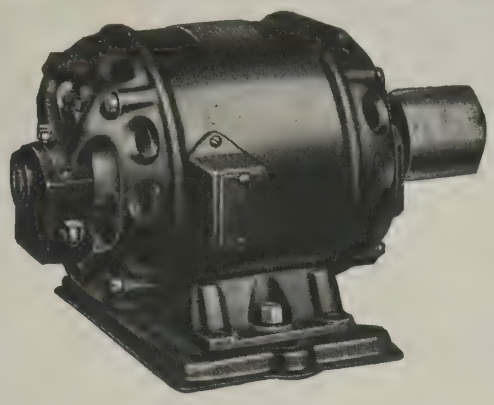
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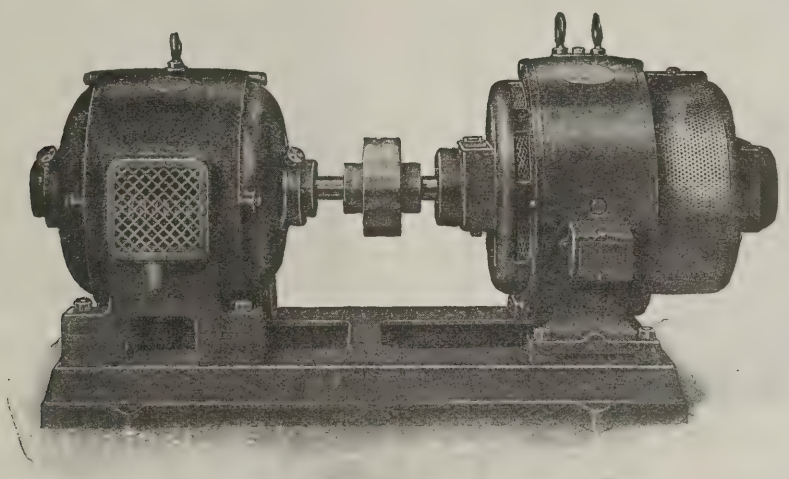
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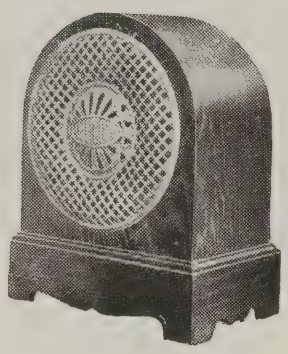
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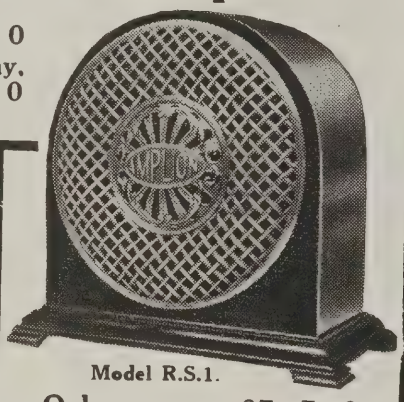
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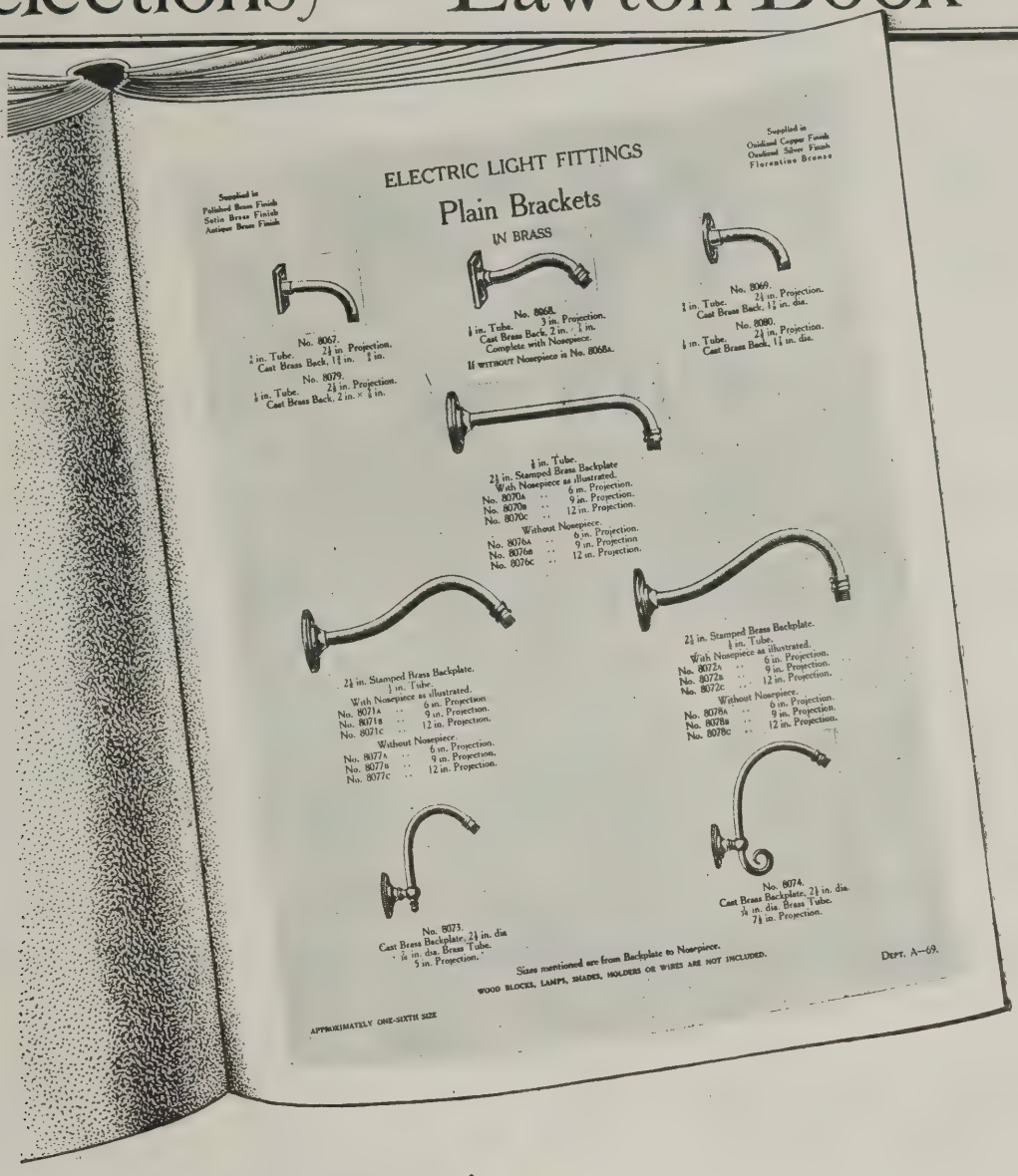
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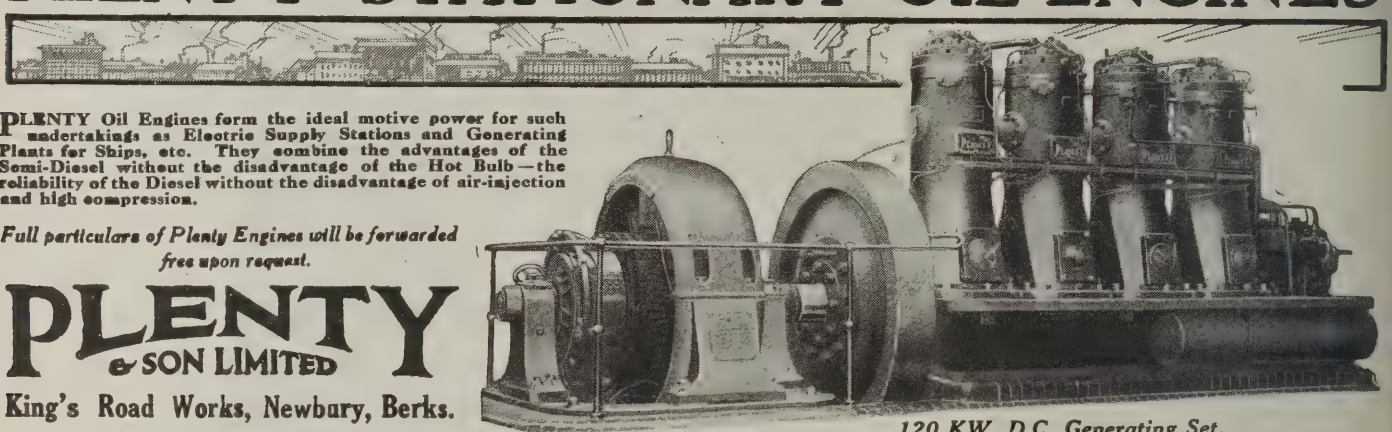
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PLENTY Oil Engines form the ideal motive power for such undertakings as Electric Supply Stations and Generating Plants for Ships, etc. They combine the advantages of the Semi-Diesel without the disadvantage of the Hot Bulb—the reliability of the Diesel without the disadvantage of air-injection and high compression.

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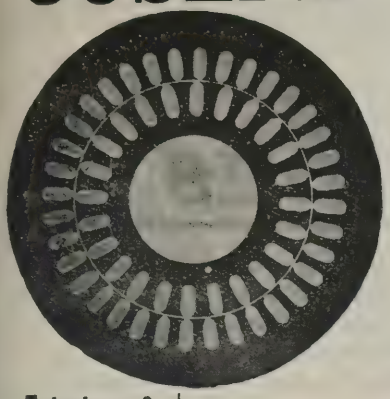
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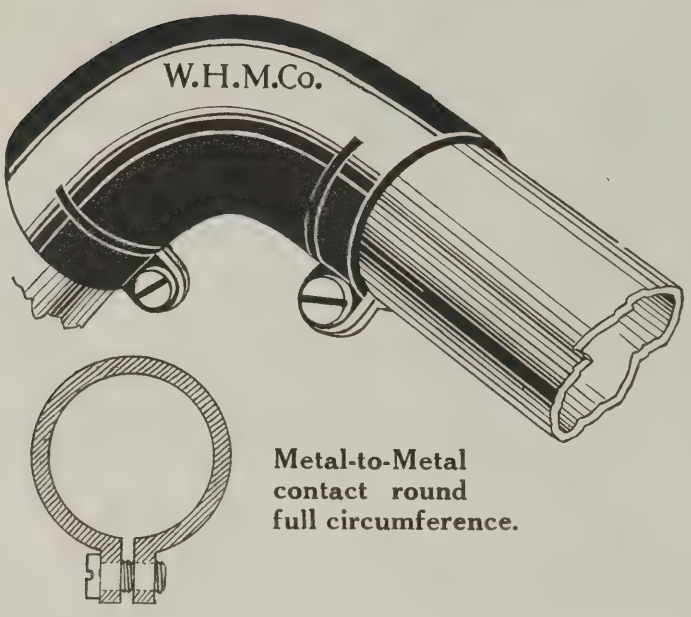
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M.G.P.

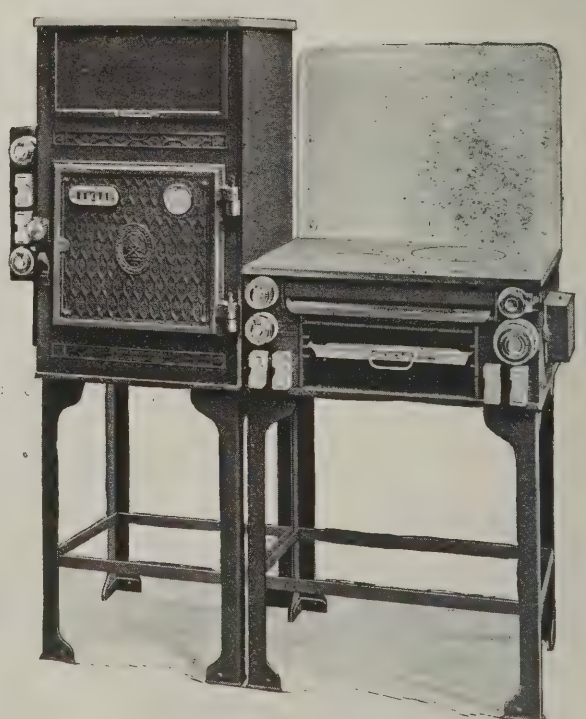
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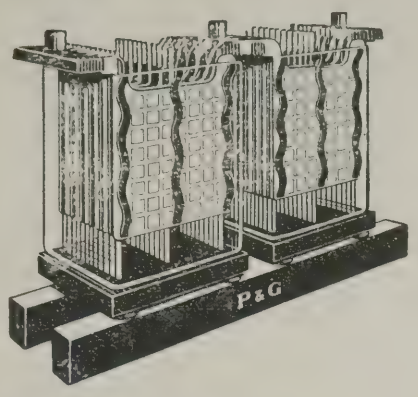
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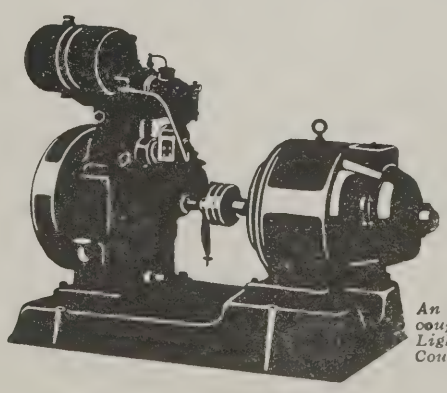
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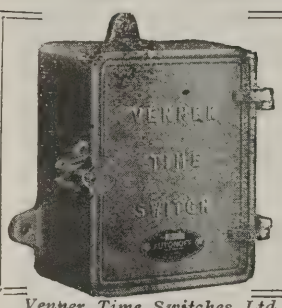
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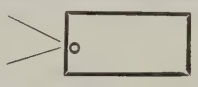
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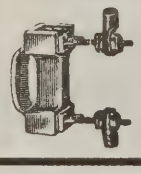
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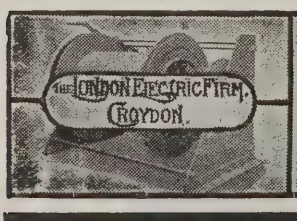


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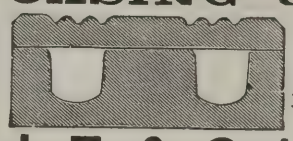


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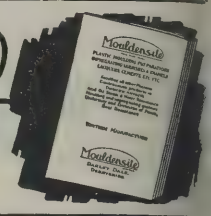
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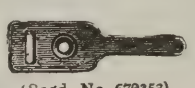
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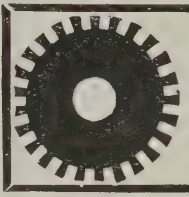
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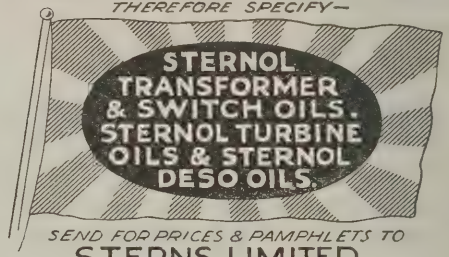
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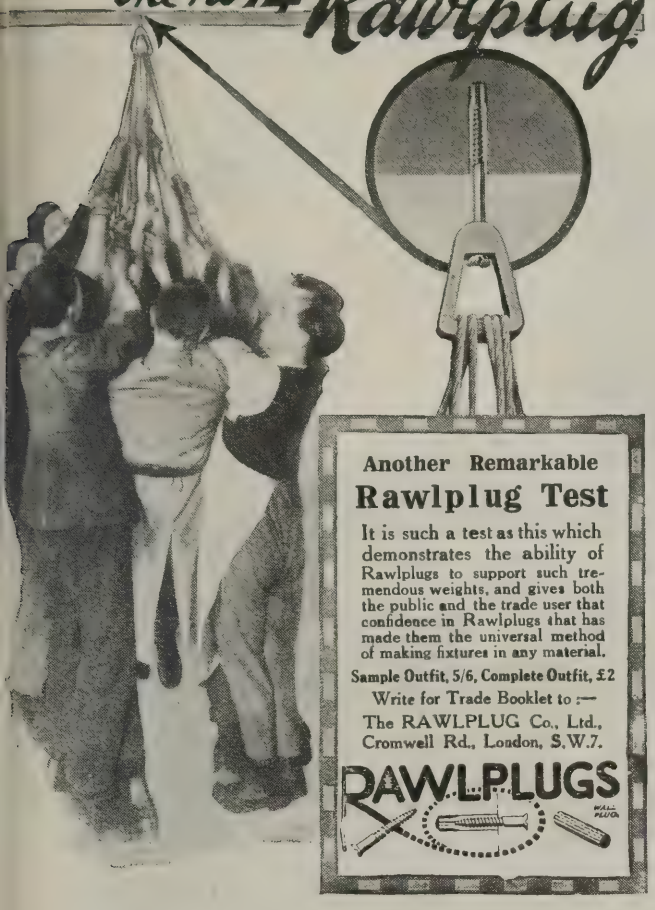
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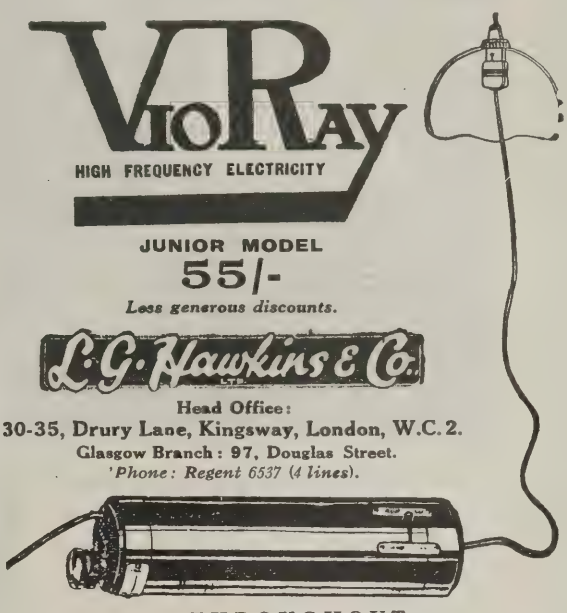


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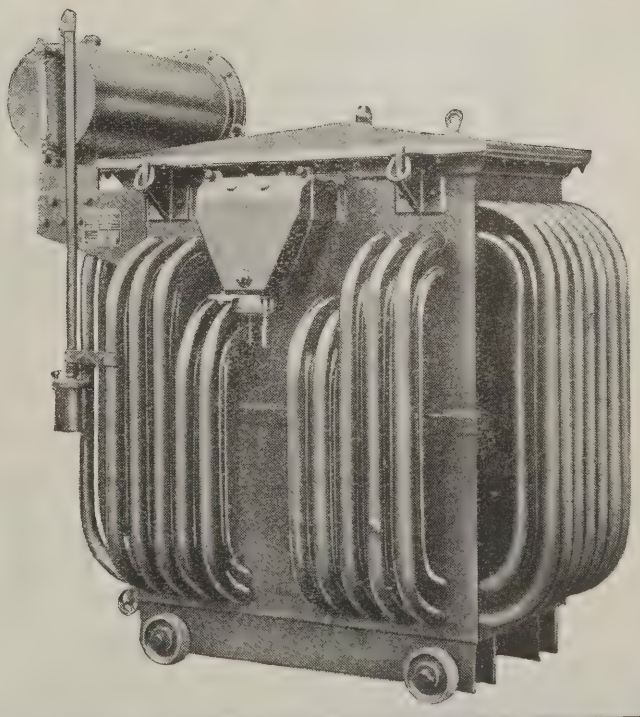
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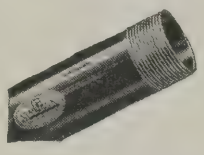
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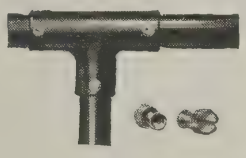
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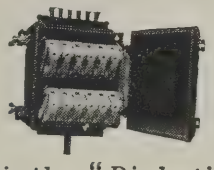
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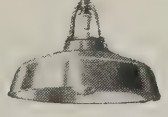
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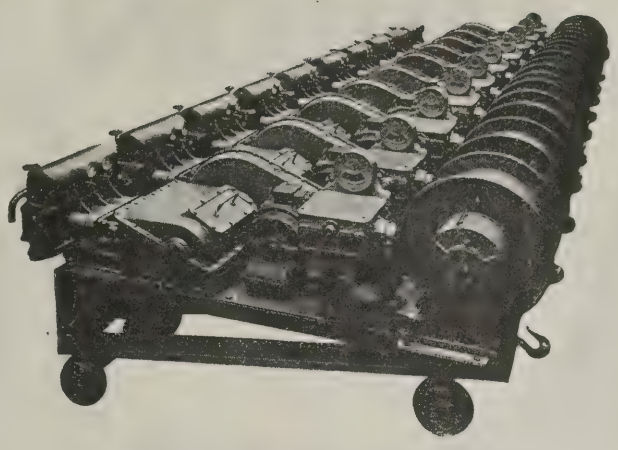
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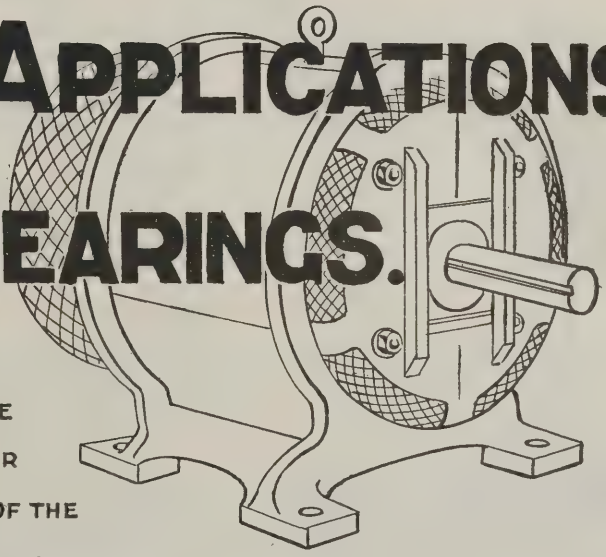
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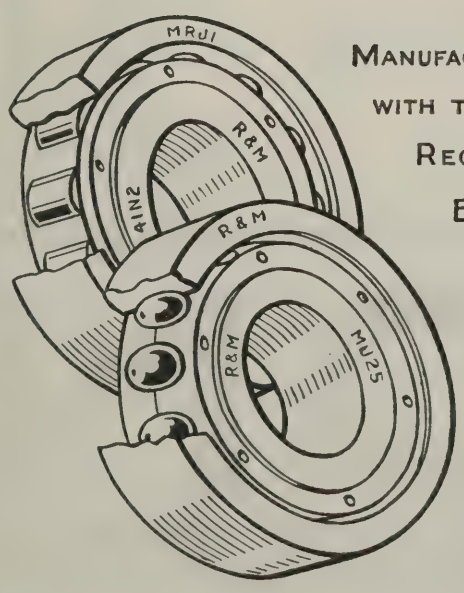
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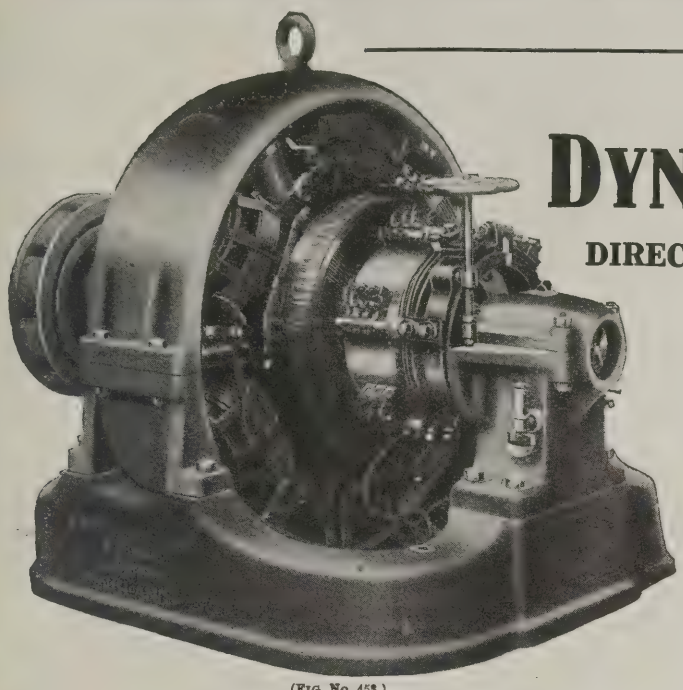
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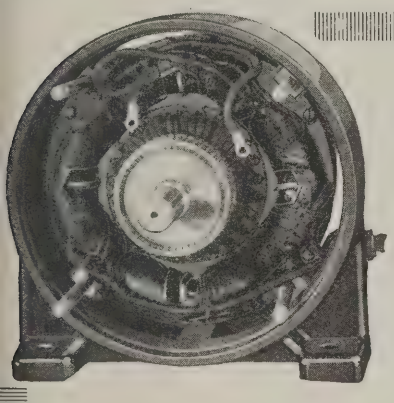
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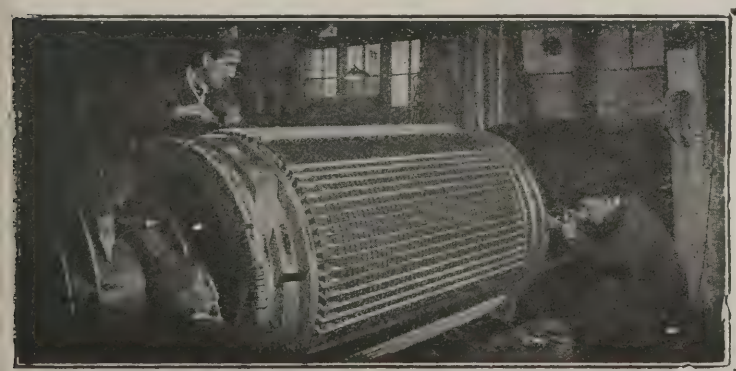
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OBSERVE first of all that D.C. Batwins from 1/8 H.P. upwards are all of FOUR-POLE CONSTRUCTION which provides a balanced magnetic field. It produces better commutation and more even torque than is possible with 2-pole construction usually offered on small motors. Note the laminated pole pieces. The sturdy construction and the careful finish. BATWINS will bear the closest inspection.

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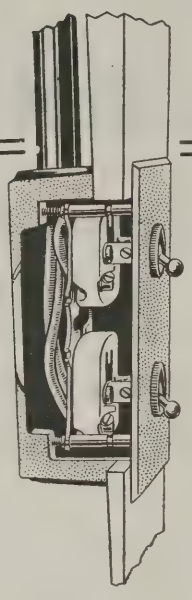
REWINDING OF MOTORS and GENERATORS
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← *(Illustration shows large Rotor under Reconstruction.)*
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ELECTRICAL MAINTENANCE.

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TUCKER TELAC

TUCKER



Adjustment up to $\frac{3}{8}$" Illustration shows Switchplate fixed with rings.

ADJUSTABLE GRID BOXES

FOR USE WITH TUCKER SWITCHES & ACCESSORIES.

TUCKER adjustable grid boxes, illustrated and described in this announcement, contain many features which will prove interesting to Engineers. They are constructed to the Tucker standard of quality throughout, ensuring long and satisfactory service, low erection costs and perfect installations.

SPECIAL FEATURES.

Adjustment up to $\frac{3}{8}$".

All adjusting screws are turned in the same direction—

To the left—to raise, to the right—to lower.

The switchplate is always maintained at the correct distance from the Switches by being held firmly against the head of the adjusting screws which rise and fall with the grid.

The adjusting screws cannot be detached from the grid either before or after the Switches or Accessories are fitted.

The grid consists of a stout steel stamping, galvanized, and is consequently unbreakable and rust-proof. Its quick removal and replacement is assured.

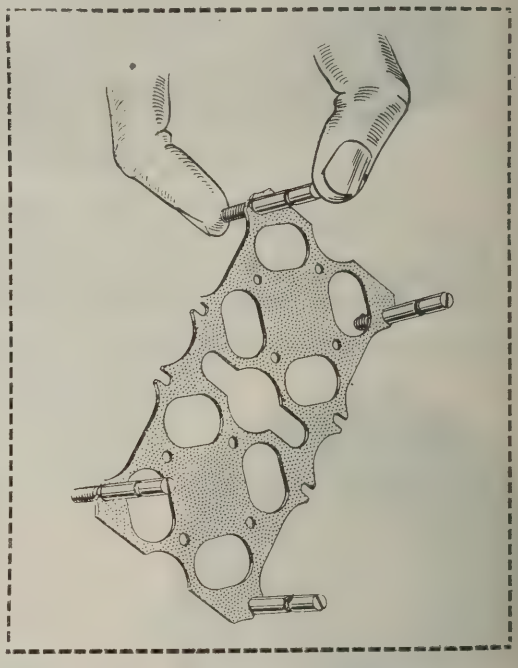


Illustration showing grid removed from box. Adjusting Screws cannot become detached.

CORNER FIXING ARRANGEMENTS.

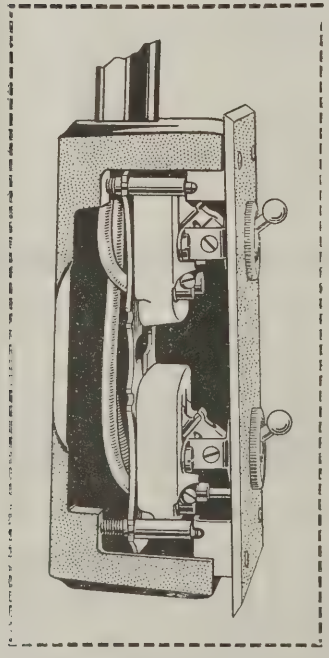


Illustration showing Switchplate fixed with corner fixing screws.

Hitherto, great trouble has been experienced in fixing the switchplate with corner fixing screws owing to the "tilt" of the plate, and the resulting difficulty of engaging screw threads in the tapped holes of the box.

In the Tucker adjustable grid boxes this has been overcome by a special patented feature, whereby the tapped holes to receive the fixing screws are located in brackets attached to the adjusting screws. These brackets are consequently always parallel to the Switchplate, rising and falling with the adjustment.

Descriptive Folder No. S.1, complete with prices, will be gladly sent on request.

J. H. Tucker & Co. Ltd

KINGS RD TYSELEY BIRMINGHAM

BRANCH OFFICES:

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Printed by THE PREMIER LINOTYPE AND PRINTING CO., LTD., 21-26, Dean Street, Fetter Lane E.C.4. and Published by THE ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.



Public lighting connection, showing the spare insulator for a switch wire in the event of street lighting being required.

Special guarding arrangements at Blofield Road. The "cage" consists of bare copper horizontal wires in line with the split neutrals.

A run of poles on the roadside. Note how the poles are tucked away by the gateways.

Lighting Schemes

The illustrations show views of the village lighting and power scheme at Brundall, Norfolk, which serves the parishes of Brundall, Blofield and the surrounding areas.

The Main Cables are laid underground from Norwich, the current being distributed by overhead bare copper wires carried on wooden poles. The length of the main overhead line is about 1½ miles.

Henley's were responsible for the overhead work, transformer house, switchboard, etc., the Consulting Engineer being Mr. G. T. Redgment, of Norwich.

Henley's have unique experience in the electrification of town and country areas and are able to carry out schemes of any magnitude—overhead or underground.

HENLEY CABLES and overhead lines

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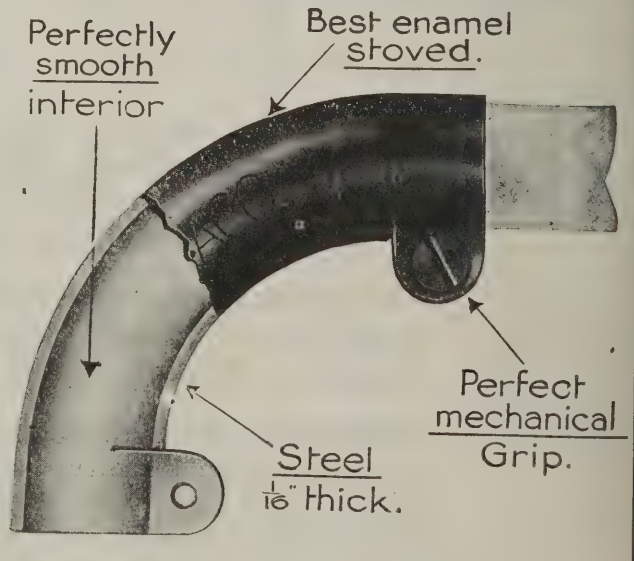
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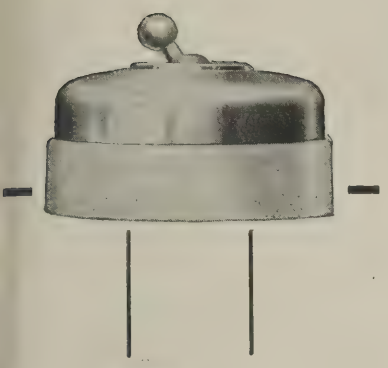


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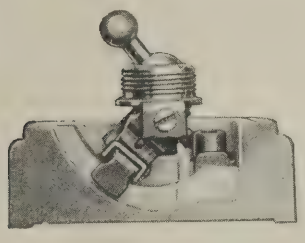
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TUCKER TELAC









Why

THE TUCKER B4000

is

SOUND

ELECTRICALLY *AND* MECHANICALLY

COMPLETE POSITIVE ACTION

It will be seen from the illustration that the contact arm is *positively* and *mechanically* controllable throughout its entire stroke, by the movement of the "dolly" and is not fundamentally dependent on the spring, which is therefore called upon to act in the proper capacity of a spring, i.e., as an accelerator and not as a prime mover.

EXCEPTIONALLY LONG BREAK

The load breaking abilities are exceptional —the "break" being longer than in any switch of a similar type.

The standard 5 ampere single pole switch has successfully dealt with a load of 33 amps. at 250 volts, and with its normal rated current of 5 amps. at 525 volts,

on independent tests.

HIGH INSULATION VALUE

15 AMPERE SIZE.

Otherwise of the same general design and construction as the 5 ampere size the 15 amp. is fitted with and the actual contact arm mounted upon a solid insulator of Mica and Steatite—giving a very high insulation value.

J. N. Tucker & Co. Ltd

KINGS Rd TYSELEY BIRMINGHAM

CONTRACTORS' COLUMN.

(These particulars of new building schemes are published for the use of contractors and others in search of possible electrical business. Every care is taken by our correspondents to ensure accuracy; if alleged errors are reported to the Editors they will be fully investigated.)

ASHBY-DE-LA-ZOUCH.—Additional 40 houses, for the R.D.C.; surveyor.

AUDENSHAW (Manchester).—Re-erection of hat works, Stamford Road, for Robert Fox & Co.

BARGOED.—Re-erection of by-product plant, for the Powell Duffryn Steam Coal Co., Ltd. (£20,000).

BARNSLEY.—68 houses, Carlton site; Clarke & Squire. New hotel, Cliffe Cross; Barnsley Brewery Co. Housing scheme, Worsborough site; borough engineer.

BEDDINGTON AND WALLINGTON.—Housing scheme (40), Beddington Corner, for the U.D.C.; surveyor.

BEDWAS.—Housing scheme (40), Machen, for the U.D.C.; Idris Leyshon, architect.

BIGGLESWADE (Beds.).—Housing scheme (90), for the U.D.C.; T. R. Howitt, surveyor.

BIRKENHEAD.—Kinema, Bidston Avenue; T. T. Rees, architect. Housing scheme (22), for the T.C.; Charles Brownridge, borough engineer.

BLANTYRE.—Child welfare centre and health institute, with electrical work, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

BOURNEMOUTH.—Church, Wooton Gardens; trustees. Shops, offices and bank, Wimborne Road; H. C. Barnes. Fire station, Wimborne Road; borough engineer.

BRADFORD.—12 combined shops and houses at No. 3 Bradford Moor housing scheme; city architect.

BRENTWOOD.—Girls' high school, with electrical work, for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

BROMLEY (Kent).—Administrative block, isolation hospital, for the Bromley and Beckenham Joint Hospital Board; A. B. Coomber, clerk

BUSHBURY (Staffs.).—Works, Fordhouses, for the Uniflo Pump Co.

CAERPHILLY.—Housing scheme (48), Nantgarw, for the U.D.C.; B. Jenkins, housing officer.

CALDAY GRANGE.—Schools (£22,625), for Cheshire E.C.; F. A. Browne, county architect, Chester.

CANNOCK.—Additional 58 houses, St. John's estate, for the U.D.C.; S. Harrison, architect.

CARLISLE.—Estate scheme, Upperby Road; Harrison Bros.

CLARKSTON.—Secondary school; Renfrewshire Education Authority.

COVENTRY.—Residential school, Corley, for the borough E.C.; F. Smith, clerk.

CROMPTON (Lancs.).—Additional 48 houses, for the U.D.C.; surveyor.

DONCASTER.—Premises and showrooms, for C. H. Pickles, Ltd., Leeds; Hustler & Taylor, architects, Pontefract.

DORCHESTER.—26 houses; C. W. Pike, for Corporation.

DOUGLAS.—Extensions, mental hospital, for the Isle of Man Asylums Board; J. E. Teare, architect, 46, Athol Street.

DUMFRIES.—Housing scheme (98), Cresswell, for the T.C.; John Barker, burgh surveyor.

EAST KILBRIDE.—School extensions, Hairmyres Colony, with electrical work, for Lanarkshire E.C.; P. C. Smith, District Offices, Hamilton.

ECCLES.—Housing scheme (68), Edison Road, Patricroft, for the T.C.; borough surveyor.

EDINBURGH.—New mining school (£23,500); clerk, George Heriot's Trust, Edinburgh.

ELY.—Housing scheme (50), for the R.D.C.; H. F. Wykes, architect, Downham Road.

ETON.—Houses (50), for the U.D.C.; Lacey & Sons, builders.

EXETER.—Houses (114), for staffs, for Devon C.C.; county architect.

FARINGDON.—Girls' schools, for Berkshire E.C.; W. C. F. Anderson, secretary, Shire Hall, Reading.

FARNBOROUGH (Hants.).—Kinema, Camp Road, with electrical work, for Charles Darby; Robert A. Briggs, architect, Shripney, Bognor, Sussex. Business premises, Alexandra Road, for Oakey & Sons.

FIFESHIRE.—Reconstruction of Newburgh railway station, for L. & N.E. Railway Co., after fire; engineer, Edinburgh.

GILLINGHAM (Kent).—Housing scheme (44), Woodlands site, for the T.C.; borough surveyor.

GLASGOW.—Building in David Street, Mile End; Roman Catholic Church trustees. Picture house at Kilmarnock Road; Albert E. Pickard, theatre proprietor, 101, Trongate. Housing scheme at Tollcross (£40,500), for Corporation; city architect. Church hall in Anderston, for Cranstonhill U.F. Church; the minister.

HARROGATE.—Additional 50 houses, for the T.C.; borough surveyor.

HASTINGS.—Hotel, restaurant, shops, &c., White Rock, for Palace Chambers (Hastings), Ltd.; S. H. Burdwood, architect, 80, George Street, Portman Square, London, W.

HATFIELD (Herts.).—Electric light installation, Parish Church; Parochial Council secretary.

HITCHIN (Herts.).—Housing scheme (70), West Mill Lane site, for the U.D.C.; surveyor.

HOUGHTON-LE-SPRING (Co. Durham).—Additional housing scheme (26), for the U.D.C.; surveyor.

INVERNESS.—Alterations (£3,600), for Woolworth & Co., Ltd.; the manager.

KNARESBOROUGH.—20 houses, for U.D.C., Stockwell Road; S. Blenkhorn, architect, Bondend.

LONDON (Camden Town, N.W.).—Rebuilding "Gipsy Queen," Malden Road; licensee.

(Bermondsey, S.E.).—Rebuilding shops, 188-194, Southwark Park Road, and 145, St. James's Road; Leighton & Higgs.

(Camberwell, S.E.).—Flats on site off Champion Park; R. W. K. Goddard.

(Eltham, S.E.).—Additional 500 houses, Well Hall, for Woolwich T.C.; borough surveyor. Schools, Well Hall estate, for the London Education Committee.

LONDON—*continued*.

(Woolwich, S.E.).—500 houses, Eltham; borough engineer.

(Fulham, S.W.).—Buildings, corner of Broughton Road and Bulow Road; Loud & Western, Ltd.

(East Ham, E.).—38 garages, Flanders Road; S. H. Anstead. Extensions, electricity works, Elizabeth Road; Dawson, Son and Allerdyce. Store, High Street Market; L. G. Elkins. Forty houses, Central site; borough engineer. 30 houses, Central Park Road; F. Hamlett. 44 houses, Charlemont Road; R. Cheke and Co. (Wanstead), Ltd.

LUTON.—Shops and showrooms, George Street; Hillier, Parker, May and Rowden. Ten houses and shops, Dunstable Road, for J. Frost.

LYE.—Additional 52 houses, Brook Crescent estate, for the U.D.C.; H. E. Folkes, surveyor.

LYTHAM-ST. ANNES.—Girls' secondary school, for the governors of Lytham School Charities; the clerk.

MACCLESFIELD.—Board room and offices (£4,600), for the R.D.C.; G. Clayton, architect.

MANCHESTER.—New Masonic temple; R. V. Clayton, 2, Cooper Street.

MERTHYR TYDFIL.—Additional 52 houses, Heolgerrig, for the T.C.; borough architect.

NEWCASTLE.—26 houses, Wharrier estate. 34 houses, Walker estate; G. G. Carr. 230 houses, Walker estate; H. Kelly (Contractor), Ltd.

NORTHAMPTON.—Electric lighting installation, Clare Street headquarters, for Northants. Territorial Army Association; Major J. A. C. Wetherall, secretary.

NORTON (Yorks.).—Schools, for West Riding E.C.; F. A. Darwin, clerk, County Hall, Wakefield.

OTLEY.—Extensions, Atlas Works; Dawson, Payne & Elliott. 56 U.D.C. houses, Harefield estate; Council surveyor, North Parade.

PAISLEY.—New premises for Paisley Savings Bank; the manager. Dance hall, tea lounge, &c., for Paisley Plaza, Ltd., 114, West Campbell Street, Glasgow; the secretary.

PETERBOROUGH.—Headquarters, for the Northants. Territorial Army Association; J. W. Fisher, architect, Burystead Place, Wellingborough.

PLYMOUTH.—44 garages, showrooms, workshops, &c., Stuart Road, Penny Comequick; W. Reed. Estate scheme, Lower Compton; H. J. Hammick.

PONTEFRACT.—New hotel at Upton, for Wm. Pickersgill & Co., Ltd.; Garside & Pennington, architects, Ropergate.

POOLE.—Garden village scheme, Wallis Down, for a local syndicate; particulars from the Mayor, Alderman H. S. Carter.

RICHMOND-ON-THAMES.—Housing scheme (63), Manor Road estate, for the T.C.; borough engineer. Extensions to Greyhound Hotel; Brewer, Smith & Brewer, architects.

ROMFORD.—Houses (20), Pettits Lane, for H. J. Finch. Houses (18), Collier Row Lane, for Limbert & Walker.

RUNCORN.—Houses (21), Cornwall Street, for W. H. Davey & Co., Ltd.

RYHOPE (Co. Durham).—Extensions to Parish Church (£4,300); Hicks and Charlewood, architects, Newcastle-on-Tyne; A. Pringle, Ltd., builders, Gateshead.

SALFORD.—Secondary schools (£25,000), Weaste Lane, Pendleton, for the De la Salle Roman Catholic College; the principal.

SHANKLIN (Isle of Wight).—Municipal offices, for the T.C.; E. C. Cooper, architect, Post Office Chambers.

SOUTHAMPTON.—Extensions to University College, for the Council; the registrar.

SOWERBY.—Extensions to New Road schools (£5,000), for West Riding E.C.; Director of Education, County Hall, Wakefield.

SPALDING.—Kinema; Percy L. Brown & Son, architects, Newcastle-on-Tyne.

STAFFORD.—Housing scheme (52), Tithe Barn estate, for the T.C.; W. Plant, borough engineer.

STARCROSS.—Colony for defectives; Plymouth Corporation and joint authorities.

STORNOWAY.—Reconstruction of municipal buildings and library, for the T.C.; J. G. Chisholm, architect, 15, Union Street, Inverness.

STRETFORD.—Church, for St. Cuthbert's, Third Avenue; Robert Martin, architect. Dance hall, Chester Road; J. Hayes. 38 houses, off Barton Road; J. W. Maunders. Baths, Trafford Park; U.D.C. surveyor. Proposed 340 houses, Trafford estate; U.D.C. surveyor.

STUBBINS (Ramsbottom).—New St. Philip's Church; Robert Martin, architect, Deansgate, Manchester; Leonard Clough, Ltd., builders, Adlington, Chorley.

SWANSEA.—Church hall, Cwm Level Road, Landore; Rev. T. Harrington. Additions, Horeb Congregational Church, Morriston; trustees. Estate development, Trigwl Farm, St. Thomas; E. R. Griffiths, architect for Grenfell Estate Co. Remodelling old Waverley Hotel premises, Cradock Street; Blewitt, Jenkins & Son. Public utility housing scheme, Waunwen Road; Church Army Housing, Ltd. 150 houses, Maesteg; J. & F. Weaver. Police station, Llansamlet; John Goodridge & Son, Neath.

TUNBRIDGE WELLS.—Extensions, General Hospital (£80,000), for the governors; secretary.

WAKEFIELD.—Additions to Clayton Hospital; W. H. Watson, architect, Barstow Square, Wakefield.

WINCHESTER.—Housing scheme (68), for the R.D.C.; Haynes, Johnson and Ebbs, architects, 95, High Street.

WINTON (Manchester).—New St. Michael's Church; R. Martin, architect; Ginger, Lee & Co., builders, Longsight, Manchester.

WORTHING.—Development of Findon Valley estate, for the Findon Valley (Worthing) Estate Co., Ltd.; J. H. Gray, managing director, 15, Harringay Park, Crouch End, London, N.8.

Square Trimmed in Original Cases or Selected to Specified Sizes. • Cut Exact to Patterns for Commutator Segments, Condenser Plates, Heater Elements and Insulators, Washers, Discs, &c. • Slab in all Electrical Qualities. Splittings in All Grades.

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IMPORTANT ANNOUNCEMENT

by the

CABLE MAKERS' ASSOCIATION.

The term **"Non-Association"** was introduced by the Cable Makers' Association in 1905 to distinguish cables of the second quality from the **"Association Grade"** (first quality) Cables of its members. For some time it has been urged upon the C.M.A. that the description is being applied by manufacturers at Home and Abroad who are not members of the Association, to their own cables, which are sometimes of inferior quality. This has caused confusion and possible loss to buyers of electric cables, and it is felt that some definite distinction is necessary.

Buyers of Electric cables will, therefore, be glad to know that the Registrar of Trade Marks has recently registered in the name of the **Cable Makers' Association,** as a new Trade Mark the word

NONAZO

Registered No. 458865.

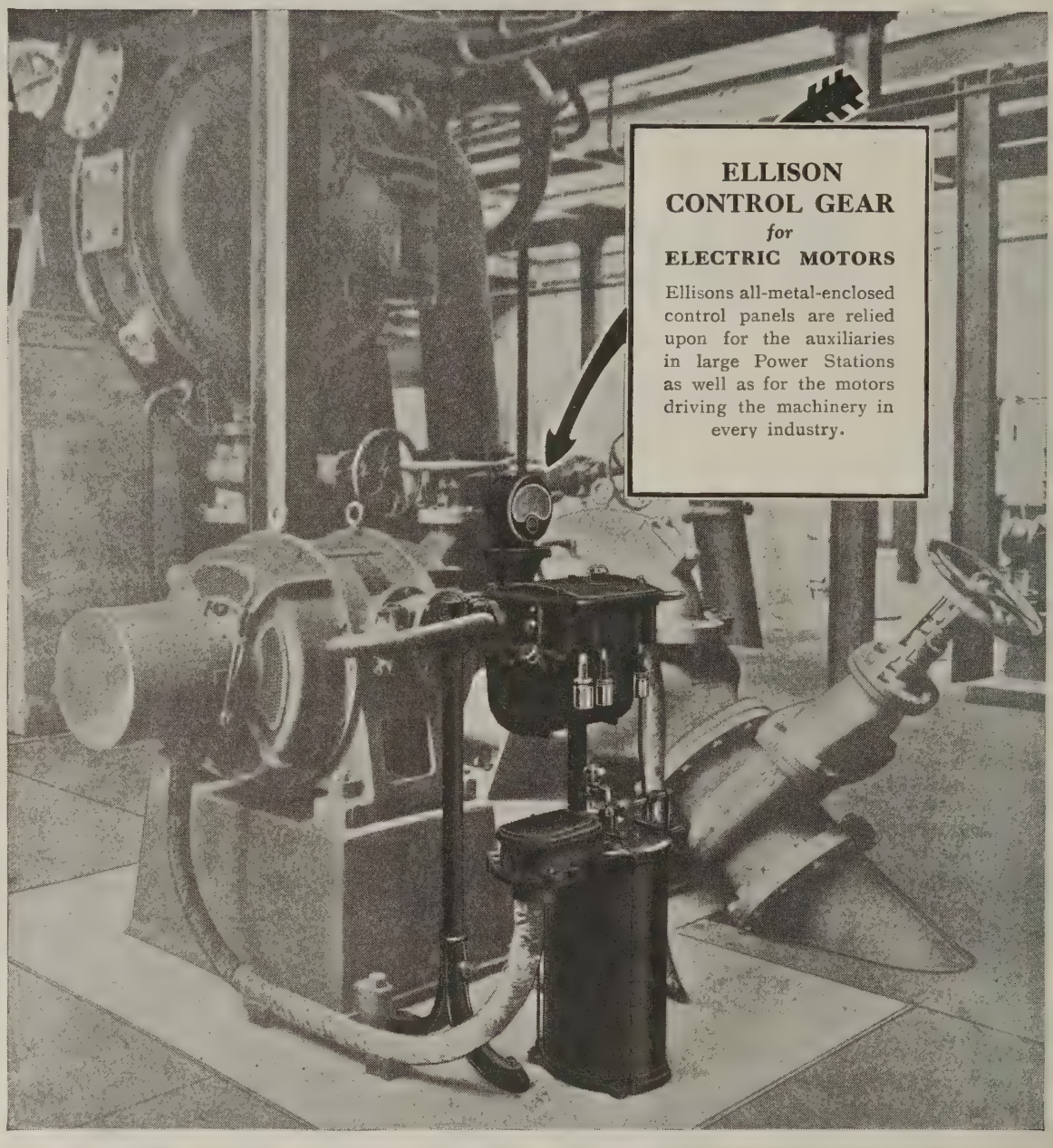
After March 31st, 1926, this registered Trade Mark will be introduced on the labels of "Non-Association" Class Cable made by all members of the Cable Makers' Association.



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British Insulated Cables Ltd.
Callender's Cable and Construction Co., Ltd.
The Craigpark Electric Cable Co., Ltd.
The Enfield Cable Works, Ltd.
The Greengate and Irwell Rubber Co., Ltd.
W. T. Glover & Co., Ltd.
W. T. Henley's Telegraph Works Co., Ltd.
The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
Johnson & Phillips, Ltd.
Liverpool Electric Cable Co., Ltd.
The London Electric Wire Co. and Smiths, Ltd.
The Macintosh Cable Co., Ltd.
Pirelli-General Cable Works, Ltd.
St. Helens Cable and Rubber Co., Ltd.
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Works: **PERRY BARR, BIRMINGHAM.**

Makers of

Metalclad Switchgear for Sub-stations

(High and Low Pressure)

Control Gear for

Slip-ring and Squirrel-Cage A.C. Motors, Circuit Breakers, Controllers and Limit Switches, D.C. Magnets, Plug and Socket Connectors, etc.

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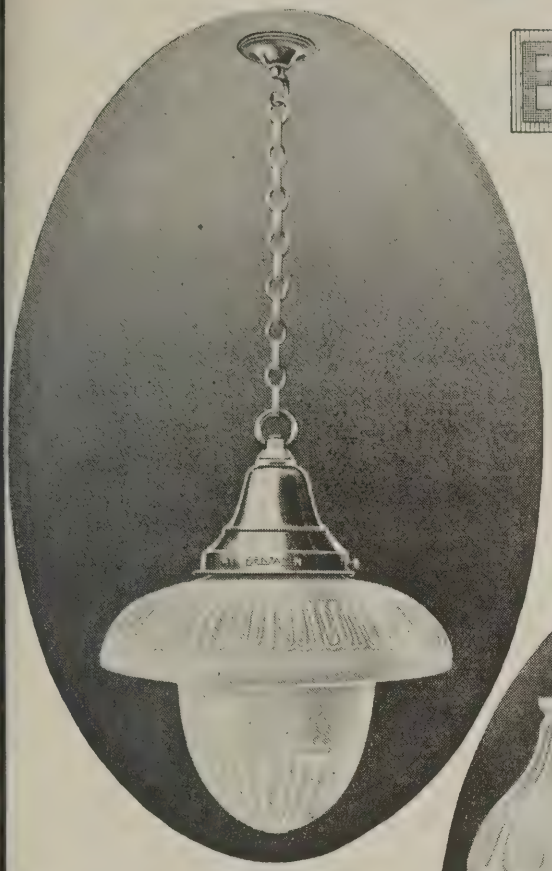
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BENCOLITES

make good lighting better

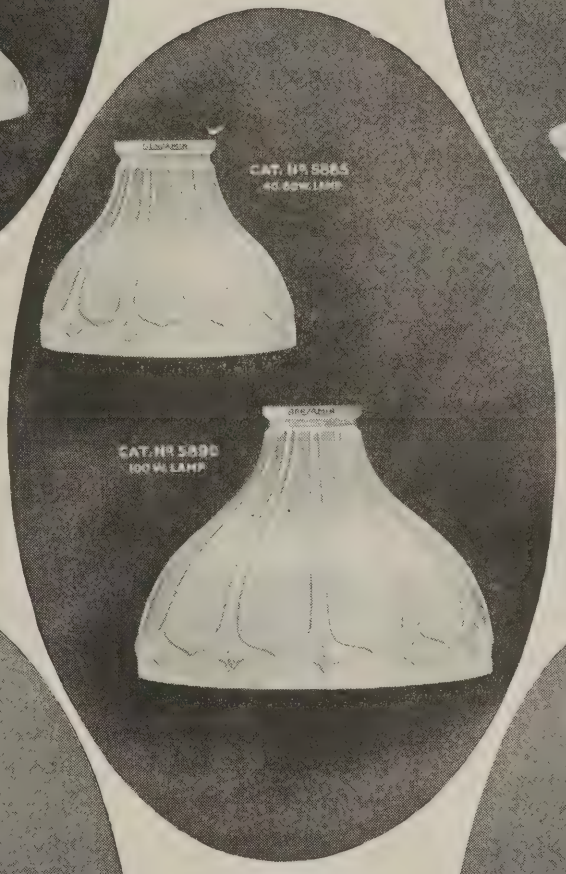
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BENCOLITE UNITS combine scientific design and attractive appearance. Ideal fittings for all commercial installations.



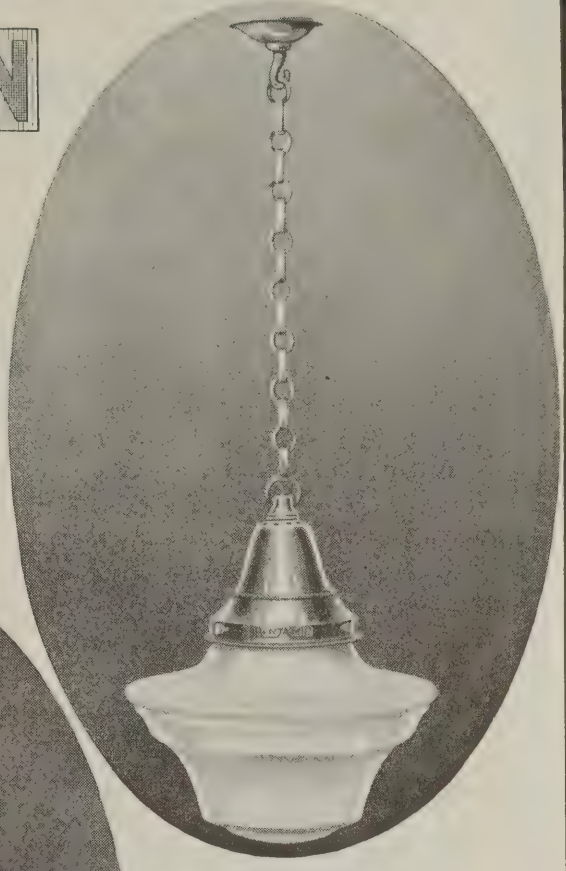
DESIGN "B."

60 w. - - - - - **42/-**
100 w. - - - - - **57/6**
200 w. - - - - - **84/-**
300/500 w. - - - **105/-**



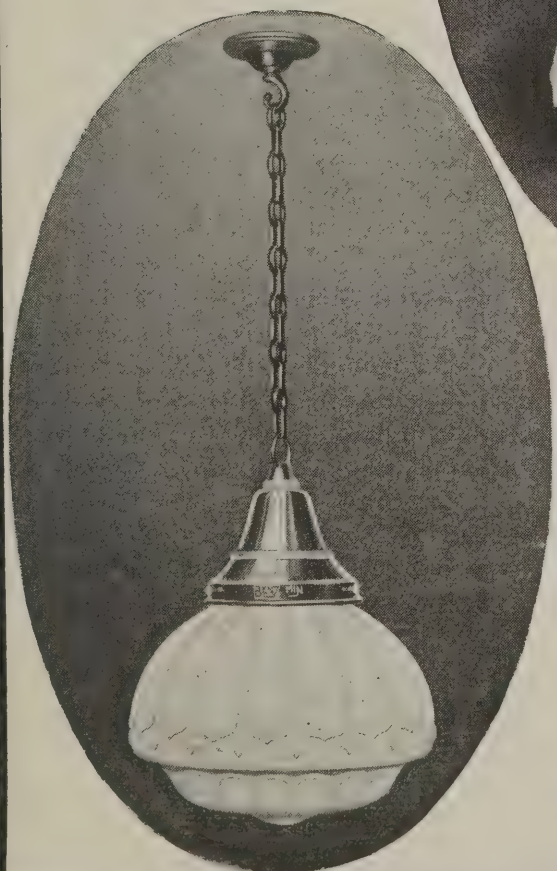
DESIGN "D."

40/60 w. - - - - - - **3/-**
100 w. - - - - - - **5/-**



DESIGN "C."

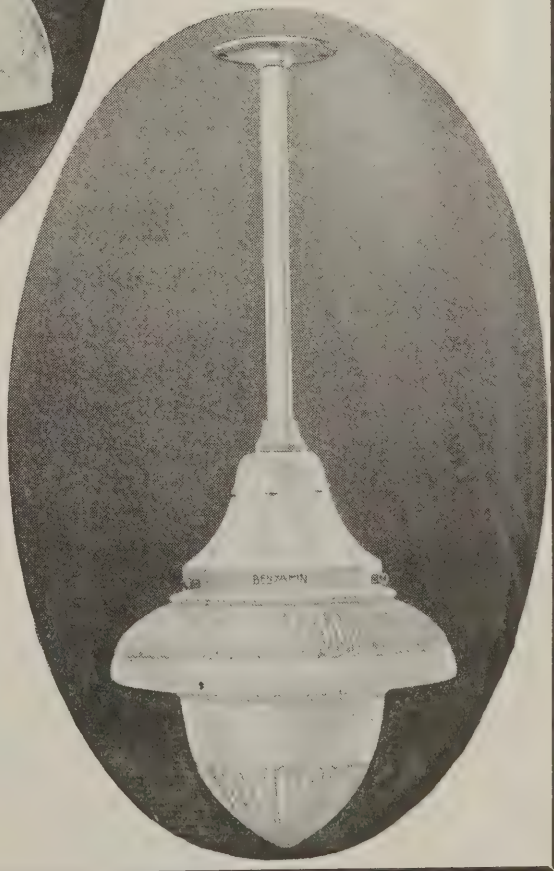
60 w. - - - - - - **25/-**
100/200 w. - - - **35/-**
300/500 w. - - - **55/-**



(Left)

DESIGN "A."

60 w. - - - - - - **21/-**
100/200 w. - - - - **30/-**
300/500 w. - - - - **40/-**



(Right)

Showing all-white rigid suspension. Accommodates design A, B, or C glassware. *Prices as standard finish.*

Advert. of THE BENJAMIN ELECTRIC, LTD., BRANTWOOD WORKS, TOTTENHAM, LONDON, N. 17.

RECORD

SWITCHBOARD INSTRUMENTS.

NEW MODEL

MOVING IRON AMMETERS & VOLTMETERS



Sizes: 4", 6" and 8" Dial.
Scales: Equal to the Dial Diameter.

Special Features:—

'XTRA SCALE LENGTH.

Equal to the dial diameter.
Easy to read.

'XTRA DAMPED.

Equal to Moving Coil Type.
Easy to read on fluctuating load.

'XTRA ACCURACY & FINISH.

Enhances the appearance of all Switchboards.

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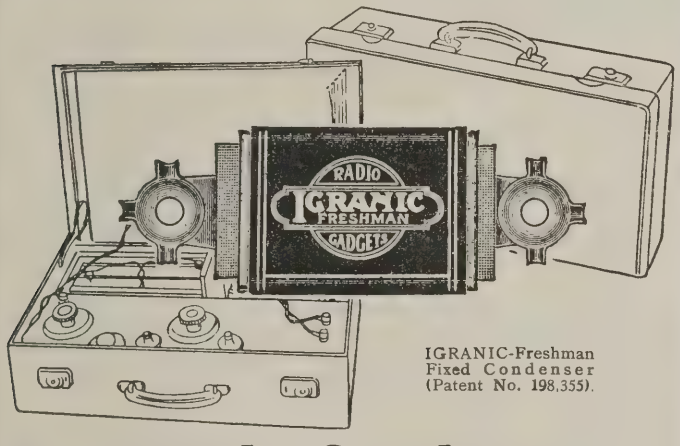
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The Igranic-Freshman is a *fixed* condenser in the truest sense. No matter what the climatic conditions may be, its capacity will always be within 5% of nominal value. This is a strong selling point during Summer-time when sets go into the open air. The method of assembling the Igranic-Freshman Fixed Condenser rigorously excludes moisture and dust, and prevents the losses which result in indifferent reception when unreliable fixed condensers are used. Nine capacities are available, the smaller ones retailing at **2/-** each, and the larger at **2/6.**

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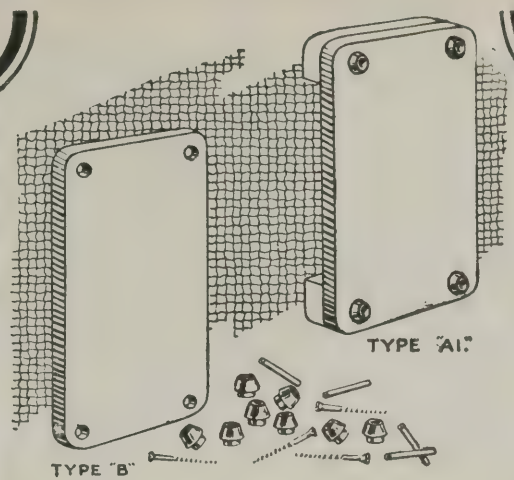
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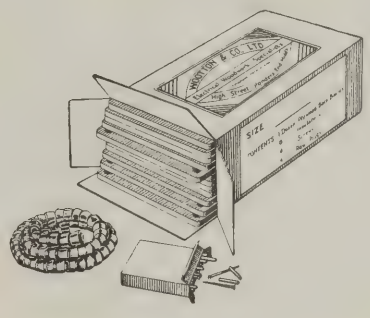
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First quality 12½" m/m 7-ply Birch (approx. ½" thick), Two 2" × ⅞" Yellow Deal Battens, screwed on back on shortest side. Varnished ALL OVER two coats best Shellac; front finished French polish.

Type "B." Plywood.

First quality 12½" m/m 7-ply Birch (approx. ½" thick), round corners, varnished ALL OVER two coats best Shellac. No battens; each board supplied with eight Porcelain Insulators, four 2¼" × No. 10, Iron Screws, and four 1½" Rawlplugs to suit.

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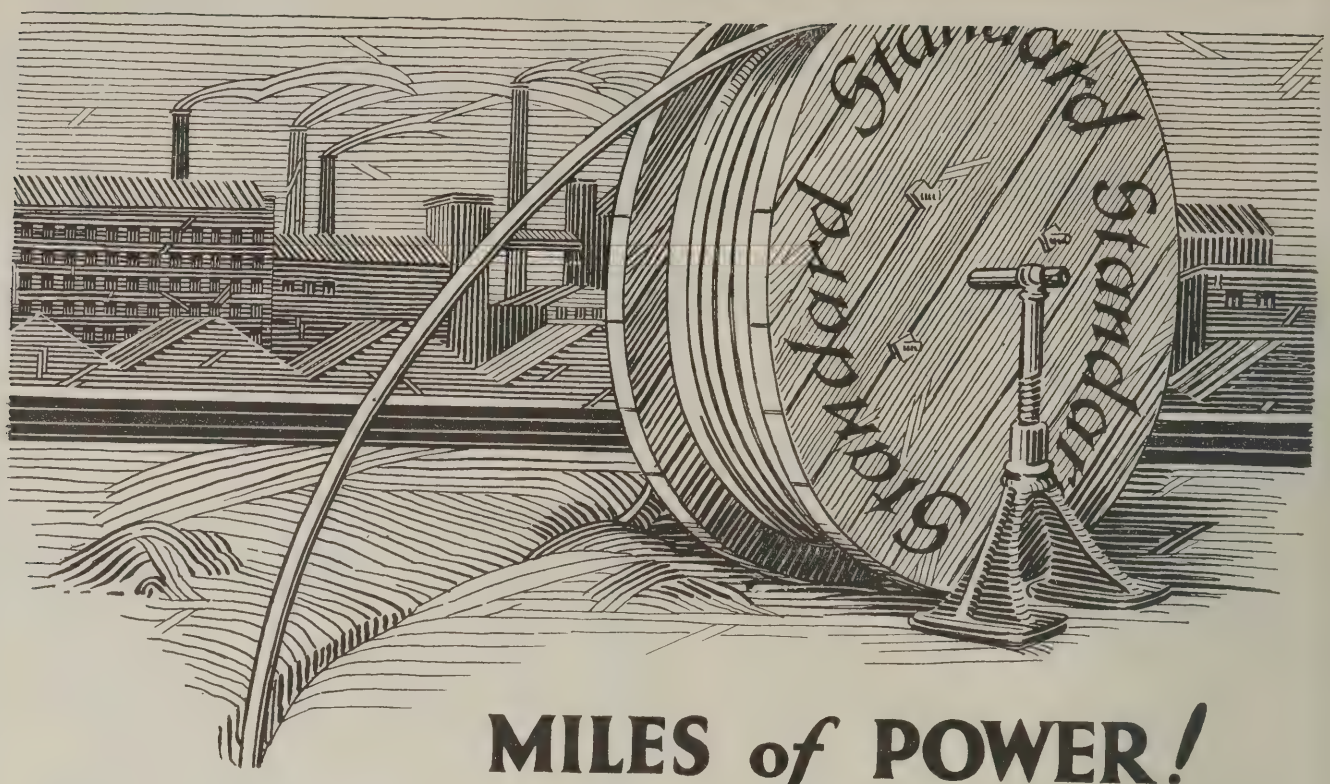


Type "B" Meter Board is supplied in Millboard Cartons convenient to stock and ready for use. Each carton contains: 12 Plywood Backboards (½" thick), each board protected by greaseproof paper. 96 Porcelain Insulators, 48 screws, 48 Rawplugs.

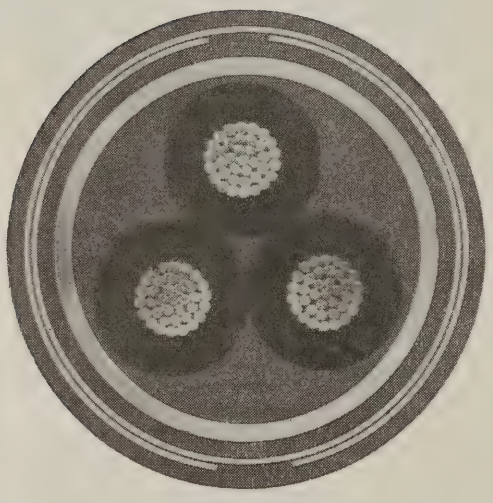
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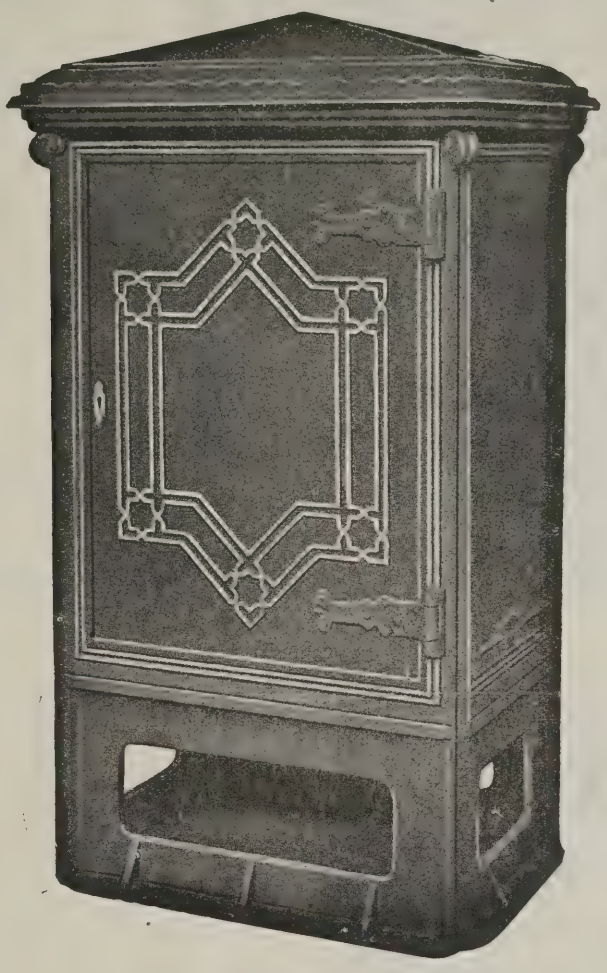
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Feeder Pillar Casings.

N.B.

Please give us your enquiries for odd sizes whether taller or shorter or



N.B.

with divided up interiors, &c., &c., also for Doors and Frames for Brick Chambers.

No. 1326. Registered Design.

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	Inside Dimensions.	Clear Openings of Doors.	Height Overall Above Ground.
Size 1 ...	19 × 12 ins. ...	33 × 15 ins.	45½ ins.
„ 1a ...	19 × 14 ins. ...	33 × 15 ins.	
„ 1b ...	21 × 12 ins. ...	33 × 17 ins.	
„ 2 ...	21 × 14 ins. ...	33 × 17 ins.	
„ 2a ...	21 × 16 ins. ...	33 × 17 ins.	
„ 2c ...	21 × 18 ins. ...	33 × 17 ins.	46½ ins.
„ 2b ...	25 × 14 ins. ...	36 × 21 ins.	49 ins.
„ 3 ...	25 × 16 ins. ...	36 × 21 ins.	
„ 3a ...	25 × 20 ins. ...	36 × 21 ins.	
„ 3b ...	31 × 16 ins. ...	36 × 27 ins.	49½ ins.
„ 4 ...	31 × 20 ins. ...	36 × 27 ins.	
„ 5 ...	36 × 24 ins. ...	42 × 33 ins.	55½ ins.
„ 6 ...	42 × 24 ins. ...	61 × 38 ins.	74½ ins.
„ 7 ...	36 × 30 ins. ...	46 × 30 ins.	65½ ins.
„ 8 ...	42 × 30 ins. ...	46 × 36 ins.	
„ 9 ...	36 × 36 ins. ...	42 × 33 ins.	61½ ins.
„ 10 ...	36 × 30 ins. ...	42 × 33 ins.	

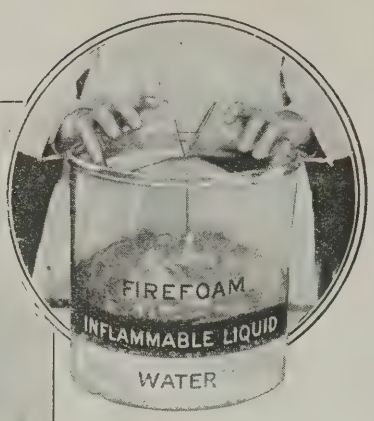
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By courtesy of Messrs The Dorland Agency Ltd., London.



Laboratory illustration showing how Firefoam, generated by Foamite equipment, instantly smothers fire by blanketing the burning surface and so shutting out air. Inflammable liquids float upon water but Firefoam floats upon inflammable liquids. After a fire is out, Firefoam dries and may be brushed or washed away. There is no dripping or soaking through which is experienced with water or liquid chemicals.

None but the best was good enough

The completed wing of the new Dorland Agency building is equipped with Foamite appliances.

The mistaken belief that all fire extinguishing methods are the same has lost hundreds of lives and millions in property.

That is why leaders in industry now call upon specialists to ensure that *the right fire protection is installed in the right place.*

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Liquid—or Gas—or Foam

Water is effective upon ordinary fires. So are soda acid extinguishers, like the "Firespray," which discharge mostly water. But liquids are generally useless on oil fires—petrol fires—paint fires.

Gas, as formed by carbon tetrachloride from an extinguisher like the "Fire-Gun," has a distinct place in fighting certain types of fires. How often, though, are such devices used upon fires which they can *not* extinguish!

The foam method of smothering fire under a blanket of tough, clinging bubbles called Firefoam, is effective upon practically every type of fire. Not only does Firefoam instantly kill ordinary fires, but it is the only dependable method of extinguishing highly inflammable liquids. Yet even this method needs expert adaption to certain special risks.

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Send for a free copy of the booklet entitled "Extinguishing Oil and Other Fires," which describes the road to freedom from uncontrolled fire.

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Representatives in all leading towns.

Foamite Fire Protection

A Complete Engineering Service

Against Fire

THE Creda ELECTRIC COOKERS.

BRITAIN'S BEST.

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WERE OBJECTS OF OUTSTANDING INTEREST.

THE REASON.

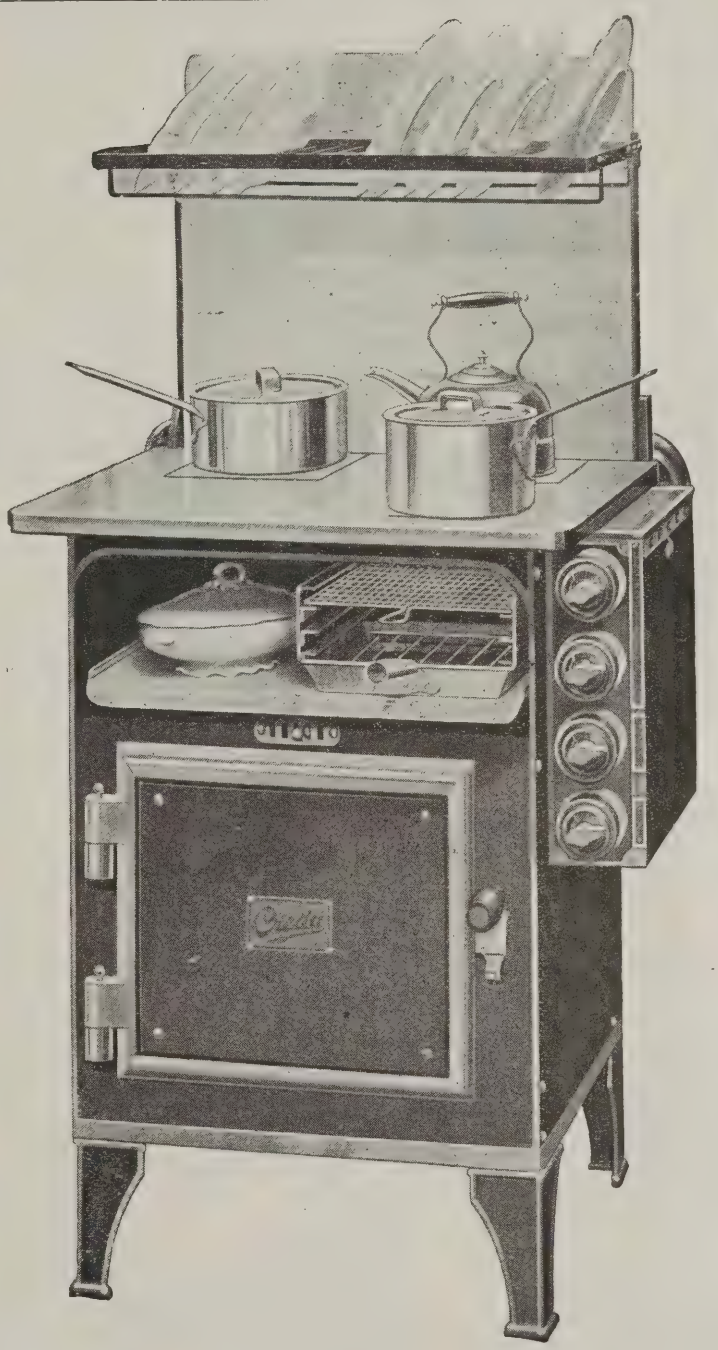
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The lines described below are all high-class productions. They have an extremely low current consumption. They are easy to use and to understand.

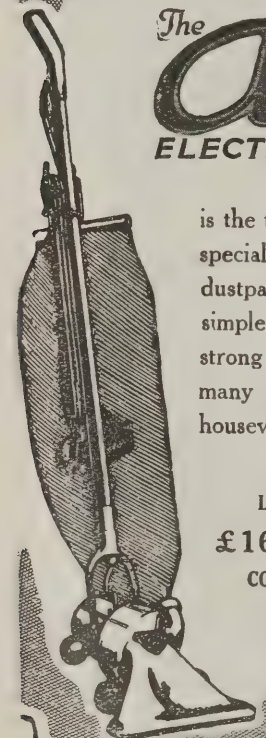
Best of all, they're extremely easy to sell, and show a handsome profit on every sale.

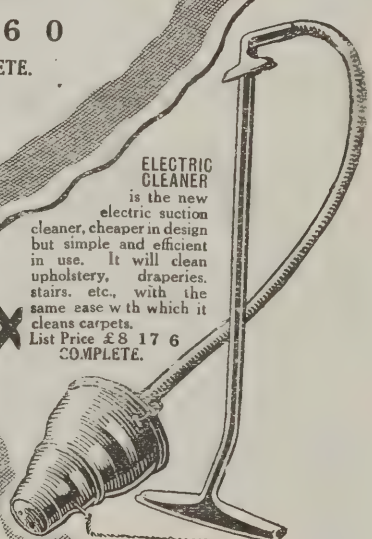


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is the thorough cleaner. The special nozzle shaped like a dustpan, the sensible handle, simple lubrication and the strong motor are a few of many good points that the housewife will appreciate.

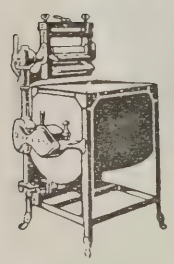
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COMPLETE.





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ELECTRIC CLEANER is the new electric suction cleaner, cheaper in design but simple and efficient in use. It will clean upholstery, draperies, stairs, etc., with the same ease with which it cleans carpets.
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ELECTRIC WASHING MACHINE.

Washes safely, gently and efficiently all kinds of clothes. A perfect washing machine for home use without troublesome fittings and contrivances. The new model has all aluminium cylinder and wringer.

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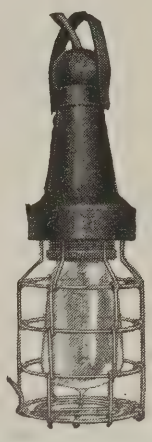
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Our range of eight patterns covers everything you need. Send for list.



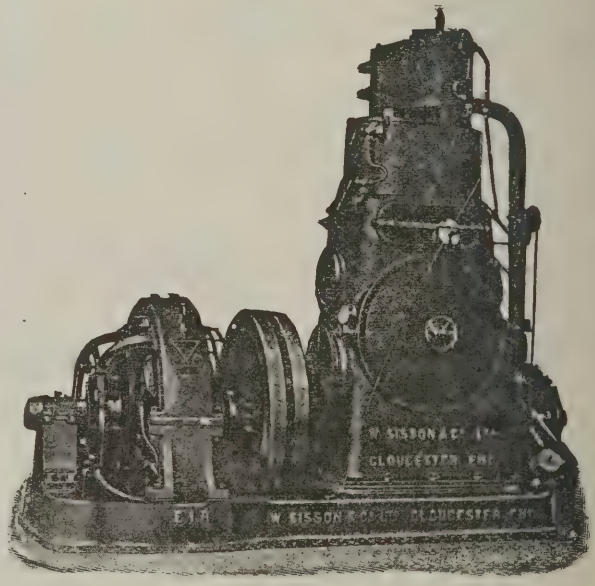
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:: *May 1st, 1925,* ::

:: ON TWO 30 AMP. ::

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Tests were made with direct current, the source of supply being a battery giving 600 Volts. The resistance of the circuit was adjusted so that the current should rise to a maximum value of 15,000 amps.

RESULT.

The Cut-outs opened the circuit cleanly without damage to any part, the only apparent change was a very slight warning of the container.

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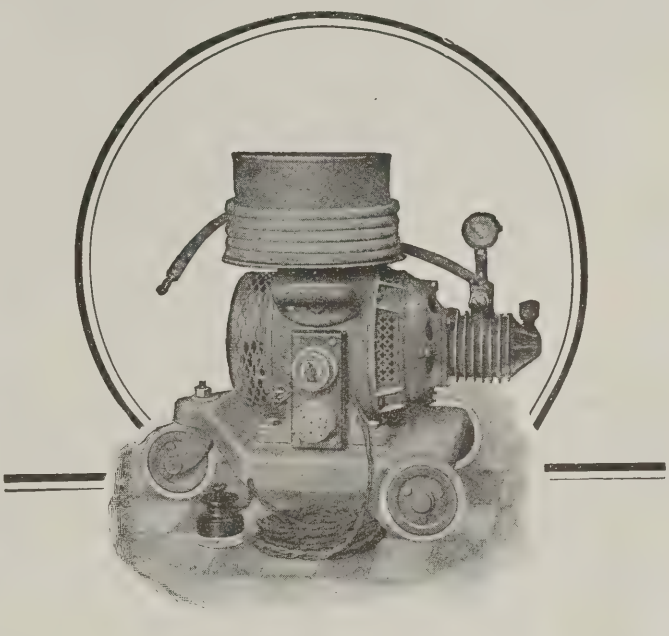
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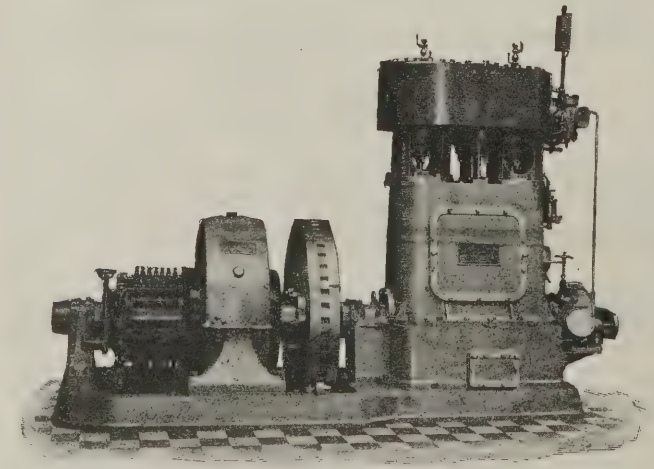
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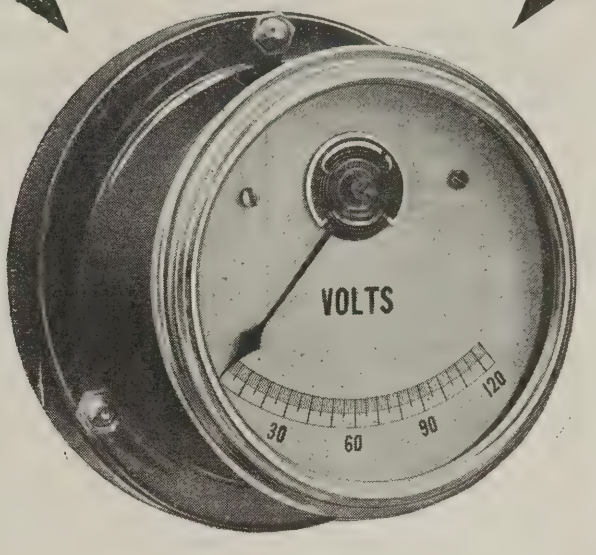
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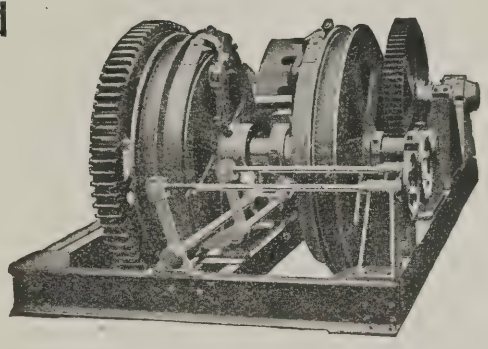
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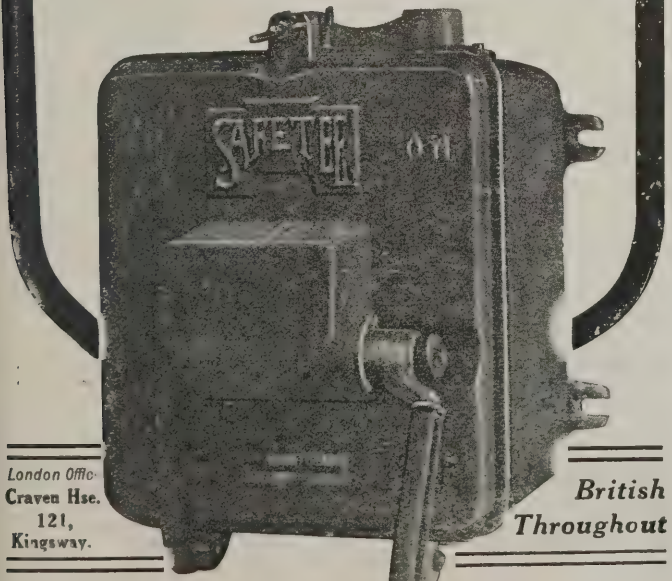
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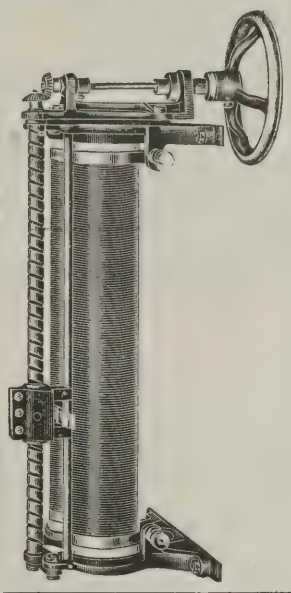
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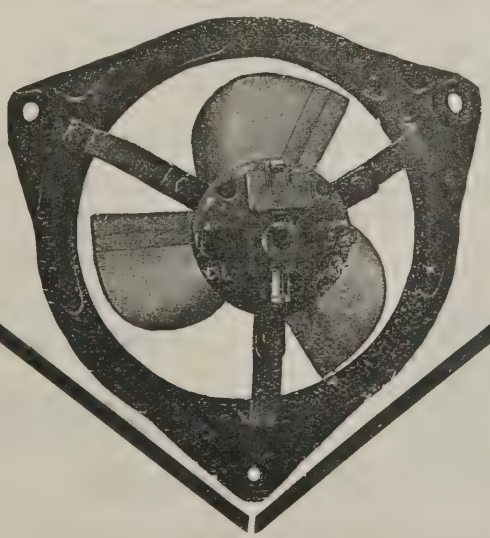
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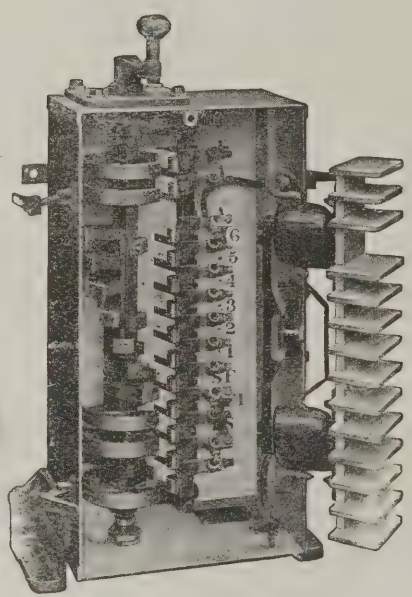
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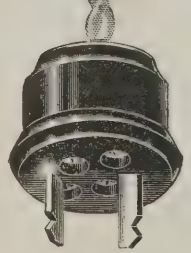
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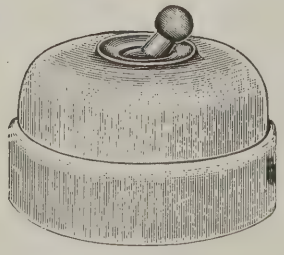
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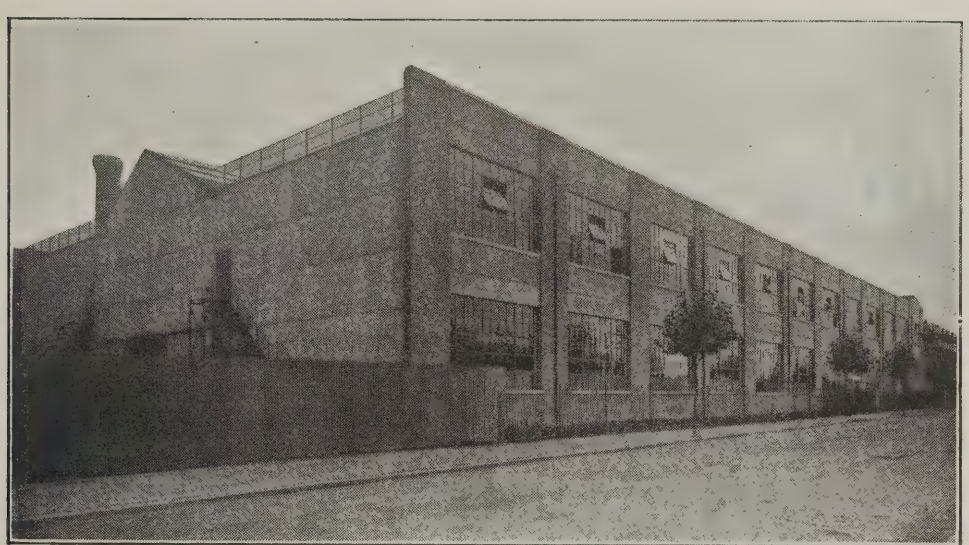
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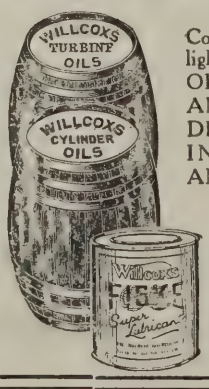
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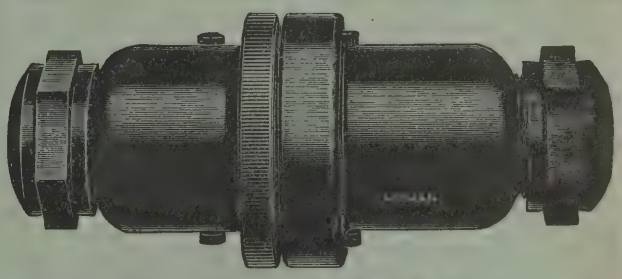
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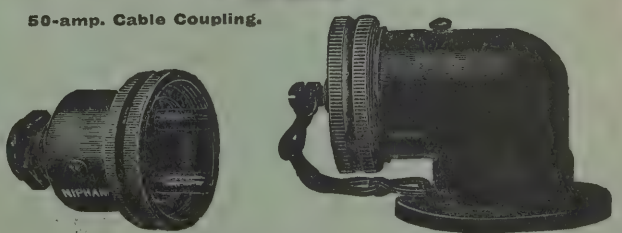
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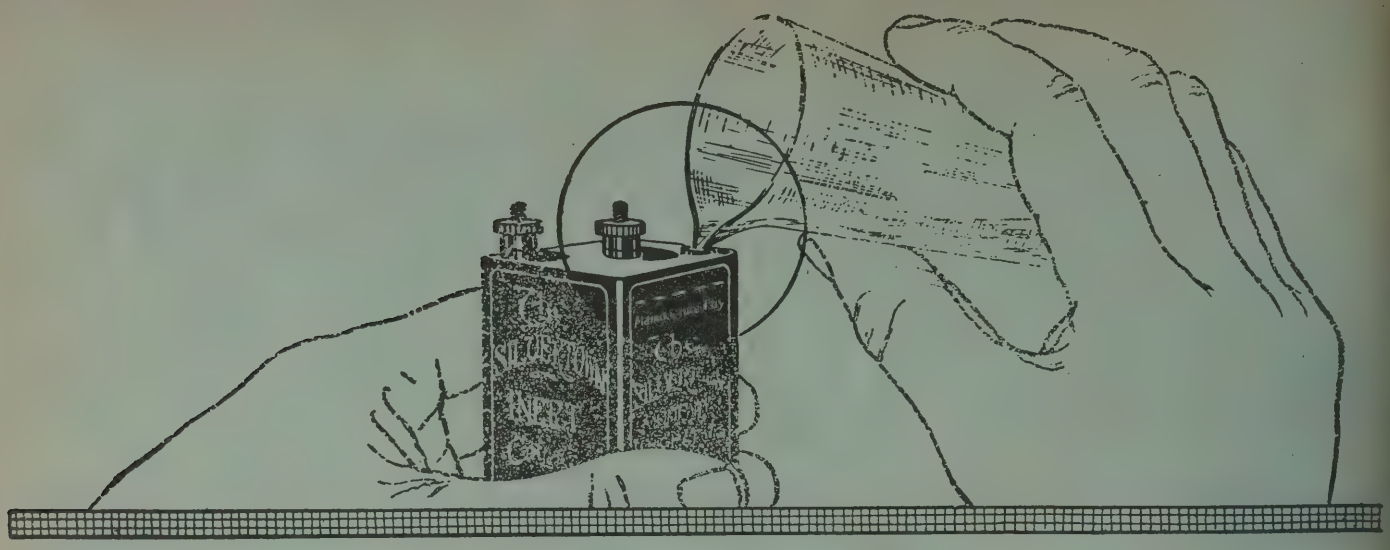
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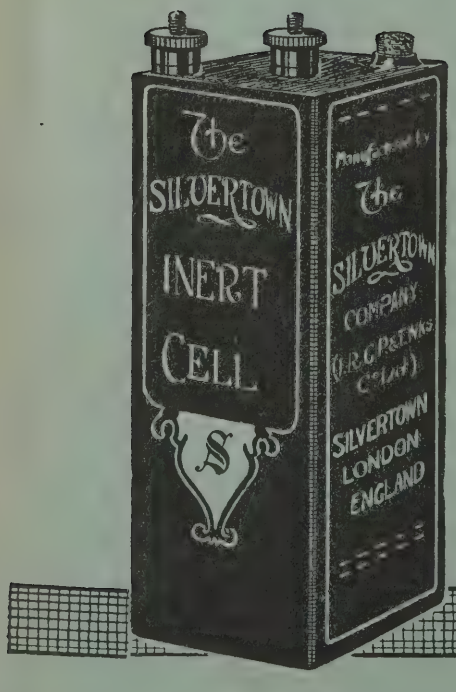
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